ACS550

User's Manual
ACS550-01 Drives (0.75...160 kW)
ACS550-U1 Drives (1...200 hp)

List of related manuals

GENERAL MANUALS

ACS550-01/U1 User's Manual (0.75…160 kW) / (1…200 hp)
3AFE64804588 (3AUA0000001418) (English)

- Safety
- Installation
- Start-up, control with I/O and ID Run
- Control panels
- Application macros
- Parameters
- Embedded fieldbus
- Fieldbus adapter
- Diagnostics
- Maintenance
- Technical data

Flange Mounting Instructions

Kit, IP21 / UL type 1	Frame size	Code (English)
FMK-A-R1	R1	100000982
FMK-A-R2	R2	100000984
FMK-A-R3	R3	100000986
FMK-A-R4	R4	100000988
AC8-FLNGMT-R5 [1]	R5	ACS800-PNTG01U-EN
AC8-FLNGMT-R6 [1]	R6	

1. Not available for ACS550-01 series

Kit, IP54 / UL type 12	Frame size	Code (English)
FMK-B-R1	R1	100000990
FMK-B-R2	R2	100000992
FMK-B-R3	R3	100000994
FMK-B-R4	R4	100000996

OPTION MANUALS

(delivered with optional equipment)

MFDT-01 FlashDrop User's Manual
3AFE68591074 (English)

OHDI-01 115/230 V Digital Input Module User's Manual
3AUA0000003101 (English)

OREL-01 Relay Output Extension Module User's Manual
3AUA0000001935 (English)

OTAC-01 User’s Manual Pulse Encoder Interface Module User’s Manual
3AUA0000001938 (English)

RCAN-01 CANopen Adapter User's Manual
3AFE64504231 (English)

RCCL-01 CC-Link Adapter Module User's Manual
3AUA0000061340 (English)

RCNA-01 ControlNet Adapter User's Manual
3AFE64506005 (English)

RDNA-01 DeviceNet Adapter User's Manual
3AFE64504223 (English)

RECA-01 EtherCAT Adapter Module User's Manual
3AUA0000043520 (English)

REPL-01 Ethernet POWERLINK Adapter Module User's Manual
3AUA0000052289 (English)

RETA-01 Ethernet Adapter Module User's Manual
3AFE64539736 (English)

RETA-02 Ethernet Adapter Module User's Manual
3AFE68895383 (English)

RLON-01 LONWORKS® Adapter Module User’s Manual
3AFE64798693 (English)

RPBA-01 PROFIBUS DP Adapter User's Manual
3AFE64504215 (English)

SREA-01 Ethernet Adapter User's Manual
3AUA0000042896 (English)

Typical contents

- Safety
- Installation
- Programming/Start-up
- Diagnostics
- Technical data

MAINTENANCE MANUALS

Guide for Capacitor Reforming in ACS50, ACS55, ACS150, ACS310, ACS320, ACS350, ACS550 and ACH550
3AFE68735190 (English)

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ACS550-01/U1 Drives
0.75…160 kW
1…200 hp

User's Manual

3AFE64804588 (3AUA0000001418) Rev G
EN
EFFECTIVE: 2009-07-07
SUPERSEDES: 3AFE64804588 (3AUA0000001418) Rev F 2007-04-16

Safety

Use of warnings and notes

There are two types of safety instructions throughout this manual:

- Notes draw attention to a particular condition or fact, or give information on a subject.
- Warnings caution you about conditions which can result in serious injury or death and/or damage to the equipment. They also tell you how to avoid the danger. The warning symbols are used as follows:

Electricity warning warns of hazards from electricity which can cause physical injury and/or damage to the equipment.

General warning warns about conditions, other than those caused by electricity, which can result in physical injury and/or damage to the equipment.

WARNING! The ACS550 adjustable speed AC drive should ONLY be installed by a qualified electrician.

WARNING! Even when the motor is stopped, dangerous voltage is present at the power circuit terminals U1, V1, W1 and U2, V2, W2 and, depending on the frame size, UDC+ and UDC-, or BRK+ and BRK-.

WARNING! Dangerous voltage is present when input power is connected. After disconnecting the supply, wait at least 5 minutes (to let the intermediate circuit capacitors discharge) before removing the cover.

WARNING! Even when power is switched off from the input terminals of the ACS550, there may be dangerous voltage (from external sources) on the terminals of the relay outputs RO1...RO3.

WARNING! When the control terminals of two or more drives are connected in parallel, the auxiliary voltage for these control connections must be taken from a single source which can either be one of the drives or an external supply.

WARNING! Disconnect the internal EMC filter when installing the drive on an IT system (an ungrounded power system or a high-resistance-grounded [over 30 ohm] power system), otherwise the system will be connected to ground potential through the EMC filter capacitors. This may cause danger, or damage the drive.

Disconnect the internal EMC filter when installing the drive on a corner grounded TN system, otherwise the drive will be damaged.

Note: When the internal EMC filter is disconnected, the drive is not EMC compatible.

See section *Disconnecting the internal EMC filter* on page *23*. Also see sections *IT systems* on page *280* and *Corner grounded TN systems* on page *279*.

WARNING! Do not attempt to install or remove EM1, EM3, F1 or F2 screws while power is applied to the drive's input terminals.

WARNING! Do not control the motor with the disconnecting device (disconnecting means); instead, use the control panel start and stop keys ◇ and ▽, or commands via the I/O board of the drive. The maximum allowed number of charging cycles of the DC capacitors (i.e. power-ups by applying power) is five in ten minutes.

WARNING! The ACS550-01/U1 is not field repairable. Never attempt to repair a malfunctioning drive; contact the factory or your local Authorized Service Center for replacement.

WARNING! The ACS550 will start up automatically after an input voltage interruption if the external run command is on.

WARNING! The heat sink may reach a high temperature. See chapter *Technical data* on page *271*.

Note: For more technical information, contact the factory or your local ABB representative.

Table of contents

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Further information

Installation

Study these installation instructions carefully before proceeding. **Failure to observe the warnings and instructions may cause a malfunction or personal hazard.**

WARNING! Before you begin read chapter *Safety* on page *5*.

Note: The installation must always be designed and made according to applicable local laws and regulations. ABB does not assume any liability whatsoever for any installation which breaches the local laws and/or other regulations. Furthermore, if the recommendations given by ABB are not followed, the drive may experience problems that the warranty does not cover.

Installation flow chart

The installation of the ACS550 adjustable speed AC drive follows the outline below. The steps must be carried out in the order shown. At the right of each step are references to the detailed information needed for the correct installation of the drive.

Task	See
PREPARE for installation	*Preparing for installation* on page *12*
PREPARE the mounting location	*Prepare the mounting location* on page *16*
REMOVE the front cover	*Remove the front cover* on page *17*
MOUNT the drive	*Mount the drive* on page *18*
INSTALL wiring	*Wiring overview* on page *19* and *Install the wiring* on page *26*
CHECK installation	*Check installation* on page *31*
REINSTALL the cover	*Reinstall the cover* on page *32*
START-UP	*How to start up the drive* on page *33*

Preparing for installation

Lifting the drive

Lift the drive only by the metal chassis.

Unpacking the drive

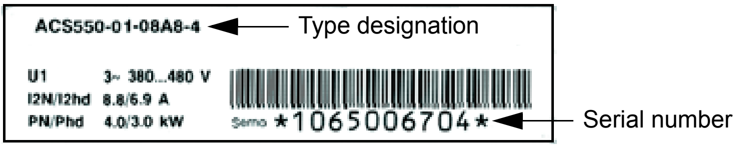
1. Unpack the drive.
2. Check for any damage and notify the shipper immediately if damaged components are found.
3. Check the contents against the order and the shipping label to verify that all parts have been received.

Drive identification

Drive labels

To determine the type of drive you are installing, refer to either:

- serial number label attached on upper part of the chokeplate between the mounting holes, or



ACS550-01-08A8-4

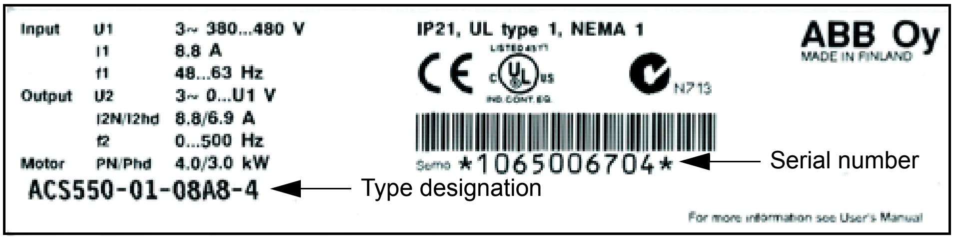
U1 3~ 380...480 V

I2N/I2hd 8.8/6.9 A

PN/Phd 4.0/3.0 kW

Serno *1065006704*

- type designation label attached on the heat sink – on the right side of the drive cover. Two examples of the type designation label are given below.



Input U1 3~ 380...480 V

I1 8.8 A

f1 48...63 Hz

Output U2 3~ 0...U1 V

I2N/I2hd 8.8/6.9 A

f2 0...500 Hz

Motor PN/Phd 4.0/3.0 kW

ACS550-01-08A8-4

IP21, UL type 1, NEMA 1

LISTED 45Y1

IND.CONT.EQ.

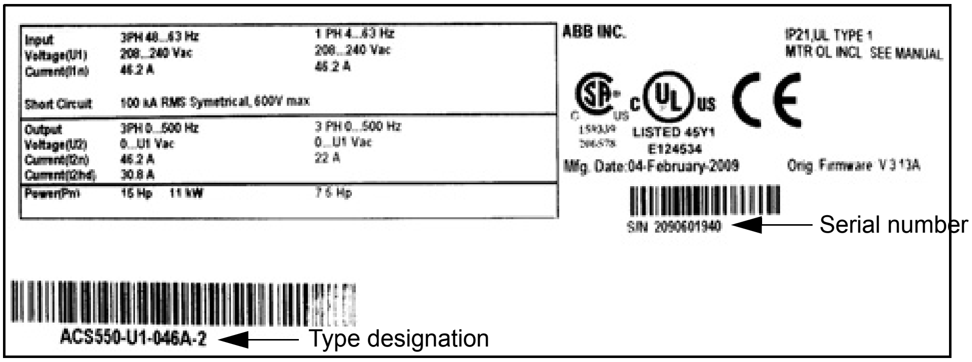
N713

Serno *1065006704*

ABB Oy

MADE IN FINLAND

For more information see User's Manual



Input	3PH 48...63 Hz	1 PH 4...63 Hz
Voltage(U1)	208...240 Vac	208...240 Vac
Current(I1n)	46.2 A	46.2 A
Short Circuit	100 kA RMS Symetrical, 600V max	
Output	3PH 0...500 Hz	3 PH 0...500 Hz
Voltage(U2)	0...U1 Vac	0...U1 Vac
Current(I2n)	46.2 A	22 A
Current(I2hd)	30.8 A	
Power(Pn)	15 Hp 11 kW	7.5 Hp

ABB INC.

IP21,UL TYPE 1

MTR OL INCL SEE MANUAL

LISTED 45Y1

E124534

Mfg. Date:04-February-2009

Orig. Firmware V 313A

S/N 2090601940

ACS550-U1-046A-2

Type designation

Use the following chart to interpret the type designation found on both the type designation and the serial number label.

ACS550-01-08A8-4+J404+…

AC, Standard Drive – 550 product series

Construction (region specific)
01 = Setup and parts specific to IEC installation and compliance
U1 = Setup and parts specific to US installation and NEMA compliance

Output current rating
e.g. 08A8 = 8.8 A, see section *Ratings* on page *271* for details

Voltage rating
2 = 208…240 V AC
4 = 380…480 V AC
6 = 500…600 V AC

Options
Examples of options:
B055 = IP54 / UL type 12 (no specification = IP21 / UL type 1). UL type 12 is not available for type ACS550-01-290A-4.
0J400 = No control panel
J404 = ACS-CP-C Basic Control Panel
L511 = OREL-01 Relay output extension
K451 = RDNA-01 DeviceNet
K452 = RLON-01 LONWORKS
K454 = RPBA-01 PROFIBUS DP

Ratings and frame size

The chart in section *Ratings* on page *271* lists technical specifications and identifies the drive's frame size – significant, since some instructions in this document vary, depending on the drive's frame size. To read the ratings table, you need the "Output current rating" entry from the type designation. Also, when using the ratings table, note that the table is broken into sections based on the drive's "Voltage rating".

Serial number

The format of the drive serial number shown on the labels is described below.

Serial number is of format CYYWWXXXXX, where
C: Country of manufacture
YY: Year of manufacture
WW: Week of manufacture; 01, 02, 03, … for week 1, week 2, week 3, …
XXXXX: Integer starting every week from 00001.

Motor compatibility

The motor, drive and supply power must be compatible:

Motor specification	Verify	Reference
Motor type	3-phase induction motor	–
Nominal current	Motor value is within this range: 0.2…2.0 · I_{2hd} (I_{2hd} = drive heavy duty current)	• Type designation label on drive, entry for Output I_{2hd}, or • Type designation on drive and rating table in chapter *Technical data* on page *271*.
Nominal frequency	10…500 Hz	–
Voltage range	Motor is compatible with the ACS550 voltage range.	208…240 V (for ACS550-X1-XXXX-2) or 380…480 V (for ACS550-X1-XXXX-4) or 500…600 V (for ACS550-U1-XXXX-6)
Insulation	500…600 V drives: Either the motor complies with NEMA MG1 Part 31, or a du/dt filter is used between the motor and drive.	For ACS550-U1-XXXX-6

Tools required

To install the ACS550 you need the following:

- screwdrivers (as appropriate for the mounting hardware used)
- wire stripper
- tape measure
- drill
- for installations involving ACS550-U1, frame sizes R5 or R6 and IP54 / UL type 12 enclosures: punch for creating conduit mounting holes
- for installations involving ACS550-U1, frame size R6: appropriate crimping tool for power cable lugs. See section *Power terminal considerations – R6 frame size* on page *281*.
- mounting hardware: screws or nuts and bolts, four each. The type of hardware depends on the mounting surface and the frame size:

Frame size	Mounting hardware	
R1…R4	M5	#10
R5	M6	1/4 in
R6	M8	5/16 in

Suitable environment and enclosure

Confirm that the site meets the environmental requirements. To prevent damage prior to installation, store and transport the drive according to the environmental requirements specified for storage and transportation. See section *Ambient conditions* on page *300*.

Confirm that the enclosure is appropriate, based on the site contamination level:

- IP21 / UL type 1 enclosure: The site must be free of airborne dust, corrosive gases or liquids, and conductive contaminants such as dripping water, condensation, carbon dust and metallic particles.
- IP54 / UL type 12 enclosure: This enclosure provides protection from airborne dust and light sprays or splashing water from all directions.
- If, for some reason, an IP21 drive needs to be installed without the conduit box or cover, or an IP54 drive without the conduit plate or hood, see the note in chapter *Technical data*, page *304*.

Suitable mounting location

Confirm that the mounting location meets the following constraints:

- The drive must be mounted vertically on a smooth, solid surface, and in a suitable environment as defined above. For horizontal installation, contact your local ABB representative for more information.
- The minimum space requirements for the drive are the outside dimensions (see section *Outside dimensions* on page *298*), plus air flow space around the drive (see section *Cooling* on page *295*).
- The distance between the motor and the drive is limited by the maximum motor cable length. See section *Motor connection specifications* on page *283*.
- The mounting site must support the drive's modest weight. See section *Weight* on page *299*.

Installing the drive

WARNING! Before installing the ACS550, ensure the input power supply to the drive is off.

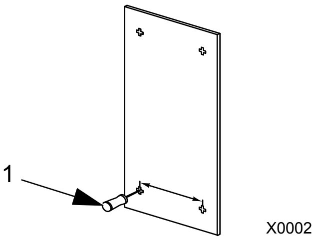
For flange mounting (mounting the drive in a cooling air duct), see the appropriate *Flange Mounting Instructions*:

Frame size	IP21 / UL type 1		IP54 / UL type 12	
	Kit	Code (English)	Kit	Code (English)
R1	FMK-A-R1	100000982	FMK-B-R1	100000990
R2	FMK-A-R2	100000984	FMK-B-R2	100000992
R3	FMK-A-R3	100000986	FMK-B-R3	100000994
R4	FMK-A-R4	100000988	FMK-B-R4	100000996
R5	AC8-FLNGMT-R5 [1]	ACS800-PNTG01U-EN	-	-
R6	AC8-FLNGMT-R6 [1]		-	-

[1] Not available in ACS550-01 series.

Prepare the mounting location

The ACS550 should only be mounted where all of the requirements defined in section *Preparing for installation* on page *12* are met.



1. Mark the position of the mounting holes with the help of the mounting template provided with the drive.
2. Drill the holes.

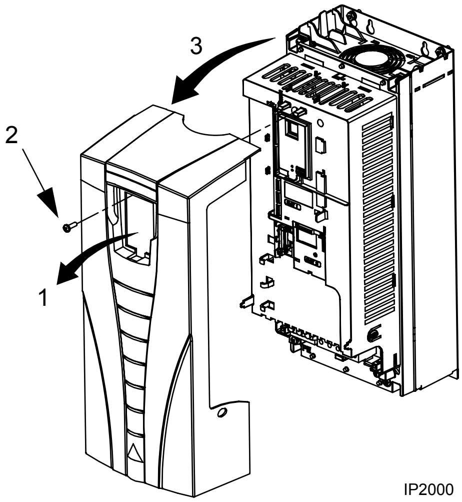
Note: Frame sizes R3 and R4 have four holes along the top. Use only two. If possible, use the two outside holes (to allow room to remove the fan for maintenance).

Note: ACS400 drives can be replaced using the original mounting holes. For R1 and R2 frame sizes, the mounting holes are identical. For R3 and R4 frame sizes, the inside mounting holes on the top of ACS550 drives match ACS400 mounts.

Remove the front cover

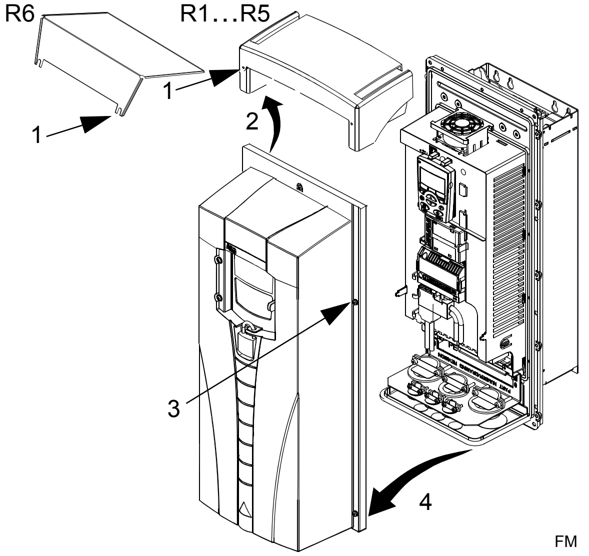
IP21 / UL type 1

1. Remove the control panel, if attached.
2. Loosen the captive screw at the top.
3. Pull near the top to remove the cover.



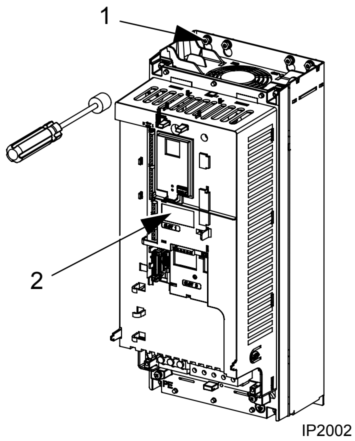
IP54 / UL type 12

1. If hood is present: Remove screws (2) holding hood in place.
2. If hood is present: Slide hood up and off of the cover.
3. Loosen the captive screws around the edge of the cover.
4. Remove the cover.



Mount the drive

IP21 / UL type 1



1. Position the ACS550 onto the mounting screws or bolts and securely tighten in all four corners.

Note: Lift the ACS550 by its metal chassis (frame size R6 by the lifting holes on both sides at the top).

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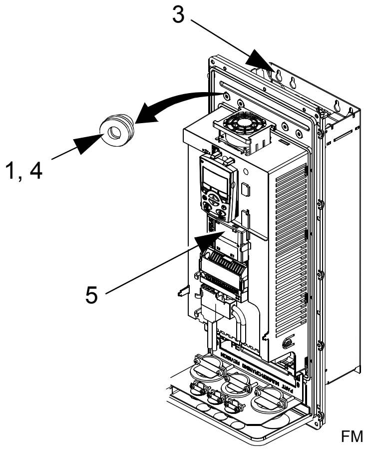
2. Non-English speaking locations: Add a warning sticker in the appropriate language over the existing warning on the top of the module.

IP54 / UL type 12

For the IP54 / UL type 12 enclosures, rubber plugs are required in the holes provided for access to the drive mounting slots.



1. As required for access, remove the rubber plugs. Push plugs out from the back of the drive.
2. R5 & R6: Align the sheet metal hood (not shown) in front of the drive's top mounting holes. (Attach as part of next step.)
3. Position the ACS550 onto the mounting screws or bolts and securely tighten in all four corners.

Note: Lift the ACS550 by its metal chassis (frame size R6 by the lifting holes on both sides at the top).

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4. Reinstall the rubber plugs.
5. Non-English speaking locations: Add a warning sticker in the appropriate language over the existing warning on the top of the module.

Wiring overview

Conduit/Gland kit

Wiring drives with the IP21 / UL type 1 enclosure requires a conduit/gland kit with the following items:

- conduit/gland box
- five (5) cable clamps (ACS550-01 only)
- screws
- cover.

The kit is included with IP21 / UL type 1 enclosures.

Wiring requirements

WARNING! Ensure the motor is compatible for use with the ACS550. The drive must be installed by a competent person in accordance with the considerations defined in section *Preparing for installation* on page *12*. If in doubt, contact your local ABB sales or service office.

As you install the wiring, observe the following:

- There are four sets of wiring instructions – one set for each combination of drive enclosure type (IP21 / UL type and IP54 / UL type 12) and wiring type (conduit or cable). Be sure to select the appropriate procedure.
- Determine electro-magnetic compliance (EMC) requirements per local codes. See section *Motor cable requirements for CE & C-Tick compliance* on page *287*. In general:
  - Follow local codes for cable size.
  - Keep these four classes of wiring separated: input power wiring, motor wiring, control/communications wiring and braking unit wiring.
- When installing input power and motor wiring, refer to the following, as appropriate:

Terminal	Description	Specifications and notes
U1, V1, W1[1]	3-phase power supply input	*Input power connections* on page *275*
PE	Protective Ground	*Ground connections* on page *279*
U2, V2, W2	Power output to motor	*Motor connections* on page *283*

[1] The ACS550 -x1-xxxx-2 (208…240 V series) can be used with a single phase supply, if output current is derated by 50%. For single phase supply voltage, connect power at U1 and W1.

- To locate input power and motor connection terminals, see section *Power connection diagrams* on page *21*. For specifications on power terminals, see section *Drive's power connection terminals* on page *280*.
- For corner grounded TN systems, see section *Corner grounded TN systems* on page *279*.
- For IT systems, see section *IT systems* on page *280*.

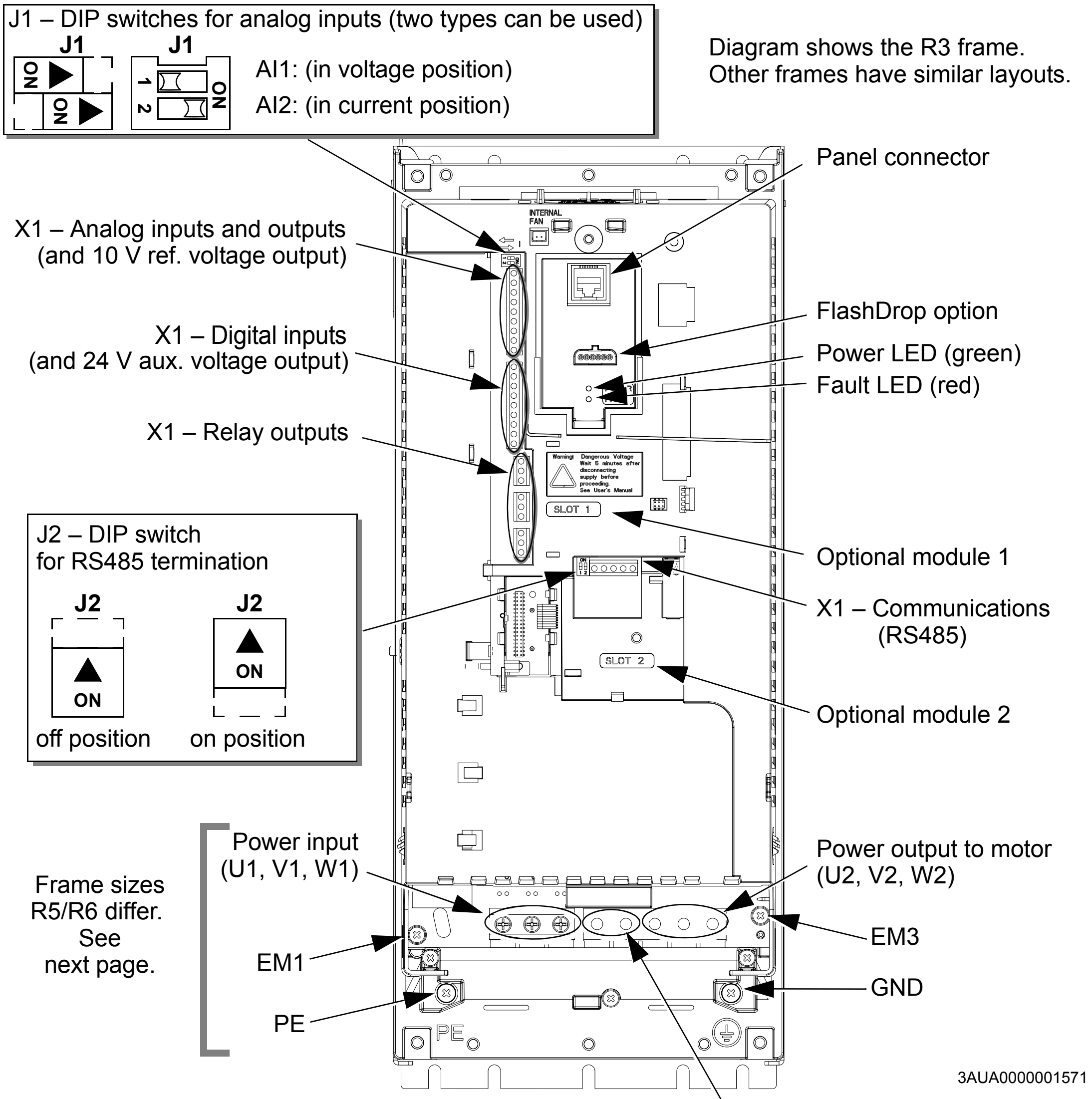
- For frame size R6, see section *Power terminal considerations – R6 frame size* on page *281* to install the appropriate cable lugs.
- For drives using braking (optional), refer to the following, as appropriate:

Frame size	**Terminal**	**Description**	**Braking accessory**
R1, R2	BRK+, BRK-	Braking resistor	Braking resistor. See section *Brake components* on page *289*.
R3, R4, R5, R6	UDC+, UDC-	DC bus	Contact your ABB representative to order either: • braking unit or • chopper and resistor

- When installing control wiring, refer to the following chapters or sections, as appropriate:
  - *Control terminals table* on page *24*
  - *Control connections* on page *293*
  - *Application macros* on page *73*
  - *Complete parameter descriptions* on page *102*
  - *Embedded fieldbus* on page *199*
  - *Fieldbus adapter* on page *231*.

Power connection diagrams

The following diagram shows the terminal layout for frame size R3, which, in general, applies to frame sizes R1...R6, except for the R5/R6 power and ground terminals.

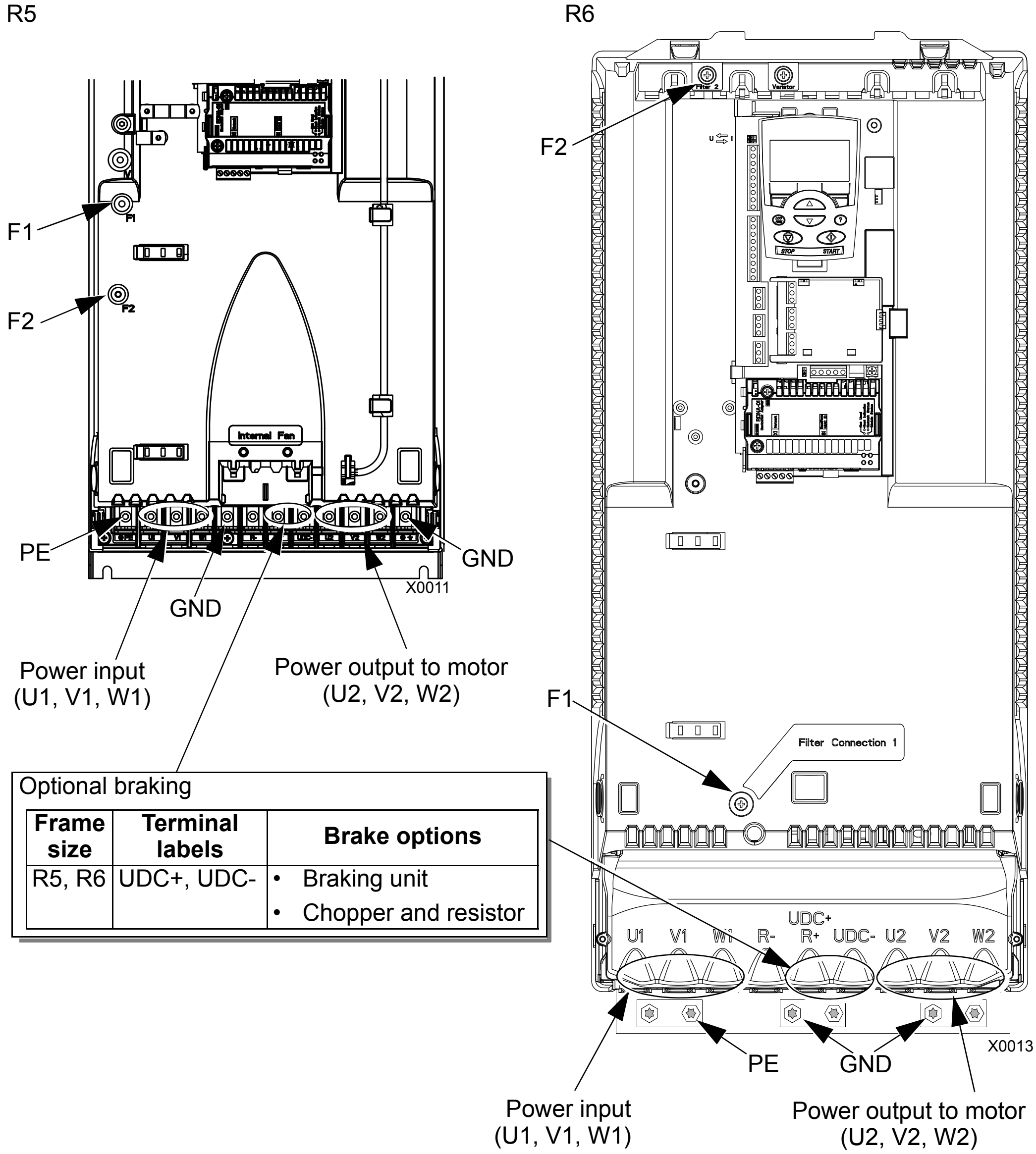


Optional braking

Frame size	Terminal labels	Brake options
R1, R2	BRK+, BRK-	Brake resistor
R3, R4	UDC+, UDC-	• Braking unit • Chopper and resistor

WARNING! To avoid danger, or damage to the drive, on IT systems and corner grounded TN systems, see section *Disconnecting the internal EMC filter* on page 23.

The following diagram shows the power and ground terminal layout for frame sizes R5 and R6.



Optional braking

Frame size	**Terminal labels**	**Brake options**
R5, R6	UDC+, UDC-	• Braking unit • Chopper and resistor

WARNING! To avoid danger, or damage to the drive, on IT systems and corner grounded TN systems, see section *Disconnecting the internal EMC filter* on page 23.

Disconnecting the internal EMC filter

On certain types of systems, you must disconnect the internal EMC filter, otherwise the system will be connected to ground potential through the EMC filter capacitors, which might cause danger, or damage the drive.

Note: When the internal EMC filter is disconnected, the drive is not EMC compatible.

The following table shows the installation rules for the EMC filter screws in order to connect or disconnect the filter, depending on the system type and the frame size. For more information on the different system types, see *IT systems* on page *280* and *Corner grounded TN systems* on page *279*.

The locations of screws EM1 and EM3 are shown in the diagram on page *21*. The locations of screws F1 and F2 are shown in the diagram on page *22*.

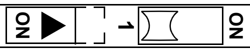
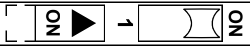
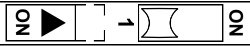
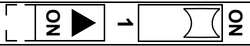
Frame sizes	Screw	Symmetrically grounded TN systems (TN-S systems)	Corner grounded TN systems	IT systems (ungrounded or high-resistance-grounded [> 30 ohm])
R1…R3	EM1	x	x	•
	EM3[1]	x	•	•
R4	EM1	x	x	–
	EM3[1]	x	–	–
R5…R6	F1	x	x	–
	F2	x	x	–

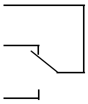
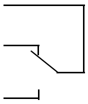
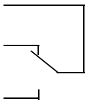
x = Install the screw. (EMC filter will be connected.)
• = Replace the screw with the provided polyamide screw. (EMC filter will be disconnected.)
– = Remove the screw. (EMC filter will be disconnected.)

[1] ACS550-U1 drives are shipped with screw EM3 already removed.

Control terminals table

The following provides information for connecting control wiring at X1 on the drive.

	X1		Hardware description
Analog I/O	1	SCR	Terminal for signal cable shield (screen). (Connected internally to chassis ground.)
	2	AI1	Analog input channel 1, programmable. Default[2] = frequency reference. Resolution 0.1%, accuracy ±1%.
			Two different DIP switch types can be used.
			J1: AI1 OFF: 0…10 V (R_i = 312 kohm) 
			J1: AI1 ON: 0…20 mA (R_i = 100 ohm) 
	3	AGND	Analog input circuit common (connected internally to chassis gnd. through 1 Mohm).
	4	+10 V	Potentiometer reference source: 10 V ±2%, max. 10 mA (1 kohm ≤ R ≤ 10 kohm).
	5	AI2	Analog input channel 2, programmable. Default[2] = not used. Resolution 0.1%, accuracy ±1%.
			Two different DIP switch types can be used.
			J1: AI2 OFF: 0…10 V (R_i = 312 kohm) 
			J1: AI2 ON: 0…20 mA (R_i = 100 ohm) 
	6	AGND	Analog input circuit common (connected internally to chassis gnd. through 1 Mohm).
	7	AO1	Analog output, programmable. Default[2] = frequency. 0…20 mA (load < 500 ohm). Accuracy ±3%.
	8	AO2	Analog output, programmable. Default[2] = current. 0…20 mA (load < 500 ohm). Accuracy ±3%.
	9	AGND	Analog output circuit common (connected internally to chassis gnd. through 1 Mohm).
Digital inputs[1]	10	+24V	Auxiliary voltage output 24 V DC / 250 mA (reference to GND), short circuit protected.
	11	GND	Auxiliary voltage output common (connected internally as floating).
	12	DCOM	Digital input common. To activate a digital input, there must be ≥ +10 V (or ≤ -10 V) between that input and DCOM. The 24 V may be provided by the ACS550 (X1-10) or by an external 12…24 V source of either polarity.
	13	DI1	Digital input 1, programmable. Default[2] = start/stop.
	14	DI2	Digital input 2, programmable. Default[2] = fwd/rev.
	15	DI3	Digital input 3, programmable. Default[2] = constant speed sel (code).
	16	DI4	Digital input 4, programmable. Default[2] = constant speed sel (code).
	17	DI5	Digital input 5, programmable. Default[2] = ramp pair selection (code).
	18	DI6	Digital input 6, programmable. Default[2] = not used.

	X1			**Hardware description**
Relay outputs	19	RO1C		Relay output 1, programmable. Default[2] = Ready Maximum: 250 V AC / 30 V DC, 2 A Minimum: 500 mW (12 V, 10 mA)
	20	RO1A		
	21	RO1B		
	22	RO2C		Relay output 2, programmable. Default[2] = Running Maximum: 250 V AC / 30 V DC, 2 A Minimum: 500 mW (12 V, 10 mA)
	23	RO2A		
	24	RO2B		
	25	RO3C		Relay output 3, programmable. Default[2] = Fault (-1) Maximum: 250 V AC / 30 V DC, 2 A Minimum: 500 mW (12 V, 10 mA)
	26	RO3A		
	27	RO3B		

[1] Digital input impedance 1.5 kohm. Maximum voltage for digital inputs is 30 V.

[2] Default values depend on the macro used. Values specified are for the default macro. See chapter *Application macros* on page *73*.

Note: Terminals 3, 6 and 9 are at the same potential.

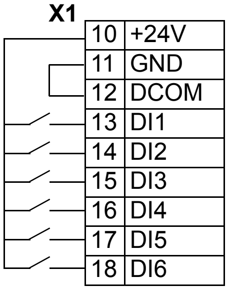
Note: For safety reasons the fault relay signals a “fault” when the ACS550 is powered down.

WARNING! All ELV (Extra Low Voltage) circuits connected to the drive must be used within a zone of equipotential bonding, i.e. within a zone where all simultaneously accessible conductive parts are electrically connected to prevent hazardous voltages appearing between them. This is accomplished by a proper factory grounding.

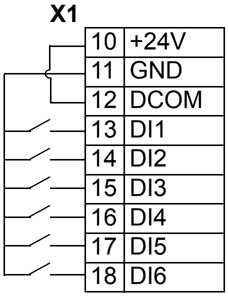
The terminals on the control board as well as on the optional modules attachable to the board fulfil the Protective Extra Low Voltage (PELV) requirements stated in EN 50178, provided that the external circuits connected to the terminals also fulfil the requirements and the installation site is below 2000 m (6562 ft).

You can wire the digital input terminals in either a PNP or NPN configuration.

PNP connection (source)



NPN connection (sink)



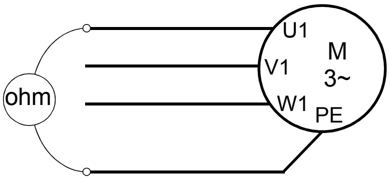
Install the wiring

Checking motor and motor cable insulation

WARNING! Check the motor and motor cable insulation before connecting the drive to input power. For this test, make sure that motor cables are NOT connected to the drive.

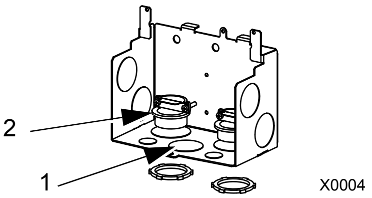
---

1. Complete motor cable connections to the motor, but NOT to the drive output terminals (U2, V2, W2).
2. Measure the insulation resistance between each phase conductor and the Protective Earth conductor using a measuring voltage of 500 V DC. The insulation resistance of an ABB motor must exceed 10 Mohm (reference value at 25 °C or 77 °F). For the insulation resistance of other motors, please consult the manufacturer's instructions. **Note:** Moisture inside the motor casing will reduce the insulation resistance. If moisture is suspected, dry the motor and repeat the measurement.

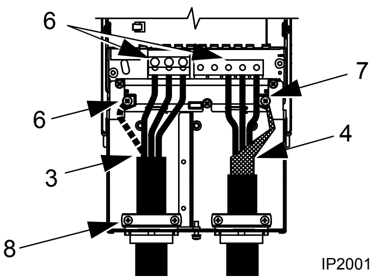


*Wiring **IP21** / UL type 1 enclosure with **cables***

1. Open the appropriate knockouts in the conduit/gland box. (See section *Conduit/Gland kit* on page *19*.)
2. Install the cable clamps for the power/motor cables.

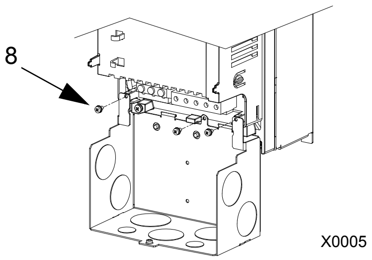


3. On the input power cable, strip the sheathing back far enough to route individual wires.
4. On the motor cable, strip the sheathing back far enough to expose the copper wire shield so that the shield can be twisted into a bundle (pig-tail). Keep the bundle not longer than five times its width to minimize noise radiation.
   360° grounding under the clamp is recommended for the motor cable to minimize noise radiation. In this case, remove the sheathing at the cable clamp.
5. Route both cables through the clamps.
6. Strip and connect the power/motor wires and the power ground wire to the drive terminals. See the table on the right for tightening torques.

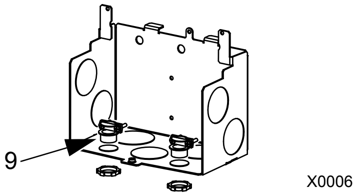


Frame size	Tightening torque	
	N·m	**lb·ft**
R1, R2	1.4	1
R3	2.5	1.8
R4	5.6; PE: 2	4; PE 1.5
R5	15	11
R6	40; PE: 8	30; PE: 6

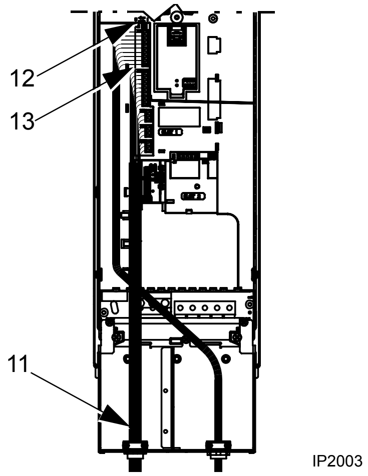
Note: For R6 frame size, refer to section *Power terminal considerations – R6 frame size* on page *281*.



7. Connect the bundle (pig-tail) created from the motor cable shield to the GND terminal.
8. Install conduit/gland box and tighten the cable clamps.
9. Install the cable clamp(s) for the control cable(s). (Power/motor cables and clamps not shown in the figure.)

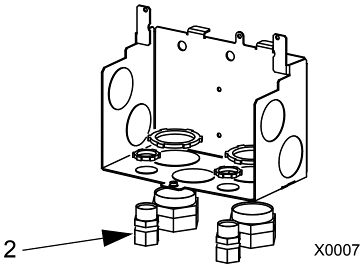


10. Strip control cable sheathing and twist the copper shield into a bundle (pig-tail).
11. Route control cable(s) through clamp(s) and tighten clamp(s).
12. Connect the ground shield bundle (pig-tail) for digital and analog I/O cables at X1-1. (Ground only at the drive end.)
13. Strip and connect the individual control wires to the drive terminals. See section *Control terminals table* on page *24*. Use a tightening torque of 0.4 N·m (0.3 lb·ft).
14. Install the conduit/gland box cover (1 screw).

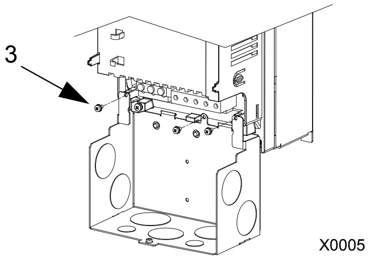


*Wiring **IP21** / UL type 1 enclosure with **conduit***

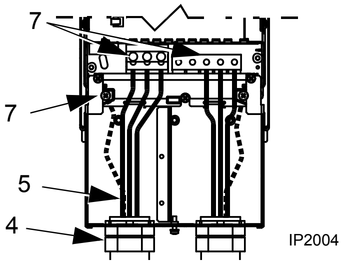
1. Open the appropriate knockouts in the conduit/gland box. (See section *Conduit/Gland kit* on page *19*.)
2. Install thin-wall conduit clamps (not supplied).



3. Install conduit/gland box.
4. Connect conduit runs to box.



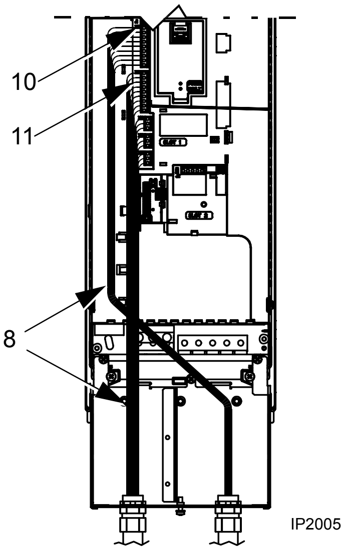
5. Route input power and motor wiring through conduits (must be separate conduit runs).
6. Strip wires.
7. Connect power, motor and ground wires to the drive terminals. See the table on the right for tightening torques.



Note: For R6 frame size, refer to section *Power terminal considerations – R6 frame size* on page *281*.

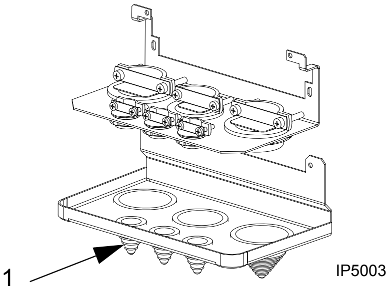
Frame size	Tightening torque	
	N·m	**lb·ft**
R1, R2	1.4	1
R3	2.5	1.8
R4	5.6; PE: 2	4; PE 1.5
R5	15	11
R6	40; PE: 8	30; PE: 6

8. Route the control cable through the conduit (must be separate from input power and motor conduit runs).
9. Strip the control cable sheathing and twist the copper shield into a bundle (pig-tail).
10. Connect the ground shield bundle (pig-tail) for digital and analog I/O cables at X1-1. (Ground only at the drive end.)
11. Strip and connect the individual control wires to the drive terminals. See section *Control terminals table* on page *24*. Use a tightening torque of 0.4 N·m (0.3 lb·ft).
12. Install the conduit/gland box cover (1 screw).

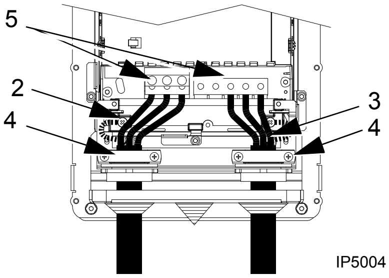


*Wiring **IP54** / UL type 12 enclosure with **cables***

1. Cut the cable seals as needed for the power, motor and control cables. The cable seals are cone-shaped, rubber seals on the bottom of the drive. The conical part of the seals must face downwards when the seals are inserted in the lead-through plate holes.



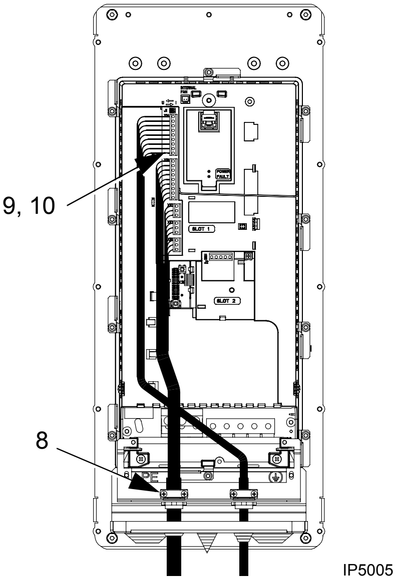
2. On the input power cable, strip the sheathing back far enough to route individual wires.
3. On the motor cable, strip the sheathing back far enough to expose the copper wire shield so that the shield can be twisted into a bundle (pig-tail). Keep the bundle not longer than five times its width to minimize noise radiation.
   360° grounding under the clamp is recommended for the motor cable to minimize noise radiation. In this case, remove the sheathing at the cable clamp.
4. Route both cables through the clamps and tighten the clamps.
5. Strip and connect the power/motor wires and the power ground wire to the drive terminals. See the table on the right for tightening torques.



Frame size	Tightening torque	
	N·m	lb·ft
R1, R2	1.4	1
R3	2.5	1.8
R4	5.6; PE: 2	4; PE 1.5
R5	15	11
R6	40; PE: 8	30; PE: 6

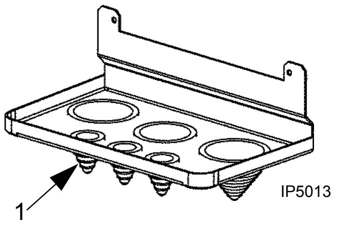
Note: For R6 frame size, refer to section *Power terminal considerations – R6 frame size* on page *281*.

6. Connect the bundle (pig-tail) created from the motor cable shield to the GND terminal.
7. Strip control cable sheathing and twist the copper shield into a bundle (pig-tail).
8. Route control cable(s) through clamp(s) and tighten clamp(s).
9. Connect the ground shield bundle (pig-tail) for digital and analog I/O cables at X1-1. (Ground only at the drive end.)
10. Strip and connect the individual control wires to the drive terminals. See section *Control terminals table* on page *24*. Use a tightening torque of 0.4 N·m (0.3 lb·ft).

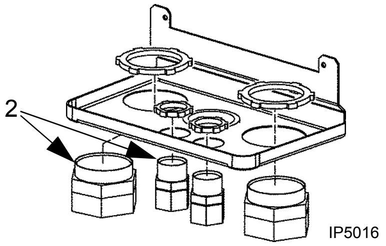


*Wiring **IP54** / UL type 12 enclosure with **conduit***

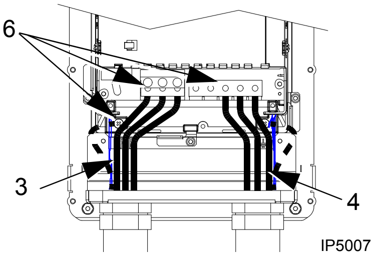
1. Remove and discard the cable seals where conduit will be installed. (The cable seals are cone-shaped, rubber seals on the bottom of the drive.)



2. For each conduit run, install water tight conduit connectors (not supplied).



3. Route the power wiring through the conduit.
4. Route the motor wiring through the conduit.
5. Strip the wires.
6. Connect the power, motor and ground wires to the drive terminals. See the table on the right for tightening torques.



Note: For R6 frame size, refer to section *Power terminal considerations – R6 frame size* on page *281*.

Frame size	Tightening torque	
	N·m	**lb·ft**
R1, R2	1.4	1
R3	2.5	1.8
R4	5.6; PE: 2	4; PE 1.5
R5	15	11
R6	40; PE: 8	30; PE: 6

7. Route the control cable through the conduit.
8. Strip the control cable sheathing and twist the copper shield into a bundle (pig-tail).
9. Connect the ground shield bundle (pig-tail) for digital and analog I/O cables at X1-1. (Ground only at the drive end.)
10. Strip and connect the individual control wires to the drive terminals. See section *Control terminals table* on page *24*. Use a tightening torque of 0.4 N·m (0.3 lb·ft).

Check installation

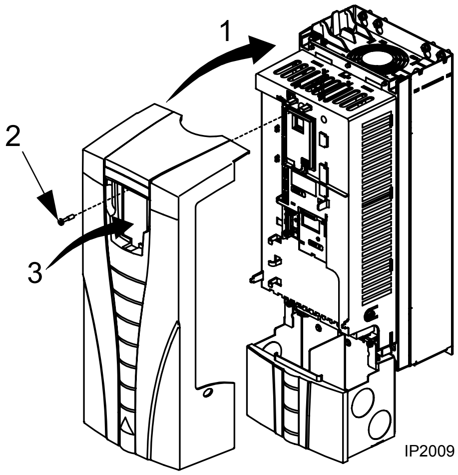
Before applying power, perform the following checks.

✓	**Check**
	Installation environment conforms to the drive's specifications for ambient conditions.
	The drive is mounted securely.
	Space around the drive meets the drive's specifications for cooling.
	The motor and driven equipment are ready for start.
	For IT systems and corner grounded TN systems: The internal EMC filter is disconnected (see section *Disconnecting the internal EMC filter* on page *23*).
	The drive is properly grounded.
	The input power (mains) voltage matches the drive nominal input voltage.
	The input power (mains) connections at U1, V1 and W1 are connected and tightened as specified.
	The input power (mains) fuses are installed.
	The motor connections at U2, V2 and W2 are connected and tightened as specified.
	The motor cable is routed away from other cables.
	NO power factor compensation capacitors are in the motor cable.
	The control connections are connected and tightened as specified.
	NO tools or foreign objects (such as drill shavings) are inside the drive.
	NO alternate power source for the motor (such as a bypass connection) is connected – no voltage is applied to the output of the drive.

Reinstall the cover

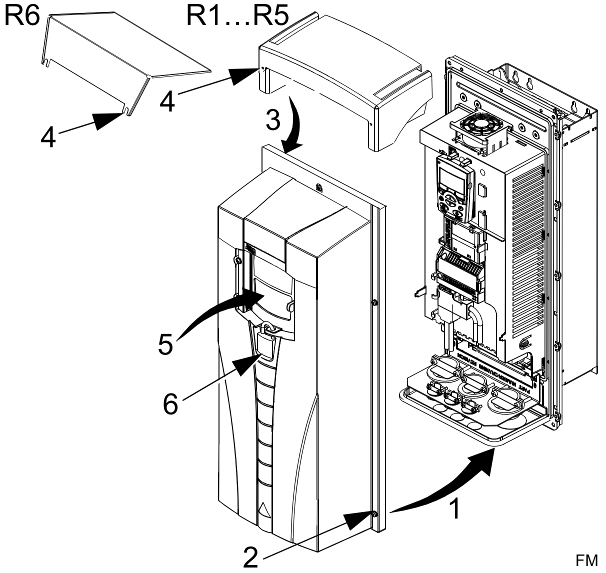
IP21 / UL type 1

1. Align the cover and slide it on.
2. Tighten the captive screw.
3. Reinstall the control panel.
4. Continue with start-up. See chapter *Start-up, control with I/O and ID Run* on page 33.



IP54 / UL type 12

1. Align the cover and slide it on.
2. Tighten the captive screws around the edge of the cover.
3. Slide the hood down over the top of the cover. (Only needed for UL type 12 installations.)
4. Install the two screws that attach the hood. (Only needed for UL type 12 installations.)
5. Install the control panel.



Note: The control panel window must be closed to comply with IP54 / UL type 12.

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6. Optional: Add a lock (not supplied) to secure the control panel window.
7. Continue with start-up. See chapter *Start-up, control with I/O and ID Run* on page 33.

Start-up, control with I/O and ID Run

The chapter instructs how to:

- perform the start-up
- start, stop, change the direction of rotation and adjust the speed of the motor through the I/O interface
- perform an Identification Run for the drive.

Using the control panel to do these tasks is explained briefly in this chapter. For details on how to use the control panel, refer to chapter *Control panels* starting on page *43*.

How to start up the drive

How you start up the drive depends on the control panel you have.

- **If you have an Assistant Control Panel**, you can either run the Start-up Assistant (see section *How to perform the guided start-up* on page *38*) or perform a limited start-up (see section *How to perform the limited start-up* on page *33*).

  The Start-up Assistant, which is included in the Assistant Control Panel only, guides you through all essential settings to be done. In the limited start-up, the drive gives no guidance; you go through the very basic settings by following the instructions given in the manual.
- **If you have a Basic Control Panel**, follow the instructions given in section *How to perform the limited start-up* on page *33.*

How to perform the limited start-up

For the limited start-up, you can use the Basic Control Panel or the Assistant Control Panel. The instructions below are valid for both control panels, but the displays shown are the Basic Control Panel displays, unless the instruction applies to the Assistant Control Panel only.

Before you start, ensure that you have the motor nameplate data on hand.

SAFETY

⚡ The start-up may only be carried out by a qualified electrician.

The safety instructions given in chapter *Safety* must be followed during the start-up procedure.

⚠ The drive will start up automatically at power up, if the external run command is on.

☐ Check the installation. See the checklist in chapter *Installation*, page *31*.

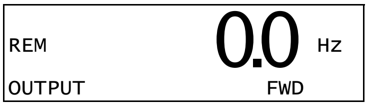
☐ Check that the starting of the motor does not cause any danger.
De-couple the driven machine if:

- there is a risk of damage in case of incorrect direction of rotation, or
- an ID Run needs to be performed during the drive start-up. ID Run is essential only in applications that require the ultimate in motor control accuracy.

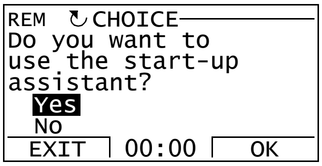
POWER-UP

☐ Apply input power.

The Basic Control Panel powers up into the Output mode.

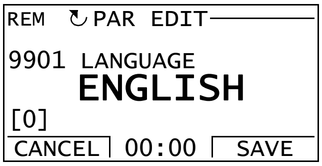


The Assistant Control Panel asks if you want to run the Start-up Assistant. If you press EXIT, the Start-up Assistant is not run, and you can continue with manual start-up in a similar manner as described below for the Basic Control Panel.



MANUAL ENTRY OF START-UP DATA (*Group 99: START-UP DATA*)

☐ If you have an Assistant Control Panel, select the language (the Basic Control Panel does not support languages). See parameter *9901* for the values of the available language alternatives. You find parameter descriptions in section *Complete parameter descriptions* starting on page *102*.

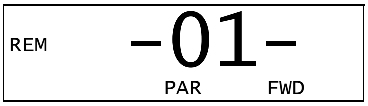


The general parameter setting procedure is described below for the Basic Control Panel. You find more detailed instructions for the Basic Control Panel on page *69*. Instructions for the Assistant Control Panel are on page *51*.

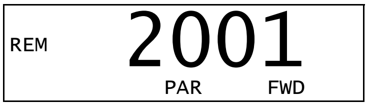
The general parameter setting procedure:

1. To go to the Main menu, press ⏎ if the bottom line shows OUTPUT; otherwise press ⏎ repeatedly until you see MENU at the bottom.

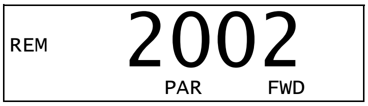
2. Press keys ▲/▼ until you see "PAr" and press ⏎.



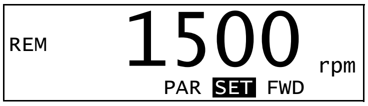
3. Find the appropriate parameter group with keys ▲/▼ and press ⏎.



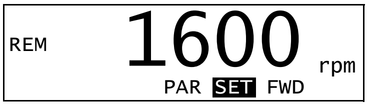
4. Find the appropriate parameter in the group with keys ▲/▼.



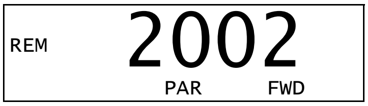
5. Press and hold ⏎ for about two seconds until the parameter value is shown with **SET** under the value.



6. Change the value with keys ▲/▼. The value changes faster while you keep the key pressed down.

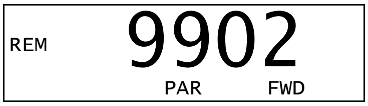


7. Save the parameter value by pressing ⏎.



☐ Select the application macro (parameter *9902*). The general parameter setting procedure is given above.

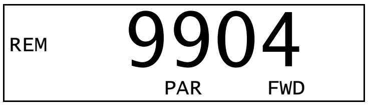
The default value 1 (ABB STANDARD) is suitable in most cases.


REM 9902 PAR FWD

☐ Select the motor control mode (parameter *9904*).

1 (VECTOR:SPEED) is suitable in most cases. 2 (VECTOR:TORQ) is suitable for torque control applications. 3 (SCALAR:FREQ) is recommended

- for multimotor drives when the number of the motors connected to the drive is variable
- when the nominal current of the motor is less than 20% of the nominal current of the drive
- when the drive is used for test purposes with no motor connected.


REM 9904 PAR FWD

☐ Enter the motor data from the motor nameplate:

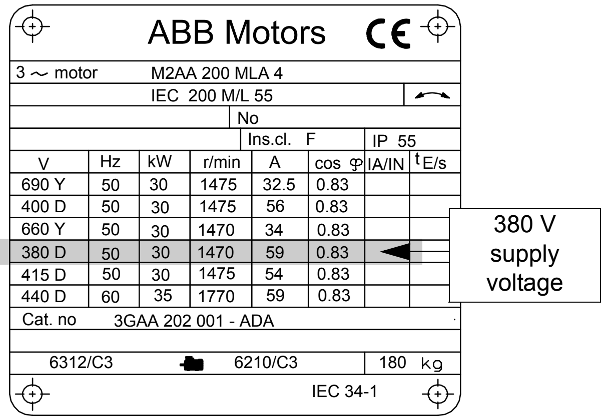


ABB Motors

3 ~ motor M2AA 200 MLA 4

IEC 200 M/L 55

No

Ins.cl. F IP 55

V	Hz	kW	r/min	A	cos φ	IA/IN	tE/s
690 Y	50	30	1475	32.5	0.83		
400 D	50	30	1475	56	0.83		
660 Y	50	30	1470	34	0.83		
380 D	50	30	1470	59	0.83		
415 D	50	30	1475	54	0.83		
440 D	60	35	1770	59	0.83		

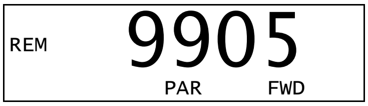
Cat. no 3GAA 202 001 - ADA

6312/C3 6210/C3 180 kg

IEC 34-1

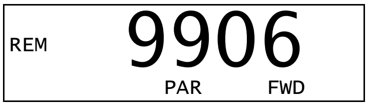
Note*:* Set the motor data to exactly the same value as on the motor nameplate. For example, if the motor nominal speed is 1470 rpm on the nameplate, setting the value of parameter *9908* MOTOR NOM SPEED to 1500 rpm results in the wrong operation of the drive.

- motor nominal voltage (parameter *9905*)

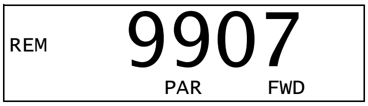

REM 9905 PAR FWD

- motor nominal current (parameter *9906*)

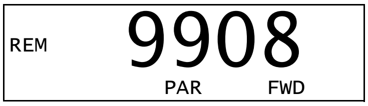
  Allowed range: 0.2…2.0 · I_{2hd} A


REM 9906 PAR FWD

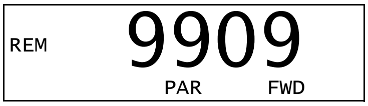
- motor nominal frequency (parameter *9907*)


REM 9907 PAR FWD

- motor nominal speed (parameter *9908*)


REM 9908 PAR FWD

- motor nominal power (parameter *9909*)


REM 9909 PAR FWD

☐ Select the motor identification method (parameter *9910*).

The default value 0 (OFF/IDMAGN) using the identification magnetization is suitable for most applications. It is applied in this basic start-up procedure. Note however that this requires that:

- parameter *9904* is set to 1 (VECTOR:SPEED) or 2 (VECTOR:TORQ), or
- parameter *9904* is set to 3 (SCALAR:FREQ) and parameter *2101* is set to 3 (SCALAR FLYST) or 5 (FLY + BOOST).

If your selection is 0 (OFF/IDMAGN), move to the next step.

Value 1 (ON), which performs a separate ID Run, should be selected if:

- vector control mode is used [parameter *9904* = 1 (VECTOR:SPEED) or 2 (VECTOR:TORQ)], and/or
- the operation point is near zero speed, and/or
- operation at torque range above the motor nominal torque over a wide speed range and without any measured speed feedback is required.

If you decide to do the ID Run [value 1 (ON)], continue by following the separate instructions given on page *41* in section *How to perform the ID Run* and then return to step *DIRECTION OF THE MOTOR ROTATION* on page *36*.

IDENTIFICATION MAGNETIZATION WITH ID RUN SELECTION 0 (OFF/IDMAGN)

☐ As stated above, the identification magnetization is performed only if:

- parameter *9904* is set to 1 (VECTOR:SPEED) or 2 (VECTOR:TORQ), or
- parameter *9904* is set to 3 (SCALAR:FREQ) and parameter *2101* is set to 3 (SCALAR FLYST) or 5 (FLY + BOOST).

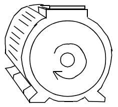
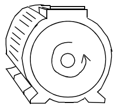
Press key LOC REM to switch to local control (LOC shown on the left).

Press ◇ to start the drive. The motor model is now calculated by magnetizing the motor for 10 to 15 s at zero speed (motor not rotating).

DIRECTION OF THE MOTOR ROTATION

☐ Check the direction of the motor rotation.

- If the drive is in remote control (REM shown on the left), switch to local control by pressing LOC REM.
- To go to the Main menu, press ◸ if the bottom line shows OUTPUT; otherwise press ◹ repeatedly until you see MENU at the bottom.
- Press keys ▲/▼ until you see “rEF” and press ◸.
- Increase the frequency reference from zero to a small value with key ▲.
- Press ◇ to start the motor.
- Check that the actual direction of the motor is the same as indicated on the display (FWD means forward and REV reverse).
- Press ▽ to stop the motor.

	To change the direction of the motor rotation: • Disconnect input power from the drive, and wait 5 minutes for the intermediate circuit capacitors to discharge. Measure the voltage between each input terminal (U1, V1 and W1) and earth with a multimeter to ensure that the drive is discharged. • Exchange the position of two motor cable phase conductors at the drive output terminals or at the motor connection box. • Verify your work by applying input power and repeating the check as described above.	 
	SPEED LIMITS AND ACCELERATION/DECELERATION TIMES	
☐	Set the minimum speed (parameter *2001*).	LOC 2001 PAR FWD
☐	Set the maximum speed (parameter *2002*).	LOC 2002 PAR FWD
☐	Set the acceleration time 1 (parameter *2202*). **Note:** Check also acceleration time 2 (parameter *2205*) if two acceleration times will be used in the application.	LOC 2202 PAR FWD
☐	Set the deceleration time 1 (parameter *2203*). **Note:** Set also deceleration time 2 (parameter *2206*) if two deceleration times will be used in the application.	LOC 2203 PAR FWD
	SAVING A USER PARAMETER SET AND FINAL CHECK	
☐	The start-up is now completed. However, it might be useful at this stage to set the parameters required by your application and save the settings as a user parameter set as instructed in section *User parameter sets* on page *83*.	LOC 9902 PAR FWD
☐	Check that the drive state is OK. Basic Control Panel: Check that there are no faults or alarms shown on the display. If you want to check the LEDs on the front of the drive, switch first to remote control (otherwise a fault is generated) before removing the panel and verifying that the red LED is not lit and the green LED is lit but not blinking. Assistant Control Panel: Check that there are no faults or alarms shown on the display and that the panel LED is green and does not blink.	
	The drive is now ready for use.	

How to perform the guided start-up

To be able to perform the guided start-up, you need the Assistant Control Panel.

Before you start, ensure that you have the motor nameplate data on hand.

SAFETY

⚠ The start-up may only be carried out by a qualified electrician.

The safety instructions given in chapter *Safety* must be followed during the start-up procedure.

⚠ The drive will start up automatically at power up, if the external run command is on.

☐ Check the installation. See the checklist in chapter *Installation*, page *31*.

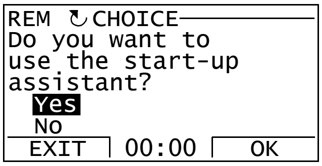
☐ Check that the starting of the motor does not cause any danger.
De-couple the driven machine if:

- there is a risk of damage in case of incorrect direction of rotation, or
- an ID Run needs to be performed during the drive start-up. ID Run is essential only in applications that require the ultimate in motor control accuracy.

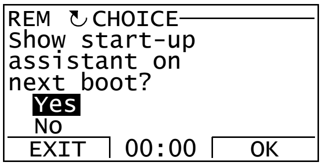
POWER-UP

☐ Apply input power. The control panel first asks if you want to use the Start-up Assistant.

- Press OK (when **Yes** is highlighted) to run the Start-up Assistant.
- Press EXIT if you do not want to run the Start-up Assistant.
- Press key ▼ to highlight **No** and then press OK if you want to make the panel ask (or not ask) the question about running the Start-up Assistant again the next time you switch on the power to the drive.



```
REM ↻CHOICE
Do you want to
use the start-up
assistant?
  Yes
  No
EXIT   00:00   OK
```

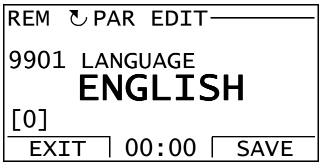


```
REM ↻CHOICE
Show start-up
assistant on
next boot?
  Yes
  No
EXIT   00:00   OK
```

SELECTING THE LANGUAGE

☐ If you decided to run the Start-up Assistant, the display then asks you to select the language. Scroll to the desired language with keys ▲/▼ and press SAVE to accept.

If you press EXIT, the Start-up Assistant is stopped.



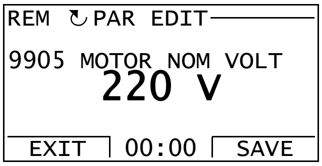
```
REM ↻PAR EDIT

9901 LANGUAGE
     ENGLISH
[0]
EXIT   00:00   SAVE
```

STARTING THE GUIDED SET-UP

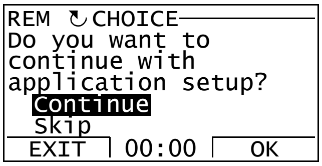
☐ The Start-up Assistant now guides you through the set-up tasks, starting with the motor set-up. Set the motor data to exactly the same value as on the motor nameplate.

Scroll to the desired parameter value with keys ▲/▼ and press SAVE to accept and continue with the Start-up Assistant.

Note: At any time, if you press EXIT, the Start-up Assistant is stopped and the display goes to the Output mode.



```
REM ↻PAR EDIT

9905 MOTOR NOM VOLT
      220 V

EXIT   00:00   SAVE
```

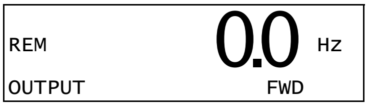
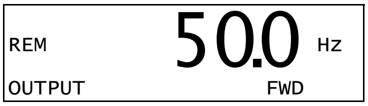
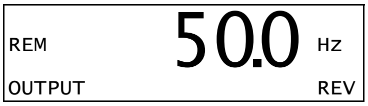
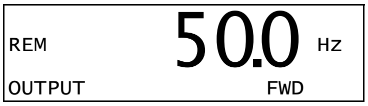
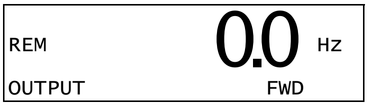
☐	After completing a set-up task, the Start-up Assistant suggests the next one. • Press OK (when Continue is highlighted) to continue with the suggested task. • Press key ▼ to highlight Skip and then press OK to move to the following task without doing the suggested task. • Press EXIT to stop the Start-up Assistant.	 REM ↻CHOICE Do you want to continue with application setup? Continue Skip EXIT 00:00 OK
	SAVING A USER PARAMETER SET AND FINAL CHECK	
☐	The start-up is now completed. However, it might be useful at this stage to set the parameters required by your application and save the settings as a user parameter set as instructed in section *User parameter sets* on page *83*.	
☐	After the whole set-up is completed, check there are no faults or alarms shown on the display and the panel LED is green and does not blink.	
	The drive is now ready for use.	

How to control the drive through the I/O interface

The table below instructs how to operate the drive through the digital and analog inputs when:

- the motor start-up is performed, and
- the default (standard) parameter settings are valid.

Displays of the Basic Control Panel are shown as an example.

<table>
<tr><th colspan="2">PRELIMINARY SETTINGS</th></tr>
<tr><td>If you need to change the direction of rotation, check that parameter <i>1003</i> is set to 3 (REQUEST).</td><td></td></tr>
<tr><td>Ensure that the control connections are wired according to the connection diagram given for the ABB Standard macro.</td><td>See section <i>ABB Standard macro</i> on page <i>74</i>.</td></tr>
<tr><td>Ensure that the drive is in remote control. Press key LOC REM to switch between remote and local control.</td><td>In remote control, the panel display shows text REM.</td></tr>
<tr><th colspan="2">STARTING AND CONTROLLING THE SPEED OF THE MOTOR</th></tr>
<tr><td>Start by switching digital input DI1 on.
Assistant Control Panel: The arrow starts rotating. It is dotted until the setpoint is reached.
Basic Control Panel: Text FWD starts flashing fast and stops after the setpoint is reached</td><td>REM 0.0 Hz
OUTPUT FWD</td></tr>
<tr><td>Regulate the drive output frequency (motor speed) by adjusting the voltage of analog input AI1.</td><td>REM 50.0 Hz
OUTPUT FWD</td></tr>
<tr><th colspan="2">CHANGING THE DIRECTION OF ROTATION OF THE MOTOR</th></tr>
<tr><td>Reverse direction: Switch digital input DI2 on.</td><td>REM 50.0 Hz
OUTPUT REV</td></tr>
<tr><td>Forward direction: Switch digital input DI2 off.</td><td>REM 50.0 Hz
OUTPUT FWD</td></tr>
<tr><th colspan="2">STOPPING THE MOTOR</th></tr>
<tr><td>Switch digital input DI1 off. The motor stops.
Assistant Control Panel: The arrow stops rotating.
Basic Control Panel: Text FWD starts flashing slowly.</td><td>REM 0.0 Hz
OUTPUT FWD</td></tr>
</table>

How to perform the ID Run

The drive estimates motor characteristics automatically using identification magnetization when the drive is started for the first time and after any motor parameter (*Group 99: START-UP DATA*) is changed. This is valid when parameter *9910* ID RUN has value 0 (OFF/IDMAGN), and

- parameter *9904* = 1 (VECTOR:SPEED) or 2 (VECTOR:TORQ), or
- parameter *9904* = 3 (SCALAR:FREQ) and parameter *2101* = 3 (SCALAR FLYST) or 5 (FLY + BOOST).

In most applications there is no need to perform a separate ID Run [*9910* ID RUN = 1 (ON)]. The ID Run should be selected if:

- vector control mode is used [parameter *9904* = 1 (VECTOR:SPEED) or 2 (VECTOR:TORQ)], and/or
- the operation point is near zero speed, and/or
- operation at torque range above the motor nominal torque over a wide speed range and without any measured speed feedback is required.

Note: If motor parameters (*Group 99: START-UP DATA*) are changed after the ID Run, it must be repeated.

ID Run procedure

The general parameter setting procedure is not repeated here. For Assistant Control Panel see page *51* and for Basic Control Panel page *69* in chapter *Control panels*.

PRE-CHECK

WARNING! The motor will run at up to approximately 50…80% of the nominal speed during the ID Run. The motor will rotate in the forward direction. **Ensure that it is safe to run the motor before performing the ID Run!**

☐ De-couple the motor from the driven equipment.

☐ Check that the values of the motor data parameters *9905*…*9909* are equivalent to those on the motor nameplate, as shown in the steps on page *35*.

☐ If parameter values (*Group 01: OPERATING DATA* to *Group 98: OPTIONS*) are changed before the ID Run, check that the new settings meet the following conditions:

☐ *2001* MINIMUM SPEED ≤ 0 rpm

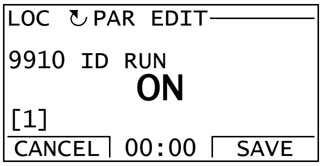
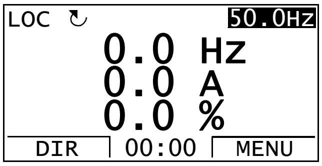
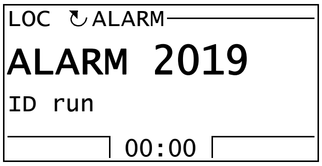
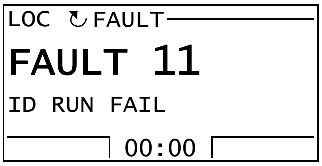
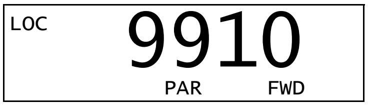
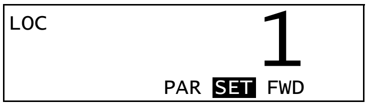
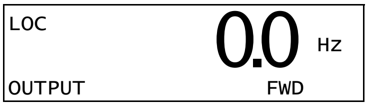
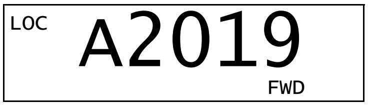
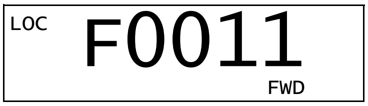
☐ *2002* MAXIMUM SPEED > 80% of the motor rated speed

☐ *2003* MAXIMUM CURRENT ≥ I_{2hd}

☐ *2017* MAX TORQUE 1 > 50% or *2018* MAX TORQUE 2 > 50%, depending on which limit is in use according to parameter *2014* MAX TORQUE SEL.

☐ Check that the Run Enable signal is on (parameter *1601*).

☐ Ensure that the panel is in local control (LOC shown on the left / at the top). Press key LOC REM to switch between local and remote control.

ID RUN WITH THE ASSISTANT CONTROL PANEL		
☐	Change parameter *9910* ID RUN to 1 (ON). Save the new setting by pressing SAVE.	 LOC ↻PAR EDIT 9910 ID RUN ON [1] CANCEL 00:00 SAVE
☐	If you want to monitor actual values during the ID Run, go to the Output mode by pressing EXIT repeatedly until you get there.	 LOC ↻ 50.0Hz 0.0 Hz 0.0 A 0.0 % DIR 00:00 MENU
☐	Press to start the ID Run. The panel keeps switching between the display that was shown when you started the ID Run and the alarm display presented on the right. In general, it is recommended not to press any control panel keys during the ID Run. However, you can stop the ID Run at any time by pressing . After the ID Run is completed, the alarm display is not shown any more. If the ID Run fails, the fault display presented on the right is shown.	 LOC ↻ALARM ALARM 2019 ID run 00:00  LOC ↻FAULT FAULT 11 ID RUN FAIL 00:00
ID RUN WITH THE BASIC CONTROL PANEL		
☐	Change parameter *9910* ID RUN to 1 (ON). Save the new setting by pressing .	 LOC 9910 PAR FWD  LOC 1 PAR SET FWD
☐	If you want to monitor actual values during the ID Run, go to the Output mode by pressing repeatedly until you get there.	 LOC 0.0 Hz OUTPUT FWD
☐	Press to start the ID Run. The panel keeps switching between the display that was shown when you started the ID Run and the alarm display presented on the right. In general, it is recommended not to press any control panel keys during the ID Run. However, you can stop the ID Run at any time by pressing . After the ID Run is completed, the alarm display is not shown any more. If the ID Run fails, the fault display presented on the right is shown.	 LOC A2019 FWD  LOC F0011 FWD

Control panels

About control panels

Use a control panel to control the drive, read status data and adjust parameters. The drive works with either of two different control panel types:

- Basic Control Panel – This panel (described in section *Basic Control Panel* on page *64*) provides basic tools for manual entry of parameter values.
- Assistant Control Panel – This panel (described below) includes pre-programmed assistants to automate the most common parameter setups. The panel provides language support. It is available with different language sets.

Compatibility

The manual is compatible with the following panel versions:

- Basic Control Panel: ACS-CP-C Rev. M or later
- Assistant Control Panel (Area 1): ACS-CP-A Rev. F or later (new panel series manufactured since 2007 with serial number XYYWWRXXXX, where year YY = 07 or greater and revision R = F, G, E, …)
- Assistant Control Panel (Asia): ACS-CP-D Rev. Q or later

See page *47* for how to find out the version of your Assistant Control Panel. See parameter *9901* LANGUAGE to see the languages supported by the different Assistant Control Panels.

Assistant Control Panel

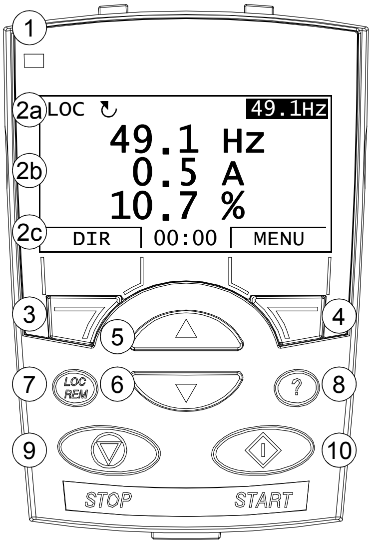
Features

The Assistant Control Panel features:

- alphanumeric control panel with an LCD display
- language selection for the display
- Start-up Assistant to ease drive commissioning
- copy function – parameters can be copied to the control panel memory for later transfer to other drives or for backup of a particular system.
- context sensitive help
- real time clock.

Overview

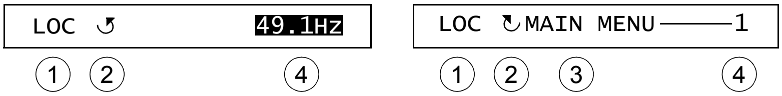
The following table summarizes the key functions and displays on the Assistant Control Panel.



No.	Use
1	Status LED – Green for normal operation. If LED is flashing, or red, see section *Diagnostic displays* on page *253*.
2	LCD display – Divided into three main areas: a. Status line – variable, depending on the mode of operation, see section *Status line* on page *45*. b. Center – variable; in general, shows signal and parameter values, menus or lists. Shows also faults and alarms. c. Bottom line – shows current functions of the two soft keys and, if enabled, the clock display.
3	Soft key 1 – Function depends on the context. The text in the lower left corner of the LCD display indicates the function.
4	Soft key 2 – Function depends on the context. The text in the lower right corner of the LCD display indicates the function.
5	Up – • Scrolls up through a menu or list displayed in the center of the LCD display. • Increments a value if a parameter is selected. • Increments the reference value if the upper right corner is highlighted. Holding the key down changes the value faster.
6	Down – • Scrolls down through a menu or list displayed in the center of the LCD display. • Decrements a value if a parameter is selected. • Decrements the reference value if the upper right corner is highlighted. Holding the key down changes the value faster.
7	LOC/REM – Changes between local and remote control of the drive.
8	Help – Displays context sensitive information when the key is pressed. The information displayed describes the item currently highlighted in the center of the display.
9	STOP – Stops the drive in local control.
10	START – Starts the drive in local control.

Status line

The top line of the LCD display shows the basic status information of the drive.



No.	Field	Alternatives	Significance
1	Control location	LOC	Drive control is local, that is, from the control panel.
		REM	Drive control is remote, such as the drive I/O or fieldbus.
2	State	↻	Forward shaft direction
		↺	Reverse shaft direction
		Rotating arrow	Drive is running at setpoint.
		Dotted rotating arrow	Drive is running but not at setpoint.
		Stationary arrow	Drive is stopped.
		Dotted stationary arrow	Start command is present, but the motor is not running, e.g. because start enable is missing.
3	Panel operation mode		• Name of the current mode • Name of the list or menu shown • Name of the operation state, e.g. PAR EDIT.
4	Reference value or number of the selected item		• Reference value in the Output mode • Number of the highlighted item, e.g mode, parameter group or fault.

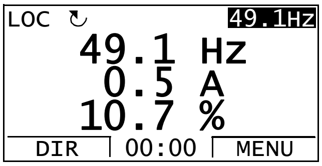
Operation

You operate the control panel with menus and keys. The keys include two context-sensitive soft keys, whose current function is indicated by the text shown in the display above each key.

You select an option, e.g. operation mode or parameter, by scrolling the ▲ and ▼ arrow keys until the option is highlighted (in reverse video) and then pressing the relevant soft key. With the right soft key you usually enter a mode, accept an option or save the changes. The left soft key is used to cancel the made changes and return to the previous operation level.

The Assistant Control Panel has nine panel modes: Output, Parameters, Assistants, Changed Parameters, Fault Logger, Time and Date, Parameter Backup, I/O Settings and Fault. The operation in the first eight modes is described in this chapter. When a fault or alarm occurs, the panel goes automatically to the Fault mode showing the fault or alarm. You can reset it in the Output or Fault mode (see chapter *Diagnostics*).

Initially, the panel is in the Output mode, where you can start, stop, change the direction, switch between local and remote control, modify the reference value and monitor up to three actual values. To do other tasks, go first to the Main menu and select the appropriate mode on the menu. The status line (see section *Status line* on page *45*) shows the name of the current menu, mode, item or state.

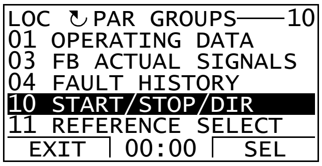
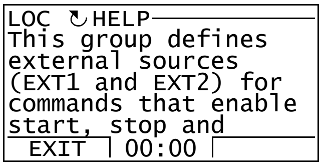
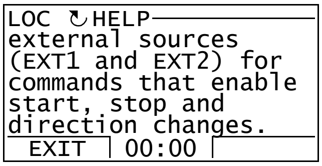
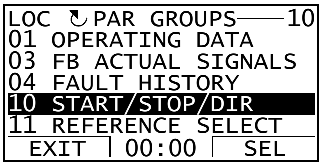


How to do common tasks

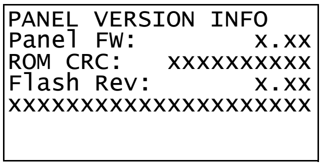
The table below lists common tasks, the mode in which you can perform them and the page number where the steps to do the task are described in detail.

Task	**Mode**	**Page**
How to get help	Any	*47*
How to find out the panel version	At power up	*47*
How to adjust the display contrast	Output	*50*
How to switch between local and remote control	Any	*48*
How to start and stop the drive	Any	*48*
How to change the direction of the motor rotation	Output	*49*
How to set the speed, frequency or torque reference	Output	*50*
How to change the value of a parameter	Parameters	*51*
How to select the monitored signals	Parameters	*52*
How to do guided tasks (specification of related parameter sets) with assistants	Assistants	*53*
How to view and edit changed parameters	Changed Parameters	*56*
How to view faults	Fault Logger	*57*
How to reset faults and alarms	Output, Fault	*259*
How to show/hide the clock, change date and time formats, set the clock and enable/disable automatic clock transitions according to the daylight saving changes	Time and Date	*58*
How to copy parameters from the drive to the control panel	Parameter Backup	*61*
How to restore parameters from the control panel to the drive	Parameter Backup	*61*
How to view backup information	Parameter Backup	*62*
How to edit and change parameter settings related to I/O terminals	I/O Settings	*63*

How to get help

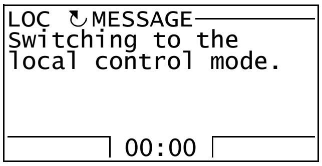
Step	Action	Display
1.	Press ? to read the context-sensitive help text for the item that is highlighted. If help text exists for the item, it is shown on the display.	 LOC ↻PAR GROUPS 10 01 OPERATING DATA 03 FB ACTUAL SIGNALS 04 FAULT HISTORY 10 START/STOP/DIR 11 REFERENCE SELECT EXIT 00:00 SEL  LOC ↻HELP This group defines external sources (EXT1 and EXT2) for commands that enable start, stop and EXIT 00:00
2.	If the whole text is not visible, scroll the lines with keys ▲ and ▼.	 LOC ↻HELP external sources (EXT1 and EXT2) for commands that enable start, stop and direction changes. EXIT 00:00
3.	After reading the text, return to the previous display by pressing EXIT.	 LOC ↻PAR GROUPS 10 01 OPERATING DATA 03 FB ACTUAL SIGNALS 04 FAULT HISTORY 10 START/STOP/DIR 11 REFERENCE SELECT EXIT 00:00 SEL

How to find out the panel version

Step	Action	Display
1.	If the power is switched on, switch it off.	
2.	Keep key ? pressed down while you switch on the power and read the information. The display shows the following panel information: Panel FW: panel firmware version ROM CRC: panel ROM check sum Flash Rev: flash content version Flash content comment. When you release the ? key, the panel goes to the Output mode.	 PANEL VERSION INFO Panel FW: x.xx ROM CRC: xxxxxxxxxx Flash Rev: x.xx xxxxxxxxxxxxxxxxxxxxx

How to start, stop and switch between local and remote control

You can start, stop and switch between local and remote control in any mode. To be able to start or stop the drive, the drive must be in local control.

Step	Action	Display
1.	• To switch between remote control (REM shown on the status line) and local control (LOC shown on the status line), press (LOC REM). **Note:** Switching to local control can be disabled with parameter *1606* LOCAL LOCK. The very first time the drive is powered up, it is in remote control (REM) and controlled through the drive I/O terminals. To switch to local control (LOC) and control the drive using the control panel, press (LOC REM). The result depends on how long you press the key: • If you release the key immediately (the display flashes "Switching to the local control mode"), the drive stops. Set the local control reference as instructed on page *50*. • If you press the key for about two seconds, the drive continues as before. The drive copies the current remote values for the run/stop status and the reference, and uses them as the initial local control settings. • To stop the drive in local control, press ▽. • To start the drive in local control, press ◇.	 LOC ↻MESSAGE Switching to the local control mode. 00:00 The arrow (↻ or ↺) on the status line stops rotating. The arrow (↻ or ↺) on the status line starts rotating. It is dotted until the drive reaches the setpoint.

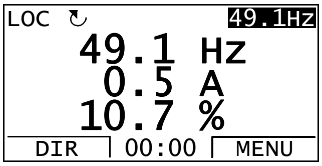
Output mode

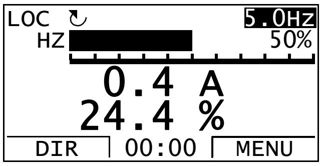
In the Output mode, you can:

- monitor actual values of up to three signals in *Group 01: OPERATING DATA*
- change the direction of the motor rotation
- set the speed, frequency or torque reference
- adjust the display contrast
- start, stop, change the direction and switch between local and remote control.

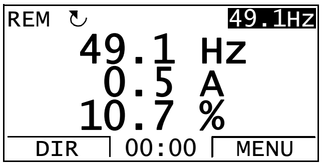
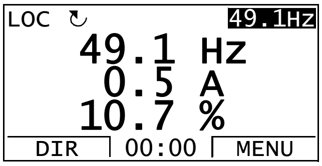
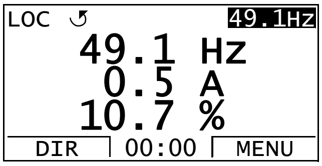
You get to the Output mode by pressing EXIT repeatedly.

The top right corner of the display shows the reference value. The center can be configured to show up to three signal values or bar graphs. If just one or two signals are selected for display, the number and name of each displayed signal are shown in addition to the value or bar graph. See page 52 for instructions on selecting and modifying the monitored signals.

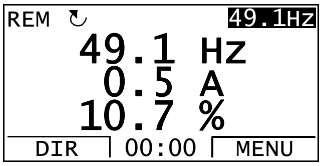
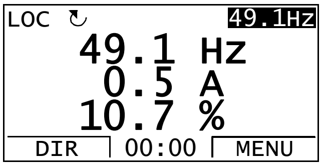
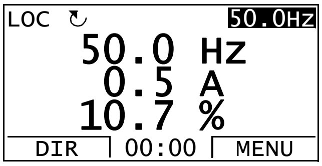

LOC ↻ 49.1Hz
49.1 Hz
0.5 A
10.7 %
DIR 00:00 MENU


LOC ↻ 5.0Hz
HZ 50%
0.4 A
24.4 %
DIR 00:00 MENU

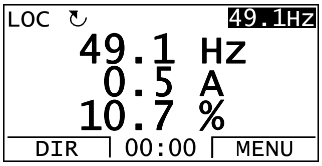
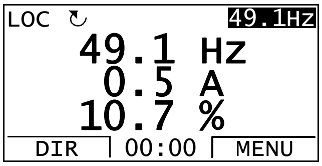
How to change the direction of the motor rotation

Step	Action	Display
1.	If you are not in the Output mode, press EXIT repeatedly until you get there.	 REM ↻ 49.1Hz 49.1 Hz 0.5 A 10.7 % DIR 00:00 MENU
2.	If the drive is in remote control (REM shown on the status line), switch to local control by pressing LOC REM. The display briefly shows a message about changing the mode and then returns to the Output mode.	 LOC ↻ 49.1Hz 49.1 Hz 0.5 A 10.7 % DIR 00:00 MENU
3.	To change the direction from forward (↻ shown on the status line) to reverse (↺ shown on the status line), or vice versa, press DIR. **Note**: Parameter *1003* DIRECTION must be set to 3 (REQUEST).	 LOC ↺ 49.1Hz 49.1 Hz 0.5 A 10.7 % DIR 00:00 MENU

How to set the speed, frequency or torque reference

Step	Action	Display
1.	If you are not in the Output mode, press EXIT repeatedly until you get there.	 REM ↻ 49.1Hz 49.1 Hz 0.5 A 10.7 % DIR 00:00 MENU
2.	If the drive is in remote control (REM shown on the status line), switch to local control by pressing LOC REM. The display briefly shows a message about changing the mode and then returns to the Output mode. **Note**: With *Group 11: REFERENCE SELECT*, you can allow the reference modification in remote control.	 LOC ↻ 49.1Hz 49.1 Hz 0.5 A 10.7 % DIR 00:00 MENU
3.	• To increase the highlighted reference value shown in the top right corner of the display, press ▲. The value changes immediately. It is stored in the drive permanent memory and restored automatically after power switch-off. • To decrease the value, press ▼.	 LOC ↻ 50.0Hz 50.0 Hz 0.5 A 10.7 % DIR 00:00 MENU

How to adjust the display contrast

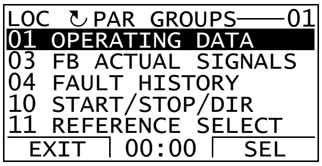
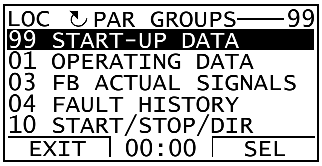
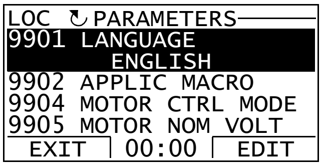
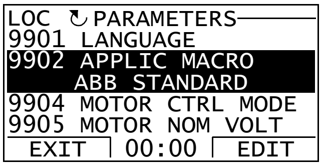
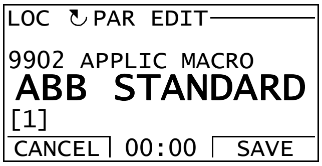
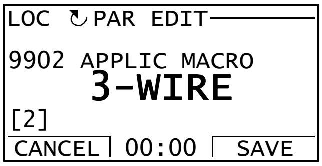
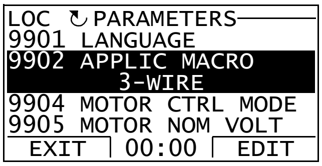
Step	Action	Display
1.	If you are not in the Output mode, press EXIT repeatedly until you get there.	 LOC ↻ 49.1Hz 49.1 Hz 0.5 A 10.7 % DIR 00:00 MENU
2.	• To increase the contrast, press keys MENU and ▲ simultaneously. • To decrease the contrast, press keys MENU and ▼ simultaneously.	 LOC ↻ 49.1Hz 49.1 Hz 0.5 A 10.7 % DIR 00:00 MENU

Parameters mode

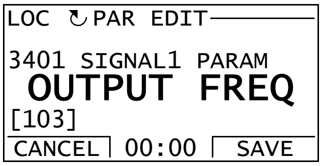
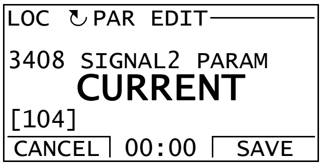
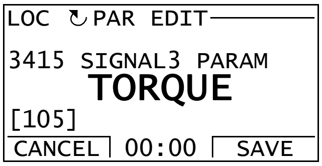
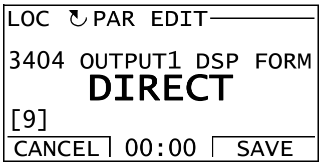
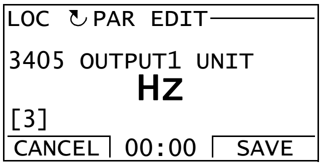
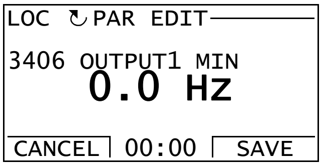
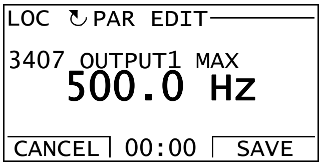
In the Parameters mode, you can:

- view and change parameter values
- start, stop, change the direction and switch between local and remote control.

How to select a parameter and change its value

Step	Action	Display
1.	Go to the Main menu by pressing MENU if you are in the Output mode, otherwise by pressing EXIT repeatedly until you get to the Main menu.	 LOC ↻MAIN MENU 1 PARAMETERS ASSISTANTS CHANGED PAR EXIT 00:00 ENTER
2.	Go to the Parameters mode by selecting PARAMETERS on the menu with keys ▲ and ▼, and pressing ENTER.	 LOC ↻PAR GROUPS 01 01 OPERATING DATA 03 FB ACTUAL SIGNALS 04 FAULT HISTORY 10 START/STOP/DIR 11 REFERENCE SELECT EXIT 00:00 SEL
3.	Select the appropriate parameter group with keys ▲ and ▼.	 LOC ↻PAR GROUPS 99 99 START-UP DATA 01 OPERATING DATA 03 FB ACTUAL SIGNALS 04 FAULT HISTORY 10 START/STOP/DIR EXIT 00:00 SEL
	Press SEL.	 LOC ↻PARAMETERS 9901 LANGUAGE ENGLISH 9902 APPLIC MACRO 9904 MOTOR CTRL MODE 9905 MOTOR NOM VOLT EXIT 00:00 EDIT
4.	Select the appropriate parameter with keys ▲ and ▼. The current value of the parameter is shown below the selected parameter.	 LOC ↻PARAMETERS 9901 LANGUAGE 9902 APPLIC MACRO ABB STANDARD 9904 MOTOR CTRL MODE 9905 MOTOR NOM VOLT EXIT 00:00 EDIT
	Press EDIT.	 LOC ↻PAR EDIT 9902 APPLIC MACRO ABB STANDARD [1] CANCEL 00:00 SAVE
5.	Specify a new value for the parameter with keys ▲ and ▼. Pressing the key once increments or decrements the value. Holding the key down changes the value faster. Pressing the keys simultaneously replaces the displayed value with the default value.	 LOC ↻PAR EDIT 9902 APPLIC MACRO 3-WIRE [2] CANCEL 00:00 SAVE
6.	• To save the new value, press SAVE. • To cancel the new value and keep the original, press CANCEL.	 LOC ↻PARAMETERS 9901 LANGUAGE 9902 APPLIC MACRO 3-WIRE 9904 MOTOR CTRL MODE 9905 MOTOR NOM VOLT EXIT 00:00 EDIT

How to select the monitored signals

Step	Action	Display
1.	You can select which signals are monitored in the Output mode and how they are displayed with *Group 34: PANEL DISPLAY* parameters. See page *51* for detailed instructions on changing parameter values. By default, the display shows three signals. The particular default signals depend on the value of parameter *9902* APPLIC MACRO: For macros whose default value of parameter *9904* MOTOR CTRL MODE is 1 (VECTOR:SPEED), the default for signal 1 is *0102* SPEED, otherwise *0103* OUTPUT FREQ. The defaults for signals 2 and 3 are always *0104* CURRENT and *0105* TORQUE, respectively. To change the default signals, select up to three signals from *Group 01: OPERATING DATA* to be shown. Signal 1: Change the value of parameter *3401* SIGNAL1 PARAM to the index of the signal parameter in *Group 01: OPERATING DATA* (= number of the parameter without the leading zero), e.g. 105 means parameter *0105* TORQUE. Value 100 means that no signal is displayed. Repeat for signals 2 (*3408* SIGNAL2 PARAM) and 3 (*3415* SIGNAL3 PARAM).	 LOC ↻PAR EDIT 3401 SIGNAL1 PARAM OUTPUT FREQ [103] CANCEL 00:00 SAVE  LOC ↻PAR EDIT 3408 SIGNAL2 PARAM CURRENT [104] CANCEL 00:00 SAVE  LOC ↻PAR EDIT 3415 SIGNAL3 PARAM TORQUE [105] CANCEL 00:00 SAVE
2.	Select how you want the signals to be displayed: as a decimal number or a bar graph. For decimal numbers, you can specify the decimal point location, or use the decimal point location and unit of the source signal [setting (9 (DIRECT)]. For details, see parameter *3404*. Signal 1: parameter *3404* OUTPUT1 DSP FORM Signal 2: parameter *3411* OUTPUT2 DSP FORM Signal 3: parameter *3418* OUTPUT3 DSP FORM.	 LOC ↻PAR EDIT 3404 OUTPUT1 DSP FORM DIRECT [9] CANCEL 00:00 SAVE
3.	Select the units to be displayed for the signals. This has no effect if parameter *3404*/*3411*/*3418* is set to 9 (DIRECT). For details, see parameter *3405*. Signal 1: parameter *3405* OUTPUT1 UNIT Signal 2: parameter *3412* OUTPUT2 UNIT Signal 3: parameter *3419* OUTPUT3 UNIT.	 LOC ↻PAR EDIT 3405 OUTPUT1 UNIT Hz [3] CANCEL 00:00 SAVE
4.	Select the scalings for the signals by specifying the minimum and maximum display values. This has no effect if parameter *3404*/*3411*/*3418* is set to 9 (DIRECT). For details, see parameters *3406* and *3407*. Signal 1: parameters *3406* OUTPUT1 MIN and *3407* OUTPUT1 MAX Signal 2: parameters *3413* OUTPUT2 MIN and *3414* OUTPUT2 MAX Signal 3: parameters *3420* OUTPUT3 MIN and *3421* OUTPUT3 MAX.	 LOC ↻PAR EDIT 3406 OUTPUT1 MIN 0.0 Hz CANCEL 00:00 SAVE  LOC ↻PAR EDIT 3407 OUTPUT1 MAX 500.0 Hz CANCEL 00:00 SAVE

Assistants mode

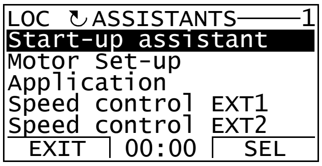
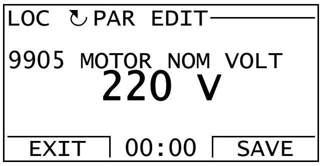
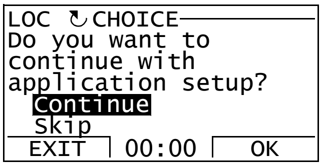
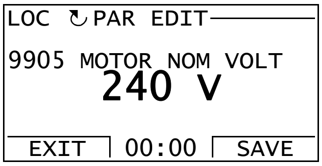
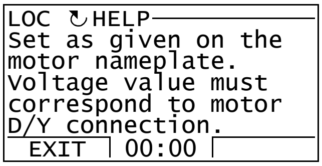
When the drive is first powered up, the Start-up Assistant guides you through the setup of the basic parameters. The Start-up Assistant is divided into assistants, each of which guides you through the task of specifying a related parameter set, for example Motor Set-up or PID Control. You can activate the assistants one after the other as the Start-up Assistant suggests, or independently. The tasks of the assistants are listed in the table on page 54.

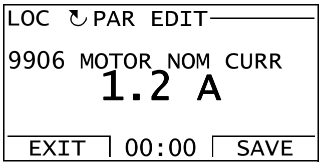
In the Assistants mode, you can:

- use assistants to guide you through the specification of a set of basic parameters
- start, stop, change the direction and switch between local and remote control.

How to use an assistant

The table below shows the basic operation sequence which leads you through assistants. The Motor Set-up Assistant is used as an example.

Step	Action	Display
1.	Go to the Main menu by pressing MENU if you are in the Output mode, otherwise by pressing EXIT repeatedly until you get to the Main menu.	 LOC ↻MAIN MENU 1 PARAMETERS ASSISTANTS CHANGED PAR EXIT 00:00 ENTER
2.	Go to the Assistants mode by selecting ASSISTANTS on the menu with keys ▲ and ▼, and pressing ENTER.	 LOC ↻ASSISTANTS 1 Start-up assistant Motor Set-up Application Speed control EXT1 Speed control EXT2 EXIT 00:00 SEL
3.	Select the assistant with keys ▲ and ▼, and press SEL. If you select any other assistant than the Start-up Assistant, it guides you through the task of specification of its parameter set as shown in steps 4. and 5. below. After that you can select another assistant on the Assistants menu or exit the Assistants mode. The Motor Set-up Assistant is used here as an example. If you select the Start-up Assistant, it activates the first assistant, which guides you through the task of specification of its parameter set as shown in steps 4. and 5. below. The Start-up Assistant then asks if you want to continue with the next assistant or skip it – select the appropriate answer with keys ▲ and ▼, and press SEL. If you choose to skip, the Start-up Assistant asks the same question about the next assistant, and so on.	 LOC ↻PAR EDIT 9905 MOTOR NOM VOLT 220 V EXIT 00:00 SAVE  LOC ↻CHOICE Do you want to continue with application setup? Continue Skip EXIT 00:00 OK
4.	• To specify a new value, press keys ▲ and ▼. • To ask for information on the requested parameter, press key ?. Scroll the help text with keys ▲ and ▼. Close the help by pressing EXIT.	 LOC ↻PAR EDIT 9905 MOTOR NOM VOLT 240 V EXIT 00:00 SAVE  LOC ↻HELP Set as given on the motor nameplate. Voltage value must correspond to motor D/Y connection. EXIT 00:00

Step	Action	Display
5.	• To accept the new value and continue to the setting of the next parameter, press SAVE. • To stop the assistant, press EXIT.	LOC ↻PAR EDIT 9906 MOTOR NOM CURR 1.2 A EXIT 00:00 SAVE

The table below lists the tasks of the assistants and the relevant drive parameters. Depending on the selection made in the Application task (parameter *9902* APPLIC MACRO), the Start-up Assistant decides, which consequent tasks it suggests.

Name	Description	Set parameters
Language select	Selecting the language	*9901*
Motor set-up	Setting the motor data Performing the motor identification. (If the speed limits are not in the allowed range: Setting the limits.)	*9904…9909* *9910*
Application	Selecting the application macro	*9902*, parameters associated to the macro
Option modules	Activating the option modules	*Group 35: MOTOR TEMP MEAS* *Group 52: PANEL COMM* *9802*
Speed control EXT1	Selecting the source for the speed reference (If AI1 is used: Setting analog input AI1 limits, scale, inversion) Setting the reference limits Setting the speed (frequency) limits Setting the acceleration and deceleration times	*1103* (*1301…1303*, *3001*) *1104*, *1105* *2001*, *2002*, (*2007*, *2008*) *2202*, *2203*
Speed control EXT2	Selecting the source for the speed reference (If AI1 is used: Setting analog input AI1 limits, scale, inversion) Setting the reference limits	*1106* (*1301…1303*, *3001*) *1107*, *1108*
Torque control	Selecting the source for the torque reference (If AI1 is used: Setting analog input AI1 limits, scale, inversion) Setting the reference limits Setting the torque ramp up and ramp down times	*1106* (*1301…1303*, *3001*) *1107*, *1108* *2401*, *2402*
PID control	Selecting the source for the process reference (If AI1 is used: Setting analog input AI1 limits, scale, inversion) Setting the reference limits Setting the speed (reference) limits Setting the source and limits for the process actual value	*1106* (*1301…1303*, *3001*) *1107*, *1108* *2001*, *2002*, (*2007*, *2008*) *4016*, *4018*, *4019*
Start/Stop control	Selecting the source for start and stop signals of the two external control locations, EXT1 and EXT2 Selecting between EXT1 and EXT2 Defining the direction control Defining the start and stop modes Selecting the use of Run Enable signal	*1001*, *1002* *1102* *1003* *2101…2103* *1601*
Timed functions	Setting the timed functions Selecting the timed start/stop control for external control locations EXT1 and EXT2 Selecting timed EXT1/EXT2 control Activation of timed constant speed 1	*Group 36: TIMED FUNCTIONS* *1001*, *1002* *1102* *1201*

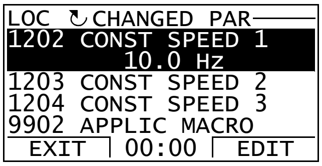
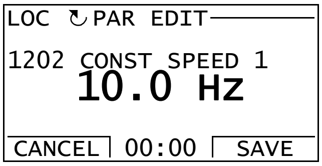
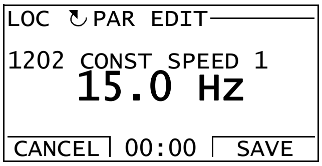
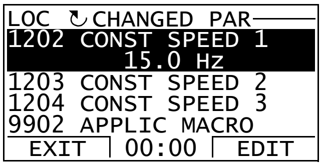
Name	**Description**	**Set parameters**
	Selecting timed function status indicated through relay output RO Selecting timed PID1 parameter set 1/2 control	*1401* *4027*
Protections	Setting the current and torque limits	*2003*, *2017*
Output signals	Selecting the signals indicated through relay output RO Selecting the signals indicated through analog output AO Setting the minimum, maximum, scaling and inversion	*Group 14: RELAY OUTPUTS* *Group 15: ANALOG OUTPUTS*

Changed Parameters mode

In the Changed Parameters mode, you can:

- view a list of all parameters that have been changed from the macro default values
- change these parameters
- start, stop, change the direction and switch between local and remote control.

How to view and edit changed parameters

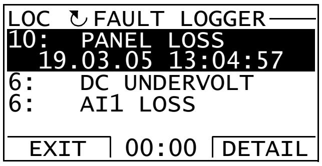
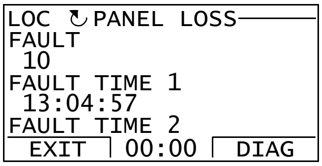
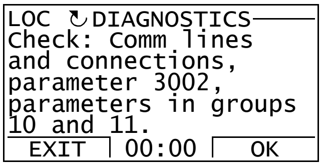
Step	Action	Display
1.	Go to the Main menu by pressing MENU if you are in the Output mode, otherwise by pressing EXIT repeatedly until you get to the Main menu.	 LOC ↻MAIN MENU 1 PARAMETERS ASSISTANTS CHANGED PAR EXIT 00:00 ENTER
2.	Go to the Changed Parameters mode by selecting CHANGED PAR on the menu with keys ▲ and ▼, and pressing ENTER.	 LOC ↻CHANGED PAR 1202 CONST SPEED 1 10.0 Hz 1203 CONST SPEED 2 1204 CONST SPEED 3 9902 APPLIC MACRO EXIT 00:00 EDIT
3.	Select the changed parameter on the list with keys ▲ and ▼. The value of the selected parameter is shown below it. Press EDIT to modify the value.	 LOC ↻PAR EDIT 1202 CONST SPEED 1 10.0 Hz CANCEL 00:00 SAVE
4.	Specify a new value for the parameter with keys ▲ and ▼. Pressing the key once increments or decrements the value. Holding the key down changes the value faster. Pressing the keys simultaneously replaces the displayed value with the default value.	 LOC ↻PAR EDIT 1202 CONST SPEED 1 15.0 Hz CANCEL 00:00 SAVE
5.	• To accept the new value, press SAVE. If the new value is the default value, the parameter is removed from the list of changed parameters. • To cancel the new value and keep the original, press CANCEL.	 LOC ↻CHANGED PAR 1202 CONST SPEED 1 15.0 Hz 1203 CONST SPEED 2 1204 CONST SPEED 3 9902 APPLIC MACRO EXIT 00:00 EDIT

Fault Logger mode

In the Fault Logger mode, you can:

- view the drive fault history of maximum ten faults (after a power off, only the three latest faults are kept in the memory)
- see the details of the three latest faults (after a power off, the details of only the most recent fault is kept in the memory)
- read the help text for the fault
- start, stop, change the direction and switch between local and remote control.

How to view faults

Step	Action	Display
1.	Go to the Main menu by pressing MENU if you are in the Output mode, otherwise by pressing EXIT repeatedly until you get to the Main menu.	 LOC ↻MAIN MENU 1 PARAMETERS ASSISTANTS CHANGED PAR EXIT 00:00 ENTER
2.	Go to the Fault Logger mode by selecting FAULT LOGGER on the menu with keys ▲ and ▼, and pressing ENTER. The display shows the fault log starting with the latest fault. The number on the row is the fault code according to which the causes and corrective actions are listed in chapter *Diagnostics*.	 LOC ↻FAULT LOGGER 10: PANEL LOSS 19.03.05 13:04:57 6: DC UNDERVOLT 6: AI1 LOSS EXIT 00:00 DETAIL
3.	To see the details of a fault, select it with keys ▲ and ▼, and press DETAIL.	 LOC ↻PANEL LOSS FAULT 10 FAULT TIME 1 13:04:57 FAULT TIME 2 EXIT 00:00 DIAG
4.	To show the help text, press DIAG. Scroll the help text with keys ▲ and ▼. After reading the help, press OK to return to the previous display.	 LOC ↻DIAGNOSTICS Check: Comm lines and connections, parameter 3002, parameters in groups 10 and 11. EXIT 00:00 OK

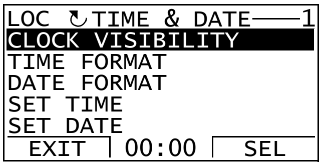
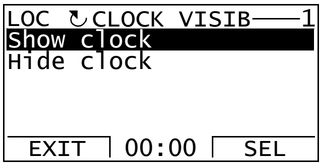
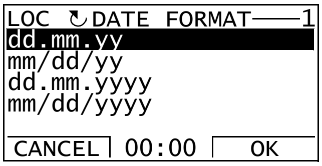
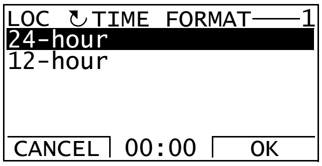
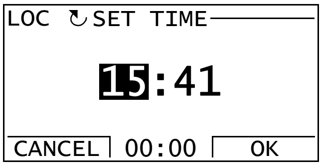
Time and Date mode

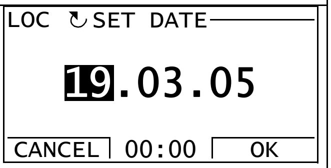
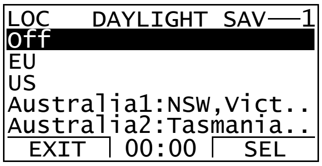
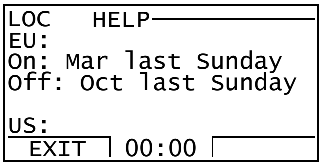
In the Time and Date mode, you can:

- show or hide the clock
- change date and time display formats
- set the date and time
- enable or disable automatic clock transitions according to the daylight saving changes
- start, stop, change the direction and switch between local and remote control.

The Assistant Control Panel contains a battery to ensure the function of the clock when the panel is not powered by the drive.

How to show or hide the clock, change display formats, set the date and time and enable or disable clock transitions due to daylight saving changes

Step	Action	Display
1.	Go to the Main menu by pressing MENU if you are in the Output mode, otherwise by pressing EXIT repeatedly until you get to the Main menu.	 LOC ↻MAIN MENU 1 PARAMETERS ASSISTANTS CHANGED PAR EXIT 00:00 ENTER
2.	Go to the Time and Date mode by selecting TIME & DATE on the menu with keys ▲ and ▼, and pressing ENTER.	 LOC ↻TIME & DATE 1 CLOCK VISIBILITY TIME FORMAT DATE FORMAT SET TIME SET DATE EXIT 00:00 SEL
3.	• To show (hide) the clock, select CLOCK VISIBLILITY on the menu, press SEL, select Show clock (Hide clock) and press SEL, or, if you want to return to the previous display without making changes, press EXIT.	 LOC ↻CLOCK VISIB 1 Show clock Hide clock EXIT 00:00 SEL
	• To specify the date format, select DATE FORMAT on the menu, press SEL and select a suitable format. Press OK to save or CANCEL to cancel your changes.	 LOC ↻DATE FORMAT 1 dd.mm.yy mm/dd/yy dd.mm.yyyy mm/dd/yyyy CANCEL 00:00 OK
	• To specify the time format, select TIME FORMAT on the menu, press SEL and select a suitable format. Press OK to save or CANCEL to cancel your changes.	 LOC ↻TIME FORMAT 1 24-hour 12-hour CANCEL 00:00 OK
	• To set the time, select SET TIME on the menu and press SEL. Specify the hours with keys ▲ and ▼, and press OK.Then specify the minutes. Press OK to save or CANCEL to cancel your changes.	 LOC ↻SET TIME 15:41 CANCEL 00:00 OK

Step	Action	Display
	• To set the date, select SET DATE on the menu and press SEL. Specify the first part of the date (day or month depending on the selected date format) with keys ▲ and ▼, and press OK. Repeat for the second part. After specifying the year, press OK. To cancel your changes, press CANCEL. • To enable or disable the automatic clock transitions according to the daylight saving changes, select DAYLIGHT SAVING on the menu and press SEL. Pressing ? opens the help that shows the beginning and end dates of the period during which daylight saving time is used in each country or area whose daylight saving changes you can select to be followed. • To disable automatic clock transitions according to the daylight saving changes, select Off and press SEL. • To enable automatic clock transitions, select the country or area whose daylight saving changes are followed and press SEL. • To return to the previous display without making changes, press EXIT.	 LOC ↻SET DATE 19.03.05 CANCEL 00:00 OK  LOC DAYLIGHT SAV 1 Off EU US Australia1:NSW,Vict.. Australia2:Tasmania.. EXIT 00:00 SEL  LOC HELP EU: On: Mar last Sunday Off: Oct last Sunday US: EXIT 00:00

Parameter Backup mode

The Parameter Backup mode is used to export parameters from one drive to another or to make a backup of the drive parameters. Uploading to the panel stores all drive parameters, including up to two user sets, to the Assistant Control Panel. The full set, partial parameter set (application) and user sets can then be downloaded from the control panel to another drive or the same drive. Uploading and downloading can be performed in local control.

The control panel memory is non-volatile and does not depend on the panel battery.

In the Parameter Backup mode, you can:

- copy all parameters from the drive to the control panel (UPLOAD TO PANEL). This includes all defined user sets of parameters and internal (not adjustable by the user) parameters such as those created by the ID Run.
- view the information about the backup stored to the control panel with UPLOAD TO PANEL (BACKUP INFO). This includes e.g. the type and rating of the drive where the backup was made. It is useful to check this information when you are going to copy the parameters to another drive with DOWNLOAD FULL SET to ensure that the drives match.
- restore the full parameter set from the control panel to the drive (DOWNLOAD FULL SET). This writes all parameters, including the internal non-user-adjustable motor parameters, to the drive. It does not include the user sets of parameters.

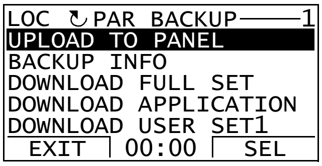
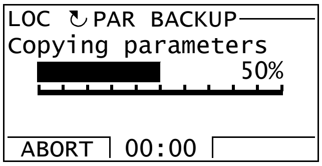
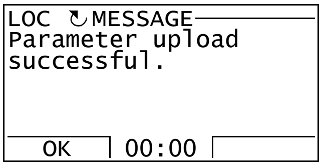
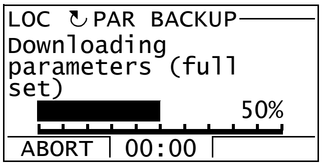
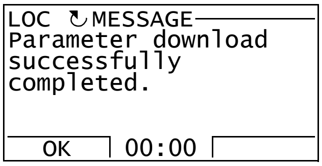
  Note: Only use this function to restore a drive from a backup or to transfer parameters to systems that are identical to the original system.
- copy a partial parameter set (part of the full set) from the control panel to a drive (DOWNLOAD APPLICATION). The partial set does not include user sets, internal motor parameters, parameters *9905*…*9909*, *1605*, *1607*, *5201*, nor any *Group 51: EXT COMM MODULE* and *Group 53: EFB PROTOCOL* parameters.

  The source and target drives and their motor sizes do not need to be the same.
- copy USER S1 parameters from the control panel to the drive (DOWNLOAD USER SET1). A user set includes *Group 99: START-UP DATA* parameters and the internal motor parameters.

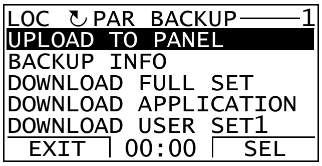
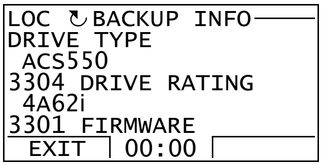
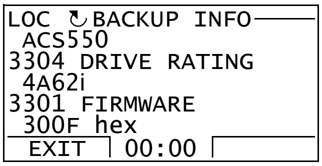
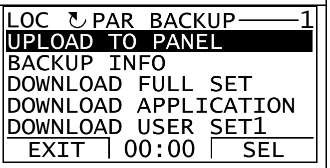
  The function is only shown on the menu when User Set 1 has been first saved using parameter *9902* APPLIC MACRO (see section *User parameter sets* on page *83*) and then uploaded to the control panel with UPLOAD TO PANEL.
- copy USER S2 parameters from the control panel to the drive (DOWNLOAD USER SET2). As DOWNLOAD USER SET1 above.
- start, stop, change the direction and switch between local and remote control.

How to upload and download parameters

For the upload and download functions available, see above. Note that the drive has to be in local control for uploading and downloading.

Step	Action	Display
1.	Go to the Main menu by pressing MENU if you are in the Output mode, otherwise by pressing EXIT repeatedly until you get to the Main menu. – If REM is shown on the status line, press LOC REM to switch to local control.	 LOC ↻MAIN MENU 1 PARAMETERS ASSISTANTS CHANGED PAR EXIT 00:00 ENTER
2.	Go to the Par Backup mode by selecting PAR BACKUP on the menu with keys ▲ and ▼, and pressing ENTER.	 LOC ↻PAR BACKUP 1 UPLOAD TO PANEL BACKUP INFO DOWNLOAD FULL SET DOWNLOAD APPLICATION DOWNLOAD USER SET1 EXIT 00:00 SEL
3.	• To copy all parameters (including user sets and internal parameters) from the drive to the control panel, select UPLOAD TO PANEL on the Par Backup menu with keys ▲ and ▼, and press SEL. During the transfer, the display shows the transfer status as a percentage of completion. Press ABORT if you want to stop the operation.	 LOC ↻PAR BACKUP Copying parameters 50% ABORT 00:00
	After the upload is completed, the display shows a message about the completion. Press OK to return to the Par Backup menu.	 LOC ↻MESSAGE Parameter upload successful. OK 00:00
	• To perform downloads, select the appropriate operation (here DOWNLOAD FULL SET is used as an example) on the Par Backup menu with keys ▲ and ▼, and press SEL. The display shows the transfer status as a percentage of completion. Press ABORT if you want stop the operation.	 LOC ↻PAR BACKUP Downloading parameters (full set) 50% ABORT 00:00
	After the download is completed, the display shows a message about the completion. Press OK to return to the Par Backup menu.	 LOC ↻MESSAGE Parameter download successfully completed. OK 00:00

How to view information about the backup

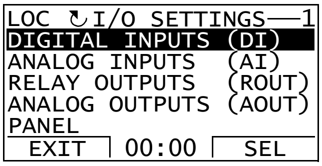
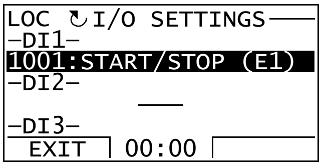
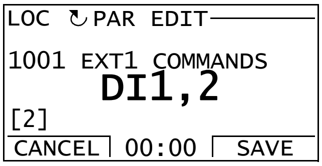
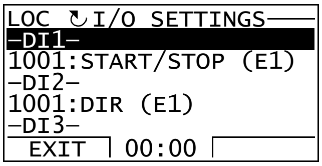
Step	Action	Display
1.	Go to the Main menu by pressing MENU if you are in the Output mode, otherwise by pressing EXIT repeatedly until you get to the Main menu.	 LOC ↻MAIN MENU 1 PARAMETERS ASSISTANTS CHANGED PAR EXIT 00:00 ENTER
2.	Go to the Par Backup mode by selecting PAR BACKUP on the menu with keys ▲ and ▼, and pressing ENTER.	 LOC ↻PAR BACKUP 1 UPLOAD TO PANEL BACKUP INFO DOWNLOAD FULL SET DOWNLOAD APPLICATION DOWNLOAD USER SET1 EXIT 00:00 SEL
3.	Select BACKUP INFO on the Par Backup menu with keys ▲ and ▼, and press SEL. The display shows the following information about the drive where the backup was made: DRIVE TYPE: type of the drive DRIVE RATING: rating of the drive in format XXXYZ, where XXX: nominal current rating. If present, an "A" indicates a decimal point, e.g. 4A6 means 4.6 A. Y: 2 = 200 V 4 = 400 V 6 = 600 V Z: i = European loading package n = US loading package FIRMWARE: firmware version of the drive. You can scroll the information with keys ▲ and ▼.	 LOC ↻BACKUP INFO DRIVE TYPE ACS550 3304 DRIVE RATING 4A62i 3301 FIRMWARE EXIT 00:00  LOC ↻BACKUP INFO ACS550 3304 DRIVE RATING 4A62i 3301 FIRMWARE 300F hex EXIT 00:00
4.	Press EXIT to return to the Par Backup menu.	 LOC ↻PAR BACKUP 1 UPLOAD TO PANEL BACKUP INFO DOWNLOAD FULL SET DOWNLOAD APPLICATION DOWNLOAD USER SET1 EXIT 00:00 SEL

I/O Settings mode

In the I/O Settings mode, you can:

- check the parameter settings related to any I/O terminal
- edit the parameter setting. For example, if "1103: REF1" is listed under Ain1 (Analog input 1), that is, parameter *1103* REF1 SELECT has value AI1, you can change its value to e.g. AI2. You cannot, however, set the value of parameter *1106* REF2 SELECT to AI1.
- start, stop, change the direction and switch between local and remote control.

How to edit and change parameter settings related to I/O terminals

Step	Action	Display
1.	Go to the Main menu by pressing MENU if you are in the Output mode, otherwise by pressing EXIT repeatedly until you get to the Main menu.	 LOC ↻MAIN MENU 1 PARAMETERS ASSISTANTS CHANGED PAR EXIT 00:00 ENTER
2.	Go the I/O Settings mode by selecting I/O SETTINGS on the menu with keys ▲ and ▼, and pressing ENTER.	 LOC ↻I/O SETTINGS 1 DIGITAL INPUTS (DI) ANALOG INPUTS (AI) RELAY OUTPUTS (ROUT) ANALOG OUTPUTS (AOUT) PANEL EXIT 00:00 SEL
3.	Select the I/O group, e.g. DIGITAL INPUTS, with keys ▲ and ▼, and press SEL. After a brief pause, the display shows the current settings for the selection.	 LOC ↻I/O SETTINGS -DI1- 1001:START/STOP (E1) -DI2- ——— -DI3- EXIT 00:00
4.	Select the setting (line with a parameter number) with keys ▲ and ▼, and press EDIT.	 LOC ↻PAR EDIT 1001 EXT1 COMMANDS DI1 [1] CANCEL 00:00 SAVE
5.	Specify a new value for the setting with keys ▲ and ▼. Pressing the key once increments or decrements the value. Holding the key down changes the value faster. Pressing the keys simultaneously replaces the displayed value with the default value.	 LOC ↻PAR EDIT 1001 EXT1 COMMANDS DI1,2 [2] CANCEL 00:00 SAVE
6.	• To save the new value, press SAVE. • To cancel the new value and keep the original, press CANCEL.	 LOC ↻I/O SETTINGS -DI1- 1001:START/STOP (E1) -DI2- 1001:DIR (E1) -DI3- EXIT 00:00

Basic Control Panel

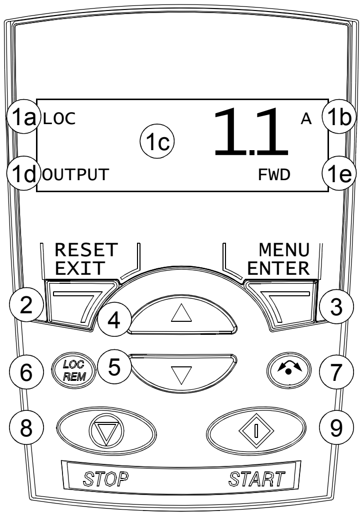
Features

The Basic Control Panel features:

- numeric control panel with an LCD display
- copy function – parameters can be copied to the control panel memory for later transfer to other drives or for backup of a particular system.

Overview

The following table summarizes the key functions and displays on the Basic Control Panel.



No.	Use
1	LCD display – Divided into five areas: a. Upper left – Control location: LOC: drive control is local, that is, from the control panel REM: drive control is remote, such as the drive I/O or fieldbus. b. Upper right – Unit of the displayed value. c. Center – Variable; in general, shows parameter and signal values, menus or lists. Shows also fault and alarm codes. d. Lower left and center – Panel operation state: OUTPUT: Output mode PAR: Parameter mode MENU: Main menu FAULT: Fault mode. e. Lower right – Indicators: FWD (forward) / REV (reverse): direction of the motor rotation Flashing slowly: stopped Flashing rapidly: running, not at setpoint Steady: running, at setpoint SET: Displayed value can be modified (in the Parameter and Reference modes).
2	RESET/EXIT – Exits to the next higher menu level without saving changed values. Resets faults in the Output and Fault modes.
3	MENU/ENTER – Enters deeper into menu level. In the Parameter mode, saves the displayed value as the new setting.
4	Up – • Scrolls up through a menu or list. • Increases a value if a parameter is selected. • Increases the reference value in the Reference mode. Holding the key down changes the value faster.
5	Down – • Scrolls down through a menu or list. • Decreases a value if a parameter is selected. • Decreases the reference value in the Reference mode. Holding the key down changes the value faster.
6	LOC/REM – Changes between local and remote control of the drive.
7	DIR – Changes the direction of the motor rotation.
8	STOP – Stops the drive in local control.
9	START – Starts the drive in local control.

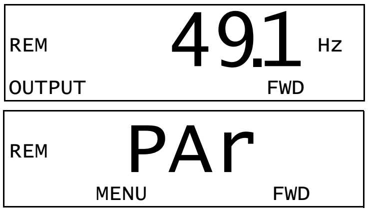
Operation

You operate the control panel with menus and keys. You select an option, e.g. operation mode or parameter, by scrolling the ▲ and ▼ arrow keys until the option is visible in the display and then pressing the key.

With the key, you return to the previous operation level without saving the made changes.

The Basic Control Panel has five panel modes: Output, Reference, Parameter, Copy and Fault. The operation in the first four modes is described in this chapter. When a fault or alarm occurs, the panel goes automatically to the Fault mode showing the fault or alarm code. You can reset the fault or alarm in the Output or Fault mode (see chapter *Diagnostics*).

After the power is switched on, the panel is in the Output mode, where you can start, stop, change the direction, switch between local and remote control and monitor up to three actual values (one at a time). To do other tasks, go first to the Main menu and select the appropriate mode.



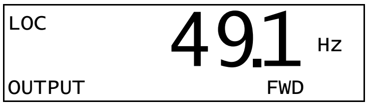
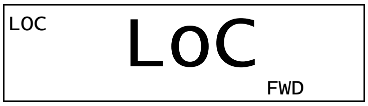
How to do common tasks

The table below lists common tasks, the mode in which you can perform them and the page number where the steps to do the task are described in detail.

Task	**Mode**	**Page**
How to switch between local and remote control	Any	*66*
How to start and stop the drive	Any	*66*
How to change the direction of the motor rotation	Any	*66*
How to browse the monitored signals	Output	*67*
How to set the speed, frequency or torque reference	Reference	*68*
How to change the value of a parameter	Parameter	*69*
How to select the monitored signals	Parameter	*70*
How to reset faults and alarms	Output, Fault	*259*
How to copy parameters from the drive to the control panel	Copy	*72*
How to restore parameters from the control panel to the drive	Copy	*72*

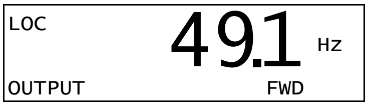
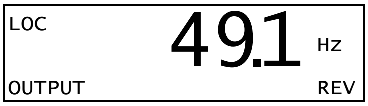
How to start, stop and switch between local and remote control

You can start, stop and switch between local and remote control in any mode. To be able to start or stop the drive, the drive must be in local control.

Step	Action	Display
1.	• To switch between remote control (REM shown on the left) and local control (LOC shown on the left), press LOC REM. **Note:** Switching to local control can be disabled with parameter *1606* LOCAL LOCK. After pressing the key, the display briefly shows message "LoC" or "rE", as appropriate, before returning to the previous display. The very first time the drive is powered up, it is in remote control (REM) and controlled through the drive I/O terminals. To switch to local control (LOC) and control the drive using the control panel, press LOC REM. The result depends on how long you press the key: • If you release the key immediately (the display flashes "LoC"), the drive stops. Set the local control reference as instructed on page *68*. • If you press the key for about two seconds (release when the display changes from "LoC" to "LoC r"), the drive continues as before. The drive copies the current remote values for the run/stop status and the reference, and uses them as the initial local control settings.	 
	• To stop the drive in local control, press ▽.	Text FWD or REV on the bottom line starts flashing slowly.
	• To start the drive in local control, press ◇.	Text FWD or REV on the bottom line starts flashing rapidly. It stops flashing when the drive reaches the setpoint.

How to change the direction of the motor rotation

You can change the direction of the motor rotation in any mode.

Step	Action	Display
1.	If the drive is in remote control (REM shown on the left), switch to local control by pressing LOC REM. The display briefly shows message "LoC" before returning to the previous display.	
2.	To change the direction from forward (FWD shown at the bottom) to reverse (REV shown at the bottom), or vice versa, press ↷. **Note**: Parameter *1003* DIRECTION must be set to 3 (REQUEST).	

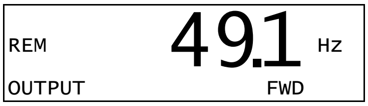
Output mode

In the Output mode, you can:

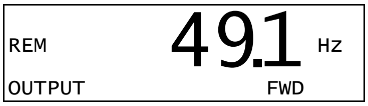
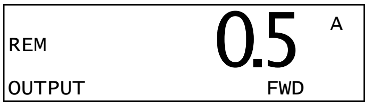
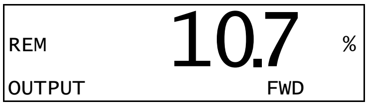
- monitor actual values of up to three *Group 01: OPERATING DATA* signals, one signal at a time
- start, stop, change the direction and switch between local and remote control.

You get to the Output mode by pressing until the display shows text OUTPUT at the bottom.

The display shows the value of one *Group 01: OPERATING DATA* signal. The unit is shown on the right. Page *70* tells how to select up to three signals to be monitored in the Output mode. The table below shows how to view them one at a time.


REM 49.1 Hz
OUTPUT FWD

How to browse the monitored signals

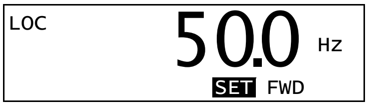
Step	Action	Display
1.	If more than one signals have been selected to be monitored (see page *70*), you can browse them in the Output mode. To browse the signals forward, press key ▲ repeatedly. To browse them backward, press key ▼ repeatedly.	 REM 49.1 Hz OUTPUT FWD  REM 0.5 A OUTPUT FWD  REM 10.7 % OUTPUT FWD

Reference mode

In the Reference mode, you can:

- set the speed, frequency or torque reference
- start, stop, change the direction and switch between local and remote control.

How to set the speed, frequency or torque reference

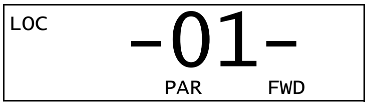
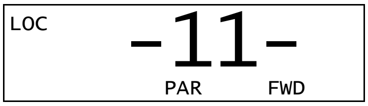
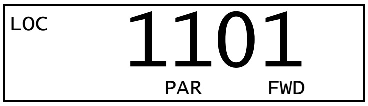
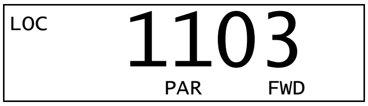
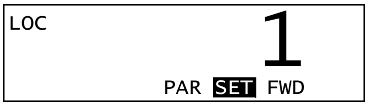
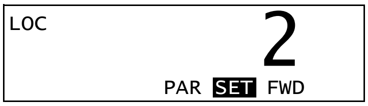
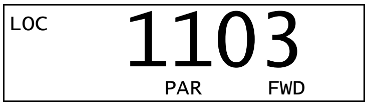
Step	Action	Display
1.	Go to the Main menu by pressing ⤶ if you are in the Output mode, otherwise by pressing ↗ repeatedly until you see MENU at the bottom.	 REM PAr MENU FWD
2.	If the drive is in remote control (REM shown on the left), switch to local control by pressing LOC/REM. The display briefly shows "LoC" before switching to local control. **Note**: With *Group 11: REFERENCE SELECT*, you can allow the reference modification in remote control (REM).	 LOC PAr MENU FWD
3.	If the panel is not in the Reference mode ("rEF" not visible), press key ▲ or ▼ until you see "rEF" and then press ⤶. Now the display shows the current reference value with **SET** under the value.	 LOC rEF MENU FWD  LOC 49.1 Hz SET FWD
4.	• To increase the reference value, press ▲. • To decrease the reference value, press ▼. The value changes immediately when you press the key. It is stored in the drive permanent memory and restored automatically after power switch-off.	 LOC 50.0 Hz SET FWD

Parameter mode

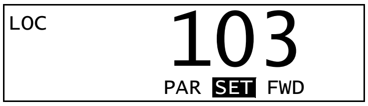
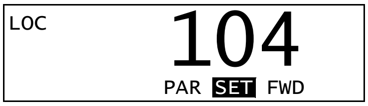
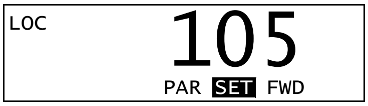
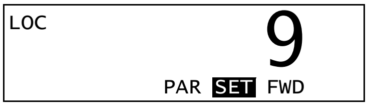
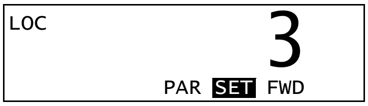
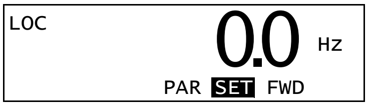
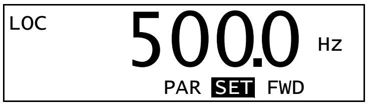
In the Parameter mode, you can:

- view and change parameter values
- select and modify the signals shown in the Output mode
- start, stop, change the direction and switch between local and remote control.

How to select a parameter and change its value

Step	Action	Display
1.	Go to the Main menu by pressing ⏎ if you are in the Output mode, otherwise by pressing ↩ repeatedly until you see MENU at the bottom.	 LOC rEF MENU FWD
2.	If the panel is not in the Parameter mode ("PAr" not visible), press key ▲ or ▼ until you see "PAr" and then press ⏎. The display shows the number of one of the parameter groups.	 LOC PAr MENU FWD  LOC -01- PAR FWD
3.	Use keys ▲ and ▼ to find the desired parameter group.	 LOC -11- PAR FWD
4.	Press ⏎. The display shows one of the parameters in the selected group.	 LOC 1101 PAR FWD
5.	Use keys ▲ and ▼ to find the desired parameter.	 LOC 1103 PAR FWD
6.	Press and hold ⏎ for about two seconds until the display shows the value of the parameter with SET underneath indicating that changing of the value is now possible. **Note:** When SET is visible, pressing keys ▲ and ▼ simultaneously changes the displayed value to the default value of the parameter.	 LOC 1 PAR SET FWD
7.	Use keys ▲ and ▼ to select the parameter value. When you have changed the parameter value, SET starts flashing. • To save the displayed parameter value, press ⏎. • To cancel the new value and keep the original, press ↩.	 LOC 2 PAR SET FWD  LOC 1103 PAR FWD

How to select the monitored signals

Step	Action	Display
1.	You can select which signals are monitored in the Output mode and how they are displayed with *Group 34: PANEL DISPLAY* parameters. See page *51* for detailed instructions on changing parameter values. By default, you can monitor three signals by browsing (see page *67*). The particular default signals depend on the value of parameter *9902* APPLIC MACRO: For macros whose default value of parameter *9904* MOTOR CTRL MODE is 1 (VECTOR:SPEED), the default for signal 1 is *0102* SPEED, otherwise *0103* OUTPUT FREQ. The defaults for signals 2 and 3 are always *0104* CURRENT and *0105* TORQUE, respectively. To change the default signals, select from *Group 01: OPERATING DATA* up to three signals to be browsed. Signal 1: Change the value of parameter *3401* SIGNAL1 PARAM to the index of the signal parameter in *Group 01: OPERATING DATA* (= number of the parameter without the leading zero), e.g. 105 means parameter *0105* TORQUE. Value 100 means that no signal is displayed. Repeat for signals 2 (*3408* SIGNAL2 PARAM) and 3 (*3415* SIGNAL3 PARAM). For example, if *3401* = 0 and *3415* = 0, browsing is disabled and only the signal specified by *3408* appears in the display. If all three parameters are set to 0, i.e. no signals are selected for monitoring, the panel displays text "n.A".	 LOC 103 PAR SET FWD  LOC 104 PAR SET FWD  LOC 105 PAR SET FWD
2.	Specify the decimal point location, or use the decimal point location and unit of the source signal [setting (9 (DIRECT)]. Bar graphs are not available for Basic Operation Panel. For details, see parameter *3404*. Signal 1: parameter *3404* OUTPUT1 DSP FORM Signal 2: parameter *3411* OUTPUT2 DSP FORM Signal 3: parameter *3418* OUTPUT3 DSP FORM.	 LOC 9 PAR SET FWD
3.	Select the units to be displayed for the signals. This has no effect if parameter *3404*/*3411*/*3418* is set to 9 (DIRECT). For details, see parameter *3405*. Signal 1: parameter *3405* OUTPUT1 UNIT Signal 2: parameter *3412* OUTPUT2 UNIT Signal 3: parameter *3419* OUTPUT3 UNIT.	 LOC 3 PAR SET FWD
4.	Select the scalings for the signals by specifying the minimum and maximum display values. This has no effect if parameter *3404*/*3411*/*3418* is set to 9 (DIRECT). For details, see parameters *3406* and *3407*. Signal 1: parameters *3406* OUTPUT1 MIN and *3407* OUTPUT1 MAX Signal 2: parameters *3413* OUTPUT2 MIN and *3414* OUTPUT2 MAX Signal 3: parameters *3420* OUTPUT3 MIN and *3421* OUTPUT3 MAX.	 LOC 0.0 Hz PAR SET FWD  LOC 500.0 Hz PAR SET FWD

Copy mode

The Basic Control Panel can store a full set of drive parameters and up to two user sets of drive parameters to the control panel. The control panel memory is non-volatile.

In the Copy mode, you can:

- copy all parameters from the drive to the control panel (uL – Upload). This includes all defined user sets of parameters and internal (not adjustable by the user) parameters such as those created by the ID Run.
- restore the full parameter set from the control panel to the drive (dL A – Download All). This writes all parameters, including the internal non-user-adjustable motor parameters, to the drive. It does not include the user sets of parameters.

  Note: Only use this function to restore a drive, or to transfer parameters to systems that are identical to the original system.
- copy a partial parameter set from the control panel to a drive (dL P – Download Partial). The partial set does not include user sets, internal motor parameters, parameters *9905*…*9909*, *1605*, *1607*, *5201*, nor any *Group 51: EXT COMM MODULE* and *Group 53: EFB PROTOCOL* parameters.

  The source and target drives and their motor sizes do not need to be the same.
- copy USER S1 parameters from the control panel to the drive (dL u1 – Download User Set 1). A user set includes *Group 99: START-UP DATA* parameters and the internal motor parameters.

  The function is only shown on the menu when User Set 1 has been first saved using parameter *9902* APPLIC MACRO (see section *User parameter sets* on page *83*) and then uploaded to panel.
- copy USER S2 parameters from the control panel to the drive (dL u2 – Download User Set 2). As dL u1 – Download User Set 1 above.
- start, stop, change the direction and switch between local and remote control.

How to upload and download parameters

For the upload and download functions available, see above.

Step	Action	Display
1.	Go to the Main menu by pressing if you are in the Output mode, otherwise by pressing repeatedly until you see MENU at the bottom.	LOC PAr MENU FWD
2.	If the panel is not in the Copy mode ("CoPY" not visible), press key ▲ or ▼ until you see "CoPY".	LOC CoPY MENU FWD
	Press .	LOC dL u1 MENU FWD
3.	• To upload all parameters (including user sets) from the drive to the control panel, step to "uL" with keys ▲ and ▼.	LOC uL MENU FWD
	Press . During the transfer, the display shows the transfer status as a percentage of completion.	LOC uL 50 % FWD
	• To perform downloads, step to the appropriate operation (here "dL A", Download All, is used as an example) with keys ▲ and ▼.	LOC dL A MENU FWD
	Press . During the transfer, the display shows the transfer status as a percentage of completion.	LOC dL 50 % FWD

Basic Control Panel alarm codes

In addition to the faults and alarms generated by the drive (see chapter *Diagnostics*), the Basic Control Panel indicates control panel alarms with a code of form A5xxx. See section *Alarm codes (Basic Control Panel)* on page *263* for a list of the alarm codes and descriptions.

Application macros

Macros change a group of parameters to new, predefined values. Use macros to minimize the need for manual editing of parameters. Selecting a macro sets all other parameters to their default values, except:

- *Group 99: START-UP DATA* parameters (except parameter *9904*)
- *1602* PARAMETER LOCK
- *1607* PARAM SAVE
- *3018* COMM FAULT FUNC and *3019* COMM FAULT TIME
- *9802* COMM PROT SEL
- *Group 50: ENCODER* … *Group 53: EFB PROTOCOL* parameters
- *Group 29: MAINTENANCE TRIG* parameters.

After selecting a macro, you can make additional parameter changes manually with the control panel.

You enable application macros by setting the value for parameter *9902* APPLIC MACRO. By default, 1, ABB STANDARD, is the enabled macro.

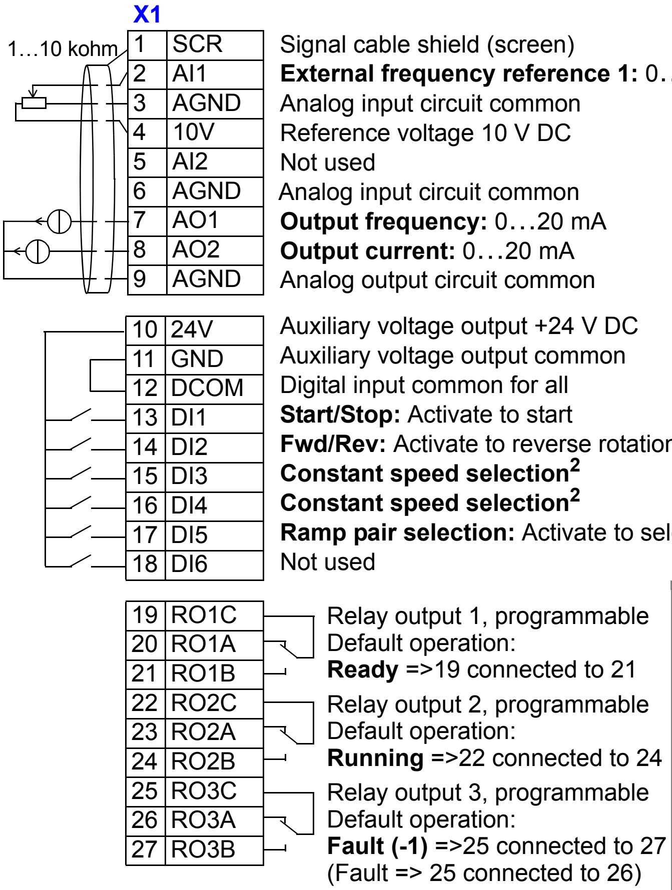
The following sections describe each of the application macros and provide a connection example for each macro.

The last section in this chapter, *Macro default values for parameters*, lists the parameters that the macros change and the default values established by each macro.

ABB Standard macro

This is the default macro. It provides a general purpose, 2-wire I/O configuration, with three (3) constant speeds. Parameter values are the default values defined in section *Complete parameter list* on page *87*.

Connection example:



1	SCR	Signal cable shield (screen)
2	AI1	**External frequency reference 1:** 0…10 V^1
3	AGND	Analog input circuit common
4	10V	Reference voltage 10 V DC
5	AI2	Not used
6	AGND	Analog input circuit common
7	AO1	**Output frequency:** 0…20 mA
8	AO2	**Output current:** 0…20 mA
9	AGND	Analog output circuit common
10	24V	Auxiliary voltage output +24 V DC
11	GND	Auxiliary voltage output common
12	DCOM	Digital input common for all
13	DI1	**Start/Stop:** Activate to start
14	DI2	**Fwd/Rev:** Activate to reverse rotation direction
15	DI3	**Constant speed selection**^{2}
16	DI4	**Constant speed selection**^{2}
17	DI5	**Ramp pair selection:** Activate to select 2nd acc/dec ramp pair
18	DI6	Not used
19	RO1C	Relay output 1, programmable
20	RO1A	Default operation:
21	RO1B	**Ready** =>19 connected to 21
22	RO2C	Relay output 2, programmable
23	RO2A	Default operation:
24	RO2B	**Running** =>22 connected to 24
25	RO3C	Relay output 3, programmable
26	RO3A	Default operation:
27	RO3B	**Fault (-1)** =>25 connected to 27 (Fault => 25 connected to 26)

Note 1. The external reference is used as a speed reference if a vector mode is selected.

Note 2. Code:
0 = open, 1 = connected

DI3	DI4	Output
0	0	Reference through AI1
1	0	CONST SPEED 1 (1202)
0	1	CONST SPEED 2 (1203)
1	1	CONST SPEED 3 (1204)

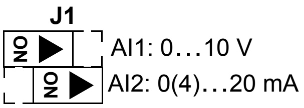
Input signals

- Analog reference (AI1)
- Start, stop and direction (DI1,2)
- Constant speed selection (DI3,4)
- Ramp pair (1 of 2) selection (DI5)

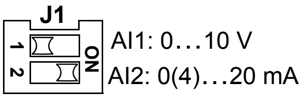
Output signals

- Analog output AO1: Frequency
- Analog output AO2: Current
- Relay output 1: Ready
- Relay output 2: Running
- Relay output 3: Fault (-1)

Jumper setting



or

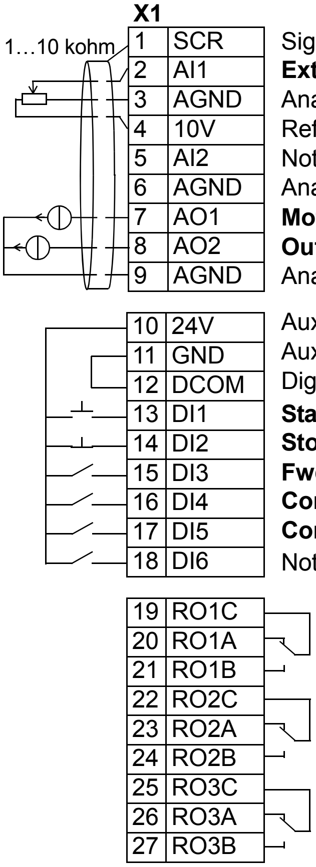


3-wire macro

This macro is used when the drive is controlled using momentary push-buttons. It provides three (3) constant speeds. To enable, set the value of parameter 9902 to 2 (3-WIRE).

Note: When the stop input (DI2) is deactivated (no input), the control panel start/stop buttons are disabled.

Connection example:



1	SCR	Signal cable shield (screen)
2	AI1	**External speed reference 1:** 0…10 V
3	AGND	Analog input circuit common
4	10V	Reference voltage 10 V DC
5	AI2	Not used
6	AGND	Analog input circuit common
7	AO1	**Motor output speed:** 0…20 mA
8	AO2	**Output current:** 0…20 mA
9	AGND	Analog output circuit common
10	24V	Auxiliary voltage output +24 V DC
11	GND	Auxiliary voltage output common
12	DCOM	Digital input common for all
13	DI1	**Start:** Momentary activation with DI2 activated starts the drive
14	DI2	**Stop:** Momentary deactivation stops the drive
15	DI3	**Fwd/Rev:** Activation reverses rotation direction
16	DI4	**Constant speed selection**^{1}
17	DI5	**Constant speed selection**^{1}
18	DI6	Not used
19	RO1C	Relay output 1, programmable
20	RO1A	Default operation:
21	RO1B	**Ready** =>19 connected to 21
22	RO2C	Relay output 2, programmable
23	RO2A	Default operation:
24	RO2B	**Running** =>22 connected to 24
25	RO3C	Relay output 3, programmable
26	RO3A	Default operation:
27	RO3B	**Fault (-1)** =>25 connected to 27 (Fault => 25 connected to 26)

Note 1. Code:
0 = open, 1 = connected

DI4	DI5	Output
0	0	Reference through AI1
1	0	CONST SPEED 1 (1202)
0	1	CONST SPEED 2 (1203)
1	1	CONST SPEED 3 (1204)

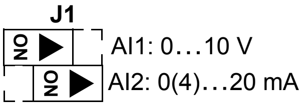
Input signals

- Analog reference (AI1)
- Start, stop and direction (DI1,2,3)
- Constant speed selection (DI4,5)

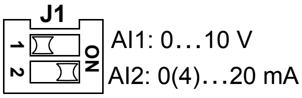
Output signals

- Analog output AO1: Speed
- Analog output AO2: Current
- Relay output 1: Ready
- Relay output 2: Running
- Relay output 3: Fault (-1)

Jumper setting



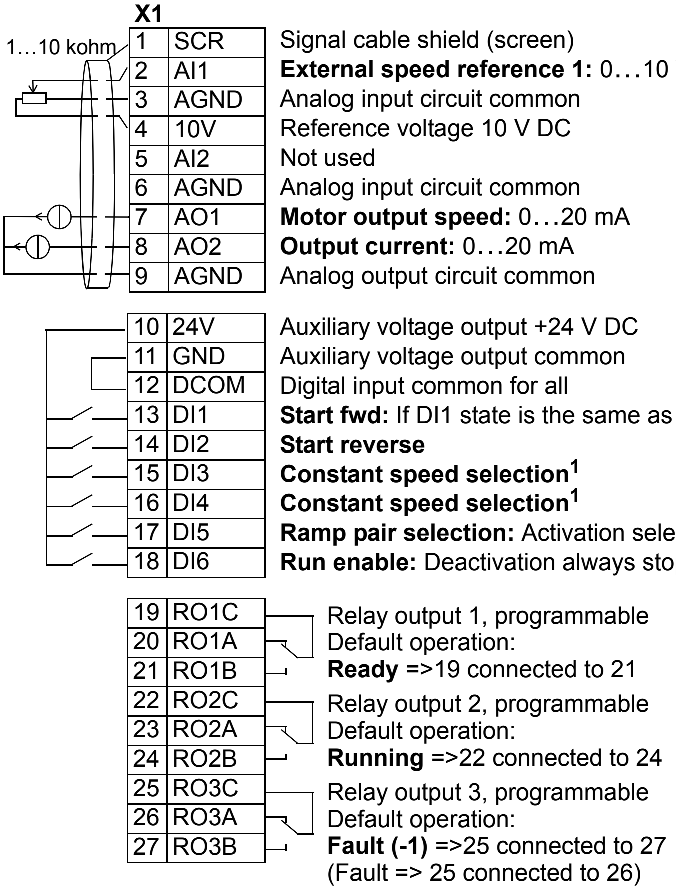
or



Alternate macro

This macro provides an I/O configuration adopted to a sequence of DI control signals used when alternating the rotation direction of the motor. To enable, set the value of parameter 9902 to 3 (ALTERNATE).

Connection example:



X1		
1	SCR	Signal cable shield (screen)
2	AI1	**External speed reference 1:** 0…10 V
3	AGND	Analog input circuit common
4	10V	Reference voltage 10 V DC
5	AI2	Not used
6	AGND	Analog input circuit common
7	AO1	**Motor output speed:** 0…20 mA
8	AO2	**Output current:** 0…20 mA
9	AGND	Analog output circuit common
10	24V	Auxiliary voltage output +24 V DC
11	GND	Auxiliary voltage output common
12	DCOM	Digital input common for all
13	DI1	**Start fwd:** If DI1 state is the same as DI2, the drive **stops**
14	DI2	**Start reverse**
15	DI3	**Constant speed selection**[1]
16	DI4	**Constant speed selection**[1]
17	DI5	**Ramp pair selection:** Activation selects 2nd acc/dec ramp pair
18	DI6	**Run enable:** Deactivation always stops the drive
19	RO1C	Relay output 1, programmable Default operation: **Ready** =>19 connected to 21
20	RO1A	
21	RO1B	
22	RO2C	Relay output 2, programmable Default operation: **Running** =>22 connected to 24
23	RO2A	
24	RO2B	
25	RO3C	Relay output 3, programmable Default operation: **Fault (-1)** =>25 connected to 27 (Fault => 25 connected to 26)
26	RO3A	
27	RO3B	

Note 1. Code:
0 = open, 1 = connected

DI3	DI4	Output
0	0	Reference through AI1
1	0	CONST SPEED 1 (1202)
0	1	CONST SPEED 2 (1203)
1	1	CONST SPEED 3 (1204)

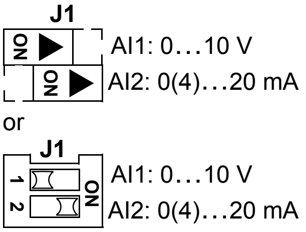
Input signals

- Analog reference (AI1)
- Start, stop and direction (DI1,2)
- Constant speed selection (DI3,4)
- Ramp pair 1/2 selection (DI5)
- Run enable (DI6)

Output signals

- Analog output AO1: Speed
- Analog output AO2: Current
- Relay output 1: Ready
- Relay output 2: Running
- Relay output 3: Fault (-1)

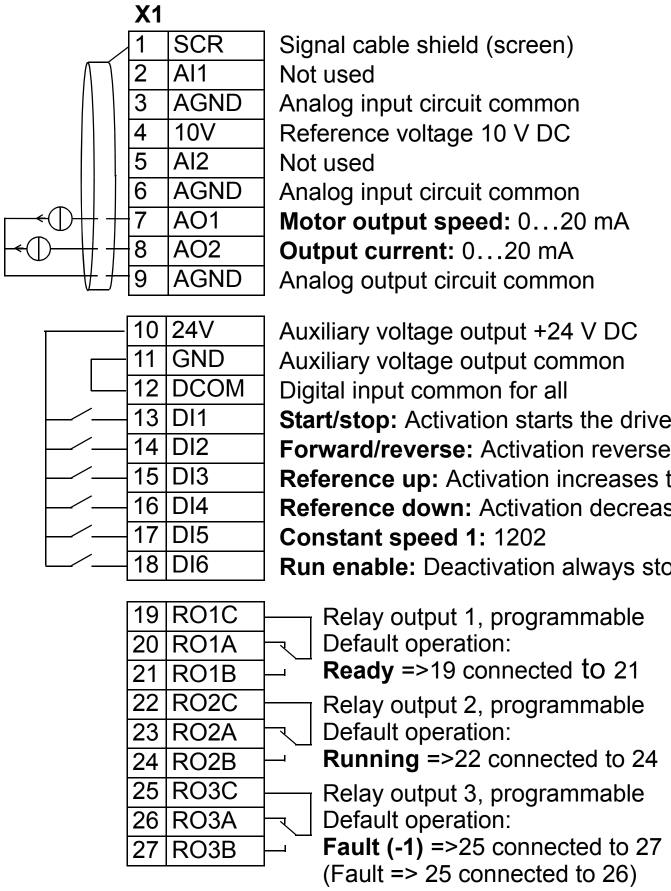
Jumper setting



Motor Potentiometer macro

This macro provides a cost-effective interface for PLCs that vary the speed of the motor using only digital signals. To enable, set the value of parameter 9902 to 4 (MOTOR POT).

Connection example:



X1

1	SCR	Signal cable shield (screen)
2	AI1	Not used
3	AGND	Analog input circuit common
4	10V	Reference voltage 10 V DC
5	AI2	Not used
6	AGND	Analog input circuit common
7	AO1	**Motor output speed:** 0…20 mA
8	AO2	**Output current:** 0…20 mA
9	AGND	Analog output circuit common
10	24V	Auxiliary voltage output +24 V DC
11	GND	Auxiliary voltage output common
12	DCOM	Digital input common for all
13	DI1	**Start/stop:** Activation starts the drive.
14	DI2	**Forward/reverse:** Activation reverses rotation direction.
15	DI3	**Reference up:** Activation increases the reference[1]
16	DI4	**Reference down:** Activation decreases the reference[1]
17	DI5	**Constant speed 1:** 1202
18	DI6	**Run enable:** Deactivation always stops the drive.
19	RO1C	Relay output 1, programmable Default operation: **Ready** =>19 connected to 21
20	RO1A	
21	RO1B	
22	RO2C	Relay output 2, programmable Default operation: **Running** =>22 connected to 24
23	RO2A	
24	RO2B	
25	RO3C	Relay output 3, programmable Default operation: **Fault (-1)** =>25 connected to 27 (Fault => 25 connected to 26)
26	RO3A	
27	RO3B	

Note 1. For DI3 and DI4:

- If both are active or inactive the speed reference is unchanged.
- The existing speed reference is stored during stop or power down.

Note 2.

- Settings of the ramp times with acceleration and deceleration time 2 (parameters 2205 and 2206).

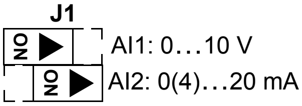
Input signals

- Start, stop and direction (DI1,2)
- Reference up/down (DI3,4)
- Constant speed selection (DI5)
- Run enable (DI6)

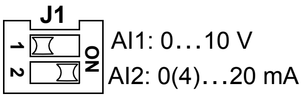
Output signals

- Analog output AO1: Speed
- Analog output AO2: Current
- Relay output 1: Ready
- Relay output 2: Running
- Relay output 3: Fault (-1)

Jumper setting



or

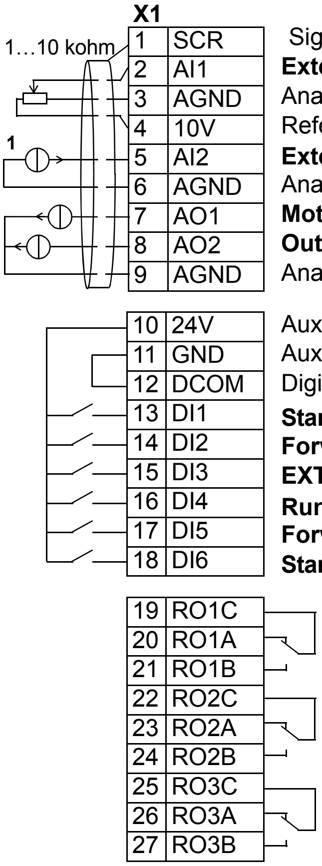


Hand-Auto macro

This macro provides an I/O configuration that is typically used in HVAC applications. To enable, set the value of parameter 9902 to 5 (HAND/AUTO).

Note: Parameter 2108 START INHIBIT must remain in the default setting, 0 (OFF).

Connection example:



1	SCR	Signal cable shield (screen)
2	AI1	**External reference 1:** 0…10 V **(Hand Control)**
3	AGND	Analog input circuit common
4	10V	Reference voltage 10 V DC
5	AI2	**External reference 2:** 0…20 mA **(Auto Control)**
6	AGND	Analog input circuit common
7	AO1	**Motor output speed:** 0…20 mA
8	AO2	**Output current:** 0…20 mA
9	AGND	Analog output circuit common
10	24V	Auxiliary voltage output +24 V DC
11	GND	Auxiliary voltage output common
12	DCOM	Digital input common for all
13	DI1	**Start/Stop (Hand):** Activation starts the drive
14	DI2	**Forward/Reverse (Hand):** Activation reverses rotation direction
15	DI3	**EXT1/EXT2 Selection:** Activation selects auto control
16	DI4	**Run enable:** Deactivation always stops the drive
17	DI5	**Forward/Reverse (Auto):** Activation reverses rotation direction
18	DI6	**Start/Stop (Auto):** Activation starts the drive
19	RO1C	Relay output 1, programmable Default operation: **Ready** =>19 connected to 21
20	RO1A	
21	RO1B	
22	RO2C	Relay output 2, programmable Default operation: **Running** =>22 connected to 24
23	RO2A	
24	RO2B	
25	RO3C	Relay output 3, programmable Default operation: **Fault (-1)** =>25 connected to 27 (Fault => 25 connected to 26)
26	RO3A	
27	RO3B	

Note 1.
The sensor for AI2 is powered externally. See the manufacturer's instructions. To use sensors supplied by the drive aux. voltage output, see page 82.

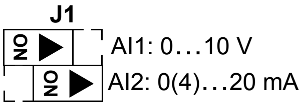
Input signals

- Two analog references (AI1, 2)
- Start/stop – hand/auto (DI1, 6)
- Direction – hand/auto (DI2, 5)
- Control location selection (DI3)
- Run enable (DI4)

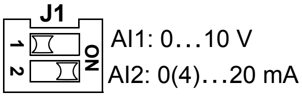
Output signals

- Analog output AO1: Speed
- Analog output AO2: Current
- Relay output 1: Ready
- Relay output 2: Running
- Relay output 3: Fault (-1)

Jumper setting



or

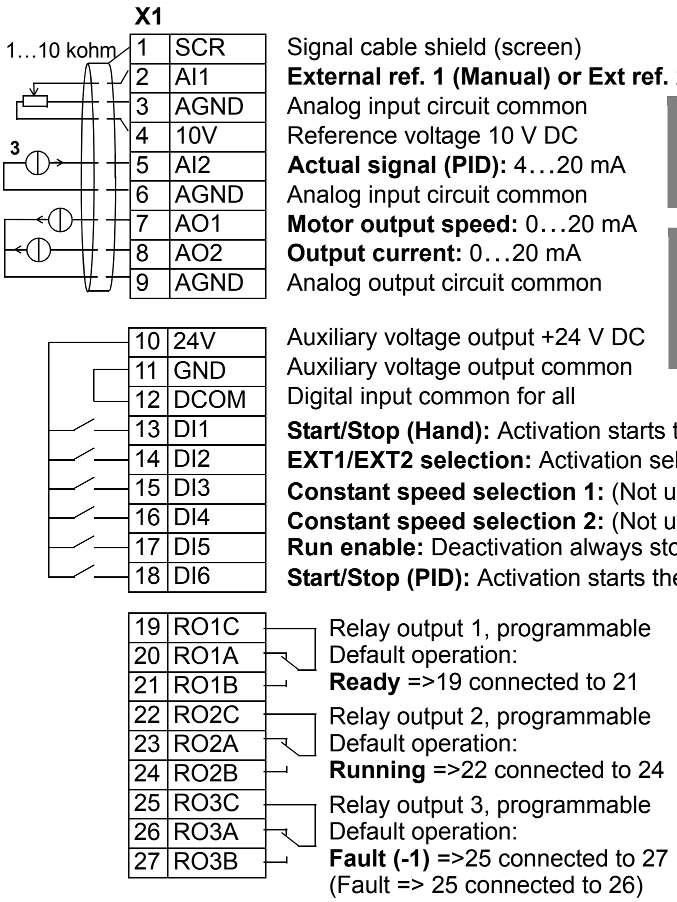


PID Control macro

This macro provides parameter settings for closed-loop control systems such as pressure control, flow control, etc. To enable, set the value of parameter 9902 to 6 (PID CONTROL).

Note: Parameter 2108 START INHIBIT must remain in the default setting, 0 (OFF).

Connection example:



X1		
1	SCR	Signal cable shield (screen)
2	AI1	**External ref. 1 (Manual) or Ext ref. 2 (PID):** 0…10 V[1]
3	AGND	Analog input circuit common
4	10V	Reference voltage 10 V DC
5	AI2	**Actual signal (PID):** 4…20 mA
6	AGND	Analog input circuit common
7	AO1	**Motor output speed:** 0…20 mA
8	AO2	**Output current:** 0…20 mA
9	AGND	Analog output circuit common
10	24V	Auxiliary voltage output +24 V DC
11	GND	Auxiliary voltage output common
12	DCOM	Digital input common for all
13	DI1	**Start/Stop (Hand):** Activation starts the drive
14	DI2	**EXT1/EXT2 selection:** Activation selects PID control
15	DI3	**Constant speed selection 1:** (Not used in PID control)[2]
16	DI4	**Constant speed selection 2:** (Not used in PID control)[2]
17	DI5	**Run enable:** Deactivation always stops the drive
18	DI6	**Start/Stop (PID):** Activation starts the drive
19	RO1C	Relay output 1, programmable Default operation: **Ready** =>19 connected to 21
20	RO1A	
21	RO1B	
22	RO2C	Relay output 2, programmable Default operation: **Running** =>22 connected to 24
23	RO2A	
24	RO2B	
25	RO3C	Relay output 3, programmable Default operation: **Fault (-1)** =>25 connected to 27 (Fault => 25 connected to 26)
26	RO3A	
27	RO3B	

Note 1.
Manual: 0…10V => speed reference
PID: 0…10V => 0…100% PID setpoint

Note 3.
The sensor for AI2 is powered externally. See the manufacturer's instructions. To use sensors supplied by the drive aux. voltage output, see page 82.

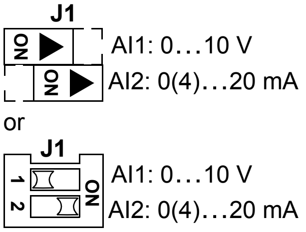
Note 2. Code:
0 = open, 1 = connected

DI3	DI4	Output
0	0	Reference through AI1
1	0	CONST SPEED 1 (1202)
0	1	CONST SPEED 2 (1203)
1	1	CONST SPEED 3 (1204)

Input signals
- Analog reference (AI1)
- Actual value (AI2)
- Start/stop – hand/PID (DI1, 6)
- EXT1/EXT2 selection (DI2)
- Constant speed selection (DI3, 4)
- Run enable (DI5)

Output signals
- Analog output AO1: Speed
- Analog output AO2: Current
- Relay output 1: Ready
- Relay output 2: Running
- Relay output 3: Fault (-1)

Jumper setting



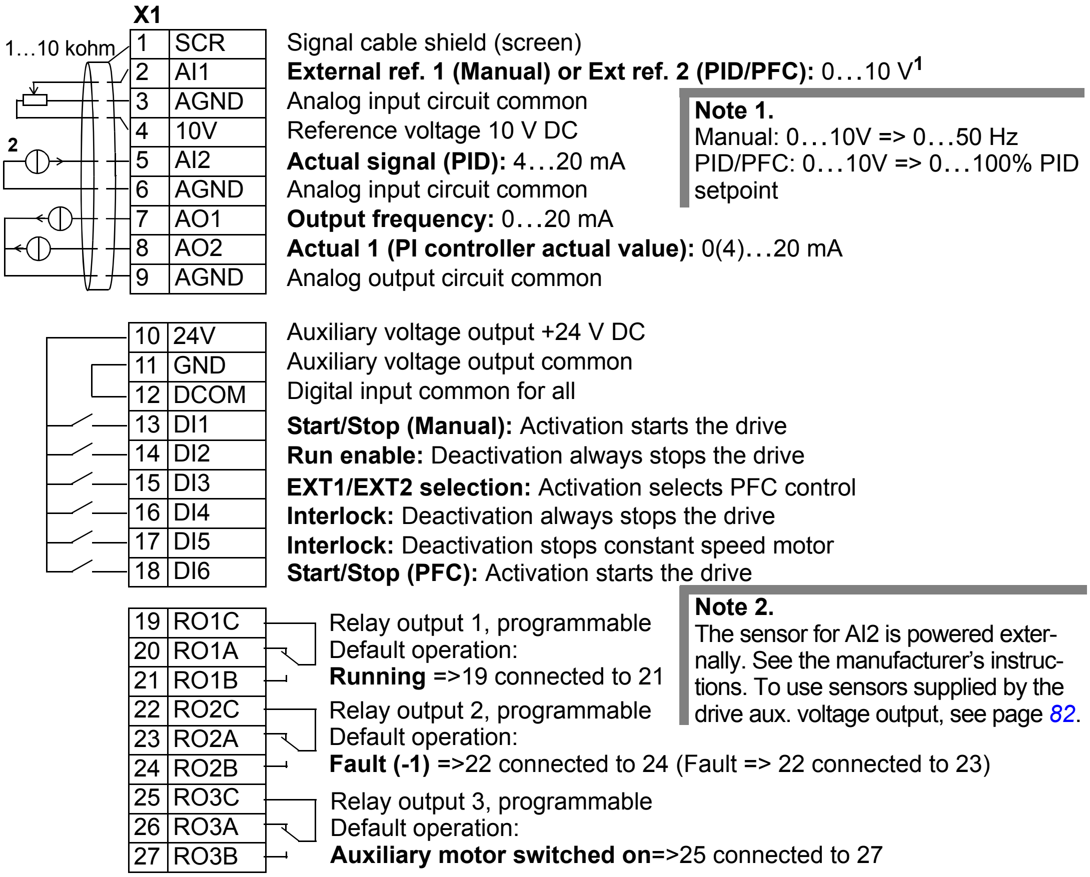
Note: Use the following switch-on order:
1. EXT1/EXT2
2. Run Enable
3. Start.

PFC macro

This macro provides parameter settings for pump and fan control (PFC) applications. To enable, set the value of parameter 9902 to 7 (PFC CONTROL).

Note: Parameter 2108 START INHIBIT must remain in the default setting, 0 (OFF).

Connection example:



1	SCR	Signal cable shield (screen)
2	AI1	**External ref. 1 (Manual) or Ext ref. 2 (PID/PFC):** 0…10 V[1]
3	AGND	Analog input circuit common
4	10V	Reference voltage 10 V DC
5	AI2	**Actual signal (PID):** 4…20 mA
6	AGND	Analog input circuit common
7	AO1	**Output frequency:** 0…20 mA
8	AO2	**Actual 1 (PI controller actual value):** 0(4)…20 mA
9	AGND	Analog output circuit common
10	24V	Auxiliary voltage output +24 V DC
11	GND	Auxiliary voltage output common
12	DCOM	Digital input common for all
13	DI1	**Start/Stop (Manual):** Activation starts the drive
14	DI2	**Run enable:** Deactivation always stops the drive
15	DI3	**EXT1/EXT2 selection:** Activation selects PFC control
16	DI4	**Interlock:** Deactivation always stops the drive
17	DI5	**Interlock:** Deactivation stops constant speed motor
18	DI6	**Start/Stop (PFC):** Activation starts the drive
19	RO1C	Relay output 1, programmable Default operation: **Running** =>19 connected to 21
20	RO1A	
21	RO1B	
22	RO2C	Relay output 2, programmable Default operation: **Fault (-1)** =>22 connected to 24 (Fault => 22 connected to 23)
23	RO2A	
24	RO2B	
25	RO3C	Relay output 3, programmable Default operation: **Auxiliary motor switched on**=>25 connected to 27
26	RO3A	
27	RO3B	

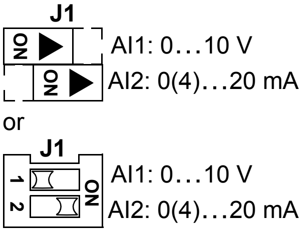
Note 1.
Manual: 0…10V => 0…50 Hz
PID/PFC: 0…10V => 0…100% PID setpoint

Note 2.
The sensor for AI2 is powered externally. See the manufacturer's instructions. To use sensors supplied by the drive aux. voltage output, see page 82.

Input signals
- Analog ref. and actual (AI1, 2)
- Start/stop – manual/PFC (DI1, 6)
- Run enable (DI2)
- EXT1/EXT2 selection (DI3)
- Interlock (DI4, 5)

Output signals
- Analog output AO1: Frequency
- Analog output AO2: Actual 1
- Relay output 1: Running
- Relay output 2: Fault (-1)
- Relay output 3: Aux. motor ON

Jumper setting

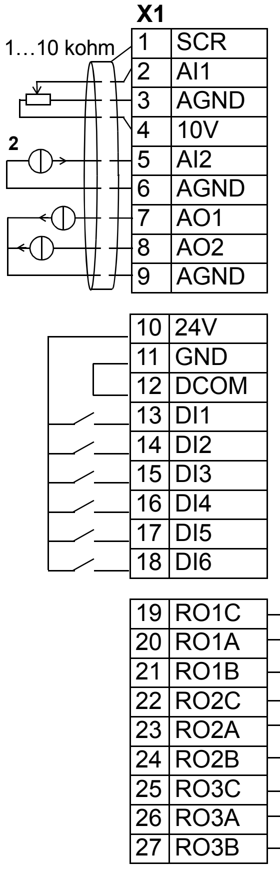


Note: Use the following switch-on order:
1. EXT1/EXT2
2. Run Enable
3. Start.

Torque Control macro

This macro provides parameter settings for applications that require torque control of the motor. Control can also be switched to speed control. To enable, set the value of parameter 9902 to 8 (TORQUE CTRL).

Connection example:



X1		
1	SCR	Signal cable shield (screen)
2	AI1	**External speed reference 1:** 0…10 V
3	AGND	Analog input circuit common
4	10V	Reference voltage 10 V DC
5	AI2	**External torque reference:** 4…20 mA
6	AGND	Analog input circuit common
7	AO1	**Motor output speed:** 0…20 mA
8	AO2	**Output current:** 0…20 mA
9	AGND	Analog output circuit common
10	24V	Auxiliary voltage output +24 V DC
11	GND	Auxiliary voltage output common
12	DCOM	Digital input common for all
13	DI1	**Start/stop:** Activation starts the drive.
14	DI2	**Forward/reverse:** Activation reverses direction[1]
15	DI3	**Speed/torque control:** Activation selects torque control
16	DI4	**Constant speed 1:** 1202
17	DI5	**Ramp pair selection:** Activate to select 2nd acc/dec ramp pair
18	DI6	**Run enable:** Deactivation always stops the drive
19	RO1C	Relay output 1, programmable
20	RO1A	Default operation:
21	RO1B	**Ready** =>19 connected to 21
22	RO2C	Relay output 2, programmable
23	RO2A	Default operation:
24	RO2B	**Running** =>22 connected to 24
25	RO3C	Relay output 3, programmable
26	RO3A	Default operation:
27	RO3B	**Fault (-1)** =>25 connected to 27 (Fault => 25 connected to 26)

Note 1.

- Reverses rotation direction in speed control.
- Reverses torque direction in torque control.

Note 2.
The sensor for AI2 is powered externally. See the manufacturer's instructions. To use sensors supplied by the drive aux. voltage output, see page 82.

Input signals

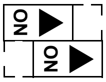
- Two analog references (AI1, 2)
- Start/stop and direction (DI1, 2)
- Speed/torque control (DI3)
- Constant speed selection (DI4)
- Ramp pair 1/2 selection (DI5)
- Run enable (DI6)

Output signals

- Analog output AO1: Speed
- Analog output AO2: Current
- Relay output 1: Ready
- Relay output 2: Running
- Relay output 3: Fault (-1)

Jumper setting

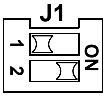
J1



AI1: 0…10 V
AI2: 0(4)…20 mA

or

J1



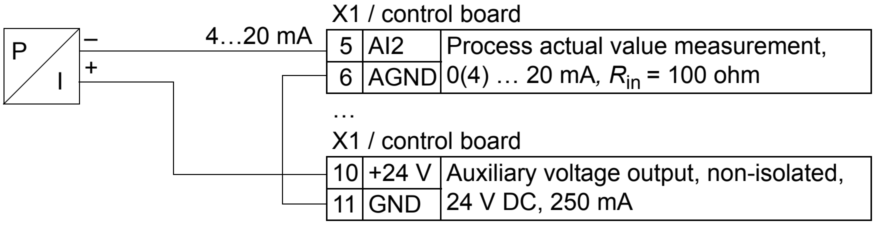
AI1: 0…10 V
AI2: 0(4)…20 mA

Connection examples of two-wire and three-wire sensors

Many applications use process PI(D) and need a feedback signal from the process. The feedback signal is typically connected to analog input 2 (AI2).

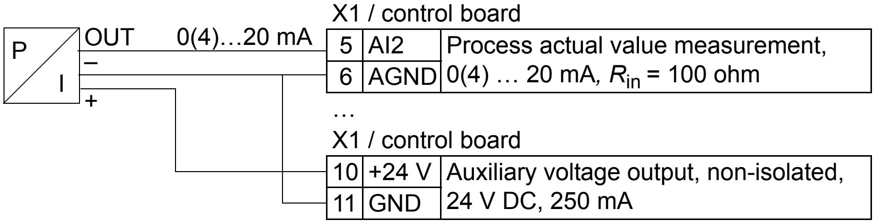
The macro wiring diagrams for each macro earlier in this chapter use an externally powered sensor (connections not shown). The figures below give examples of connections using a two-wire or three-wire sensor/transmitter supplied by the drive auxiliary voltage output.

Two-wire sensor/transmitter



Note: The sensor is supplied through its current output and the drive feeds the supply voltage (+24 V). Thus the output signal must be 4…20 mA, not 0…20 mA

Three-wire sensor/transmitter



User parameter sets

In addition to the standard application macros, it is possible to save two user parameter sets into the permanent memory and load them at a later time. A user parameter set consists of the user parameter settings, including *Group 99: START-UP DATA*, and the results of the motor identification. The panel reference is also saved if the user parameter set is saved and loaded in local control. The remote control setting is saved into the user parameter set, but the local control setting is not.

The steps below show how to save and load User Parameter Set 1. The procedure for User Parameter Set 2 is identical, only the parameter *9902* values are different.

To save User Parameter Set 1:

- Adjust the parameters. Perform the motor identification if it is needed in the application but it is not done yet.
- Save the parameter settings and the results of the motor identification to the permanent memory by changing parameter *9902* to -1 (USER S1 SAVE).
- Press SAVE (Assistant Control Panel) or MENU ENTER (Basic Control Panel).

To load User Parameter Set 1:

- Change parameter *9902* to 0 (USER S1 LOAD).
- Press SAVE (Assistant Control Panel) or MENU ENTER (Basic Control Panel) to load.

The user parameter set can also be switched through digital inputs (see parameter *1605*).

Note: Loading the user parameter set restores the parameter settings including *Group 99: START-UP DATA* and the results of the motor identification. Check that the settings correspond to the motor used.

Hint: The user can for example switch the drive between two motors without having to adjust the motor parameters and to repeat the motor identification every time the motor is changed. The user needs only to adjust the settings and perform the motor identification once for each motor and then to save the data as two user parameter sets. When the motor is changed, only the corresponding user parameter set needs to be loaded, and the drive is ready to operate.

Macro default values for parameters

Parameter default values are listed in section *Complete parameter list* on page 87. Changing from the default macro (ABB Standard), that is, editing the value of parameter 9902, changes the parameter default values as defined in the following tables.

Note: There are two sets of values because the defaults are configured for 50 Hz/ IEC compliance (ACS550-01) and 60 Hz/NEMA compliance (ACS550-U1).

ACS550-01

Parameter		ABB Standard	3-wire	Alternate	Motor Potenti-ometer	Hand-auto	PID Control	PFC Control	Torque Control
9902	APPLIC MACRO	1 = ABB STANDARD	2 = 3-WIRE	3 = ALTERNATE	4 = MOTOR POT	5 = HAND/AUTO	6 = PID CONTROL	7 = PFC CONTROL	8 = TORQUE CTRL
9904	MOTOR CTRL MODE	3 = SCALAR: FREQ	1 = VECTOR: SPEED	1 = VECTOR: SPEED	1 = VECTOR: SPEED	1 = VECTOR: SPEED	1 = VECTOR: SPEED	3 = SCALAR: FREQ	2 = VECTOR: TORQUE
1001	EXT1 COMMANDS	2 = DI1,2	4 = DI1P,2P,3	9 = DI1F,2R	2 = DI1,2	2 = DI1,2	1 = DI1	1 = DI1	2 = DI1,2
1002	EXT2 COMMANDS	0 = NOT SEL	0 = NOT SEL	0 = NOT SEL	0 = NOT SEL	7 = DI6,5	6 = DI6	6 = DI6	2 = DI1,2
1003	DIRECTION	3 = REQUEST	3 = REQUEST	3 = REQUEST	3 = REQUEST	3 = REQUEST	1 = FORWARD	1 = FORWARD	3 = REQUEST
1102	EXT1/EXT2 SEL	0 = EXT1	0 = EXT1	0 = EXT1	0 = EXT1	3 = DI3	2 = DI2	3 = DI3	3 = DI3
1103	REF1 SELECT	1 = AI1	1 = AI1	1 = AI1	12 = DI3U,4D(NC)	1 = AI1	1 = AI1	1 = AI1	1 = AI1
1106	REF2 SELECT	2 = AI2	2 = AI2	2 = AI2	2 = AI2	2 = AI2	19 = PID1OUT	19 = PID1OUT	2 = AI2
1201	CONST SPEED SEL	9 = DI3,4	10 = DI4,5	9 = DI3,4	5 = DI5	0 = NOT SEL	9 = DI3,4	0 = NOT SEL	4 = DI4
1304	MINIMUM AI2	0.0%	0.0%	0.0%	0.0%	20.0%	20.0%	20.0%	20.0%
1401	RELAY OUTPUT 1	1 = READY	1 = READY	1 = READY	1 = READY	1 = READY	1 = READY	2 = RUN	1 = READY
1402	RELAY OUTPUT 2	2 = RUN	2 = RUN	2 = RUN	2 = RUN	2 = RUN	2 = RUN	3 = FAULT(-1)	2 = RUN
1403	RELAY OUTPUT 3	3 = FAULT(-1)	3 = FAULT(-1)	3 = FAULT(-1)	3 = FAULT(-1)	3 = FAULT(-1)	3 = FAULT(-1)	31 = PFC	3 = FAULT(-1)
1501	AO1 CONTENT SEL	103 = 0103 OUTPUT FREQ	102 = 0102 SPEED	102 = 0102 SPEED	102 = 0102 SPEED	102 = 0102 SPEED	102 = 0102 SPEED	103 = 0103 OUTPUT FREQ	102 = 0102 SPEED
1507	AO2 CONTENT SEL	104 = CURRENT	104 = CURRENT	104 = CURRENT	104 = CURRENT	104 = CURRENT	104 = CURRENT	130 = PID 1 FBK	104 = CURRENT
1510	MINIMUM AO2	0.0 mA	0.0 mA	0.0 mA	0.0 mA	0.0 mA	0.0 mA	4.0 mA	0.0 mA
1601	RUN ENABLE	0 = NOT SEL	0 = NOT SEL	6 = DI6	6 = DI6	4 = DI4	5 = DI5	2 = DI2	6 = DI6
2201	ACC/DEC 1/2 SEL	5 = DI5	0 = NOT SEL	5 = DI5	0 = NOT SEL	0 = NOT SEL	0 = NOT SEL	0 = NOT SEL	5 = DI5
3201	SUPERV 1 PARAM	103 = 0103 OUTPUT FREQ	102 = 0102 SPEED	102 = 0102 SPEED	102 = 0102 SPEED	102 = 0102 SPEED	102 = 0102 SPEED	103 = 0103 OUTPUT FREQ	102 = 0102 SPEED
3401	SIGNAL1 PARAM	103 = 0103 OUTPUT FREQ	102 = 0102 SPEED	102 = 0102 SPEED	102 = 0102 SPEED	102 = 0102 SPEED	102 = 0102 SPEED	103 = 0103 OUTPUT FREQ	102 = 0102 SPEED
4001	GAIN	1.0	1.0	1.0	1.0	1.0	1.0	2.5	1.0
4002	INTEGRATION TIME	60.0 s	60.0 s	60.0 s	60.0 s	60.0 s	60.0 s	3.0 s	60.0 s
4101	GAIN	1.0	1.0	1.0	1.0	1.0	1.0	2.5	1.0
4102	INTEGRATION TIME	60.0 s	60.0 s	60.0 s	60.0 s	60.0 s	60.0 s	3.0 s	60.0 s
8123	PFC ENABLE	0 = NOT SEL	0 = NOT SEL	0 = NOT SEL	0 = NOT SEL	0 = NOT SEL	0 = NOT SEL	1 = ACTIVE	0 = NOT SEL

ACS550-U1

Parameter		ABB Standard	3-wire	Alternate	Motor Potenti-ometer	Hand-auto	PID Control	PFC Control	Torque Control
9902	APPLIC MACRO	1 = ABB STANDARD	2 = 3-WIRE	3 = ALTERNATE	4 = MOTOR POT	5 = HAND/AUTO	6 = PID CONTROL	7 = PFC CONTROL	8 = TORQUE CTRL
9904	MOTOR CTRL MODE	3 = SCALAR: FREQ	1 = VECTOR: SPEED	1 = VECTOR: SPEED	1 = VECTOR: SPEED	1 = VECTOR: SPEED	1 = VECTOR: SPEED	3 = SCALAR: FREQ	2 = VECTOR: TORQUE
1001	EXT1 COMMANDS	2 = DI1,2	4 = DI1P,2P,3	9 = DI1F,2R	2 = DI1,2	2 = DI1,2	1 = DI1	1 = DI1	2 = DI1,2
1002	EXT2 COMMANDS	0 = NOT SEL	0 = NOT SEL	0 = NOT SEL	0 = NOT SEL	7 = DI6,5	6 = DI6	6 = DI6	2 = DI1,2
1003	DIRECTION	3 = REQUEST	3 = REQUEST	3 = REQUEST	3 = REQUEST	3 = REQUEST	1 = FORWARD	1 = FORWARD	3 = REQUEST
1102	EXT1/EXT2 SEL	0 = EXT1	0 = EXT1	0 = EXT1	0 = EXT1	3 = DI3	2 = DI2	3 = DI3	3 = DI3
1103	REF1 SELECT	1 = AI1	1 = AI1	1 = AI1	12 = DI3U,4D(NC)	1 = AI1	1 = AI1	1 = AI1	1 = AI1
1106	REF2 SELECT	2 = AI2	2 = AI2	2 = AI2	2 = AI2	2 = AI2	19 = PID1OUT	19 = PID1OUT	2 = AI2
1201	CONST SPEED SEL	9 = DI3,4	10 = DI4,5	9 = DI3,4	5 = DI5	0 = NOT SEL	9 = DI3,4	0 = NOT SEL	4 = DI4
1304	MINIMUM AI2	0.0%	0.0%	0.0%	0.0%	20.0%	20.0%	20.0%	20.0%
1401	RELAY OUTPUT 1	1 = READY	1 = READY	1 = READY	1 = READY	1 = READY	1 = READY	2 = RUN	1 = READY
1402	RELAY OUTPUT 2	2 = RUN	2 = RUN	2 = RUN	2 = RUN	2 = RUN	2 = RUN	3 = FAULT(-1)	2 = RUN
1403	RELAY OUTPUT 3	3 = FAULT(-1)	3 = FAULT(-1)	3 = FAULT(-1)	3 = FAULT(-1)	3 = FAULT(-1)	3 = FAULT(-1)	31 = PFC	3 = FAULT(-1)
1501	AO1 CONTENT SEL	103 = 0103 OUTPUT FREQ	102 = 0102 SPEED	102 = 0102 SPEED	102 = 0102 SPEED	102 = 0102 SPEED	102 = 0102 SPEED	103 = 0103 OUTPUT FREQ	102 = 0102 SPEED
1507	AO2 CONTENT SEL	104 = CURRENT	104 = CURRENT	104 = CURRENT	104 = CURRENT	104 = CURRENT	104 = CURRENT	130 = PID 1 FBK	104 = CURRENT
1510	MINIMUM AO2	0.0 mA	0.0 mA	0.0 mA	0.0 mA	0.0 mA	0.0 mA	4.0 mA	0.0 mA
1601	RUN ENABLE	0 = NOT SEL	0 = NOT SEL	6 = DI6	6 = DI6	4 = DI4	5 = DI5	2 = DI2	6 = DI6
2201	ACC/DEC 1/2 SEL	5 = DI5	0 = NOT SEL	5 = DI5	0 = NOT SEL	0 = NOT SEL	0 = NOT SEL	0 = NOT SEL	5 = DI5
3201	SUPERV 1 PARAM	103 = 0103 OUTPUT FREQ	102 = 0102 SPEED	102 = 0102 SPEED	102 = 0102 SPEED	102 = 0102 SPEED	102 = 0102 SPEED	103 = 0103 OUTPUT FREQ	102 = 0102 SPEED
3401	SIGNAL1 PARAM	103 = 0103 OUTPUT FREQ	102 = 0102 SPEED	102 = 0102 SPEED	102 = 0102 SPEED	102 = 0102 SPEED	102 = 0102 SPEED	103 = 0103 OUTPUT FREQ	102 = 0102 SPEED
4001	GAIN	1.0	1.0	1.0	1.0	1.0	1.0	2.5	1.0
4002	INTEGRATION TIME	60.0 s	60.0 s	60.0 s	60.0 s	60.0 s	60.0 s	3.0 s	60.0 s
4101	GAIN	1.0	1.0	1.0	1.0	1.0	1.0	2.5	1.0
4102	INTEGRATION TIME	60.0 s	60.0 s	60.0 s	60.0 s	60.0 s	60.0 s	3.0 s	60.0 s
8123	PFC ENABLE	0 = NOT SEL	0 = NOT SEL	0 = NOT SEL	0 = NOT SEL	0 = NOT SEL	0 = NOT SEL	1 = ACTIVE	0 = NOT SEL

Parameters

Complete parameter list

The following table lists all parameters. Table header abbreviations are:

- S = Parameters can be modified only when the drive is stopped.
- User = Space to enter desired parameter values.

Some values depend on the "construction" as indicated in the table by
"-01:" = Setup and parts specific to IEC installation and compliance or
"-U1:" = Setup and parts specific to US installation and NEMA compliance.
Refer to the type designation on the drive, for example ACS550-**01**-08A8-4.

Code	Name	Range	Resolution	Default	User	S
Group 99: START-UP DATA						
9901	LANGUAGE	0…16 / 0…3	1	0 (ENGLISH)		
9902	APPLIC MACRO	-3…8, 31	1	1 (ABB STANDARD)		✓
9904	MOTOR CTRL MODE	1 = VECTOR:SPEED, 2 = VECTOR:TORQUE, 3 = SCALAR:FREQ	1	3 (SCALAR:FREQ)		✓
9905	MOTOR NOM VOLT	-01-yyyy-2: 115…345 V / -U1-yyyy-2: 115…345 V -01-yyyy-4: 200…600 V / -U1-yyyy-4: 230…690 V -U1-yyyy-6: 288…862 V	1 V	-01-yyyy-2: 230 V / -U1-yyyy-2: 230 V -01:-yyyy-4 400 V / -U1-yyyy-4: 460 V -U1-yyyy-6: 575 V		✓
9906	MOTOR NOM CURR	$0.2 \cdot I_{2hd} \ldots 2.0 \cdot I_{2hd}$	0.1 A	$1.0 \cdot I_{2hd}$		✓
9907	MOTOR NOM FREQ	10.0…500.0 Hz	0.1 Hz	-01: 50.0 Hz / -U1: 60.0 Hz		✓
9908	MOTOR NOM SPEED	50…30000 rpm	1 rpm	Size dependent		✓
9909	MOTOR NOM POWER	$0.2 \ldots 3.0 \cdot P_{hd}$	-01: 0.1 kW / -U1: 0.1 hp	$1.0 \cdot P_{hd}$		✓
9910	ID RUN	0 = OFF/IDMAGN, 1 = ON	1	0 (OFF/IDMAGN)		✓
9915	MOTOR COSPHI	0 = IDENTIFIED, 0.01…0.97	0.01	0 (IDENTIFIED)		✓
Group 01: OPERATING DATA						
0101	SPEED & DIR	-30000…30000 rpm	1 rpm	-		
0102	SPEED	0…30000 rpm	1 rpm	-		
0103	OUTPUT FREQ	0.0…500.0 Hz	0.1 Hz	-		
0104	CURRENT	$0.0 \ldots 2.0 \cdot I_{2hd}$	0.1 A	-		
0105	TORQUE	-200.0…200.0%	0.1%	-		
0106	POWER	$-2.0 \ldots 2.0 \cdot P_{hd}$	0.1 kW	-		
0107	DC BUS VOLTAGE	$0 \ldots 2.5 \cdot V_{dN}$	1 V	-		
0109	OUTPUT VOLTAGE	$0 \ldots 2.0 \cdot V_{dN}$	1 V	-		
0110	DRIVE TEMP	0.0…150.0 °C	0.1 °C	-		
0111	EXTERNAL REF 1	0.0…500.0 Hz / 0…30000 rpm	0.1 Hz / 1 rpm	-		
0112	EXTERNAL REF 2	0.0…100.0% (0.0…600.0% for torque)	0.1%	-		
0113	CTRL LOCATION	0 = LOCAL, 1 = EXT1, 2 = EXT2	1	-		

Code	**Name**	**Range**	**Resolution**	**Default**	**User**	**S**
0114	RUN TIME (R)	0…9999 h	1 h	-		
0115	KWH COUNTER (R)	0…65535 kWh	1 kWh	-		
0116	APPL BLK OUTPUT	0.0…100.0% (0.0…600.0% for torque)	0.1%	-		
0118	DI 1-3 STATUS	000…111 (0…7 decimal)	1	-		
0119	DI 4-6 STATUS	000…111 (0…7 decimal)	1	-		
0120	AI 1	0.0…100.0%	0.1%	-		
0121	AI 2	0.0…100.0%	0.1%	-		
0122	RO 1-3 STATUS	000…111 (0…7 decimal)	1	-		
0123	RO 4-6 STATUS	000…111 (0…7 decimal)	1	-		
0124	AO 1	0.0…20.0 mA	0.1 mA	-		
0125	AO 2	0.0…20.0 mA	0.1 mA	-		
0126	PID 1 OUTPUT	-1000.0…1000.0%	0.1%	-		
0127	PID 2 OUTPUT	-100.0…100.0%	0.1%	-		
0128	PID 1 SETPNT	Unit and scale defined by par. 4006/ 4106 and 4007/4107	-	-		
0129	PID 2 SETPNT	Unit and scale defined by par. 4206 and 4207		-		
0130	PID 1 FBK	Unit and scale defined by par. 4006/ 4106 and 4007/4107	-	-		
0131	PID 2 FBK	Unit and scale defined by par. 4206 and 4207	-	-		
0132	PID 1 DEVIATION	Unit and scale defined by par. 4006/ 4106 and 4007/4107	-	-		
0133	PID 2 DEVIATION	Unit and scale defined by par. 4206 and 4207	-	-		
0134	COMM RO WORD	0…65535	1	-		
0135	COMM VALUE 1	-32768…+32767	1	-		
0136	COMM VALUE 2	-32768…+32767	1	-		
0137	PROCESS VAR 1	-	1			
0138	PROCESS VAR 2	-	1			
0139	PROCESS VAR 3	-	1			
0140	RUN TIME	0.00…499.99 kh	0.01 kh	-		
0141	MWH COUNTER	0…65535 MWh	1 MWh	-		
0142	REVOLUTION CNTR	0…65535 Mrev	1 Mrev	-		
0143	DRIVE ON TIME HI	0…65535 days	1 day	-		
0144	DRIVE ON TIME LO	00:00:00…23:59:58	1 = 2 s	-		
0145	MOTOR TEMP	Par. 3501 = 1…3: -10…200 °C Par. 3501 = 4: 0…5000 ohm Par. 3501 = 5…6: 0…1	1	-		
0146	MECH ANGLE	0…32768	1	-		
0147	MECH REVS	-32768 …+32767	1	-		
0148	Z PLS DETECTED	0 = NOT DETECTED, 1 = DETECTED	1	-		
0150	CB TEMP	-20.0…150.0 °C	1.0 °C	-		
0153	MOT THERM STRESS	0.0…100.0%	0.1%	-		
0158	PID COMM VALUE 1	-32768 …+32767	1	-		
0159	PID COMM VALUE 2	-32768 …+32767	1	-		
0174	SAVED KWH	0.0…999.9 kWh	0.1 kWh	-		

Code	Name	Range	Resolution	Default	User	S
0175	SAVED MWH	0…65535 MWh	1 MWh	-		
0176	SAVED AMOUNT 1	0.0…999.9	0.1	-		
0177	SAVED AMOUNT 2	0…65535	1	-		
0178	SAVED CO2	0.0…6553.5 tn	0.1 tn	-		
Group 03: FB ACTUAL SIGNALS						
0301	FB CMD WORD 1	-	-	-		
0302	FB CMD WORD 2	-	-	-		
0303	FB STS WORD 1	-	-	-		
0304	FB STS WORD 2	-	1	-		
0305	FAULT WORD 1	-	1	-		
0306	FAULT WORD 2	-	1	-		
0307	FAULT WORD 3	-	1	-		
0308	ALARM WORD 1	-	1	-		
0309	ALARM WORD 2	-	1	-		
Group 04: FAULT HISTORY						
0401	LAST FAULT	Fault codes (panel displays as text)	1	0		
0402	FAULT TIME 1	Date dd.mm.yy / power-on time in days	1 day	0		
0403	FAULT TIME 2	Time hh.mm.ss	2 s	0		
0404	SPEED AT FLT	-32768…+32767	1 rpm	0		
0405	FREQ AT FLT	-3276.8…+3276.7	0.1 Hz	0		
0406	VOLTAGE AT FLT	0.0…6553.5	0.1 V	0		
0407	CURRENT AT FLT	0.0…6553.5	0.1 A	0		
0408	TORQUE AT FLT	-3276.8…+3276.7	0.1%	0		
0409	STATUS AT FLT	0000…FFFF hex	1	0		
0410	DI 1-3 AT FLT	000…111 (0…7 decimal)	1	0		
0411	DI 4-6 AT FLT	000…111 (0…7 decimal)	1	0		
0412	PREVIOUS FAULT 1	As par. 0401	1	0		
0413	PREVIOUS FAULT 2	As par. 0401	1	0		
Group 10: START/STOP/DIR						
1001	EXT1 COMMANDS	0…14	1	2 (DI1,2)		✓
1002	EXT2 COMMANDS	0…14	1	0 (NOT SEL)		✓
1003	DIRECTION	1 = FORWARD, 2 = REVERSE, 3 = REQUEST	1	3 (REQUEST)		✓
1004	JOGGING SEL	-6…6	1	0 (NOT SEL)		✓
Group 11: REFERENCE SELECT						
1101	KEYPAD REF SEL	1 = REF1(Hz/rpm), 2 = REF2(%)	1	1 [REF1(Hz/rpm)]		
1102	EXT1/EXT2 SEL	-6…12	1	0 (EXT1)		✓
1103	REF1 SELECT	0…17, 20…21	1	1 (AI1)		✓
1104	REF1 MIN	0.0…500.0 Hz / 0…30000 rpm	0.1 Hz / 1 rpm	0.0 Hz / 0 rpm		
1105	REF1 MAX	0.0…500.0 Hz / 0…30000 rpm	0.1 Hz / 1 rpm	-01: 50.0 (52.0) Hz / 1500 rpm -U1: 60.0 (62.0) Hz / 1800 rpm		
1106	REF2 SELECT	0…17, 19…21	1	2 (AI2)		✓
1107	REF2 MIN	0.0…100.0% (0.0…600.0% for torque)	0.1%	0.0%		
1108	REF2 MAX	0.0…100.0% (0.0…600.0% for torque)	0.1%	100.0%		

Code	Name	Range	Resolution	Default	User	S
Group 12: CONSTANT SPEEDS						
1201	CONST SPEED SEL	-14 …19	1	9 (DI3,4)		✓
1202	CONST SPEED 1	0.0…500.0 Hz / 0…30000 rpm	0.1 Hz / 1 rpm	-01: 5.0 Hz / 300 rpm -U1: 6.0 Hz / 360 rpm		
1203	CONST SPEED 2	0.0…500.0 Hz / 0…30000 rpm	0.1 Hz / 1 rpm	-01: 10.0 Hz / 600 rpm -U1: 12.0 Hz / 720 rpm		
1204	CONST SPEED 3	0.0…500.0 Hz / 0…30000 rpm	0.1 Hz / 1 rpm	-01: 15.0 Hz / 900 rpm -U1: 18.0 Hz / 1080 rpm		
1205	CONST SPEED 4	0.0…500.0 Hz / 0…30000 rpm	0.1 Hz / 1 rpm	-01: 20.0 Hz / 1200 rpm -U1: 24.0 Hz / 1440 rpm		
1206	CONST SPEED 5	0.0…500.0 Hz / 0…30000 rpm	0.1 Hz / 1 rpm	-01: 25.0 Hz / 1500 rpm -U1: 30.0 Hz / 1800 rpm		
1207	CONST SPEED 6	0.0…500.0 Hz / 0…30000 rpm	0.1 Hz / 1 rpm	-01: 40.0 Hz / 2400 rpm -U1: 48.0 Hz / 2880 rpm		
1208	CONST SPEED 7	0.0…500.0 Hz / 0…30000 rpm	0.1 Hz / 1 rpm	-01: 50.0 Hz / 3000 rpm -U1: 60.0 Hz / 3600 rpm		
1209	TIMED MODE SEL	1 = EXT/CS1/2/3, 2 = CS1/2/3/4	1	2 (CS1/2/3/4)		✓
Group 13: ANALOG INPUTS						
1301	MINIMUM AI1	0.0…100.0%	0.1%	0.0%		
1302	MAXIMUM AI1	0.0…100.0%	0.1%	100.0%		
1303	FILTER AI1	0.0…10.0 s	0.1 s	0.1 s		
1304	MINIMUM AI2	0.0…100.0%	0.1%	0.0%		
1305	MAXIMUM AI2	0.0…100.0%	0.1%	100.0%		
1306	FILTER AI2	0.0…10.0 s	0.1 s	0.1 s		
Group 14: RELAY OUTPUTS						
1401	RELAY OUTPUT 1	0…44, 46, 47, 52	1	1 (READY)		
1402	RELAY OUTPUT 2	0…44, 46, 47, 52	1	2 (RUN)		
1403	RELAY OUTPUT 3	0…44, 46, 47, 52	1	3 [FAULT(-1)]		
1404	RO 1 ON DELAY	0.0…3600.0 s	0.1 s	0.0 s		
1405	RO 1 OFF DELAY	0.0…3600.0 s	0.1 s	0.0 s		
1406	RO 2 ON DELAY	0.0…3600.0 s	0.1 s	0.0 s		
1407	RO 2 OFF DELAY	0.0…3600.0 s	0.1 s	0.0 s		
1408	RO 3 ON DELAY	0.0…3600.0 s	0.1 s	0.0 s		
1409	RO 3 OFF DELAY	0.0…3600.0 s	0.1 s	0.0 s		
1410	RELAY OUTPUT 4	0…44, 46, 47, 52	1	0 (NOT SEL)		
1411	RELAY OUTPUT 5	0…44, 46, 47, 52	1	0 (NOT SEL)		
1412	RELAY OUTPUT 6	0…44, 46, 47, 52	1	0 (NOT SEL)		
1413	RO 4 ON DELAY	0.0…3600.0 s	0.1 s	0.0 s		
1414	RO 4 OFF DELAY	0.0…3600.0 s	0.1 s	0.0 s		
1415	RO 5 ON DELAY	0.0…3600.0 s	0.1 s	0.0 s		
1416	RO 5 OFF DELAY	0.0…3600.0 s	0.1 s	0.0 s		
1417	RO 6 ON DELAY	0.0…3600.0 s	0.1 s	0.0 s		
1418	RO 6 OFF DELAY	0.0…3600.0 s	0.1 s	0.0 s		
Group 15: ANALOG OUTPUTS						
1501	AO1 CONTENT SEL	99…178	1	103 (parameter 0103 OUTPUT FREQ)		

Code	Name	Range	Resolution	Default	User	S
1502	AO1 CONTENT MIN	-	-	Depends on the signal selected with par. 1501		
1503	AO1 CONTENT MAX	-	-	Depends on the signal selected with par. 1501		
1504	MINIMUM AO1	0.0…20.0 mA	0.1 mA	0.0 mA		
1505	MAXIMUM AO1	0.0…20.0 mA	0.1 mA	20.0 mA		
1506	FILTER AO1	0.0…10.0 s	0.1 s	0.1 s		
1507	AO2 CONTENT SEL	99…178	1	104 (parameter 0104 CURRENT)		
1508	AO2 CONTENT MIN	-	-	Depends on the signal selected with par. 1507		
1509	AO2 CONTENT MAX	-	-	Depends on the signal selected with par. 1507		
1510	MINIMUM AO2	0.0…20.0 mA	0.1 mA	0.0 mA		
1511	MAXIMUM AO2	0.0…20.0 mA	0.1 mA	20.0 mA		
1512	FILTER AO2	0.0…10.0 s	0.1 s	0.1 s		
Group 16: SYSTEM CONTROLS						
1601	RUN ENABLE	-6…7	1	0 (NOT SEL)		✓
1602	PARAMETER LOCK	0 = LOCKED, 1 = OPEN, 2 = NOT SAVED	1	1 (OPEN)		
1603	PASS CODE	0…65535	1	0		
1604	FAULT RESET SEL	-6…8	1	0 (KEYPAD)		
1605	USER PAR SET CHG	-6…6	1	0 (NOT SEL)		
1606	LOCAL LOCK	-6…8	1	0 (NOT SEL)		
1607	PARAM SAVE	0 = DONE, 1 = SAVE…	1	0 (DONE)		
1608	START ENABLE 1	-6…7	1	0 (NOT SEL)		✓
1609	START ENABLE 2	-6…7	1	0 (NOT SEL)		✓
1610	DISPLAY ALARMS	0 = NO, 1 = YES	1	0 (NO)		
1611	PARAMETER VIEW	0 = DEFAULT, 1 = FLASHDROP	1	0 (DEFAULT)		
Group 20: LIMITS						
2001	MINIMUM SPEED	-30000…30000 rpm	1 rpm	0 rpm		✓
2002	MAXIMUM SPEED	0…30000 rpm	1 rpm	-01: 1500 rpm / -U1: 1800 rpm		✓
2003	MAX CURRENT	0… 1.8 · I_{2hd}	0.1 A	1.8 · I_{2hd}		✓
2005	OVERVOLT CTRL	0 = DISABLE, 1 = ENABLE	1	1 (ENABLE)		
2006	UNDERVOLT CTRL	0 = DISABLE, 1 = ENABLE(TIME), 2 = ENABLE	1	1 [ENABLE(TIME)]		
2007	MINIMUM FREQ	-500.0…500.0 Hz	0.1 Hz	0.0 Hz		✓
2008	MAXIMUM FREQ	0.0…500.0 Hz	0.1 Hz	-01: 50.0 (52.0) Hz / -U1: 60.0 (62.0) Hz		✓
2013	MIN TORQUE SEL	-6…7	1	0 (MIN TORQUE 1)		
2014	MAX TORQUE SEL	-6…7	1	0 (MAX TORQUE 1)		
2015	MIN TORQUE 1	-600.0…0.0%	0.1%	-300.0%		
2016	MIN TORQUE 2	-600.0…0.0%	0.1%	-300.0%		
2017	MAX TORQUE 1	0.0…600.0%	0.1%	300.0%		
2018	MAX TORQUE 2	0.0…600.0%	0.1%	300.0%		

Code	Name	Range	Resolution	Default	User	S
Group 21: START/STOP						
2101	START FUNCTION	Vector control modes: 1, 2, 8 Scalar control mode: 1…5, 8	1	8 (RAMP)		✓
2102	STOP FUNCTION	1 = COAST, 2 = RAMP	1	1 (COAST)		
2103	DC MAGN TIME	0.00…10.00 s	0.01 s	0.30 s		
2104	DC HOLD CTL	0 = NOT SEL, 1 = DC HOLD, 2 = DC BRAKING	1	0 (NOT SEL)		✓
2105	DC HOLD SPEED	0…360 rpm	1 rpm	5 rpm		
2106	DC CURR REF	0…100%	1%	30%		
2107	DC BRAKE TIME	0.0…250.0 s	0.1 s	0.0 s		
2108	START INHIBIT	0 = OFF, 1 = ON	1	0 (OFF)		
2109	EMERG STOP SEL	-6…6	1	0 (NOT SEL)		
2110	TORQ BOOST CURR	15…300%	1%	100%		
2112	ZERO SPEED DELAY	0.0 = NOT SEL, 0.1…60.0 s	0.1 s	0.0 s (NOT SEL)		
2113	START DELAY	0.00…60.00 s	0.01 s	0.00 s		
Group 22: ACCEL/DECEL						
2201	ACC/DEC 1/2 SEL	-6…7	1	5 (DI5)		
2202	ACCELER TIME 1	0.0…1800.0 s	0.1 s	5.0 s		
2203	DECELER TIME 1	0.0…1800.0 s	0.1 s	5.0 s		
2204	RAMP SHAPE 1	0.0 = LINEAR, 0.1…1000.0 s	0.1 s	0.0 s		
2205	ACCELER TIME 2	0.0…1800.0 s	0.1 s	60.0 s		
2206	DECELER TIME 2	0.0…1800.0 s	0.1 s	60.0 s		
2207	RAMP SHAPE 2	0.0 = LINEAR, 0.1…1000.0 s	0.1 s	0.0 s		
2208	EMERG DEC TIME	0.0…1800.0 s	0.1 s	1.0 s		
2209	RAMP INPUT 0	-6…7	1	0 (NOT SEL)		
Group 23: SPEED CONTROL						
2301	PROP GAIN	0.00…200.00	0.01	5.00		
2302	INTEGRATION TIME	0.00…600.00 s	0.01 s	0.50 s		
2303	DERIVATION TIME	0…10000 ms	1 ms	0 ms		
2304	ACC COMPENSATION	0.00…600.00 s	0.01 s	0.00 s		
2305	AUTOTUNE RUN	0 = OFF, 1 = ON	1	0 (OFF)		
Group 24: TORQUE CONTROL						
2401	TORQ RAMP UP	0.00…120.00 s	0.01 s	0.00 s		
2402	TORQ RAMP DOWN	0.00…120.00 s	0.01 s	0.00 s		
Group 25: CRITICAL SPEEDS						
2501	CRIT SPEED SEL	0 = OFF, 1 = ON	1	0 (OFF)		
2502	CRIT SPEED 1 LO	0.0…500.0 Hz / 0…30000 rpm	0.1 Hz / 1 rpm	0.0 Hz / 0 rpm		
2503	CRIT SPEED 1 HI	0.0…500.0 Hz / 0…30000 rpm	0.1 Hz / 1 rpm	0.0 Hz / 0 rpm		
2504	CRIT SPEED 2 LO	0.0…500.0 Hz / 0…30000 rpm	0.1 Hz / 1 rpm	0.0 Hz / 0 rpm		
2505	CRIT SPEED 2 HI	0.0…500.0 Hz / 0…30000 rpm	0.1 Hz / 1 rpm	0.0 Hz / 0 rpm		
2506	CRIT SPEED 3 LO	0.0…500.0 Hz / 0…30000 rpm	0.1 Hz / 1 rpm	0.0 Hz / 0 rpm		
2507	CRIT SPEED 3 HI	0.0…500.0 Hz / 0…30000 rpm	0.1 Hz / 1 rpm	0.0 Hz / 0 rpm		
Group 26: MOTOR CONTROL						
2601	FLUX OPT ENABLE	0 = OFF, 1 = ON	1	0 (OFF)		
2602	FLUX BRAKING	0 = OFF, 1 = ON	1	0 (OFF)		

Code	Name	Range	Resolution	Default	User	S
2603	IR COMP VOLT	0.0…100.0 V	0.1 V	Size dependent		
2604	IR COMP FREQ	0…100%	1%	80%		
2605	U/F RATIO	1 = LINEAR, 2 = SQUARED	1	1 (LINEAR)		
2606	SWITCHING FREQ	1, 2, 4, 8, 12 kHz	-	4 kHz		
2607	SWITCH FREQ CTRL	0 = OFF, 1 = ON	1	1 (ON)		
2608	SLIP COMP RATIO	0…200%	1%	0%		
2609	NOISE SMOOTHING	0 = DISABLE, 1 = ENABLE	1	0 (DISABLE)		
2619	DC STABILIZER	0 = DISABLE, 1 = ENABLE	1	0 (DISABLE)		
Group 29: MAINTENANCE TRIG						
2901	COOLING FAN TRIG	0.0…6553.5 kh, 0.0 disables	0.1 kh	0.0 kh		
2902	COOLING FAN ACT	0.0…6553.5 kh	0.1 kh	0.0 kh		
2903	REVOLUTION TRIG	0…65535 Mrev, 0 disables	1 Mrev	0 Mrev		
2904	REVOLUTION ACT	0…65535 Mrev	1 Mrev	0 Mrev		
2905	RUN TIME TRIG	0.0…6553.5 kh, 0.0 disables	0.1 kh	0.0 kh		
2906	RUN TIME ACT	0.0…6553.5 kh	0.1 kh	0.0 kh		
2907	USER MWh TRIG	0.0…6553.5 MWh, 0.0 disables	0.1 MWh	0.0 MWh		
2908	USER MWh ACT	0.0…6553.5 MWh	0.1 MWh	0.0 MWh		
Group 30: FAULT FUNCTIONS						
3001	AI<MIN FUNCTION	0…3	1	0 (NOT SEL)		
3002	PANEL COMM ERR	1…3	1	1 (FAULT)		
3003	EXTERNAL FAULT 1	-6…6	1	0 (NOT SEL)		
3004	EXTERNAL FAULT 2	-6…6	1	0 (NOT SEL)		
3005	MOT THERM PROT	0 = NOT SEL, 1 = FAULT, 2 = ALARM	1	1 (FAULT)		
3006	MOT THERM TIME	256…9999 s	1 s	500 s		
3007	MOT LOAD CURVE	50…150%	1%	100%		
3008	ZERO SPEED LOAD	25…150%	1%	70%		
3009	BREAK POINT FREQ	1…250 Hz	1 Hz	35 Hz		
3010	STALL FUNCTION	0 = NOT SEL, 1 = FAULT, 2 = ALARM	1	0 (NOT SEL)		
3011	STALL FREQUENCY	0.5…50.0 Hz	0.1 Hz	20.0 Hz		
3012	STALL TIME	10…400 s	1 s	20 s		
3017	EARTH FAULT	0 = DISABLE, 1 = ENABLE	1	1 (ENABLE)		✓
3018	COMM FAULT FUNC	0 = NOT SEL, 1 = FAULT, 2 = CONST SP 7, 3 = LAST SPEED	1	0 (NOT SEL)		
3019	COMM FAULT TIME	0.0…600.0 s	0.1 s	3.0 s		
3021	AI1 FAULT LIMIT	0.0…100.0%	0.1%	0.0%		
3022	AI2 FAULT LIMIT	0.0…100.0%	0.1%	0.0%		
3023	WIRING FAULT	0 = DISABLE, 1 = ENABLE	1	1 (ENABLE)		✓
3024	CB TEMP FAULT	0 = DISABLE, 1 = ENABLE	1	1 (ENABLE)		
Group 31: AUTOMATIC RESET						
3101	NUMBER OF TRIALS	0…5	1	0		
3102	TRIAL TIME	1.0…600.0 s	0.1 s	30.0 s		
3103	DELAY TIME	0.0…120.0 s	0.1 s	0.0 s		
3104	AR OVERCURRENT	0 = DISABLE, 1 = ENABLE	1	0 (DISABLE)		
3105	AR OVERVOLTAGE	0 = DISABLE, 1 = ENABLE	1	0 (DISABLE)		
3106	AR UNDERVOLTAGE	0 = DISABLE, 1 = ENABLE	1	0 (DISABLE)		

Code	Name	Range	Resolution	Default	User	S
3107	AR AI<MIN	0 = DISABLE, 1 = ENABLE	1	0 (DISABLE)		
3108	AR EXTERNAL FLT	0 = DISABLE, 1 = ENABLE	1	0 (DISABLE)		
Group 32: SUPERVISION						
3201	SUPERV 1 PARAM	100 = NOT SELECTED, 101…178	1	103 (parameter 0103 OUTPUT FREQ)		
3202	SUPERV 1 LIM LO	-	-	Depends on the signal selected with par. 3201		
3203	SUPERV 1 LIM HI	-	-	Depends on the signal selected with par. 3201		
3204	SUPERV 2 PARAM	100 = NOT SELECTED, 101…178	1	104 (parameter 0104 CURRENT)		
3205	SUPERV 2 LIM LO	-	-	Depends on the signal selected with par. 3204		
3206	SUPERV 2 LIM HI	-	-	Depends on the signal selected with par. 3204		
3207	SUPERV 3 PARAM	100 = NOT SELECTED, 101…178	1	105 (parameter 0105 TORQUE)		
3208	SUPERV 3 LIM LO	-	-	Depends on the signal selected with par. 3207		
3209	SUPERV 3 LIM HI	-	-	Depends on the signal selected with par. 3207		
Group 33: INFORMATION						
3301	FIRMWARE	0000…FFFF hex	1	Firmware version		
3302	LOADING PACKAGE	0000…FFFF hex	1	Type dependent		
3303	TEST DATE	yy.ww	0.01	-		
3304	DRIVE RATING	-	-	Type dependent		
3305	PARAMETER TABLE	0000…FFFF hex	1	Type dependent		
Group 34: PANEL DISPLAY						
3401	SIGNAL1 PARAM	100 = NOT SELECTED, 101…178	1	103 (parameter 0103 OUTPUT FREQ)		
3402	SIGNAL1 MIN	-	-	Depends on the signal selected with par. 3401		
3403	SIGNAL1 MAX	-	-	Depends on the signal selected with par. 3401		
3404	OUTPUT1 DSP FORM	0…9	1	9 (DIRECT)		
3405	OUTPUT1 UNIT	0…127	1	Depends on the signal selected with par. 3401		
3406	OUTPUT1 MIN	-	-	Depends on the signal selected with par. 3401		
3407	OUTPUT1 MAX	-	-	Depends on the signal selected with par. 3401		
3408	SIGNAL2 PARAM	100 = NOT SELECTED, 101…178	1	104 (parameter 0104 CURRENT)		
3409	SIGNAL2 MIN	-	-	Depends on the signal selected with par. 3408		
3410	SIGNAL2 MAX	-	-	Depends on the signal selected with par. 3408		
3411	OUTPUT2 DSP FORM	0…9	1	9 (DIRECT)		
3412	OUTPUT2 UNIT	0…127	1	Depends on the signal selected with par. 3408		

Code	Name	Range	Resolution	Default	User	S
3413	OUTPUT2 MIN	-	-	Depends on the signal selected with par. 3408		
3414	OUTPUT2 MAX	-	-	Depends on the signal selected with par. 3408		
3415	SIGNAL3 PARAM	100 = NOT SELECTED, 101…178	1	105 (parameter 0105 TORQUE)		
3416	SIGNAL3 MIN	-	-	Depends on the signal selected with par. 3415		
3417	SIGNAL3 MAX	-	-	Depends on the signal selected with par. 3415		
3418	OUTPUT3 DSP FORM	0…9	1	9 (DIRECT)		
3419	OUTPUT3 UNIT	0…127	1	Depends on the signal selected with par. 3415		
3420	OUTPUT3 MIN	-	-	Depends on the signal selected with par. 3415		
3421	OUTPUT3 MAX	-	-	Depends on the signal selected with par. 3415		
Group 35: MOTOR TEMP MEAS						
3501	SENSOR TYPE	0…6	1	0 (NONE)		
3502	INPUT SELECTION	1…8	1	1 (AI1)		
3503	ALARM LIMIT	Par. 3501 = 1…3: -10…200 °C Par. 3501 = 4: 0…5000 ohm Par. 3501 = 5…6: 0…1	1	110 °C / 1500 ohm / 0		
3504	FAULT LIMIT	Par. 3501 = 1…3: -10…200 °C Par. 3501 = 4: 0…5000 ohm Par. 3501 = 5…6: 0…1	1	130 °C / 4000 ohm / 0		
Group 36: TIMED FUNCTIONS						
3601	TIMERS ENABLE	-6…7	1	0 (NOT SEL)		
3602	START TIME 1	00:00:00…23:59:58	2 s	00:00:00		
3603	STOP TIME 1	00:00:00…23:59:58	2 s	00:00:00		
3604	START DAY 1	1…7	1	1 (MONDAY)		
3605	STOP DAY 1	1…7	1	1 (MONDAY)		
3606	START TIME 2	00:00:00…23:59:58	2 s	00:00:00		
3607	STOP TIME 2	00:00:00…23:59:58	2 s	00:00:00		
3608	START DAY 2	1…7	1	1 (MONDAY)		
3609	STOP DAY 2	1…7	1	1 (MONDAY)		
3610	START TIME 3	00:00:00…23:59:58	2 s	00:00:00		
3611	STOP TIME 3	00:00:00…23:59:58	2 s	00:00:00		
3612	START DAY 3	1…7	1	1 (MONDAY)		
3613	STOP DAY 3	1…7	1	1 (MONDAY)		
3614	START TIME 4	00:00:00…23:59:58	2 s	00:00:00		
3615	STOP TIME 4	00:00:00…23:59:58	2 s	00:00:00		
3616	START DAY 4	1…7	1	1 (MONDAY)		
3617	STOP DAY 4	1…7	1	1 (MONDAY)		
3622	BOOSTER SEL	-6…6	1	0 (NOT SEL)		
3623	BOOSTER TIME	00:00:00…23:59:58	2 s	00:00:00		
3626 … 3629	TIMED FUNC 1…4 SRC	0…31	1	0 (NOT SEL)		

Code	Name	Range	Resolution	Default	User	S
Group 37: USER LOAD CURVE						
3701	USER LOAD C MODE	0…3	1	0 (NOT SEL)		
3702	USER LOAD C FUNC	1 = FAULT, 2 = ALARM	1	1 (FAULT)		
3703	USER LOAD C TIME	10…400 s	1 s	20 s		
3704	LOAD FREQ 1	0…500 Hz	1 Hz	5 Hz		
3705	LOAD TORQ LOW 1	0…600%	1%	10%		
3706	LOAD TORQ HIGH 1	0…600%	1%	300%		
3707	LOAD FREQ 2	0…500 Hz	1 Hz	25 Hz		
3708	LOAD TORQ LOW 2	0…600%	1%	15%		
3709	LOAD TORQ HIGH 2	0…600%	1%	300%		
3710	LOAD FREQ 3	0…500 Hz	1 Hz	43 Hz		
3711	LOAD TORQ LOW 3	0…600%	1%	25%		
3712	LOAD TORQ HIGH 3	0…600%	1%	300%		
3713	LOAD FREQ 4	0…500 Hz	1 Hz	50 Hz		
3714	LOAD TORQ LOW 4	0…600%	1%	30%		
3715	LOAD TORQ HIGH 4	0…600%	1%	300%		
3716	LOAD FREQ 5	0…500 Hz	1 Hz	500 Hz		
3717	LOAD TORQ LOW 5	0…600%	1%	30%		
3718	LOAD TORQ HIGH 5	0…600%	1%	300%		
Group 40: PROCESS PID SET 1						
4001	GAIN	0.1…100.0	0.1	1.0		
4002	INTEGRATION TIME	0.0 = NOT SEL, 0.1…3600.0 s	0.1 s	60.0 s		
4003	DERIVATION TIME	0.0…10.0 s	0.1 s	0.0 s		
4004	PID DERIV FILTER	0.0…10.0 s	0.1 s	1.0 s		
4005	ERROR VALUE INV	0 = NO, 1 = YES	1	0 (NO)		
4006	UNITS	0…127	1	4 (%)		
4007	UNIT SCALE	0…4	1	1		
4008	0% VALUE	Unit and scale defined by par. 4006 and 4007	-	0.0		
4009	100% VALUE	Unit and scale defined by par. 4006 and 4007	-	100.0		
4010	SET POINT SEL	0…2, 8…17, 19…20	1	1 (AI1)		✓
4011	INTERNAL SETPNT	Unit and scale defined by par. 4006 and 4007	-	40.0		
4012	SETPOINT MIN	-500.0…500.0%	0.1%	0.0%		
4013	SETPOINT MAX	-500.0…500.0%	0.1%	100.0%		
4014	FBK SEL	1…13	1	1 (ACT1)		
4015	FBK MULTIPLIER	0.000 = NOT SEL, -32.768…32.767	0.001	0.000 (NOT SEL)		
4016	ACT1 INPUT	1…7	1	2 (AI2)		✓
4017	ACT2 INPUT	1…7	1	2 (AI2)		✓
4018	ACT1 MINIMUM	-1000…1000%	1%	0%		
4019	ACT1 MAXIMUM	-1000…1000%	1%	100%		
4020	ACT2 MINIMUM	-1000…1000%	1%	0%		
4021	ACT2 MAXIMUM	-1000…1000%	1%	100%		
4022	SLEEP SELECTION	-6…7	1	0 (NOT SEL)		
4023	PID SLEEP LEVEL	0.0…500.0 Hz / 0…30000 rpm	0.1 Hz / 1 rpm	0.0 Hz / 0 rpm		

Code	Name	Range	Resolution	Default	User	S
4024	PID SLEEP DELAY	0.0…3600.0 s	0.1 s	60.0 s		
4025	WAKE-UP DEV	Unit and scale defined by par. 4006 and 4007	-	0.0		
4026	WAKE-UP DELAY	0.00…60.00 s	0.01 s	0.50 s		
4027	PID 1 PARAM SET	-6…14	1	0 (SET 1)		
Group 41: PROCESS PID SET 2						
4101	GAIN	0.1…100.0	0.1	1.0		
4102	INTEGRATION TIME	0.0 = NOT SEL, 0.1…3600.0 s	0.1 s	60.0 s		
4103	DERIVATION TIME	0.0…10.0 s	0.1 s	0.0 s		
4104	PID DERIV FILTER	0.0…10.0 s	0.1 s	1.0 s		
4105	ERROR VALUE INV	0 = NO, 1 = YES	1	0 (NO)		
4106	UNITS	0…127	1	4 (%)		
4107	UNIT SCALE	0…4	1	1		
4108	0% VALUE	Unit and scale defined by par. 4106 and 4107	-	0.0		
4109	100% VALUE	Unit and scale defined by par. 4106 and 4107	-	100.0		
4110	SET POINT SEL	0…2, 8…17, 19…20	1	1 (AI1)		✓
4111	INTERNAL SETPNT	Unit and scale defined by par. 4106 and 4107	-	40.0		
4112	SETPOINT MIN	-500.0…500.0%	0.1%	0.0%		
4113	SETPOINT MAX	-500.0…500.0%	0.1%	100.0%		
4114	FBK SEL	1…13	1	1 (ACT1)		
4115	FBK MULTIPLIER	0.000 = NOT SEL, -32.768…32.767	0.001	0.000 (NOT SEL)		
4116	ACT1 INPUT	1…7	1	2 (AI2)		✓
4117	ACT2 INPUT	1…7	1	2 (AI2)		✓
4118	ACT1 MINIMUM	-1000…1000%	1%	0%		
4119	ACT1 MAXIMUM	-1000…1000%	1%	100%		
4120	ACT2 MINIMUM	-1000…1000%	1%	0%		
4121	ACT2 MAXIMUM	-1000…1000%	1%	100%		
4122	SLEEP SELECTION	-6…7	1	0 (NOT SEL)		
4123	PID SLEEP LEVEL	0.0…500.0 Hz / 0…30000 rpm	0.1 Hz / 1 rpm	0.0 Hz / 0 rpm		
4124	PID SLEEP DELAY	0.0…3600.0 s	0.1 s	60.0 s		
4125	WAKE-UP DEV	Unit and scale defined by par. 4106 and 4107	-	0.0		
4126	WAKE-UP DELAY	0.00…60.00 s	0.01 s	0.50 s		
Group 42: EXT / TRIM PID						
4201	GAIN	0.1…100.0	0.1	1.0		
4202	INTEGRATION TIME	0.0 = NOT SEL, 0.1…3600.0 s	0.1 s	60.0 s		
4203	DERIVATION TIME	0.0…10.0 s	0.1 s	0.0 s		
4204	PID DERIV FILTER	0.0…10.0 s	0.1 s	1.0 s		
4205	ERROR VALUE INV	0 = NO, 1 = YES	1	0 (NO)		
4206	UNITS	0…127	1	4 (%)		
4207	UNIT SCALE	0…4	1	1		
4208	0% VALUE	Unit and scale defined by par. 4206 and 4207	-	0.0		

Code	Name	Range	Resolution	Default	User	S
4209	100% VALUE	Unit and scale defined by par. 4206 and 4207	-	100.0		
4210	SET POINT SEL	0…2, 8…17, 19…20	1	1 (AI1)		✓
4211	INTERNAL SETPNT	Unit and scale defined by par. 4206 and 4207	-	40.0		
4212	SETPOINT MIN	-500.0…500.0%	0.1%	0.0%		
4213	SETPOINT MAX	-500.0…500.0%	0.1%	100.0%		
4214	FBK SEL	1…13	1	1 (ACT1)		
4215	FBK MULTIPLIER	0.000 = NOT SEL, -32.768…32.767	0.001	0.000 (NOT SEL)		
4216	ACT1 INPUT	1…7	1	2 (AI2)		✓
4217	ACT2 INPUT	1…7	1	2 (AI2)		✓
4218	ACT1 MINIMUM	-1000…1000%	1%	0%		
4219	ACT1 MAXIMUM	-1000…1000%	1%	100%		
4220	ACT2 MINIMUM	-1000…1000%	1%	0%		
4221	ACT2 MAXIMUM	-1000…1000%	1%	100%		
4228	ACTIVATE	-6…12	1	0 (NOT SEL)		
4229	OFFSET	0.0…100.0%	0.1%	0.0%		
4230	TRIM MODE	0 = NOT SEL, 1 = PROPORTIONAL, 3 = DIRECT	1	0 (NOT SEL)		
4231	TRIM SCALE	-100.0…100.0%	0.1%	0.0%		
4232	CORRECTION SRC	1 = PID2REF, 2 = PID2OUTPUT	1	1 (PID2REF)		
Group 45: ENERGY SAVING						
4502	ENERGY PRICE	0.00…655.35	0.01	0.00		
4507	CO2 CONV FACTOR	0.0…10.0 tn/MWh	0.1 tn/MWh	0.5 tn/MWh		
4508	PUMP POWER	0.0…1000.0%	0.1%	100.0%		
4509	ENERGY RESET	0 = DONE, 1 = RESET	1	0 (DONE)		
Group 50: ENCODER						
5001	PULSE NR	50…16384	1	1024		✓
5002	ENCODER ENABLE	0 = DISABLE, 1 = ENABLE	1	0 (DISABLE)		✓
5003	ENCODER FAULT	1 = FAULT, 2 = ALARM	1	1 (FAULT)		✓
5010	Z PLS ENABLE	0 = DISABLE, 1 = ENABLE	1	0 (DISABLE)		✓
5011	POSITION RESET	0 = DISABLE, 1 = ENABLE	1	0 (DISABLE)		
Group 51: EXT COMM MODULE						
5101	FBA TYPE	-	-	0 (NOT DEFINED)		
5102…5126	FB PAR 2…26	0…65535	1	0		
5127	FBA PAR REFRESH	0 = DONE, 1 = REFRESH	1	0 (DONE)		✓
5128	FILE CPI FW REV	0000…FFFF hex	1	0		
5129	FILE CONFIG ID	0000…FFFF hex	1	0		
5130	FILE CONFIG REV	0000…FFFF hex	1	0		
5131	FBA STATUS	0…6	1	0 (IDLE)		
5132	FBA CPI FW REV	0000…FFFF hex	1	0		
5133	FBA APPL FW REV	0000…FFFF hex	1	0		
Group 52: PANEL COMM						
5201	STATION ID	1…247	1	1		
5202	BAUD RATE	9.6, 19.2, 38.4, 57.6, 115.2 kbits/s	-	9.6 kbits/s		

Code	Name	Range	Resolution	Default	User	S
5203	PARITY	0 = 8 NONE 1, 1 = 8 NONE 2, 2 = 8 EVEN 1, 3 = 8 ODD 1	1	0 (8 NONE 1)		
5204	OK MESSAGES	0…65535	1	-		
5205	PARITY ERRORS	0…65535	1	-		
5206	FRAME ERRORS	0…65535	1	-		
5207	BUFFER OVERRUNS	0…65535	1	-		
5208	CRC ERRORS	0…65535	1	-		
Group 53: EFB PROTOCOL						
5301	EFB PROTOCOL ID	0…0xFFFF	1	0		
5302	EFB STATION ID	0…65535	1	1		✓
5303	EFB BAUD RATE	1.2, 2.4, 4.8, 9.6, 19.2, 38.4, 57.6, 76.8 kbits/s	-	9.6 kbits/s		
5304	EFB PARITY	0 = 8 NONE 1, 1 = 8 NONE 2, 2 = 8 EVEN 1, 3 = 8 ODD 1		0 (8 NONE 1)		
5305	EFB CTRL PROFILE	0 = ABB DRV LIM, 1 = DCU PROFILE, 2 = ABB DRV FULL	1	0 (ABB DRV LIM)		
5306	EFB OK MESSAGES	0…65535	1	0		
5307	EFB CRC ERRORS	0…65535	1	0		
5308	EFB UART ERRORS	0…65535	1	0		
5309	EFB STATUS	0…7	1	0 (IDLE)		
5310	EFB PAR 10	0…65535	1	0		
5311	EFB PAR 11	0…65535	1	0		
5312	EFB PAR 12	0…65535	1	0		
5313	EFB PAR 13	0…65535	1	0		
5314	EFB PAR 14	0…65535	1	0		
5315	EFB PAR 15	0…65535	1	0		
5316	EFB PAR 16	0…65535	1	0		
5317	EFB PAR 17	0…65535	1	0		
5318	EFB PAR 18	0…65535	1	0		
5319	EFB PAR 19	0000…FFFF hex	1	0		
5320	EFB PAR 20	0000…FFFF hex	1	0		
Group 64: LOAD ANALYZER						
6401	PVL SIGNAL	100…178	1	103 (parameter 0103 OUTPUT FREQ)		
6402	PVL FILTER TIME	0.0…120.0 s	0.1 s	0.1 s		
6403	LOGGERS RESET	-6…7	1	0 (NOT SEL)		
6404	AL2 SIGNAL	101…178	1	103 (parameter 0103 OUTPUT FREQ)		
6405	AL2 SIGNAL BASE	-	-	Depends on the signal selected with par. 6404.		
6406	PEAK VALUE	-	-	-		
6407	PEAK TIME 1	Date dd.mm.yy / power-on time in days	1 d	-		
6408	PEAK TIME 2	Time hh.mm.ss	2 s	-		
6409	CURRENT AT PEAK	0.0…6553.5 A	0.1 A	-		
6410	UDC AT PEAK	0…65535 V	1 V	-		
6411	FREQ AT PEAK	0.0…6553.5 Hz	0.1 Hz	-		
6412	TIME OF RESET 1	Date dd.mm.yy / power-on time in days	1 d	-		

Code	**Name**	**Range**	**Resolution**	**Default**	**User**	**S**
6413	TIME OF RESET 2	Time hh.mm.ss	2 s	-		
6414	AL1RANGE0TO10	0.0…100.0%	0.1%	-		
6415	AL1RANGE10TO20	0.0…100.0%	0.1%	-		
6416	AL1RANGE20TO30	0.0…100.0%	0.1%	-		
6417	AL1RANGE30TO40	0.0…100.0%	0.1%	-		
6418	AL1RANGE40TO50	0.0…100.0%	0.1%	-		
6419	AL1RANGE50TO60	0.0…100.0%	0.1%	-		
6420	AL1RANGE60TO70	0.0…100.0%	0.1%	-		
6421	AL1RANGE70TO80	0.0…100.0%	0.1%	-		
6422	AL1RANGE80TO90	0.0…100.0%	0.1%	-		
6423	AL1RANGE90TO	0.0…100.0%	0.1%	-		
6424	AL2RANGE0TO10	0.0…100.0%	0.1%	-		
6425	AL2RANGE10TO20	0.0…100.0%	0.1%	-		
6426	AL2RANGE20TO30	0.0…100.0%	0.1%	-		
6427	AL2RANGE30TO40	0.0…100.0%	0.1%	-		
6428	AL2RANGE40TO50	0.0…100.0%	0.1%	-		
6429	AL2RANGE50TO60	0.0…100.0%	0.1%	-		
6430	AL2RANGE60TO70	0.0…100.0%	0.1%	-		
6431	AL2RANGE70TO80	0.0…100.0%	0.1%	-		
6432	AL2RANGE80TO90	0.0…100.0%	0.1%	-		
6433	AL2RANGE90TO	0.0…100.0%	0.1%	-		
Group 81: PFC CONTROL						
8103	REFERENCE STEP 1	0.0…100.0%	0.1%	0.0%		
8104	REFERENCE STEP 2	0.0…100.0%	0.1%	0.0%		
8105	REFERENCE STEP 3	0.0…100.0%	0.1%	0.0%		
8109	START FREQ 1	0.0…500.0 Hz	0.1 Hz	-01: 50.0 Hz / -U1: 60.0 Hz		
8110	START FREQ 2	0.0…500.0 Hz	0.1 Hz	-01: 50.0 Hz / -U1: 60.0 Hz		
8111	START FREQ 3	0.0…500.0 Hz	0.1 Hz	-01: 50.0 Hz / -U1: 60.0 Hz		
8112	LOW FREQ 1	0.0…500.0 Hz	0.1 Hz	-01: 25.0 Hz / -U1: 30.0 Hz		
8113	LOW FREQ 2	0.0…500.0 Hz	0.1 Hz	-01: 25.0 Hz / -U1: 30.0 Hz		
8114	LOW FREQ 3	0.0…500.0 Hz	0.1 Hz	-01: 25.0 Hz / -U1: 30.0 Hz		
8115	AUX MOT START D	0.0…3600.0 s	0.1 s	5.0 s		
8116	AUX MOT STOP D	0.0…3600.0 s	0.1 s	3.0 s		
8117	NR OF AUX MOT	0…4	1	1		✓
8118	AUTOCHNG INTERV	-0.1 = TEST MODE, 0.0 = NOT SEL, 0.1…336.0 h	0.1 h	0.0 h (NOT SEL)		✓
8119	AUTOCHNG LEVEL	0.0…100.0%	0.1%	50.0%		
8120	INTERLOCKS	0…6	1	4 (DI4)		✓
8121	REG BYPASS CTRL	0 = NO, 1 = YES	1	0 (NO)		
8122	PFC START DELAY	0.00…10.00 s	0.01 s	0.50 s		
8123	PFC ENABLE	0 = NOT SEL, 1 = ACTIVE	1	0 (NOT SEL)		✓

Code	Name	Range	Resolution	Default	User	S
8124	ACC IN AUX STOP	0.0 = NOT SEL, 0.1…1800.0 s	0.1 s	0.0 s (NOT SEL)		
8125	DEC IN AUX START	0.0 = NOT SEL, 0.1…1800.0 s	0.1 s	0.0 s (NOT SEL)		
8126	TMED AUTOCHNG	0…4	1	0 (NOT SEL)		
8127	MOTORS	1…7	1	2		✓
8128	AUX START ORDER	1 = EVEN RUNTIME, 2 = RELAY ORDER	1	1 (EVEN RUNTIME)		✓
Group 98: OPTIONS						
9802	COMM PROT SEL	0 = NOT SEL, 1 = STD MODBUS, 4 = EXT FBA	1	0 (NOT SEL)		✓

Complete parameter descriptions

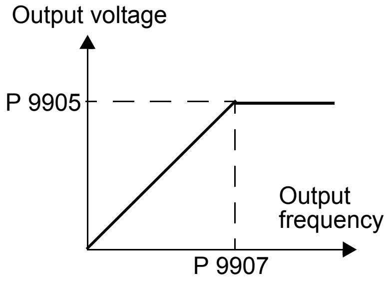
This section describes the actual signals and parameters for ACS550.

Group 99: START-UP DATA

This group defines special start-up data required to:

- set up the drive
- enter motor information.

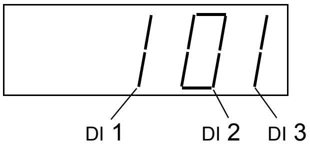
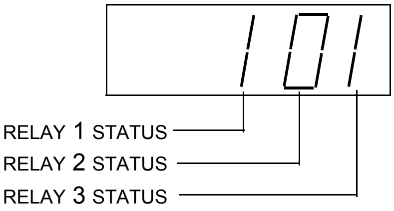
Code	Description
9901	**LANGUAGE** Selects the display language. There are two different Assistant Control Panels, each supporting a different language set. (Panel ACS-CP-L supporting languages 0, 2, 11…15 has been integrated into ACS-CP-A.) Assistant Control Panel ACS-CP-A: 0 = ENGLISH 1 = ENGLISH (AM) 2 = DEUTSCH 3 = ITALIANO 4 = ESPAÑOL 5 = PORTUGUES 6 = NEDERLANDS 7 = FRANÇAIS 8 = DANSK 9 = SUOMI 10 = SVENSKA 11 = RUSSKI 12 = POLSKI 13 = TÜRKÇE 14 = CZECH 15 = MAGYAR 16 = ELLINIKA Assistant Control Panel ACS-CP-D (Asia): 0 = ENGLISH 1 = CHINESE 2 = KOREAN 3 = JAPANESE
9902	**APPLIC MACRO** Selects an application macro. Application macros automatically edit parameters to configure the ACS550 for a particular application. 1 = ABB STANDARD 2 = 3-WIRE 3 = ALTERNATE 4 = MOTOR POT 5 = HAND/AUTO 6 = PID CONTROL 7 = PFC CONTROL 8 = TORQUE CTRL 31 = LOAD FD SET 0 = USER S1 LOAD -1 = USER S1 SAVE -2 = USER S2 LOAD -3 = USER S2 SAVE 31 = LOAD FD SET – FlashDrop parameter values as defined by the FlashDrop file. Parameter view is selected by parameter 1611 PARAMETER VIEW. • FlashDrop is an optional device for fast copying of parameters to unpowered drives. FlashDrop allows easy customization of the parameter list, e.g. selected parameters can be hidden. For more information, see *MFDT-01 FlashDrop User's Manual* (3AFE68591074 [English]). -1 = USER S1 SAVE, -3 = USER S2 SAVE – With these it is possible to save two different user parameter sets into the drive permanent memory for later use. Each set contains parameter settings, including *Group 99: START-UP DATA*, and the results of the motor identification run. 0 = USER S1 LOAD, -2 = USER S2 LOAD – With these the user parameter sets can be taken back in use.
9904	**MOTOR CTRL MODE** Selects the motor control mode. 1 = VECTOR:SPEED – sensorless vector control mode. • Reference 1 is speed reference in rpm. • Reference 2 is speed reference in % (100% is absolute maximum speed, equal to the value of parameter 2002 MAXIMUM SPEED, or 2001 MINIMUM SPEED if the absolute value of the minimum speed is greater than the maximum speed). 2 = VECTOR:TORQ. • Reference 1 is speed reference in rpm. • Reference 2 is torque reference in % (100% is nominal torque.) 3 = SCALAR:FREQ – scalar control mode. • Reference 1 is frequency reference in Hz. • Reference 2 is frequency reference in % (100% is absolute maximum frequency, equal to the value of parameter 2008 MAXIMUM FREQ, or 2007 MINIMUM FREQ if the absolute value of the minimum speed is greater than the maximum speed).

Code	Description
9905	**MOTOR NOM VOLT** Defines the nominal motor voltage. • Must equal the value on the motor rating plate. • The ACS550 cannot supply the motor with a voltage greater than the input power (mains) voltage. 
9906	**MOTOR NOM CURR** Defines the nominal motor current. • Must equal the value on the motor rating plate. • Range allowed: 0.2…2.0 · I_{2hd} (where I_{2hd} is drive current).
9907	**MOTOR NOM FREQ** Defines the nominal motor frequency. • Range: 10…500 Hz (typically 50 or 60 Hz) • Sets the frequency at which output voltage equals the MOTOR NOM VOLT. • Field weakening point = Nom Freq · Supply Volt / Mot Nom Volt
9908	**MOTOR NOM SPEED** Defines the nominal motor speed. • Must equal the value on the motor rating plate.
9909	**MOTOR NOM POWER** Defines the nominal motor power. • Must equal the value on the motor rating plate.
9910	**ID RUN** This parameter controls a self-calibration process called the Motor ID Run. During this process, the drive operates the motor (motor rotating) and makes measurements in order to identify motor characteristics and create a model used for internal calculations. An ID Run is especially effective when: • vector control mode is used [parameter *9904* = 1 (VECTOR:SPEED) or 2 (VECTOR:TORQ)], and/or • operation point is near zero speed, and/or • operation requires a torque range above the motor nominal torque, over a wide speed range, and without any measured speed feedback (i.e. without a pulse encoder). 0 = OFF/IDMAGN – The Motor ID Run process is not run. Identification magnetization is performed, depending on parameter 9904 and 2101 settings. In identification magnetization, the motor model is calculated at first start by magnetizing the motor for 10 to 15 s at zero speed (motor not rotating). The model is recalculated always at start after motor parameter changes. • Parameter *9904* = 1 (VECTOR:SPEED) or 2 (VECTOR:TORQ): Identification magnetization is performed. • Parameter *9904* = 3 (SCALAR:FREQ) and parameter *2101* = 3 (SCALAR FLYST) or 5 (FLY + BOOST): Identification magnetization is performed. • Parameter *9904* = 3 (SCALAR:FREQ) and parameter *2101* has other value than 3 (SCALAR FLYST) or 5 (FLY + BOOST): Identification magnetization is not performed. 1 = ON – Enables the Motor ID Run, during which the motor is rotating, at the next start command. After run completion, this value automatically changes to 0. **Note:** The motor must be de-coupled from the driven equipment. **Note:** If motor parameters are changed after ID Run, repeat the ID Run. ⚠ **WARNING!** The motor will run at up to approximately 50…80% of the nominal speed during the ID Run. The motor will rotate in the forward direction. **Ensure that it is safe to run the motor before performing the ID Run!** See also section *How to perform the ID Run* on page *41*.
9915	**MOTOR COSPHI** Defines the nominal motor cos phi (power factor). The parameter improves performance especially with high efficiency motors. 0 = IDENTIFIED – Drive identifies the cos phi automatically by estimation. 0.01…0.97 – Value entered used as the cos phi.

Group 01: OPERATING DATA

This group contains drive operating data, including actual signals. The drive sets the values for actual signals, based on measurements or calculations. You cannot set these values.

Code	Description
0101	**SPEED & DIR** The calculated signed speed of the motor (rpm). The absolute value of 0101 SPEED & DIR is the same as the value of 0102 SPEED. • The value of 0101 SPEED & DIR is positive if the motor runs in the forward direction. • The value of 0101 SPEED & DIR is negative if the motor runs in the reverse direction.
0102	**SPEED** The calculated speed of the motor (rpm). (Parameter 0102 or 0103 is shown by default in the control panel Output mode.)
0103	**OUTPUT FREQ** The frequency (Hz) applied to the motor. (Parameter 0102 or 0103 is shown by default in the control panel Output mode.)
0104	**CURRENT** The motor current, as measured by the ACS550. (Shown by default in the control panel Output mode.)
0105	**TORQUE** Output torque. Calculated value of torque on motor shaft in % of motor nominal torque. (Shown by default in the control panel Output mode.)
0106	**POWER** The measured motor power in kW.
0107	**DC BUS VOLTAGE** The DC bus voltage in V DC, as measured by the ACS550.
0109	**OUTPUT VOLTAGE** The voltage applied to the motor.
0110	**DRIVE TEMP** The temperature of the drive power transistors in degrees Celsius.
0111	**EXTERNAL REF 1** External reference, REF1, in rpm or Hz – units determined by parameter 9904.
0112	**EXTERNAL REF 2** External reference, REF2, in %.
0113	**CTRL LOCATION** Active control location. Alternatives are: 0 = LOCAL 1 = EXT1 2 = EXT2
0114	**RUN TIME (R)** The drive's accumulated running time in hours (h). • Can be **reset** by pressing UP and DOWN keys simultaneously when the control panel is in the Parameters mode.
0115	**KWH COUNTER (R)** The drive's accumulated power consumption in kilowatt hours. • The counter value is accumulated till it reaches 65535 after which the counter rolls over and starts again from 0. • Can be **reset** by pressing UP and DOWN keys simultaneously when the control panel is in the Parameters mode.
0116	**APPL BLK OUTPUT** Application block output signal. Value is from either: • PFC control, if PFC Control is active, or • Parameter 0112 EXTERNAL REF 2.

Code	Description	
0118	**DI 1-3 STATUS** Status of the three digital inputs. • Status is displayed as a binary number. • 1 indicates that the input is activated. • 0 indicates that the input is deactivated.	
0119	**DI 4-6 STATUS** Status of the three digital inputs. • See parameter 0118 DI 1-3 STATUS.	
0120	**AI 1** The relative value of analog input 1 in %.	
0121	**AI 2** The relative value of analog input 2 in %.	
0122	**RO 1-3 STATUS** Status of the three relay outputs. • 1 indicates that the relay is energized. • 0 indicates that the relay is de-energized.	
0123	**RO 4-6 STATUS** Status of the three relay outputs. Available if OREL-01 Relay Output Extension Module is installed. • See parameter 0122.	
0124	**AO 1** The analog output 1 value in milliamperes.	
0125	**AO 2** The analog output 2 value in milliamperes.	
0126	**PID 1 OUTPUT** The PID controller 1 output value in %.	
0127	**PID 2 OUTPUT** The PID controller 2 output value in %.	
0128	**PID 1 SETPNT** The PID 1 controller setpoint signal. • Units and scale defined by PID parameters.	
0129	**PID 2 SETPNT** The PID 2 controller setpoint signal. • Units and scale defined by PID parameters.	
0130	**PID 1 FBK** The PID 1 controller feedback signal. • Units and scale defined by PID parameters.	
0131	**PID 2 FBK** The PID 2 controller feedback signal. • Units and scale defined by PID parameters.	
0132	**PID 1 DEVIATION** The difference between the PID 1 controller reference value and actual value. • Units and scale defined by PID parameters.	
0133	**PID 2 DEVIATION** The difference between the PID 2 controller reference value and actual value. • Units and scale defined by PID parameters.	
0134	**COMM RO WORD** Free data location that can be written from serial link. • Used for relay output control. • See parameter 1401.	
0135	**COMM VALUE 1** Free data location that can be written from serial link.	

Code	Description
0136	**COMM VALUE 2** Free data location that can be written from serial link.
0137	**PROCESS VAR 1** Process variable 1 • Defined by parameters in *Group 34: PANEL DISPLAY*.
0138	**PROCESS VAR 2** Process variable 2 • Defined by parameters in *Group 34: PANEL DISPLAY*.
0139	**PROCESS VAR 3** Process variable 3 • Defined by parameters in *Group 34: PANEL DISPLAY*.
0140	**RUN TIME** The drive's accumulated running time in thousands of hours (kh). • Cannot be reset.
0141	**MWH COUNTER** The drive's accumulated power consumption in megawatt hours. • The counter value is accumulated till it reaches 65535 after which the counter rolls over and starts again from 0. • Cannot be reset.
0142	**REVOLUTION CNTR** The motor's accumulated revolutions in millions of revolutions. • Can be reset by pressing UP and DOWN keys simultaneously when the control panel is in the Parameters mode.
0143	**DRIVE ON TIME HI** The drive's accumulated power-on time in days. • Cannot be reset.
0144	**DRIVE ON TIME LO** The drive's accumulated power-on time in 2 second ticks (30 ticks = 60 seconds). • Shown in format hh.mm.ss. • Cannot be reset.
0145	**MOTOR TEMP** Motor temperature in degrees Celsius / PTC resistance in ohms. • Applies only if motor temperature sensor is set up. • See parameter 3501.
0146	**MECH ANGLE** Defines the motor shaft's angular position to about 0.01° (32,768 divisions for 360°). The position is defined as 0 at power up. During operation the zero position can be set by: • a Z-pulse input, if parameter 5010 Z PLS ENABLE = 1 (ENABLE) • parameter 5011 POSITION RESET, if parameter 5010 Z PLS ENABLE = 2 (DISABLE) • any status change of parameter 5002 ENCODER ENABLE.
0147	**MECH REVS** A signed integer that counts full revolutions of the motor shaft. The value: • increments when parameter 0146 MECH ANGLE changes from 32767 to 0 • decrements when parameter 0146 MECH ANGLE changes from 0 to 32767.
0148	**Z PLS DETECTED** Encoder zero pulse detector. When a Z-pulse defines the zero position, the shaft must pass through the zero position to trigger a Z-pulse. Until then, the shaft position is unknown (the drive uses the shaft position at power up as zero). This parameter signals when parameter 0146 MECH ANGLE is valid. The parameter starts at 0 = NOT DETECTED on power-up and changes to 1 = DETECTED only if: • parameter 5010 Z PLS ENABLE = 1 (ENABLE) and • an encoder Z-pulse has been detected.
0150	**CB TEMP** Temperature of the drive control board in degrees Celsius. **Note:** Some drives have a control board (OMIO) that does not support this feature. These drives always show the constant value of 25.0 °C.

Code	Description
0153	**MOT THERM STRESS** Estimated rise of the motor temperature. Value equals to the estimated motor thermal stress as a percentage of the motor temperature trip level.
0158	**PID COMM VALUE 1** Data received from fieldbus for PID control (PID1 and PID2).
0159	**PID COMM VALUE 2** Data received from fieldbus for PID control (PID1 and PID2).
0174	**SAVED KWH** Energy saved in kWh compared to the energy used when the pump is connected directly to the supply. See the note on page *176*. • The counter value is accumulated till it reaches 999.9 after which the counter rolls over and starts again from 0.0. • Can be reset with parameter 4509 ENERGY RESET (resets all energy calculators at the same time). • See *Group 45: ENERGY SAVING*.
0175	**SAVED MWH** Energy saved in MWh compared to the energy used when the pump is connected directly to the supply. See the note on page *176*. • The counter value is accumulated till it reaches 65535 after which the counter rolls over and starts again from 0. • Can be reset with parameter 4509 ENERGY RESET (resets all energy calculators at the same time). • See *Group 45: ENERGY SAVING*.
0176	**SAVED AMOUNT 1** Energy saved in local currency (remainder when the total saved energy is divided by 1000). See the note on page *176*. • To find out the total saved energy in currency units, add the value of parameter 0177 multiplied by 1000 to the value of parameter 0176. **Example:** 0176 SAVED AMOUNT 1 = 123.4 0177 SAVED AMOUNT 2 = 5 Total saved energy = 5 · 1000 + 123.4 = 5123.4 currency units. • The counter value is accumulated till it reaches 999.9 (the counter does not roll over). • Can be reset with parameter 4509 ENERGY RESET (resets all energy calculators at the same time). • Local energy price is set with parameter 4502 ENERGY PRICE. • See *Group 45: ENERGY SAVING*.
0177	**SAVED AMOUNT 2** Energy saved in local currency in thousand currency units. Eg value 5 means 5000 currency units. See the note on page *176*. • The counter value is accumulated till it reaches 65535 (the counter does not roll over). • See parameter 0176 SAVED AMOUNT 1.
0178	**SAVED CO2** Reduction on carbon dioxide emissions in tn. See the note on page *176*. • The counter value is accumulated till it reaches 6553.5 (the counter does not roll over). • Can be reset with parameter 4509 ENERGY RESET (resets all energy calculators at the same time). • CO2 conversion factor is set with parameter 4507 CO2 CONV FACTOR. • See *Group 45: ENERGY SAVING*.

Group 03: FB ACTUAL SIGNALS

This group monitors fieldbus communications.

Code	Description
0301	**FB CMD WORD 1** Read-only copy of the Fieldbus Command Word 1. • The fieldbus command is the principal means for controlling the drive from a fieldbus controller. The command consists of two Command Words. Bit-coded instructions in the Command Words switch the drive between states. • To control the drive, using the Command Words, an external location (EXT1 or EXT2) must be active and set to COMM. (See parameters 1001 and 1002.) • The control panel displays the word in hex. For example, all zeros and a 1 in Bit 0 displays as 0001. All zeros and a 1 in Bit 15 displays as 8000.
0302	**FB CMD WORD 2** Read-only copy of the Fieldbus Command Word 2. • See parameter 0301.

Bit #	0301, FB CMD WORD 1	0302, FB CMD WORD 2
0	STOP	FBLOCAL_CTL
1	START	FBLOCAL_REF
2	REVERSE	START_DISABLE1
3	LOCAL	START_DISABLE2
4	RESET	Reserved
5	EXT2	Reserved
6	RUN_DISABLE	Reserved
7	STPMODE_R	Reserved
8	STPMODE_EM	Reserved
9	STPMODE_C	Reserved
10	RAMP_2	Reserved
11	RAMP_OUT_0	REF_CONST
12	RAMP_HOLD	REF_AVE
13	RAMP_IN_0	LINK_ON
14	RREQ_LOCALLOC	REQ_STARTINH
15	TORQLIM2	OFF_INTERLOCK

Code	Description
0303	**FB STS WORD 1** Read-only copy of the Status Word 1. • The drive sends status information to the fieldbus controller. The status consists of two Status Words. • The control panel displays the word in hex. For example, all zeros and a 1 in Bit 0 displays as 0001. All zeros and a 1 in Bit 15 displays as 8000.
0304	**FB STS WORD 2** Read-only copy of the Status Word 2. • See parameter 0303.

Bit #	0303, FB STS WORD 1	0304, FB STS WORD 2
0	READY	ALARM
1	ENABLED	NOTICE
2	STARTED	DIRLOCK
3	RUNNING	LOCALLOCK
4	ZERO_SPEED	CTL_MODE
5	ACCELERATE	Reserved
6	DECELERATE	Reserved
7	AT_SETPOINT	CPY_CTL
8	LIMIT	CPY_REF1
9	SUPERVISION	CPY_REF2
10	REV_REF	REQ_CTL
11	REV_ACT	REQ_REF1
12	PANEL_LOCAL	REQ_REF2
13	FIELDBUS_LOCAL	REQ_REF2EXT
14	EXT2_ACT	ACK_STARTINH
15	FAULT	ACK_OFF_ILCK

Code	Description
0305	**FAULT WORD 1** Read-only copy of the Fault Word 1. • When a fault is active, the corresponding bit for the active fault is set in the Fault Words. • Each fault has a dedicated bit allocated within Fault Words. • See section *Fault listing* on page *254* for a description of the faults. • The control panel displays the word in hex. For example, all zeros and a 1 in Bit 0 displays as 0001. All zeros and a 1 in Bit 15 displays as 8000.
0306	**FAULT WORD 2** Read-only copy of the Fault Word 2. • See parameter 0305.
0307	**FAULT WORD 3** Read-only copy of the Fault Word 3. • See parameter 0305.

Bit #	0305, FAULT WORD 1	0306, FAULT WORD 2	0307, FAULT WORD 3
0	OVERCURRENT	Obsolete	EFB 1
1	DC OVERVOLT	THERM FAIL	EFB 2
2	DEV OVERTEMP	OPEX LINK	EFB 3
3	SHORT CIRC	OPEX PWR	INCOMPATIBLE SW
4	Reserved	CURR MEAS	USER LOAD CURVE
5	DC UNDERVOLT	SUPPLY PHASE	Reserved
6	AI1 LOSS	ENCODER ERR	Reserved
7	AI2 LOSS	OVERSPEED	Reserved
8	MOT OVERTEMP	Reserved	Reserved
9	PANEL LOSS	DRIVE ID	Reserved
10	ID RUN FAIL	CONFIG FILE	System error
11	MOTOR STALL	SERIAL 1 ERR	System error
12	CB OVERTEMP	EFB CON FILE	System error
13	EXT FAULT 1	FORCE TRIP	System error
14	EXT FAULT 2	MOTOR PHASE	System error
15	EARTH FAULT	OUTP WIRING	Param. setting fault

Code	Description
0308	**ALARM WORD 1** • When an alarm is active, the corresponding bit for the active alarm is set in the Alarm Words. • Each alarm has a dedicated bit allocated within Alarm Words. • Bits remain set until the whole alarm word is reset. (Reset by writing zero to the word.) • The control panel displays the word in hex. For example, all zeros and a 1 in Bit 0 displays as 0001. All zeros and a 1 in Bit 15 displays as 8000.
0309	**ALARM WORD 2** See parameter 0308.

Bit #	0308, ALARM WORD 1	0309, ALARM WORD 2
0	OVERCURRENT	Reserved
1	OVERVOLTAGE	PID SLEEP
2	UNDERVOLTAGE	ID RUN
3	DIR LOCK	Reserved
4	IO COMM	START ENABLE 1 MISSING
5	AI1 LOSS	START ENABLE 2 MISSING
6	AI2 LOSS	EMERGENCY STOP
7	PANEL LOSS	ENCODER ERROR
8	DEVICE OVERTEMP	FIRST START
9	MOTOR TEMP	Reserved
10	Reserved	USER LOAD CURVE
11	MOTOR STALL	START DELAY
12	AUTORESET	Reserved
13	AUTOCHANGE	Reserved
14	PFC I LOCK	Reserved
15	Reserved	Reserved

Group 04: FAULT HISTORY

This group stores a recent history of the faults reported by the drive.

Code	Description
0401	**LAST FAULT** 0 – Clear the fault history (on panel = NO RECORD). n – Fault code of the last recorded fault. The fault code is displayed as a name. See section *Fault listing* on page *254* for the fault codes and names. The fault name shown for this parameter may be shorter than the corresponding name in the fault listing, which shows the names as they are shown in the fault display.
0402	**FAULT TIME 1** The day on which the last fault occurred. Either as: • A date – if real time clock is operating. • The number of days after power on – if real time clock is not used, or was not set.
0403	**FAULT TIME 2** The time at which the last fault occurred. Either as: • Real time, in format hh:mm:ss – if real time clock is operating. • The time since power on (minus the whole days reported in 0402), in format hh:mm:ss – if real time clock is not used, or was not set. • Format on the Basic Control Panel: The time since power on in 2-second ticks (minus the whole days reported in 0402). 30 ticks = 60 seconds. E.g. Value 514 equals 17 minutes and 8 seconds (= 514/30).
0404	**SPEED AT FLT** The motor speed (rpm) at the time the last fault occurred.
0405	**FREQ AT FLT** The frequency (Hz) at the time the last fault occurred.
0406	**VOLTAGE AT FLT** The DC bus voltage (V) at the time the last fault occurred.
0407	**CURRENT AT FLT** The motor current (A) at the time the last fault occurred.
0408	**TORQUE AT FLT** The motor torque (%) at the time the last fault occurred.
0409	**STATUS AT FLT** The drive status (hex code word) at the time the last fault occurred.
0410	**DI 1-3 AT FLT** The status of digital inputs 1…3 at the time the last fault occurred.
0411	**DI 4-6 AT FLT** The status of digital inputs 4…6 at the time the last fault occurred.
0412	**PREVIOUS FAULT 1** Fault code of the second last fault. Read-only.
0413	**PREVIOUS FAULT 2** Fault code of the third last fault. Read-only.

Group 10: START/STOP/DIR

This group:

- defines external sources (EXT1 and EXT2) for commands that enable start, stop and direction changes
- locks direction or enables direction control.

To select between the two external locations use the next group (parameter 1102).

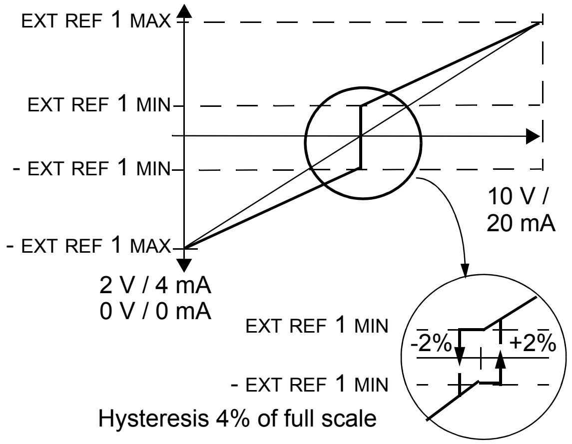
Code	Description
1001	**EXT1 COMMANDS** Defines external control location 1 (EXT1) – the configuration of start, stop and direction commands. 0 = NOT SEL – No external start, stop and direction command source. 1 = DI1 – Two-wire Start/Stop. • Start/Stop is through digital input DI1 (DI1 activated = Start; DI1 de-activated = Stop). • Parameter 1003 defines the direction. Selecting 1003 = 3 (REQUEST) is the same as 1003 = 1 (FORWARD). 2 = DI1,2 – Two-wire Start/Stop, Direction. • Start/Stop is through digital input DI1 (DI1 activated = Start; DI1 de-activated = Stop). • Direction control [requires parameter 1003 = 3 (REQUEST)] is through digital input DI2 (DI2 activated = Reverse; de-activated = Forward). 3 = DI1P,2P – Three-wire Start/Stop. • Start/Stop commands are through momentary push-buttons (the P stands for "pulse"). • Start is through a normally open push-button connected to digital input DI1. In order to start the drive, the digital input DI2 must be activated prior to the pulse in DI1. • Connect multiple Start push-buttons in parallel. • Stop is through a normally closed push-button connected to digital input DI2. • Connect multiple Stop push-buttons in series. • Parameter 1003 defines the direction. Selecting 1003 = 3 (REQUEST) is the same as 1003 = 1 (FORWARD). 4 = DI1P,2P,3 – Three-wire Start/Stop, Direction. • Start/Stop commands are through momentary push-buttons, as described for DI1P,2P. • Direction control [requires parameter 1003 = 3 (REQUEST)] is through digital input DI3 (DI3 activated = Reverse; de-activated = Forward). 5 = DI1P,2P,3P – Start Forward, Start Reverse and Stop. • Start and Direction commands are given simultaneously with two separate momentary push-buttons (the P stands for "pulse"). • Start Forward command is through a normally open push-button connected to digital input DI1. In order to start the drive, the digital input DI3 must be activated prior to the pulse in DI1. • Start Reverse command is through a normally open push-button connected to digital input DI2. In order to start the drive, the digital input DI3 must be activated during the pulse in DI2. • Connect multiple Start push-buttons in parallel. • Stop is through a normally closed push-button connected to digital input DI3. • Connect multiple Stop push-buttons in series. • Requires parameter 1003 = 3 (REQUEST). 6 = DI6 – Two-wire Start/Stop. • Start/Stop is through digital input DI6 (DI6 activated = Start; DI6 de-activated = Stop). • Parameter 1003 defines the direction. Selecting 1003 = 3 (REQUEST) is the same as 1003 = 1 (FORWARD). 7 = DI6,5 – Two-wire Start/Stop/Direction. • Start/Stop is through digital input DI6 (DI6 activated = Start; DI6 de-activated = Stop). • Direction control [requires parameter 1003 = 3 (REQUEST)] is through digital input DI5. (DI5 activated = Reverse; de-activated = Forward). 8 = KEYPAD – Control Panel. • Start/Stop and Direction commands are through the control panel when EXT1 is active. • Direction control requires parameter 1003 = 3 (REQUEST). 9 = DI1F,2R – Start/Stop/Direction commands through DI1 and DI2 combinations. • Start forward = DI1 activated and DI2 de-activated. • Start reverse = DI1 de-activated and DI2 activated. • Stop = both DI1 and DI2 activated, or both de-activated. • Requires parameter 1003 = 3 (REQUEST). 10 = COMM – Assigns the fieldbus Command Word as the source for the start/stop and direction commands. • Bits 0,1, 2 of Command Word 1 (parameter 0301) activates the start/stop and direction commands. • See Fieldbus user's manual for detailed instructions.

Code	Description
	11 = TIMED FUNC 1. – Assigns Start/Stop control to Timed Function 1 (Timed Function activated = START; Timed Function de-activated = STOP). See *Group 36: TIMED FUNCTIONS*. 12…14 = TIMED FUNC 2…4 – Assigns Start/Stop control to Timed Function 2…4. See TIMED FUNC 1 above.
1002	**EXT2 COMMANDS** Defines external control location 2 (EXT2) – the configuration of start, stop and direction commands. • See parameter 1001 EXT1 COMMANDS above.
1003	**DIRECTION** Defines the control of motor rotation direction. 1 = FORWARD – Rotation is fixed in the forward direction. 2 = REVERSE – Rotation is fixed in the reverse direction. 3 = REQUEST – Rotation direction can be changed on command.
1004	**JOGGING SEL** Defines the signal that activates the jogging function. Jogging uses Constant Speed 7 (parameter 1208) for speed reference and ramp pair 2 (parameters 2205 and 2206) for accelerating and decelerating. When the jogging activation signal is lost, the drive uses ramp stop to decelerate to zero speed, even if coast stop is used in normal operation (parameter 2102). The jogging status can be parameterized to relay outputs (parameter 1401). The jogging status is also seen in DCU Profile status bit 21. 0 = NOT SEL – Disables the jogging function. 1 = DI1 – Activates/de-activates jogging based on the state of DI1 (DI1 activated = jogging active; DI1 de-activated = jogging inactive). 2…6 = DI2…DI6 – Activates jogging based on the state of the selected digital input. See DI1 above. -1 = DI1(INV) – Activates jogging based on the state of DI1 (DI1 activated = jogging inactive; DI1 de-activated = jogging active). -2…-6 = DI2(INV)…DI6(INV) – Activates jogging based on the state of the selected digital input. See DI1(INV) above.

Group 11: REFERENCE SELECT

This group defines:

- how the drive selects between command sources
- characteristics and sources for REF1 and REF2.

Code	Description
1101	**KEYPAD REF SEL** Selects the reference controlled in local control mode. 1 = REF1(Hz/rpm) – Reference type depends on parameter 9904 MOTOR CTRL MODE. • Speed reference (rpm) if 9904 = 1 (VECTOR:SPEED) or 2 (VECTOR:TORQ). • Frequency reference (Hz) if 9904 = 3 (SCALAR:FREQ). 2 = REF2(%)
1102	**EXT1/EXT2 SEL** Defines the source for selecting between the two external control locations EXT1 or EXT2. Thus, defines the source for Start/Stop/Direction commands and reference signals. 0 = EXT1 – Selects external control location 1 (EXT1). • See parameter 1001 EXT1 COMMANDS for EXT1's Start/Stop/Dir definitions. • See parameter 1103 REF1 SELECT for EXT1's reference definitions. 1 = DI1 – Assigns control to EXT1 or EXT2 based on the state of DI1 (DI1 activated = EXT2; DI1 de-activated = EXT1). 2…6 = DI2…DI6 – Assigns control to EXT1 or EXT2 based on the state of the selected digital input. See DI1 above. 7 = EXT2 – Selects external control location 2 (EXT2). • See parameter 1002 EXT2 COMMANDS for EXT2's Start/Stop/Dir definitions. • See parameter 1106 REF2 SELECT for EXT2's reference definitions. 8 = COMM – Assigns control of the drive via external control location EXT1 or EXT2 based on the fieldbus control word. • Bit 5 of the Command Word 1 (parameter 0301) defines the active external control location (EXT1 or EXT2). • See Fieldbus user's manual for detailed instructions. 9 = TIMED FUNC 1 – Assigns control to EXT1 or EXT2 based on the state of the Timed Function (Timed Function activated = EXT2; Timed Function de-activated = EXT1). See *Group 36: TIMED FUNCTIONS*. 10…12 = TIMED FUNC 2…4 – Assigns control to EXT1 or EXT2 based on the state of the Timed Function. See TIMED FUNC 1 above. -1 = DI1(INV) – Assigns control to EXT1 or EXT2 based on the state of DI1 (DI1 activated = EXT1; DI1 de-activated = EXT2). -2…-6 = DI2(INV)…DI6(INV) – Assigns control to EXT1 or EXT2 based on the state of the selected digital input. See DI1(INV) above.
1103	**REF1 SELECT**  Selects the signal source for external reference REF1. 0 = KEYPAD – Defines the control panel as the reference source. 1 = AI1 – Defines analog input 1 (AI1) as the reference source. 2 = AI2 – Defines analog input 2 (AI2) as the reference source. 3 = AI1/JOYST – Defines analog input 1 (AI1), configured for joystick operation, as the reference source. • The minimum input signal runs the drive at the maximum reference in the reverse direction. Define the minimum using parameter 1104. • The maximum input signal runs the drive at maximum reference in the forward direction. Define the maximum using parameter 1105. • Requires parameter 1003 = 3 (REQUEST). ⚠ **WARNING!** Because the low end of the reference range commands full reverse operation, do not use 0 V as the lower end of the reference range. Doing so means that if the control signal is lost (which is a 0 V input) the result is full reverse operation. Instead, use the following set-up so that loss of the analog input triggers a fault, stopping the drive: • Set parameter 1301 MINIMUM AI1 (1304 MINIMUM AI2) at 20% (2 V or 4 mA). • Set parameter 3021 AI1 FAULT LIMIT to a value 5% or higher. • Set parameter 3001 AI<MIN FUNCTION to 1 (FAULT). 4 = AI2/JOYST – Defines analog input 2 (AI2), configured for joystick operation, as the reference source. • See above (AI1/JOYST) description.

Code **Description**

5 = DI3U,4D(R) – Defines digital inputs as the speed reference source (motor potentiometer control).
- Digital input DI3 increases the speed (the U stands for "up").
- Digital input DI4 decreases the speed (the D stands for "down").
- A Stop command resets the reference to zero (the R stands for "reset").
- Parameter 2205 ACCELER TIME 2 controls the reference signal's rate of change.

6 = DI3U,4D – Same as above (DI3U,4D(R)), except:
- A Stop command does not reset the reference to zero. The reference is stored.
- When the drive restarts, the motor ramps up (at the selected acceleration rate) to the stored reference.

7 = DI5U,6D – Same as above (DI3U,4D), except that DI5 and DI6 are the digital inputs used.

8 = COMM – Defines the fieldbus as the reference source.

9 = COMM+AI1 – Defines a fieldbus and analog input 1 (AI1) combination as the reference source. See Analog input reference correction below.

10 = COMM*AI1 – Defines a fieldbus and analog input 1 (AI1) combination as the reference source. See Analog input reference correction below.

11 = DI3U,4D(RNC) – Same as DI3U,4D(R) above, except that:
- Changing the control source (EXT1 to EXT2, EXT2 to EXT1, LOC to REM) does not copy the reference.

12 = DI3U,4D(NC) – Same as DI3U,4D above, except that:
- Changing the control source (EXT1 to EXT2, EXT2 to EXT1, LOC to REM) does not copy the reference.

13 = DI5U,6D(NC) – Same as DI5U,6D above, except that:
- Changing the control source (EXT1 to EXT2, EXT2 to EXT1, LOC to REM) does not copy the reference.

14 = AI1+AI2 – Defines an analog input 1 (AI1) and analog input 2 (AI2) combination as the reference source. See Analog input reference correction below.

15 = AI1*AI2 – Defines an analog input 1 (AI1) and analog input 2 (AI2) combination as the reference source. See Analog input reference correction below.

16 = AI1-AI2 – Defines an analog input 1 (AI1) and analog input 2 (AI2) combination as the reference source. See Analog input reference correction below.

17 = AI1/AI2 – Defines an analog input 1 (AI1) and analog input 2 (AI2) combination as the reference source. See Analog input reference correction below.

20 = KEYPAD(RNC) – Defines the control panel as the reference source.
- A Stop command resets the reference to zero (the R stands for reset.).
- Changing the control source (EXT1 to EXT2, EXT2 to EXT1) does not copy the reference.

21 = KEYPAD(NC) – Defines the control panel as the reference source.
- A Stop command does not reset the reference to zero. The reference is stored.
- Changing the control source (EXT1 to EXT2, EXT2 to EXT1) does not copy the reference.

Analog input reference correction

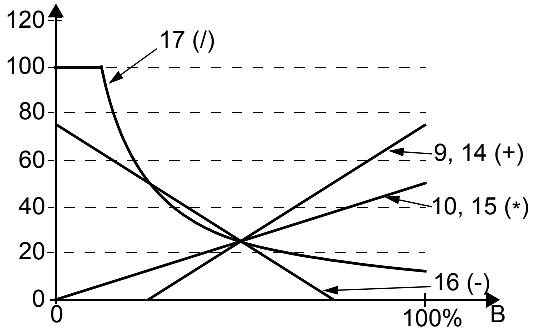
Parameter values 9, 10 and 14…17 use the formula in the following table.

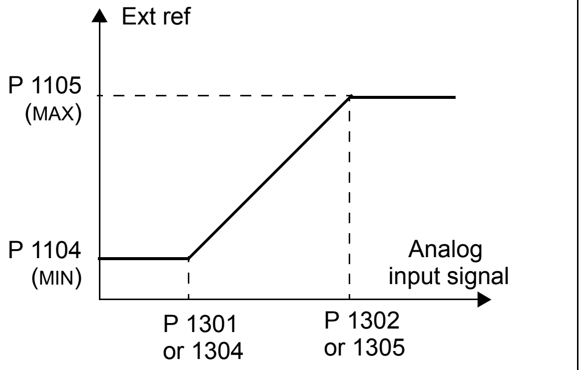
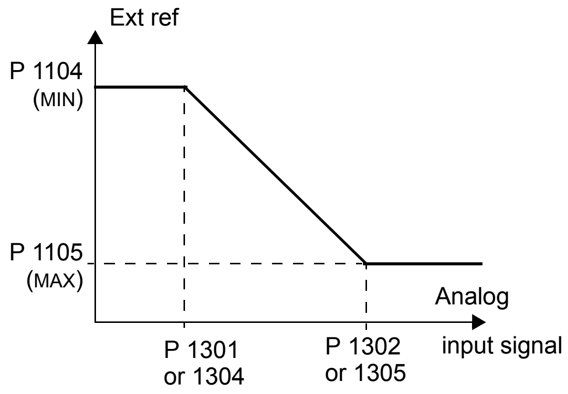
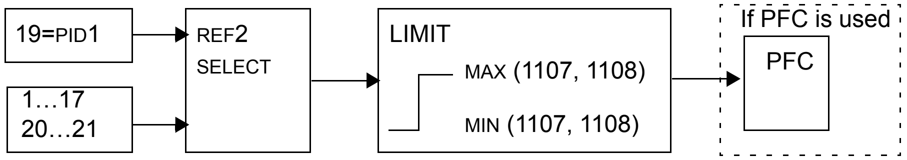
Value setting	Calculation of the AI reference
C + B	C value + (B value - 50% of reference value)
C * B	C value · (B value / 50% of reference value)
C - B	(C value + 50% of reference value) - B value
C / B	(C value · 50% of reference value) / B value

Where:
- C = Main reference value (= COMM for values 9, 10 and = AI1 for values 14…17).
- B = Correcting reference (= AI1 for values 9, 10 and = AI2 for values 14…17).

Example:

The figure shows the reference source curves for value settings 9, 10 and 14…17, where:
- C = 25%.
- P 4012 SETPOINT MIN = 0.
- P 4013 SETPOINT MAX = 0.
- B varies along the horizontal axis.



Code	Description
1104	**REF1 MIN** Sets the minimum for external reference 1. • The minimum analog input signal (as a percent of the full signal in volts or amperes) corresponds to REF1 MIN in Hz/rpm. • Parameter 1301 MINIMUM AI1 or 1304 MINIMUM AI2 sets the minimum analog input signal. • These parameters (reference and analog min. and max. settings) provide scale and offset adjustment for the reference. 
1105	**REF1 MAX** Sets the maximum for external reference 1. • The maximum analog input signal (as a percent of full the signal in volts or amperes) corresponds to REF1 MAX in Hz/rpm. • Parameter 1302 MAXIMUM AI1 or 1305 MAXIMUM AI2 sets the maximum analog input signal. 
1106	**REF2 SELECT** Selects the signal source for external reference REF2. 0…17 – Same as for parameter 1103 REF1 SELECT. 19 = PID1OUT – The reference is taken from the PID1 output. See *Group 40: PROCESS PID SET 1* and *Group 41: PROCESS PID SET 2*. 20…21 – Same as for parameter 1103 REF1 SELECT. 
1107	**REF2 MIN** Sets the minimum for external reference 2. • The minimum analog input signal (in volts or amperes) corresponds to REF2 MIN in %. • Parameter 1301 MINIMUM AI1 or 1304 MINIMUM AI2 sets the minimum analog input signal. • This parameter sets the minimum frequency reference. • The value is a percentage of the: – maximum frequency or speed – maximum process reference – nominal torque.
1108	**REF2 MAX** Sets the maximum for external reference 2. • The maximum analog input signal (in volts or amperes) corresponds to REF2 MAX in %. • Parameter 1302 MAXIMUM AI1 or 1305 MAXIMUM AI2 sets the maximum analog input signal. • This parameter sets the maximum frequency reference. • The value is a percentage of the: – maximum frequency or speed – maximum process reference – nominal torque.

Group 12: CONSTANT SPEEDS

This group defines a set of constant speeds. In general:

- You can program up to 7 constant speeds, ranging from 0...500 Hz or 0...30000 rpm.
- Values must be positive (No negative speed values for constant speeds).
- Constant speed selections are ignored if:
  - the torque control is active, or
  - the process PID reference is followed, or
  - the drive is in local control mode, or
  - PFC (Pump-Fan Control) is active.

Note: Parameter 1208 CONST SPEED 7 acts also as a so-called fault speed which may be activated if the control signal is lost. For example, see parameters 3001 AI<MIN FUNCTION, 3002 PANEL COMM ERR and 3018 COMM FAULT FUNC.

<table>
<tr><th>Code</th><th>Description</th></tr>
<tr><td>1201</td><td>

CONST SPEED SEL

Defines the digital inputs used to select Constant Speeds. See general comments in introduction.
0 = NOT SEL – Disables the constant speed function.
1 = DI1 – Selects Constant Speed 1 with digital input DI1.
• Digital input activated = Constant Speed 1 activated.
2…6 = DI2…DI6 – Selects Constant Speed 1 with digital input DI2…DI6. See above.
7 = DI1,2 – Selects one of three Constant Speeds (1…3) using DI1 and DI2.
• Uses two digital inputs, as defined below (0 = DI de-activated, 1 = DI activated):

<table>
<tr><th>DI1</th><th>DI2</th><th>Function</th></tr>
<tr><td>0</td><td>0</td><td>No constant speed</td></tr>
<tr><td>1</td><td>0</td><td>Constant speed 1 (1202)</td></tr>
<tr><td>0</td><td>1</td><td>Constant speed 2 (1203)</td></tr>
<tr><td>1</td><td>1</td><td>Constant speed 3 (1204)</td></tr>
</table>

• Can be set up as a so-called fault speed, which is activated if the control signal is lost. Refer to parameter 3001 AI<MIN function and parameter 3002 PANEL COMM ERR.
8 = DI2,3 – Selects one of three Constant Speeds (1…3) using DI2 and DI3.
• See above (DI1,2) for code.
9 = DI3,4 – Selects one of three Constant Speeds (1…3) using DI3 and DI4.
• See above (DI1,2) for code.
10 = DI4,5 – Selects one of three Constant Speeds (1…3) using DI4 and DI5.
• See above (DI1,2) for code.
11 = DI5,6 – Selects one of three Constant Speeds (1…3) using DI5 and DI6.
• See above (DI1,2) for code.
12 = DI1,2,3 – Selects one of seven Constant Speeds (1…7) using DI1, DI2 and DI3.
• Uses three digital inputs, as defined below (0 = DI de-activated, 1 = DI activated):

<table>
<tr><th>DI1</th><th>DI2</th><th>DI3</th><th>Function</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>No constant speed</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>Constant speed 1 (1202)</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>Constant speed 2 (1203)</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>Constant speed 3 (1204)</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>Constant speed 4 (1205)</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>Constant speed 5 (1206)</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>Constant speed 6 (1207)</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>Constant speed 7 (1208)</td></tr>
</table>

</td></tr>
</table>

<table>
<tr><th>Code</th><th>Description</th></tr>
<tr><td></td><td>
13 = DI3,4,5 – Selects one of seven Constant Speeds (1…7) using DI3, DI4 and DI5.
• See above (DI1,2,3) for code.
14 = DI4,5,6 – Selects one of seven Constant Speeds (1…7) using DI4, DI5 and DI6.
• See above (DI1,2,3) for code.
15…18 = TIMED FUNC 1…4 – Selects Constant Speed 1, Constant Speed 2 or the external reference, depending on the state of the Timed Function (1…4) and constant speed mode. See parameter 1209 TIMED MODE SEL and <i>Group 36: TIMED FUNCTIONS</i>.
19 = TIMED FUN1&2 – Selects a constant speed or the external reference, depending on the state of Timed Functions 1 & 2 and constant speed mode. See parameter 1209 TIMED MODE SEL and <i>Group 36: TIMED FUNCTIONS</i>.
-1 = DI1(INV) – Selects Constant Speed 1 with digital input DI1.
• Inverse operation: Digital input de-activated = Constant Speed 1 activated.
-2…- 6 = DI2(INV)…DI6(INV) – Selects Constant Speed 1 with digital input. See above.
-7 = DI1,2(INV) – Selects one of three Constant Speeds (1…3) using DI1 and DI2.
• Inverse operation uses two digital inputs, as defined below (0 = DI de-activated, 1 = DI activated):
<table>
<tr><th>DI1</th><th>DI2</th><th>Function</th></tr>
<tr><td>1</td><td>1</td><td>No constant speed</td></tr>
<tr><td>0</td><td>1</td><td>Constant speed 1 (1202)</td></tr>
<tr><td>1</td><td>0</td><td>Constant speed 2 (1203)</td></tr>
<tr><td>0</td><td>0</td><td>Constant speed 3 (1204)</td></tr>
</table>
-8 = DI2,3(INV) – Selects one of three Constant Speeds (1…3) using DI2 and DI3.
• See above (DI1,2(INV)) for code.
-9 = DI3,4(INV) – Selects one of three Constant Speeds (1…3) using DI3 and DI4.
• See above (DI1,2(INV)) for code.
-10 = DI4,5(INV) – Selects one of three Constant Speeds (1…3) using DI4 and DI5.
• See above (DI1,2(INV)) for code.
-11 = DI5,6(INV) – Selects one of three Constant Speeds (1…3) using DI5 and DI6.
• See above (DI1,2(INV)) for code.
-12 = DI1,2,3(INV) – Selects one of seven Constant Speeds (1…7) using DI1, DI2 and DI3.
• Inverse operation uses three digital inputs, as defined below (0 = DI de-activated, 1 = DI activated):
<table>
<tr><th>DI1</th><th>DI2</th><th>DI3</th><th>Function</th></tr>
<tr><td>1</td><td>1</td><td>1</td><td>No constant speed</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>Constant speed 1 (1202)</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>Constant speed 2 (1203)</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>Constant speed 3 (1204)</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>Constant speed 4 (1205)</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>Constant speed 5 (1206)</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>Constant speed 6 (1207)</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>Constant speed 7 (1208)</td></tr>
</table>
-13 = DI3,4,5(INV) – Selects one of seven Constant Speeds (1…7) using DI3, DI4 and DI5.
• See above (DI1,2,3(INV)) for code.
-14 = DI4,5,6(INV) – Selects one of seven Constant Speeds (1…7) using DI4, DI5 and DI6.
• See above (DI1,2,3(INV)) for code.
</td></tr>
<tr><td>1202</td><td>
CONST SPEED 1
Sets value for Constant Speed 1.
• The range and units depend on parameter 9904 MOTOR CTRL MODE.
• Range: 0…30000 rpm when 9904 = 1 (VECTOR:SPEED) or 2 (VECTOR:TORQ).
• Range: 0…500 Hz when 9904 = 3 (SCALAR:FREQ).
</td></tr>
<tr><td>1203
…
1208</td><td>
CONST SPEED 2…CONST SPEED 7
Each sets a value for a Constant Speed. See CONST SPEED 1 above.
Constant Speed 7 is used also as jogging speed. See parameter 1004 JOGGING SEL.
</td></tr>
</table>

Code	Description
1209	**TIMED MODE SEL**

Defines timed function activated constant speed mode. Timed function can be used to change between the external reference and constant speeds when parameter 1201 CONST SPEED SEL = 15…18 (TIMED FUNC 1…4) or 19 (TIMED FUN1&2).

1 = EXT/CS1/2/3

- If parameter 1201 = 15…18 (TIMED FUNC 1…4), selects an external speed when this timed function (1…4) is not active and selects Constant speed 1 when it is active.

TIMED FUNCTION 1…4	Function
0	External reference
1	Constant speed 1 (1202)

- If parameter 1201 = 19 (TIMED FUN1&2), selects an external speed when neither timed function is active, selects Constant speed 1 when only Timed function 1 is active, selects Constant speed 2 when only Timed function 2 is active and selects Constant speed 3 when both Timed functions 1 and 2 are active.

TIMED FUNCTION 1	TIMED FUNCTION 2	Function
0	0	External reference
1	0	Constant speed 1 (1202)
0	1	Constant speed 2 (1203)
1	1	Constant speed 3 (1204)

2 = CS1/2/3/4

- If parameter 1201 = 15…18 (TIMED FUNC 1…4), selects Constant speed 1 when this timed function (1…4) is not active and selects Constant speed 2 when it is active.

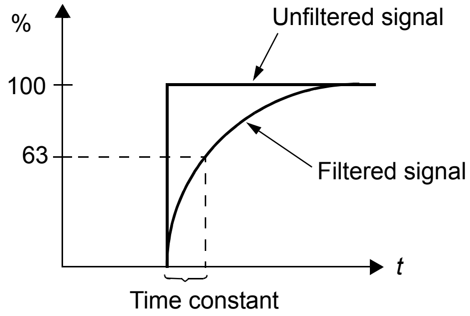
TIMED FUNCTION 1…4	Function
0	Constant speed 1 (1202)
1	Constant speed 2 (1203)

- If parameter 1201 = 19 (TIMED FUN1&2), selects Constant speed 1 when neither timed function is active, selects Constant speed 2 when only Timed function 1 is active, selects Constant speed 3 when only Timed function 2 is active and selects Constant speed 4 when both Timed functions 1 and 2 are active.

TIMED FUNCTION 1	TIMED FUNCTION 2	Function
0	0	Constant speed 1 (1202)
1	0	Constant speed 2 (1203)
0	1	Constant speed 3 (1204)
1	1	Constant speed 4 (1205)

Group 13: ANALOG INPUTS

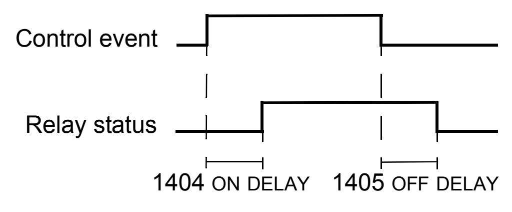
This group defines the limits and the filtering for analog inputs.

Code	Description
1301	**MINIMUM AI1** Defines the minimum value of the analog input. • Define value as a percent of the full analog signal range. See example below. • The minimum analog input signal corresponds to 1104 REF1 MIN or 1107 REF2 MIN. • MINIMUM AI cannot be greater than MAXIMUM AI. • These parameters (reference and analog min. and max. settings) provide scale and offset adjustment for the reference. • See the figure at parameter 1104. **Example:** To set the minimum analog input value to 4 mA: • Configure the analog input for 0…20 mA current signal. • Calculate the minimum (4 mA) as a percent of full range (20 mA) = 4 mA / 20 mA · 100% = 20%
1302	**MAXIMUM AI1** Defines the maximum value of the analog input. • Define value as a percent of the full analog signal range. • The maximum analog input signal corresponds to 1105 REF1 MAX or 1108 REF2 MAX. • See the figure at parameter 1104.
1303	**FILTER AI1** Defines the filter time constant for analog input 1 (AI1). • The filtered signal reaches 63% of a step change within the time specified. 
1304	**MINIMUM AI2** Defines the minimum value of the analog input. • See MINIMUM AI1 above.
1305	**MAXIMUM AI2** Defines the maximum value of the analog input. • See MAXIMUM AI1 above.
1306	**FILTER AI2** Defines the filter time constant for analog input 2 (AI2). • See FILTER AI1 above.

Group 14: RELAY OUTPUTS

This group defines the condition that activates each of the relay outputs. Relay outputs 4…6 are only available if OREL-01 Relay Output Extension Module is installed.

Code	Description
1401	**RELAY OUTPUT 1** Defines the event or condition that activates relay 1 – what relay output 1 means. 0 = NOT SEL – Relay is not used and is de-energized. 1 = READY – Energize relay when drive is ready to function. Requires: • Run enable signal present. • No faults exist. • Supply voltage is within range. • Emergency Stop command is not on. 2 = RUN – Energize relay when the drive is running. 3 = FAULT(-1) – Energize relay when power is applied. De-energizes when a fault occurs. 4 = FAULT – Energize relay when a fault is active. 5 = ALARM – Energize relay when an alarm is active. 6 = REVERSED – Energize relay when motor rotates in reverse direction. 7 = STARTED – Energize relay when drive receives a start command (even if Run Enable signal is not present). De-energized relay when drive receives a stop command or a fault occurs. 8= SUPRV1 OVER – Energize relay when first supervised parameter (3201) exceeds the limit (3203). • See *Group 32: SUPERVISION* starting on page *149*. 9 = SUPRV1 UNDER – Energize relay when first supervised parameter (3201) drops below the limit (3202). • See *Group 32: SUPERVISION* starting on page *149*. 10 = SUPRV2 OVER – Energize relay when second supervised parameter (3204) exceeds the limit (3206). • See *Group 32: SUPERVISION* starting on page *149*. 11 = SUPRV2 UNDER – Energize relay when second supervised parameter (3204) drops below the limit (3205). • See *Group 32: SUPERVISION* starting on page *149*. 12 = SUPRV3 OVER – Energize relay when third supervised parameter (3207) exceeds the limit (3209). • See *Group 32: SUPERVISION* starting on page *149*. 13 = SUPRV3 UNDER – Energize relay when third supervised parameter (3207) drops below the limit (3208). • See *Group 32: SUPERVISION* starting on page *149*. 14 = AT SET POINT – Energize relay when the output frequency is equal to the reference frequency. 15 = FAULT(RST) – Energize relay when the drive is in a fault condition and will reset after the programmed auto-reset delay. • See parameter 3103 DELAY TIME. 16 = FLT/ALARM – Energize relay when fault or alarm occurs. 17 = EXT CTRL – Energize relay when external control is selected. 18 = REF 2 SEL – Energize relay when EXT2 is selected. 19 = CONST FREQ – Energize relay when a constant speed is selected. 20 = REF LOSS – Energize relay when reference or active control place is lost. 21 = OVERCURRENT – Energize relay when an overcurrent alarm or fault occurs. 22 = OVERVOLTAGE – Energize relay when an overvoltage alarm or fault occurs. 23 = DRIVE TEMP – Energize relay when a drive or control board overtemperature alarm or fault occurs. 24 = UNDERVOLTAGE – Energize relay when an undervoltage alarm or fault occurs. 25 = AI1 LOSS – Energize relay when AI1 signal is lost. 26 = AI2 LOSS – Energize relay when AI2 signal is lost. 27 = MOTOR TEMP – Energize relay when a motor overtemperature alarm or fault occurs. 28 = STALL – Energize relay when a stall alarm or fault exists. 30 = PID SLEEP – Energize relay when the PID sleep function is active. 31 = PFC – Use relay to start/stop motor in PFC control (See *Group 81: PFC CONTROL*). • Use this option only when PFC control is used. • Selection activated / deactivated when drive is not running. 32 = AUTOCHANGE – Energize relay when PFC autochange operation is performed. • Use this option only when PFC control is used. 33 = FLUX READY – Energize relay when the motor is magnetized and able to supply nominal torque (motor has reached nominal magnetizing). 34 = USER MACRO 2 – Energize relay when User Parameter Set 2 is active.

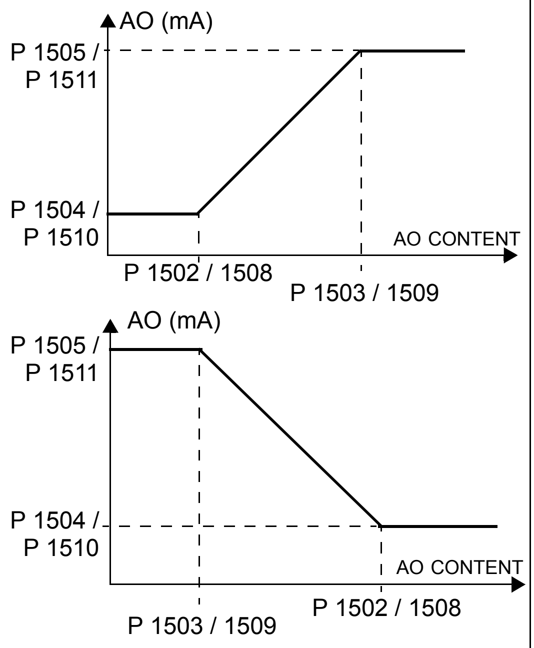
<table>
<tr><th>Code</th><th colspan="2">Description</th></tr>
<tr><td></td><td colspan="2">35 = COMM – Energize relay based on input from fieldbus communication.
• Fieldbus writes binary code in parameter 0134 that can energize relay 1…relay 6 according to the following:
<table>
<tr><th>Par. 0134</th><th>Binary</th><th>RO6</th><th>RO5</th><th>RO4</th><th>RO3</th><th>RO2</th><th>RO1</th></tr>
<tr><td>0</td><td>000000</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>000001</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>2</td><td>000010</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>3</td><td>000011</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>4</td><td>000100</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>5…62</td><td>…</td><td>…</td><td>…</td><td>…</td><td>…</td><td>…</td><td>…</td></tr>
<tr><td>63</td><td>111111</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
</table>
• 0 = De-energize relay, 1 = Energize relay.
36 = COMM(-1) – Energize relay based on input from fieldbus communication.
• Fieldbus writes binary code in parameter 0134 that can energize relay 1…relay 6 according to the following:
<table>
<tr><th>Par. 0134</th><th>Binary</th><th>RO6</th><th>RO5</th><th>RO4</th><th>RO3</th><th>RO2</th><th>RO1</th></tr>
<tr><td>0</td><td>000000</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>1</td><td>000001</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td></tr>
<tr><td>2</td><td>000010</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>3</td><td>000011</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>4</td><td>000100</td><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>5…62</td><td>…</td><td>…</td><td>…</td><td>…</td><td>…</td><td>…</td><td>…</td></tr>
<tr><td>63</td><td>111111</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
</table>
• 0 = De-energize relay, 1 = Energize relay.
37 = TIMED FUNC 1 – Energize relay when Timed Function 1 is active. See *Group 36: TIMED FUNCTIONS*.
38…40 = TIMED FUNC 2…4 – Energize relay when Timed Function 2…4 is active. See TIMED FUNC 1 above.
41 = MNT TRIG FAN – Energize relay when cooling fan counter is triggered. See *Group 29: MAINTENANCE TRIG*.
42 = MNT TRIG REV – Energize relay when revolutions counter is triggered. See *Group 29: MAINTENANCE TRIG*.
43 = MNT TRIG RUN – Energize relay when run time counter is triggered. See *Group 29: MAINTENANCE TRIG*.
44 = MNT TRIG MWH – Energize relay when MWh counter is triggered. See *Group 29: MAINTENANCE TRIG*.
46 = START DELAY – Energize relay when a start delay is active.
47 = USER LOAD C – Energize relay when a user load curve fault or alarm occurs.
52 = JOG ACTIVE – Energize relay when the jogging function is active.</td></tr>
<tr><td>1402</td><td colspan="2">RELAY OUTPUT 2
Defines the event or condition that activates relay 2 – what relay output 2 means.
• See 1401 RELAY OUTPUT 1.</td></tr>
<tr><td>1403</td><td colspan="2">RELAY OUTPUT 3
Defines the event or condition that activates relay 3 – what relay output 3 means.
• See 1401 RELAY OUTPUT 1.</td></tr>
<tr><td>1404</td><td>RO 1 ON DELAY
Defines the switch-on delay for relay 1.
• On / off delays are ignored when relay output 1401 is set to PFC.</td><td rowspan="2">
</td></tr>
<tr><td>1405</td><td>RO 1 OFF DELAY
Defines the switch-off delay for relay 1.
• On / off delays are ignored when relay output 1401 is set to PFC.</td></tr>
<tr><td>1406</td><td colspan="2">RO 2 ON DELAY
Defines the switch-on delay for relay 2.
• See RO 1 ON DELAY.</td></tr>
<tr><td>1407</td><td colspan="2">RO 2 OFF DELAY
Defines the switch-off delay for relay 2.
• See RO 1 OFF DELAY.</td></tr>
<tr><td>1408</td><td colspan="2">RO 3 ON DELAY
Defines the switch-on delay for relay 3.
• See RO 1 ON DELAY.</td></tr>
</table>

Code	Description
1409	**RO 3 OFF DELAY** Switch-off delay for relay 3. • See RO 1 OFF DELAY.
1410 … 1412	**RELAY OUTPUT 4…6** Defines the event or condition that activates relay 4…6 – what relay output 4…6 means. Available if OREL-01 Relay Output Extension Module is installed. • See 1401 RELAY OUTPUT 1.
1413	**RO 4 ON DELAY** Defines the switch-on delay for relay 4. • See RO 1 ON DELAY.
1414	**RO 4 OFF DELAY** Defines the switch-off delay for relay 4. • See RO 1 OFF DELAY.
1415	**RO 5 ON DELAY** Defines the switch-on delay for relay 5. • See RO 1 ON DELAY.
1416	**RO 5 OFF DELAY** Defines the switch-off delay for relay 5. • See RO 1 OFF DELAY.
1417	**RO 6 ON DELAY** Defines the switch-on delay for relay 6. • See RO 1 ON DELAY.
1418	**RO 6 OFF DELAY** Defines the switch-off delay for relay 6. • See RO 1 OFF DELAY.

Group 15: ANALOG OUTPUTS

This group defines the drive's analog (current signal) outputs. The drive's analog outputs can be:

- any parameter in *Group 01: OPERATING DATA*
- limited to programmable minimum and maximum values of output current
- scaled (and/or inverted) by defining the minimum and maximum values of the source parameter (or content). Defining an maximum value (parameter 1503 or 1509) that is less than the content minimum value (parameter 1502 or 1508) results in an inverted output.
- filtered.

Code	Description
1501	**AO1 CONTENT SEL** Defines the content for analog output AO1. 99 = EXCITE PTC – Provides a current source for sensor type PTC. Output = 1.6 mA. See *Group 35: MOTOR TEMP MEAS*. 100 = EXCITE PT100 – Provides a current source for sensor type PT100. Output = 9.1 mA. See *Group 35: MOTOR TEMP MEAS*. 101…178 – Output corresponds to a parameter in *Group 01: OPERATING DATA*. • Parameter defined by value (value 102 = parameter 0102)
1502	**AO1 CONTENT MIN** Sets the minimum content value. • Content is the parameter selected by parameter 1501. • Minimum value refers to the minimum content value that will be converted to an analog output. • These parameters (content and current min. and max. settings) provide scale and offset adjustment for the output. See the figure. 
1503	**AO1 CONTENT MAX** Sets the maximum content value • Content is the parameter selected by parameter 1501. • Maximum value refers to the maximum content value that will be converted to an analog output.
1504	**MINIMUM AO1** Sets the minimum output current.
1505	**MAXIMUM AO1** Sets the maximum output current.
1506	**FILTER AO1** Defines the filter time constant for AO1. • The filtered signal reaches 63% of a step change within the time specified. • See the figure in parameter 1303.
1507	**AO2 CONTENT SEL** Defines the content for analog output AO2. See AO1 CONTENT SEL above.
1508	**AO2 CONTENT MIN** Sets the minimum content value. See AO1 CONTENT MIN above.
1509	**AO2 CONTENT MAX** Sets the maximum content value. See AO1 CONTENT MAX above.
1510	**MINIMUM AO2** Sets the minimum output current. See MINIMUM AO1 above.

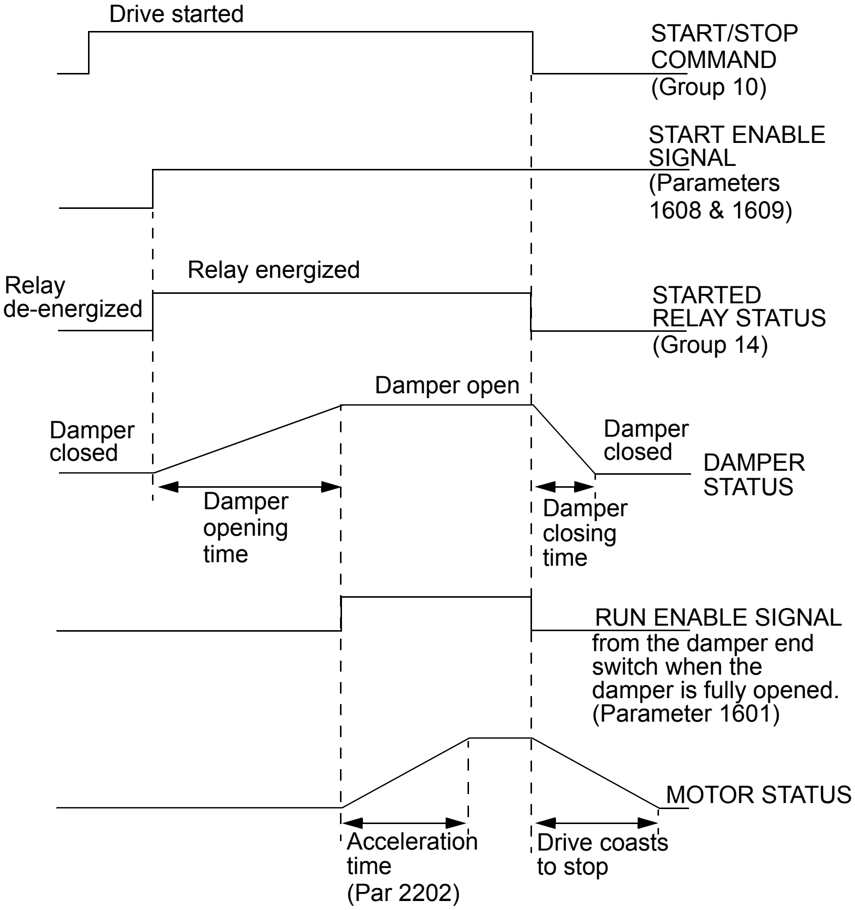
Code	Description
1511	**MAXIMUM AO2** Sets the maximum output current. See MAXIMUM AO1 above.
1512	**FILTER AO2** Defines the filter time constant for AO2. See FILTER AO1 above.

Group 16: SYSTEM CONTROLS

This group defines a variety of system level locks, resets and enables.

Code	Description
1601	**RUN ENABLE** Selects the source of the run enable signal. 0 = NOT SEL – Allows the drive to start without an external run enable signal. 1 = DI1 – Defines digital input DI1 as the run enable signal. • This digital input must be activated for run enable. • If the voltage drops and de-activates this digital input, the drive will coast to stop and not start until the run enable signal resumes. 2…6 = DI2…DI6 – Defines digital input DI2…DI6 as the run enable signal. • See DI1 above. 7 = COMM – Assigns the fieldbus Command Word as the source for the run enable signal. • Bit 6 of the Command Word 1 (parameter 0301) activates the run disable signal. • See fieldbus user's manual for detailed instructions. -1 = DI1(INV) – Defines an inverted digital input DI1 as the run enable signal. • This digital input must be de-activated for run enable. • If this digital input activates, the drive will coast to stop and not start until the run enable signal resumes. -2…-6 = DI2(INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as the run enable signal. • See DI1(INV) above.
1602	**PARAMETER LOCK** Determines if the control panel can change parameter values. • This lock does not limit parameter changes made by macros. • This lock does not limit parameter changes written by fieldbus inputs. • This parameter value can be changed only if the correct pass code is entered. See parameter 1603 PASS CODE. 0 = LOCKED – You cannot use the control panel to change parameter values. • The lock can be opened by entering the valid pass code to parameter 1603. 1 = OPEN – You can use the control panel to change parameter values. 2 = NOT SAVED – You can use the control panel to change parameter values, but they are not stored in permanent memory. • Set parameter 1607 PARAM SAVE to 1 (SAVE) to store changed parameter values to memory.
1603	**PASS CODE** Entering the correct pass code allows you to change the parameter lock. • See parameter 1602 above. • The code 358 allows you to change the value of the parameter 1602 once. • This entry reverts back to 0 automatically.
1604	**FAULT RESET SEL** Selects the source for the fault reset signal. The signal resets the drive after a fault trip if the cause of the fault no longer exists. 0 = KEYPAD – Defines the control panel as the only fault reset source. • Fault reset is always possible with control panel. 1 = DI1 – Defines digital input DI1 as a fault reset source. • Activating the digital input resets the drive. 2…6 = DI2…DI6 – Defines digital input DI2…DI6 as a fault reset source. • See DI1 above. 7 = START/STOP – Defines the Stop command as a fault reset source. • Do not use this option when fieldbus communication provides the start, stop and direction commands. 8 = COMM – Defines the fieldbus as a fault reset source. • The Command Word is supplied through fieldbus communication. • The bit 4 of the Command Word 1 (parameter 0301) resets the drive. -1 = DI1(INV) – Defines an inverted digital input DI1 as a fault reset source. • De-activating the digital input resets the drive. -2…-6 = DI2(INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as a fault reset source. • See DI1(INV) above.

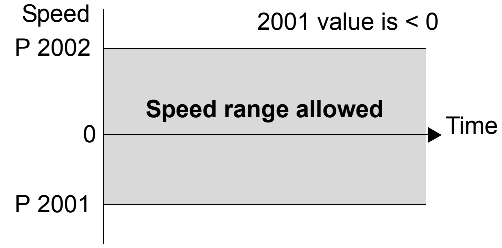
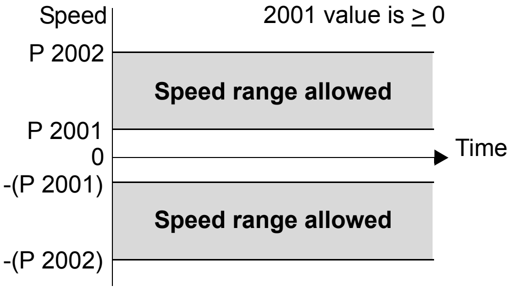
Code	Description
1605	**USER PAR SET CHG** Defines control for changing the user parameter set. • See parameter 9902 APPLIC MACRO. • The drive must be stopped to change User Parameter Sets. • During a change, the drive will not start. **Note:** Always save the User Parameter Set after changing any parameter settings, or performing a motor identification. • Whenever the power is cycled, or parameter 9902 APPLIC MACRO is changed, the drive loads the last settings saved. Any unsaved changes to a user parameter set are lost. **Note:** The value of this parameter (1605) is not included in the User Parameter Sets, and it does not change if User Parameter Sets change. **Note:** You can use a relay output to supervise the selection of User Parameter Set 2. • See parameter 1401. 0 = NOT SEL – Defines the control panel (using parameter 9902) as the only control for changing User Parameter Sets. 1 = DI1 – Defines digital input DI1 as a control for changing User Parameter Sets. • The drive loads User Parameter Set 1 on the falling edge of the digital input. • The drive loads User Parameter Set 2 on the rising edge of the digital input. • The User Parameter Set changes only when the drive is stopped. 2…6 = DI2…DI6 – Defines digital input DI2…DI6 as a control for changing User Parameter Sets. • See DI1 above. -1 = DI1(INV) – Defines an inverted digital input DI1 as a control for changing User Parameter Sets. • The drive loads User Parameter Set 1 on the rising edge of the digital input. • The drive loads User Parameter Set 2 on the falling edge of the digital input. • The User Parameter Set changes only when the drive is stopped. -2…-6 = DI2(INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as a control for changing User Parameter Sets. • See DI1(INV) above.
1606	**LOCAL LOCK** Defines control for the use of the LOC mode. The LOC mode allows drive control from the control panel. • When LOCAL LOCK is active, the control panel cannot change to LOC mode. 0 = NOT SEL – Disables the lock. The control panel can select LOC and control the drive. 1 = DI1 – Defines digital input DI1 as the control for setting the local lock. • Activating the digital input locks out local control. • De-activating the digital input enable the LOC selection. 2…6 = DI2…DI6 – Defines digital input DI2…DI6 as the control for setting the local lock. • See DI1 above. 7 = ON – Sets the lock. The control panel cannot select LOC and cannot control the drive. 8 = COMM – Defines bit 14 of the Command Word 1 as the control for setting the local lock. • The Command Word is supplied through fieldbus communication. • The Command Word is 0301. -1 = DI1(INV) – Defines an inverted digital input DI1 as the control for setting the local lock. • De-activating the digital input locks out local control. • Activating the digital input enable the LOC selection. -2…-6 = DI2(INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as the control for setting the local lock. • See DI1(INV) above.
1607	**PARAM SAVE** Saves all altered parameters to permanent memory. • Parameters altered through a fieldbus are not automatically saved to permanent memory. To save, you must use this parameter. • If 1602 PARAMETER LOCK = 2 (NOT SAVED), parameters altered from the control panel are not saved. To save, you must use this parameter. • If 1602 PARAMETER LOCK = 1 (OPEN), parameters altered from the control panel are stored immediately to permanent memory. 0 = DONE – Value changes automatically when all parameters are saved. 1 = SAVE… – Saves altered parameters to permanent memory.

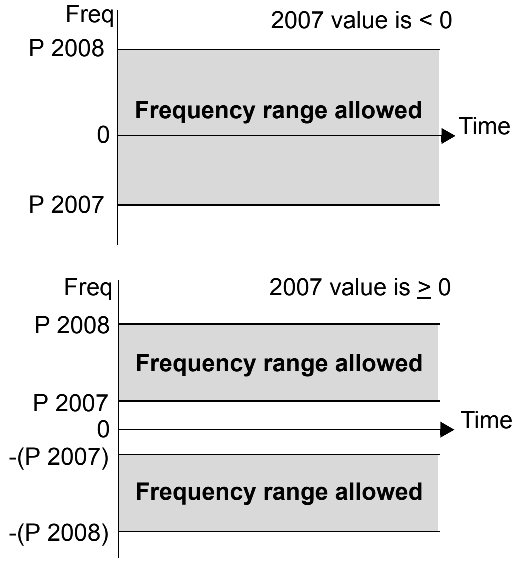
Code	Description
1608	**START ENABLE 1** Selects the source of the start enable 1 signal. **Note:** Start enable functionality differs from the run enable functionality. 0 = NOT SEL – Allows the drive to start without an external start enable signal. 1 = DI1 – Defines digital input DI1 as the start enable 1 signal. • This digital input must be activated for start enable 1 signal. • If the voltage drops and de-activates this digital input, the drive will coast to stop and show alarm 2021 on the panel display. The drive will not start until start enable 1 signal resumes. 2…6 = DI2…DI6 – Defines digital input DI2…DI6 as the start enable 1 signal. • See DI1 above. 7 = COMM – Assigns the fieldbus Command Word as the source for the start enable 1 signal. • Bit 2 of the Command word 2 (parameter 0302) activates the start disable 1 signal. • See fieldbus user's manual for detailed instructions. -1 = DI1(INV) – Defines an inverted digital input DI1 as the start enable 1 signal. -2…-6 = DI2 (INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as the start enable 1 signal. • See DI1 (INV) above. 

Code	Description
1609	**START ENABLE 2** Selects the source of the start enable 2 signal. **Note:** Start enable functionality differs from the run enable functionality. 0 = NOT SEL – Allows the drive to start without an external start enable signal. 1 = DI1 – Defines digital input DI1 as the start enable 2 signal. • This digital input must be activated for start enable 2 signal. • If the voltage drops and de-activates this digital input, the drive will coast to stop and show alarm 2022 on the panel display. The drive will not start until start enable 2 signal resumes. 2…6 = DI2…DI6 – Defines digital input DI2…DI6 as the start enable 2 signal. • See DI1 above. 7 = COMM – Assigns the fieldbus Command Word as the source for the start enable 2 signal. Bit 3 of the Command word 2 (parameter 0302) activates the start disable 2 signal. • See fieldbus user's manual for detailed instructions. -1 = DI1(INV) – Defines an inverted digital input DI1 as the start enable 2 signal. -2…-6 = DI2(INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as the start enable 2 signal. • See DI1 (INV) above.
1610	**DISPLAY ALARMS** Controls the visibility of the following alarms: • 2001, Overcurrent alarm • 2002, Overvoltage alarm • 2003, Undervoltage alarm • 2009, Device overtemperature alarm. For more information, see section *Alarm listing* on page *261*. 0 = NO – The above alarms are suppressed. 1 = YES – All of the above alarms are enabled.
1611	**PARAMETER VIEW** Selects the parameter view, i.e. which parameters are shown. **Note:** This parameter is visible only when it is activated by the optional FlashDrop device. FlashDrop is designed for fast copying of parameters to unpowered drives. It allows easy customization of the parameter list, e.g. selected parameters can be hidden. For more information, see *MFDT-01 FlashDrop User's Manual* (3AFE68591074 [English]). FlashDrop parameter values are activated by setting parameter 9902 to 31 (LOAD FD SET). 0 = DEFAULT – Complete long and short parameter lists are shown. 1 = FLASHDROP – FlashDrop parameter list is shown. Does not include short parameter list. Parameters that are hidden by the FlashDrop device are not visible.

Group 20: LIMITS

This group defines minimum and maximum limits to follow in driving the motor – speed, frequency, current, torque, etc.

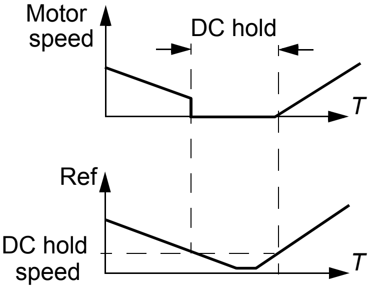
Code	Description
2001	**MINIMUM SPEED** Defines the minimum speed (rpm) allowed. • A positive (or zero) minimum speed value defines two ranges, one positive and one negative. • A negative minimum speed value defines one speed range. • See the figure. 
2002	**MAXIMUM SPEED** Defines the maximum speed (rpm) allowed. 
2003	**MAX CURRENT** Defines the maximum output current (A) supplied by the drive to the motor.
2005	**OVERVOLT CTRL** Sets the DC overvoltage controller on or off. • Fast braking of a high inertia load causes the DC bus voltage to rise to the overvoltage control limit. To prevent the DC voltage from exceeding the trip limit, the overvoltage controller automatically decreases the braking torque by increasing output frequency. 0 = DISABLE – Disables controller. 1 = ENABLE – Enables controller **Note:** If a braking chopper or a braking resistor is connected to the drive, this parameter value must be set to 0 (DISABLE) to ensure proper operation of the chopper.
2006	**UNDERVOLT CTRL** Sets the DC undervoltage controller on or off. When on: • If the DC bus voltage drops due to loss of input power, the undervoltage controller decreases the motor speed in order to keep the DC bus voltage above the lower limit. • When the motor speed decreases, the inertia of the load causes regeneration back into the drive, keeping the DC bus charged and preventing an undervoltage trip. • The DC undervoltage controller increases power loss ride-through on systems with a high inertia, such as a centrifuge or a fan. 0 = DISABLE – Disables controller. 1 = ENABLE(TIME) – Enables controller with 500 ms time limit for operation. 2 = ENABLE – Enables controller without maximum time limit for operation.

Code	Description
2007	**MINIMUM FREQ** Defines the minimum limit for the drive output frequency. • A positive or zero minimum frequency value defines two ranges, one positive and one negative. • A negative minimum frequency value defines one speed range. See the figure. **Note:** Keep MINIMUM FREQ ≤ MAXIMUM FREQ. 
2008	**MAXIMUM FREQ** Defines the maximum limit for the drive output frequency.
2013	**MIN TORQUE SEL** Defines control of the selection between two minimum torque limits (2015 MIN TORQUE 1 and 2016 MIN TORQUE 2). 0 = MIN TORQUE 1 – Selects 2015 MIN TORQUE 1 as the minimum limit used. 1 = DI1 – Defines digital input DI1 as the control for selecting the minimum limit used. • Activating the digital input selects MIN TORQUE 2 value. • De-activating the digital input selects MIN TORQUE 1 value. 2…6 = DI2…DI6 – Defines digital input DI2…DI6 as the control for selecting the minimum limit used. • See DI1 above. 7 = COMM – Defines bit 15 of the Command Word 1 as the control for selecting the minimum limit used. • The Command Word is supplied through fieldbus communication. • The Command Word is parameter 0301. -1 = DI1(INV) – Defines an inverted digital input DI1 as the control for selecting the minimum limit used. • Activating the digital input selects MIN TORQUE 1 value. • De-activating the digital input selects MIN TORQUE 2 value. -2…-6 = DI2(INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as the control for selecting the minimum limit used. • See DI1(INV) above.
2014	**MAX TORQUE SEL** Defines control of the selection between two maximum torque limits (2017 MAX TORQUE 1 and 2018 MAX TORQUE 2). 0 = MAX TORQUE 1 – Selects 2017 MAX TORQUE 1 as the maximum limit used. 1 = DI1 – Defines digital input DI1 as the control for selecting the maximum limit used. • Activating the digital input selects MAX TORQUE 2 value. • De-activating the digital input selects MAX TORQUE 1 value. 2…6 = DI2…DI6 – Defines digital input DI2…DI6 as the control for selecting the maximum limit used. • See DI1 above. 7 = COMM – Defines bit 15 of the Command Word 1 as the control for selecting the maximum limit used. • The Command Word is supplied through fieldbus communication. • The Command Word is parameter 0301. -1 = DI1(INV) – Defines an inverted digital input di1 as the control for selecting the maximum limit used. • Activating the digital input selects MAX TORQUE 1 value. • De-activating the digital input selects MAX TORQUE 2 value. -2…-6 = DI2(INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as the control for selecting the maximum limit used. • See DI1(INV) above.
2015	**MIN TORQUE 1** Sets the first minimum limit for torque (%). Value is a percent of the motor nominal torque.
2016	**MIN TORQUE 2** Sets the second minimum limit for torque (%). Value is a percent of the motor nominal torque.

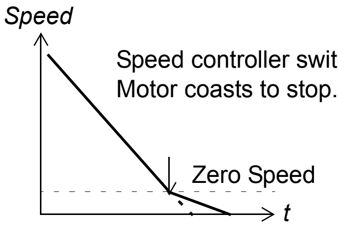
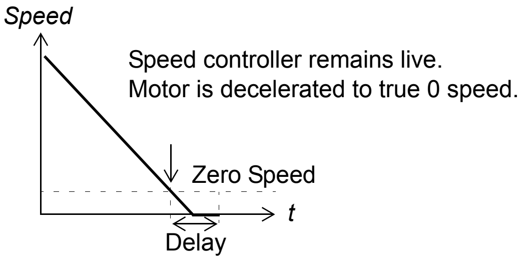
Code	Description
2017	**MAX TORQUE 1** Sets the first maximum limit for torque (%). Value is a percent of the motor nominal torque.
2018	**MAX TORQUE 2** Sets the second maximum limit for torque (%). Value is a percent of the motor nominal torque.

Group 21: START/STOP

This group defines how the motor starts and stops. The ACS550 supports several start and stop modes.

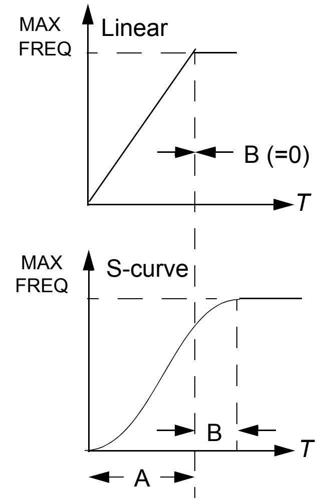
Code	Description
2101	**START FUNCTION** Selects the motor start method. The valid options depend on the value of parameter 9904 MOTOR CTRL MODE. 1 = AUTO – Selects the automatic start mode. • Vector control modes: Optimal start in most cases. The drive automatically selects the correct output frequency to start a rotating motor. • SCALAR:FREQ mode: Immediate start from zero frequency. Identical to selection 8 = RAMP. 2 = DC MAGN – Selects the DC Magnetizing start mode. **Note:** The DC Magnetizing start mode cannot start a rotating motor. **Note:** The drive starts when the set pre-magnetizing time (parameter 2103 DC MAGN TIME) has passed, even if motor magnetization is not complete. • Vector control modes: Magnetizes the motor within the time determined by the parameter 2103 DC MAGN TIME using DC current. The normal control is released exactly after the magnetizing time. This selection guarantees the highest possible break-away torque. • SCALAR:FREQ mode: Magnetizes the motor within the time determined by the parameter 2103 DC MAGN TIME using DC current. The normal control is released exactly after the magnetizing time. 3 = SCALAR FLYST – Selects the flying start mode. • Vector control modes: Not applicable. • SCALAR:FREQ mode: The drive automatically selects the correct output frequency to start a rotating motor – useful if the motor is already rotating and if the drive will start smoothly at the current frequency. • Cannot be used in multimotor systems. 4 = TORQ BOOST – Selects the automatic torque boost mode (SCALAR:FREQ mode only). • May be necessary in drives with high starting torque. • Torque boost is only applied at start, ending when output frequency exceeds 20 Hz or when output frequency is equal to reference. • In the beginning the motor magnetizes within the time determined by the parameter 2103 DC MAGN TIME using DC current. • See parameter 2110 TORQ BOOST CURR. 5 = FLY + BOOST – Selects both the flying start and the torque boost mode (SCALAR:FREQ mode only). • Flying start routine is performed first and the motor is magnetized. If the speed is found to be zero, the torque boost is done. 8 = RAMP – Immediate start from zero frequency.
2102	**STOP FUNCTION** Selects the motor stop method. 1 = COAST – Selects cutting off the motor power as the stop method. The motor coasts to stop. 2 = RAMP – Selects using a deceleration ramp. • Deceleration ramp is defined by 2203 DECELER TIME 1 or 2206 DECELER TIME 2 (whichever is active).
2103	**DC MAGN TIME** Defines the pre-magnetizing time for the DC Magnetizing start mode. • Use parameter 2101 to select the start mode. • After the start command, the drive pre-magnetizes the motor for the time defined here and then starts the motor. • Set the pre-magnetizing time just long enough to allow full motor magnetization. Too long a time heats the motor excessively.
2104	**DC HOLD CTL** Selects whether DC current is used for braking or DC Hold. 0 = NOT SEL – Disables the DC current operation. 1 = DC HOLD – Enables the DC Hold function. See the diagram. • Requires parameter 9904 MOTOR CTRL MODE = 1 (VECTOR:SPEED) • Stops generating sinusoidal current and injects DC into the motor when both the reference and the motor speed drop below the value of parameter 2105. • When the reference rises above the level of parameter 2105 the drive resumes normal operation. 2 = DC BRAKING – Enables the DC Injection Braking after modulation has stopped. • If parameter 2102 STOP FUNCTION is 1 (COAST), braking is applied after start is removed. • If parameter 2102 STOP FUNCTION is 2 (RAMP), braking is applied after ramp. 

Code	Description
2105	**DC HOLD SPEED** Sets the speed for DC Hold. Requires that parameter 2104 DC HOLD CTL = 1 (DC HOLD).
2106	**DC CURR REF** Defines the DC current control reference as a percentage of parameter 9906 MOTOR NOM CURR.
2107	**DC BRAKE TIME** Defines the DC brake time after modulation has stopped, if parameter 2104 is 2 (DC BRAKING).
2108	**START INHIBIT** Sets the Start inhibit function on or off. If the drive is not actively started and running, the Start inhibit function ignores a pending start command in any of the following situations and a new start command is required: • A fault is reset. • Run Enable (parameter 1601) activates while start command is active. • Mode changes from local to remote. • Control switches from EXT1 to EXT2. • Control switches from EXT2 to EXT1. 0 = OFF – Disables the Start inhibit function. 1 = ON – Enables the Start inhibit function.
2109	**EMERG STOP SEL** Defines control of the Emergency stop command. When activated: • Emergency stop decelerates the motor using the emergency stop ramp (parameter 2208 EMERG DEC TIME). • Requires an external stop command and removal of the emergency stop command before drive can restart. 0 = NOT SEL – Disables the Emergency stop function through digital inputs. 1 = DI1 – Defines digital input DI1 as the control for Emergency stop command. • Activating the digital input issues an Emergency stop command. • De-activating the digital input removes the Emergency stop command. 2…6 = DI2…DI6 – Defines digital input DI2…DI6 as the control for Emergency stop command. • See DI1 above. -1 = DI1(INV) – Defines an inverted digital input DI1 as the control for Emergency stop command. • De-activating the digital input issues an Emergency stop command. • Activating the digital input removes the Emergency stop command. -2…-6 = DI2(INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as the control for Emergency stop command. • See DI1(INV) above.
2110	**TORQ BOOST CURR** Sets the maximum supplied current during torque boost. • See parameter 2101 START FUNCTION.

Code	Description
2112	**ZERO SPEED DELAY** Defines the delay for the Zero Speed Delay function. If parameter value is set to zero, the Zero Speed Delay function is disabled. The function is useful in applications where a smooth and quick restarting is essential. During the delay the drive knows accurately the rotor position. **No Zero Speed Delay**  **With Zero Speed Delay**  Zero speed delay can be used e.g. with jogging function or mechanical brake. **No Zero Speed Delay** The drive receives a stop command and decelerates along a ramp. When the motor actual speed falls below an internal limit (called Zero Speed), the speed controller is switched off. The drive modulation is stopped and the motor coasts to standstill. **With Zero Speed Delay** The drive receives a stop command and decelerates along a ramp. When the motor actual speed falls below an internal limit (called Zero Speed), the zero speed delay function activates. During the delay the functions keeps the speed controller live: The drive modulates, motor is magnetized and drive is ready for a quick restart. **Note:** Parameter 2102 STOP FUNCTION must be 2 = RAMP for zero speed delay to operate. 0.0 = NOT SEL – Disables the Zero Speed Delay function.
2113	**START DELAY** Defines the Start delay. After the conditions for start have been fulfilled, the drive waits until the delay has elapsed and then starts the motor. Start delay can be used with all start modes. • If START DELAY = zero, the delay is disabled. • During the Start delay, alarm 2028 START DELAY is shown.

Group 22: ACCEL/DECEL

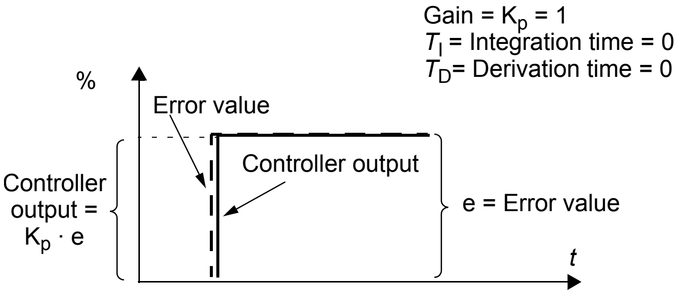
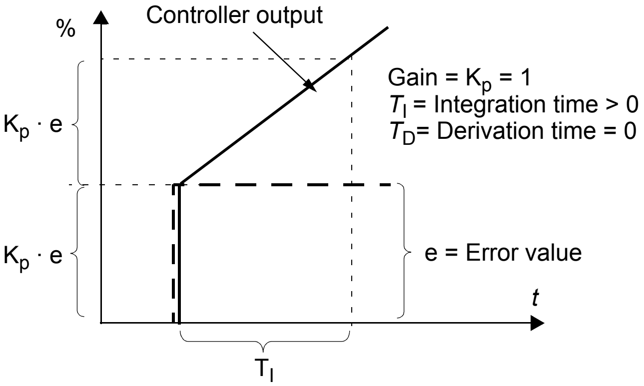
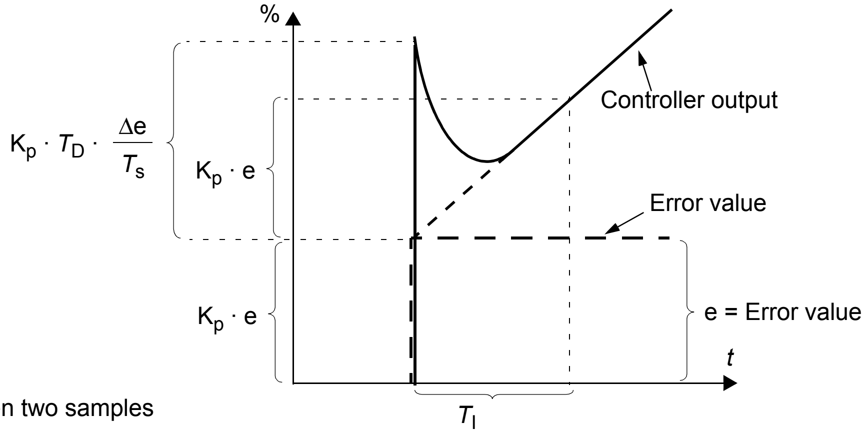
This group defines ramps that control the rate of acceleration and deceleration. You define these ramps as a pair, one for acceleration and one for deceleration. You can define two pairs of ramps and use a digital input to select one or the other pair.

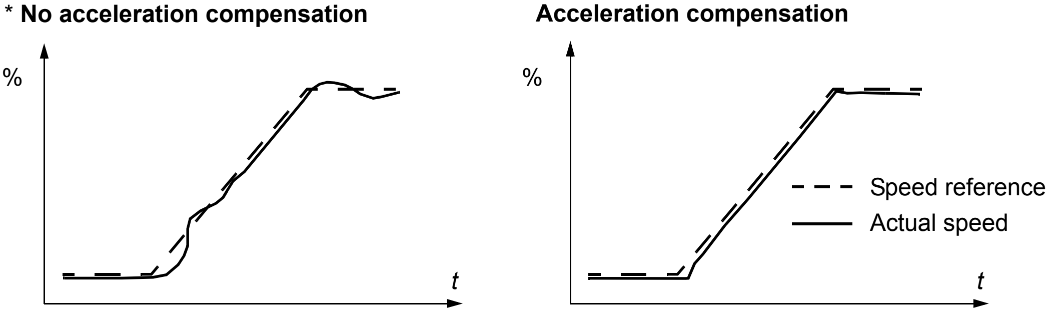
Code	Description	
2201	**ACC/DEC 1/2 SEL** Defines control for selection of acceleration/deceleration ramps. • Ramps are defined in pairs, one each for acceleration and deceleration. • See below for the ramp definition parameters. 0 = NOT SEL – Disables selection, the first ramp pair is used. 1 = DI1 – Defines digital input DI1 as the control for ramp pair selection. • Activating the digital input selects ramp pair 2. • De-activating the digital input selects ramp pair 1. 2…6 = DI2…DI6 – Defines digital input DI2…DI6 as the control for ramp pair selection. • See DI1 above. 7 = COMM – Defines bit 10 of the Command Word 1 as the control for ramp pair selection. • The Command Word is supplied through fieldbus communication. • The Command Word is parameter 0301. -1 = DI1(INV) – Defines an inverted digital input DI1 as the control for ramp pair selection. • De-activating the digital input selects ramp pair 2 • Activating the digital input selects ramp pair 1. -2…-6 = DI2(INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as the control for ramp pair selection. • See DI1(INV) above.	
2202	**ACCELER TIME 1** Sets the acceleration time for zero to maximum frequency for ramp pair 1. See A in the figure. • Actual acceleration time also depends on 2204 RAMP SHAPE 1. • See 2008 MAXIMUM FREQ.	 A = 2202 ACCELER TIME 1 B = 2204 RAMP SHAPE 1
2203	**DECELER TIME 1** Sets the deceleration time for maximum frequency to zero for ramp pair 1. • Actual deceleration time also depends on 2204 RAMP SHAPE 1. • See 2008 MAXIMUM FREQ.	
2204	**RAMP SHAPE 1** Selects the shape of the acceleration/deceleration ramp for ramp pair 1. See B in the figure. • Shape is defined as a ramp, unless additional time is specified here to reach the maximum frequency. A longer time provides a softer transition at each end of the slope. The shape becomes an s-curve. • Rule of thumb: 1/5 is a suitable relation between the ramp shape time and the acceleration ramp time. 0.0 = LINEAR – Specifies linear acceleration/deceleration ramps for ramp pair 1. 0.1…1000.0 = S-CURVE – Specifies s-curve acceleration/deceleration ramps for ramp pair 1.	
2205	**ACCELER TIME 2** Sets the acceleration time for zero to maximum frequency for ramp pair 2. • See 2202 ACCELER TIME 1. • Used also as jogging acceleration time. See 1004 JOGGING SEL.	
2206	**DECELER TIME 2** Sets the deceleration time for maximum frequency to zero for ramp pair 2. • See 2203 DECELER TIME 1. • Used also as jogging deceleration time. See 1004 JOGGING SEL.	
2207	**RAMP SHAPE 2** Selects the shape of the acceleration/deceleration ramp for ramp pair 2. • See 2204 RAMP SHAPE 1.	

Code	Description
2208	**EMERG DEC TIME** Sets the deceleration time for maximum frequency to zero for an emergency. • See parameter 2109 EMERG STOP SEL. • Ramp is linear.
2209	**RAMP INPUT 0** Defines control for forcing the speed to 0 with the currently used deceleration ramp (see parameters 2203 DECELER TIME 1 and 2206 DECELER TIME 2). 0 = NOT SEL – Not selected. 1 = DI1 – Defines digital input DI1 as the control for forcing the speed to 0. • Activating the digital input forces the speed to zero, after which the speed will stay at 0. • De-activating the digital input: speed control resumes normal operation. 2…6 = DI2…DI6 – Defines digital input DI2…DI6 as the control for forcing the speed to 0. • See DI1 above. 7 = COMM – Defines bit 13 of the Command Word 1 as the control for forcing the speed to 0. • The Command Word is supplied through fieldbus communication. • The Command Word is parameter 0301. -1 = DI1(INV) – Defines inverted digital input DI1 as the control for forcing the speed to 0. • De-activating the digital input forces the speed to 0. • Activating the digital input: speed control resumes normal operation. -2…-6 = DI2(INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as the control for forcing the speed to 0. • See DI1(INV) above.

Group 23: SPEED CONTROL

This group defines variables used for speed control operation.

Code	Description
2301	**PROP GAIN** Sets the relative gain for the speed controller. - Larger values may cause speed oscillation. - The figure shows the speed controller output after an error step (error remains constant). **Note:** You can use parameter 2305 AUTOTUNE RUN to automatically set the proportional gain. 
2302	**INTEGRATION TIME** Sets the integration time for the speed controller. - The integration time defines the rate at which the controller output changes for a constant error value. - Shorter integration times correct continuous errors faster. - Control becomes unstable if the integration time is too short. - The figure shows the speed controller output after an error step (error remains constant). **Note:** You can use parameter 2305 AUTOTUNE RUN to automatically set the integration time. 
2303	**DERIVATION TIME** Sets the derivation time for the speed controller. - Derivative action makes the control more responsive to error value changes. - The longer the derivation time, the more the speed controller output is boosted during the change. - If the derivation time is set to zero, the controller works as a PI controller, otherwise as a PID controller. The figure below shows the speed controller output after an error step when the error remains constant.  Gain = K_p = 1 T_I = Integration time > 0 T_D= Derivation time > 0 T_s= Sample time period = 2 ms Δe = Error value change between two samples

Code	Description
2304	**ACC COMPENSATION** Sets the derivation time for acceleration compensation. • Adding a derivative of the reference to the output of the speed controller compensates for inertia during acceleration. • 2303 DERIVATION TIME describes the principle of derivative action. • Rule of thumb: Set this parameter between 50 and 100% of the sum of the mechanical time constants for the motor and the driven machine. • The figure shows the speed responses when a high inertia load is accelerated along a ramp.  * **No acceleration compensation** **Acceleration compensation** ***Note:** You can use parameter 2305 AUTOTUNE RUN to automatically set acceleration compensation.
2305	**AUTOTUNE RUN** Starts automatic tuning of the speed controller. 0 = OFF – Disables the Autotune creation process. (Does not disable the operation of Autotune settings.) 1 = ON – Activates speed controller autotuning. Automatically reverts to OFF. Procedure: **Note:** The motor load must be connected. • Run the motor at a constant speed of 20 to 40% of the rated speed. • Change the autotuning parameter 2305 to ON. The drive: • Accelerates the motor. • Calculates values for proportional gain, integration time and acceleration compensation. • Changes parameters 2301, 2302 and 2304 to these values. • Resets 2305 to OFF.

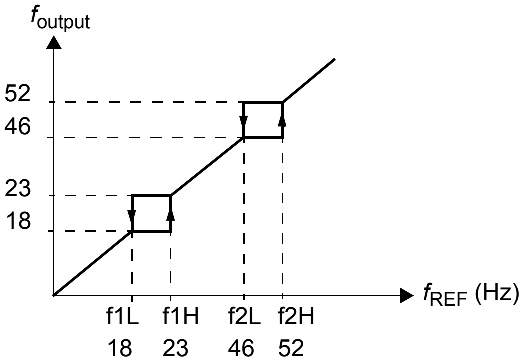
Group 24: TORQUE CONTROL

This group defines variables used for torque control operation.

Code	Description
2401	**TORQ RAMP UP** Defines the torque reference ramp up time – The minimum time for the reference to increase from zero to the nominal motor torque.
2402	**TORQ RAMP DOWN** Defines the torque reference ramp down time – The minimum time for the reference to decrease from the nominal motor torque to zero.

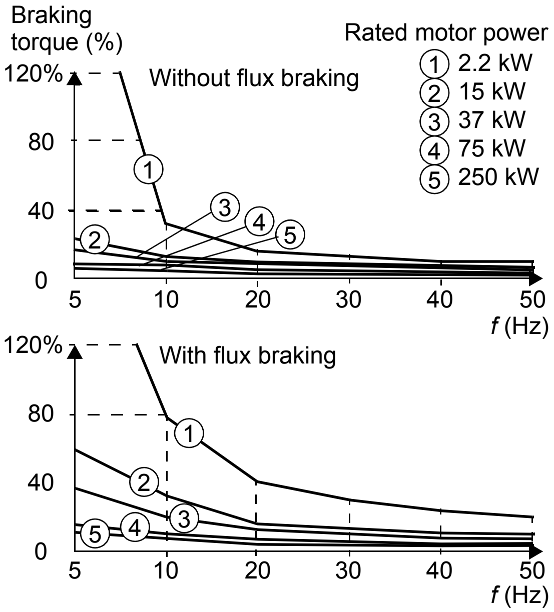
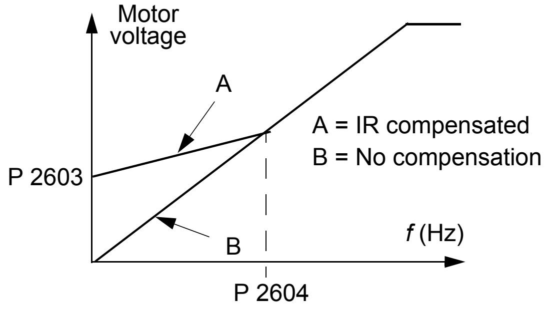
Group 25: CRITICAL SPEEDS

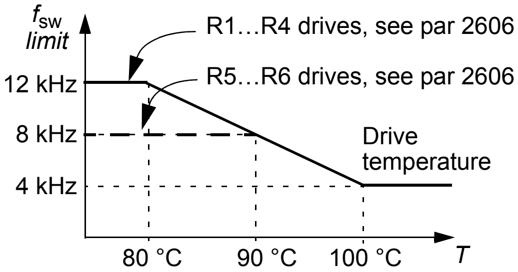
This group defines up to three critical speeds or ranges of speeds that are to be avoided due, for example, to mechanical resonance problems at certain speeds.

Code	Description
2501	**CRIT SPEED SEL** Sets the critical speeds function on or off. The critical speed function avoids specific speed ranges. 0 = OFF – Disables the critical speeds function. 1 = ON – Enables the critical speeds function. **Example:** To avoid speeds at which a fan system vibrates badly: • Determine problem speed ranges. Assume they are found to be: 18…23 Hz and 46…52 Hz. • Set 2501 CRIT SPEED SEL = 1. • Set 2502 CRIT SPEED 1 LO = 18 Hz. • Set 2503 CRIT SPEED 1 HI = 23 Hz. • Set 2504 CRIT SPEED 2 LO = 46 Hz. • Set 2505 CRIT SPEED 2 HI = 52 Hz. 
2502	**CRIT SPEED 1 LO** Sets the minimum limit for critical speed range 1. • The value must be less than or equal to 2503 CRIT SPEED 1 HI. • Units are rpm, unless 9904 MOTOR CTRL MODE = 3 (SCALAR:FREQ), then units are Hz.
2503	**CRIT SPEED 1 HI** Sets the maximum limit for critical speed range 1. • The value must be greater than or equal to 2502 CRIT SPEED 1 LO. • Units are rpm, unless 9904 MOTOR CTRL MODE = 3 (SCALAR:FREQ), then units are Hz.
2504	**CRIT SPEED 2 LO** Sets the minimum limit for critical speed range 2. • See parameter 2502.
2505	**CRIT SPEED 2 HI** Sets the maximum limit for critical speed range 2. • See parameter 2503.
2506	**CRIT SPEED 3 LO** Sets the minimum limit for critical speed range 3. • See parameter 2502.
2507	**CRIT SPEED 3 HI** Sets the maximum limit for critical speed range 3. • See parameter 2503.

Group 26: MOTOR CONTROL

This group defines variables used for motor control.

<table>
<tr><th>Code</th><th colspan="2">Description</th></tr>
<tr><td>2601</td><td colspan="2">**FLUX OPT ENABLE**
Changes the magnitude of the flux depending on the actual load. Flux Optimization can reduce the total energy consumption and noise, and it should be enabled for drives that usually operate below nominal load.
0 = OFF – Disables the feature.
1 = ON – Enables the feature.</td></tr>
<tr><td>2602</td><td>**FLUX BRAKING**
Provides faster deceleration by raising the level of magnetization in the motor when needed, instead of limiting the deceleration ramp. By increasing the flux in the motor, the energy of the mechanical system is changed to thermal energy in the motor.
• Requires parameter 9904 MOTOR CTRL MODE = 1 (VECTOR:SPEED) OR 2 (VECTOR:TORQ).
0 = OFF – Disables the feature.
1 = ON – Enables the feature.</td><td> </td></tr>
<tr><td>2603</td><td>**IR COMP VOLT**
Sets the IR compensation voltage used for 0 Hz.
• Requires parameter 9904 MOTOR CTRL MODE = 3 (SCALAR:FREQ).
• Keep IR compensation as low as possible to prevent overheating.
• Typical IR compensation values are:
<table><tr><th colspan="6">380…480 V drives</th></tr><tr><td>P_N (kW)</td><td>3</td><td>7.5</td><td>15</td><td>37</td><td>132</td></tr><tr><td>IR comp (V)</td><td>18</td><td>15</td><td>12</td><td>8</td><td>3</td></tr></table></td><td rowspan="2">IR compensation
• When enabled, IR compensation provides an extra voltage boost to the motor at low speeds. Use IR compensation, for example, in applications that require a high breakaway torque.
 </td></tr>
<tr><td>2604</td><td>**IR COMP FREQ**
Sets the frequency at which IR compensation is 0 V (in % of motor frequency).</td></tr>
<tr><td>2605</td><td colspan="2">**U/F RATIO**
Selects the form for the *U/f* (voltage to frequency) ratio below field weakening point.
1 = LINEAR – Preferred for constant torque applications.
2 = SQUARED – Preferred for centrifugal pump and fan applications. (SQUARED is more silent for most operating frequencies.)</td></tr>
</table>

<table>
<tr><th>Code</th><th colspan="2">Description</th></tr>
<tr><td>2606</td><td colspan="2">SWITCHING FREQ
Sets the switching frequency for the drive. Also see parameter 2607 SWITCH FREQ CTRL and section <i>Switching frequency derating</i> on page <i>274</i>.
• Higher switching frequencies mean less noise.
• 12 kHz switching frequency is available in scalar control mode, that is when parameter 9904 MOTOR CTRL MODE = 3 (SCALAR:FREQ).
• See the availability of switching frequencies for different drive types in the table below.
<table>
<tr><th></th><th>1, 2, 4 and 8 kHz</th><th>12 kHz</th></tr>
<tr><td>208…240 V</td><td>All types</td><td>Frame sizes R1…R4 in scalar control mode</td></tr>
<tr><td>380…480 V</td><td>All types</td><td>Frame sizes R1…R4 (except ACS550-01-097A-4) in scalar control mode</td></tr>
<tr><td>500…600 V</td><td>All types</td><td>Frame sizes R2…R4 in scalar control mode</td></tr>
</table></td></tr>
<tr><td>2607</td><td>SWITCH FREQ CTRL
The switching frequency may be reduced if the ACS550 internal temperature rises above a limit. See the figure. This function allows the highest possible switching frequency to be used based on operating conditions. Higher switching frequency results in lower acoustic noise.
0 = OFF – The function is disabled.
1 = ON – The switching frequency is limited according to the figure.</td><td>
</td></tr>
<tr><td>2608</td><td colspan="2">SLIP COMP RATIO
Sets gain for slip compensation (in %).
• A squirrel-cage motor slips under load. Increasing the frequency as the motor torque increases compensates for the slip.
• Requires parameter 9904 MOTOR CTRL MODE = 3 (SCALAR:FREQ).
0 – No slip compensation.
1…200 – Increasing slip compensation. 100% means full slip compensation.</td></tr>
<tr><td>2609</td><td colspan="2">NOISE SMOOTHING
This parameter introduces a random component to the switching frequency. Noise smoothing distributes the acoustic motor noise over a range of frequencies instead of a single tonal frequency resulting in lower peak noise intensity. The random component has an average of 0 Hz. It is added to the switching frequency set by parameter 2606 SWITCHING FREQ. This parameter has no effect if parameter 2606 = 12 kHz.
0 = DISABLE
1 = ENABLE.</td></tr>
<tr><td>2619</td><td colspan="2">DC STABILIZER
Enables or disables the DC voltage stabilizer. The DC stabilizer is used in scalar control mode to prevent possible voltage oscillations in the drive DC bus caused by motor load or weak supply network. In case of voltage variation the drive tunes the frequency reference to stabilize the DC bus voltage and therefore the load torque oscillation.
0 = DISABLE – Disables DC stabilizer.
1 = ENABLE – Enables DC stabilizer.</td></tr>
</table>

Group 29: MAINTENANCE TRIG

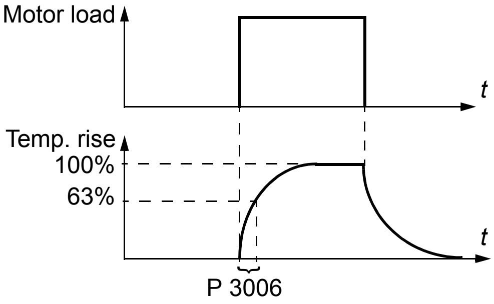
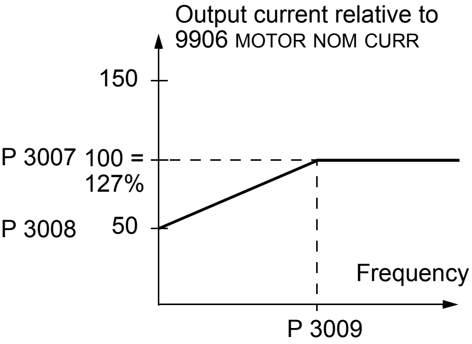
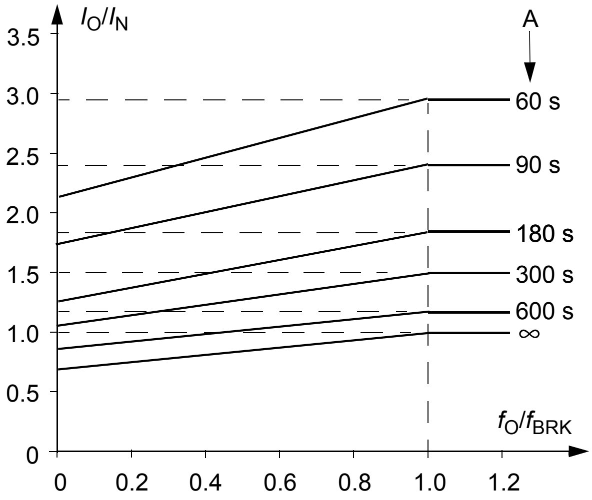
This group contains usage levels and trigger points. When usage reaches the set trigger point, a notice displayed on the control panel signals that maintenance is due.

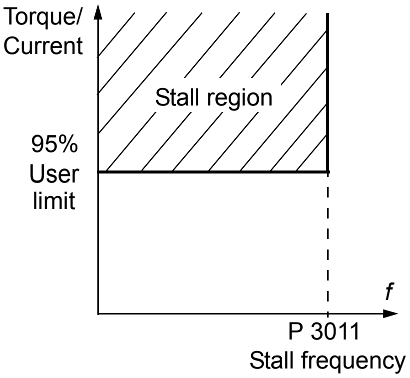
Code	Description
2901	**COOLING FAN TRIG** Sets the trigger point for the drive's cooling fan counter. • Value is compared to parameter 2902 value. 0.0 – Disables the trigger.
2902	**COOLING FAN ACT** Defines the actual value of the drive's cooling fan counter. • When parameter 2901 has been set to a non-zero value, the counter starts. • When the actual value of the counter exceeds the value defined by parameter 2901, a maintenance notice is displayed on the panel. 0.0 – Resets the parameter.
2903	**REVOLUTION TRIG** Sets the trigger point for the motor's accumulated revolutions counter. • Value is compared to parameter 2904 value. 0 – Disables the trigger.
2904	**REVOLUTION ACT** Defines the actual value of the motor's accumulated revolutions counter. • When parameter 2903 has been set to a non-zero value, the counter starts. • When the actual value of the counter exceeds the value defined by parameter 2903, a maintenance notice is displayed on the panel. 0 – Resets the parameter.
2905	**RUN TIME TRIG** Sets the trigger point for the drive's run time counter. • Value is compared to parameter 2906 value. 0.0 – Disables the trigger.
2906	**RUN TIME ACT** Defines the actual value of the drive's run time counter. • When parameter 2905 has been set to a non-zero value, the counter starts. • When the actual value of the counter exceeds the value defined by parameter 2905, a maintenance notice is displayed on the panel. 0.0 – Resets the parameter.
2907	**USER MWh TRIG** Sets the trigger point for the drive's accumulated power consumption (in megawatt hours) counter. • Value is compared to parameter 2908 value. 0.0 – Disables the trigger.
2908	**USER MWh ACT** Defines the actual value of the drive's accumulated power consumption (in megawatt hours) counter. • When parameter 2907 has been set to a non-zero value, the counter starts. • When the actual value of the counter exceeds the value defined by parameter 2907, a maintenance notice is displayed on the panel. 0.0 – Resets the parameter.

Group 30: FAULT FUNCTIONS

This group defines situations that the drive should recognize as potential faults and defines how the drive should respond if the fault is detected.

Code	Description
3001	**AI<MIN FUNCTION** Defines the drive response if the analog input (AI) signal drops below the fault limits and AI is used • as the active reference source (*Group 11: REFERENCE SELECT*) • as the Process or External PID controllers' feedback or setpoint source (*Group 40: PROCESS PID SET 1*, *Group 41: PROCESS PID SET 2* or *Group 42: EXT / TRIM PID*) and the corresponding PID controller is active. 3021 AI1 FAULT LIMIT and 3022 AI2 FAULT LIMIT set the fault limits. 0 = NOT SEL – No response. 1 = FAULT – Displays a fault (7, AI1 LOSS or 8, AI2 LOSS) and the drive coasts to stop. 2 = CONST SP 7 – Displays an alarm (2006, AI1 LOSS or 2007, AI2 LOSS) and sets speed using 1208 CONST SPEED 7. 3 = LAST SPEED – Displays an alarm (2006, AI1 LOSS or 2007, AI2 LOSS) and sets speed using the last operating level. This value is the average speed over the last 10 seconds. ⚠ **WARNING!** If you select CONST SP 7 or LAST SPEED, make sure that continued operation is safe when the analog input signal is lost.
3002	**PANEL COMM ERR** Defines the drive response to a control panel communication error. 1 = FAULT – Displays a fault (10, PANEL LOSS) and the drive coasts to stop. 2 = CONST SP 7 – Displays an alarm (2008, PANEL LOSS) and sets speed using 1208 CONST SPEED 7. 3 = LAST SPEED – Displays an alarm (2008, PANEL LOSS) and sets speed using the last operating level. This value is the average speed over the last 10 seconds. **Note:** When either of the two external control locations are active, and start, stop and/or direction are through the control panel – 1001 EXT1 COMMANDS / 1002 EXT2 COMMANDS = 8 (KEYPAD) – the drive follows speed/frequency reference according to the configuration of the external control locations, instead of the value of the last speed or parameter 1208 CONST SPEED 7. ⚠ **WARNING!** If you select CONST SP 7 or LAST SPEED, make sure that continued operation is safe when the control panel communication is lost.
3003	**EXTERNAL FAULT 1** Defines the External Fault 1 signal input and the drive response to an external fault. 0 = NOT SEL – External fault signal is not used. 1 = DI1 – Defines digital input DI1 as the external fault input. • Activating the digital input indicates a fault. The drive displays a fault (14, EXT FAULT 1) and the drive coasts to stop. 2…6 = DI2…DI6 – Defines digital input DI2…DI6 as the external fault input. • See DI1 above. -1 = DI1(INV) – Defines an inverted digital input DI1 as the external fault input. • De-activating the digital input indicates a fault. The drive displays a fault (14, EXT FAULT 1) and the drive coasts to stop. -2…-6 = DI2(INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as the external fault input. • See DI1(INV) above.
3004	**EXTERNAL FAULT 2** Defines the External Fault 2 signal input and the drive response to an external fault. • See parameter 3003 above.
3005	**MOT THERM PROT** Defines the drive response to motor overheating. 0 = NOT SEL – No response and/or motor thermal protection not set up. 1 = FAULT – When the calculated motor temperature exceeds 90 °C, displays an alarm (2010, MOTOR TEMP). When the calculated motor temperature exceeds 110 °C, displays a fault (9, MOT OVERTEMP) and the drive coasts to stop. 2 = ALARM – When the calculated motor temperature exceeds 90 °C, displays an alarm (2010, MOTOR TEMP).

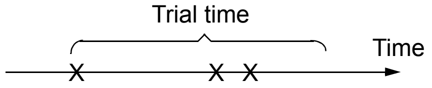
Code	Description
3006	**MOT THERM TIME** Sets the motor thermal time constant for the motor temperature model. • This is the time required for the motor to reach 63% of the final temperature with steady load. • For thermal protection according to UL requirements for NEMA class motors, use the rule of thumb: MOTOR THERM TIME equals 35 times t6, where t6 (in seconds) is specified by the motor manufacturer as the time that the motor can safely operate at six times its rated current. • The thermal time for a Class 10 trip curve is 350 s, for a Class 20 trip curve 700 s, and for a Class 30 trip curve 1050 s. 
3007	**MOT LOAD CURVE** Sets the maximum allowable operating load of the motor. • With the default value 100%, motor overload protection is functioning when the constant current exceeds 127% of the parameter 9906 MOTOR NOM CURR value. • The default overloadability is at the same level as what motor manufacturers typically allow below 30 °C (86 °F) ambient temperature and below 1000 m (3300 ft) altitude. When the ambient temperature exceeds 30 °C (86 °F) or the installation altitude is over 1000 m (3300 ft), decrease the parameter 3007 value according to the motor manufacturer's recommendation. **Example:** If the constant protection level needs to be 115% of the motor nominal current, set parameter 3007 value to 91% (= 115/127·100%). 
3008	**ZERO SPEED LOAD** Sets the maximum allowable current at zero speed. • Value is relative to 9906 MOTOR NOM CURR.
3009	**BREAK POINT FREQ** Sets the break point frequency for the motor load curve.
	Example: Thermal protection trip times when parameters 3006 MOT THERM TIME, 3007 MOT LOAD CURVE and 3008 ZERO SPEED LOAD have default values.  I_O = Output current I_N = Nominal motor current f_O = Output frequency f_{BRK} = Break point frequency A = Trip time

Code	Description
3010	**STALL FUNCTION** This parameter defines the operation of the Stall function. This protection is active if the drive operates in the stall region (see the figure) for the time defined by 3012 STALL TIME. The "User Limit" is defined in *Group 20: LIMITS* by 2017 MAX TORQUE 1, 2018 MAX TORQUE 2, or the limit on the COMM input. 0 = NOT SEL – Stall protection is not used. 1 = FAULT – When the drive operates in the stall region for the time set by 3012 STALL TIME: • The drive coasts to stop. • A fault indication is displayed. 2 = ALARM – When the drive operates in the stall region for the time set by 3012 STALL TIME: • An alarm indication is displayed. • The alarm disappears when the drive is out of the stall region for half the time set by parameter 3012 STALL TIME. 
3011	**STALL FREQUENCY** This parameter sets the frequency value for the Stall function. Refer to the figure.
3012	**STALL TIME** This parameter sets the time value for the Stall function.
3017	**EARTH FAULT** Defines the drive response if the drive detects a ground fault in the motor or motor cables. The drive monitors for ground faults while the drive is running, and while the drive is not running. Also see parameter 3023 WIRING FAULT. 0 = DISABLE – No drive response to ground faults. **Note:** Disabling earth fault (ground fault) may void the warranty. 1 = ENABLE – Ground faults display fault 16 (EARTH FAULT), and (if running) the drive coasts to stop.
3018	**COMM FAULT FUNC** Defines the drive response if the fieldbus communication is lost. 0 = NOT SEL – No response. 1 = FAULT – Displays a fault (28, SERIAL 1 ERR) and the drive coasts to stop. 2 = CONST SP 7 – Displays an alarm (2005, I/O COMM) and sets speed using 1208 CONST SPEED 7. This "alarm speed" remains active until the fieldbus writes a new reference value. 3 = LAST SPEED – Displays an alarm (2005, I/O COMM) and sets speed using the last operating level. This value is the average speed over the last 10 seconds. This "alarm speed" remains active until the fieldbus writes a new reference value. ⚠ **WARNING!** If you select CONST SP 7, or LAST SPEED, make sure that continued operation is safe when fieldbus communication is lost.
3019	**COMM FAULT TIME** Sets the communication fault time used with 3018 COMM FAULT FUNC. • Brief interruptions in the fieldbus communication are not treated as faults if they are less than the COMM FAULT TIME value.
3021	**AI1 FAULT LIMIT** Sets a fault level for analog input 1. • See 3001 AI<MIN FUNCTION.
3022	**AI2 FAULT LIMIT** Sets a fault level for analog input 2. • See 3001 AI<MIN FUNCTION.

Code	Description
3023	**WIRING FAULT** Defines the drive response to cross wiring faults and to ground faults detected when the drive is NOT running. When the drive is not running it monitors for: • Improper connections of input power to the drive output (the drive can display fault 35, OUTPUT WIRING if improper connections are detected). • Ground faults (the drive can display fault 16, EARTH FAULT if a ground fault is detected). Also, see parameter 3017 EARTH FAULT. 0 = DISABLE – No drive response to either of the above monitoring results. **Note:** Disabling wiring fault (ground fault) may void the warranty. 1 = ENABLE – The drive displays faults when this monitoring detects problems.
3024	**CB TEMP FAULT** Defines the drive response to control board overheating. Not for drives with an OMIO control board. 0 = DISABLE – No response. 1 = ENABLE – Displays fault 37 (CB OVERTEMP) and the drive coasts to stop.

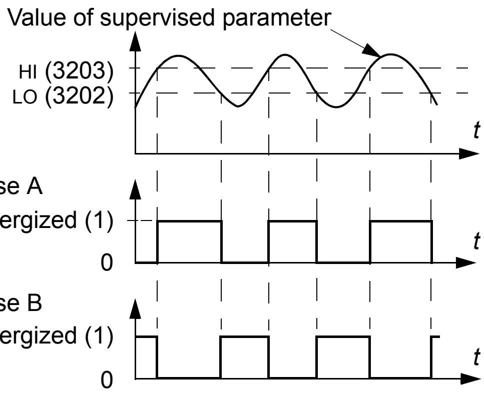
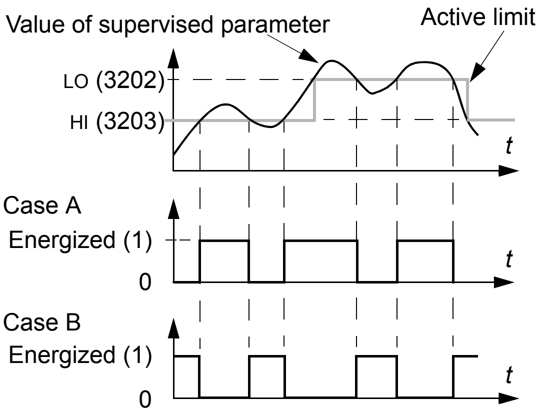
Group 31: AUTOMATIC RESET

This group defines conditions for automatic resets. An automatic reset occurs after a particular fault is detected. The drive holds for a set delay time, then automatically restarts. You can limit the number of resets in a specified time period and set up automatic resets for a variety of faults.

Code	Description	
3101	**NUMBER OF TRIALS** Sets the number of allowed automatic resets within a trial period defined by 3102 TRIAL TIME. • If the number of automatic resets exceeds this limit (within the trial time), the drive prevents additional automatic resets and remains stopped. • Starting then requires a successful reset performed from the control panel or from a source selected by 1604 FAULT RESET SEL.	**Example:** Three faults have occurred in the trial time. The last is reset only if the value for 3101 NUMBER OF TRIALS is 3 or more.  x = Automatic reset
3102	**TRIAL TIME** Sets the time period used for counting and limiting the number of resets. • See 3101 NUMBER OF TRIALS.	
3103	**DELAY TIME** Sets the delay time between a fault detection and attempted drive restart. • If DELAY TIME = zero, the drive resets immediately.	
3104	**AR OVERCURRENT** Sets the automatic reset for the overcurrent function on or off. 0 = DISABLE – Disables automatic reset. 1 = ENABLE – Enables automatic reset. • Automatically resets the fault (OVERCURRENT) after the delay set by 3103 DELAY TIME, and the drive resumes normal operation.	
3105	**AR OVERVOLTAGE** Sets the automatic reset for the overvoltage function on or off. 0 = DISABLE – Disables automatic reset. 1 = ENABLE – Enables automatic reset. • Automatically resets the fault (DC OVERVOLT) after the delay set by 3103 DELAY TIME, and the drive resumes normal operation.	
3106	**AR UNDERVOLTAGE** Sets the automatic reset for the undervoltage function on or off. 0 = DISABLE – Disables automatic reset. 1 = ENABLE – Enables automatic reset. • Automatically resets the fault (DC UNDERVOLT) after the delay set by 3103 DELAY TIME, and the drive resumes normal operation.	
3107	**AR AI<MIN** Sets the automatic reset for the analog input less than minimum value function on or off. 0 = DISABLE – Disables automatic reset. 1 = ENABLE – Enables automatic reset. • Automatically resets the fault (AI<MIN) after the delay set by 3103 DELAY TIME, and the drive resumes normal operation. ⚠ **WARNING!** When the analog input signal is restored, the drive may restart, even after a long stop. Make sure that automatic, long delayed starts will not cause physical injury and/or damage equipment.	
3108	**AR EXTERNAL FLT** Sets the automatic reset for external faults function on or off. 0 = DISABLE – Disables automatic reset. 1 = ENABLE – Enables automatic reset. • Automatically resets the fault (EXT FAULT 1 or EXT FAULT 2) after the delay set by 3103 DELAY TIME, and the drive resumes normal operation.	

Group 32: SUPERVISION

This group defines supervision for up to three signals from *Group 01: OPERATING DATA*. Supervision monitors a specified parameter and energizes a relay output if the parameter passes a defined limit. Use *Group 14: RELAY OUTPUTS* to define the relay and whether the relay activates when the signal is too low or too high.

Code	Description
3201	**SUPERV 1 PARAM** Selects the first supervised parameter. • Must be a parameter number from *Group 01: OPERATING DATA*. • 100 = NOT SELECTED – No parameter selected. • 101…178 – Selects parameter 0101…0178. • If the supervised parameter passes a limit, a relay output is energized. • The supervision limits are defined in this group. • The relay outputs are defined in *Group 14: RELAY OUTPUTS* (definition also specifies which supervision limit is monitored). **LO ≤ HI** Operating data supervision using relay outputs, when LO≤HI. • Case A = Parameter 1401 RELAY OUTPUT 1 (or 1402 RELAY OUTPUT 2, etc.) value is SUPRV1 OVER or SUPRV2 OVER. Use for monitoring when/if the supervised signal exceeds a given limit. The relay remains active until the supervised value drops below the low limit. • Case B = Parameter 1401 RELAY OUTPUT 1 (or 1402 RELAY OUTPUT 2, etc.) value is SUPRV1 UNDER or SUPRV2 UNDER. Use for monitoring when/if the supervised signal falls below a given limit. The relay remains active until the supervised value rises above the high limit. **LO > HI** Operating data supervision using relay outputs, when LO>HI. The lowest limit (HI 3203) is active initially and remains active until the supervised parameter goes above the highest limit (LO 3202), making that limit the active limit. That limit remains active until the supervised parameter goes below the lowest limit (HI 3203), making that limit active. • Case A = Parameter 1401 RELAY OUTPUT 1 (or 1402 RELAY OUTPUT 2, etc.) value is SUPRV1 OVER or SUPRV2 OVER. Initially the relay is de-energized. It is energized whenever the supervised parameter goes above the active limit. • Case B = Parameter 1401 RELAY OUTPUT 1 (or 1402 RELAY OUTPUT 2, etc.) value is SUPRV1 UNDER or SUPRV2 UNDER. Initially the relay is energized. It is de-energized whenever the supervised parameter goes below the active limit. **LO ≤ HI** **Note:** Case LO ≤ HI represents a normal hysteresis.  **LO > HI** **Note:** Case LO>HI represents a special hysteresis with two separate supervision limits. 
3202	**SUPERV 1 LIM LO** Sets the low limit for the first supervised parameter. See 3201 SUPERV 1 PARAM above.
3203	**SUPERV 1 LIM HI** Sets the high limit for the first supervised parameter. See 3201 SUPERV 1 PARAM above.
3204	**SUPERV 2 PARAM** Selects the second supervised parameter. See 3201 SUPERV 1 PARAM above.
3205	**SUPERV 2 LIM LO** Sets the low limit for the second supervised parameter. See 3204 SUPERV 2 PARAM above.
3206	**SUPERV 2 LIM HI** Sets the high limit for the second supervised parameter. See 3204 SUPERV 2 PARAM above.

Code	Description
3207	**SUPERV 3 PARAM** Selects the third supervised parameter. See 3201 SUPERV 1 PARAM above.
3208	**SUPERV 3 LIM LO** Sets the low limit for the third supervised parameter. See 3207 SUPERV 3 PARAM above.
3209	**SUPERV 3 LIM HI** Sets the high limit for the third supervised parameter. See 3207 SUPERV 3 PARAM above.

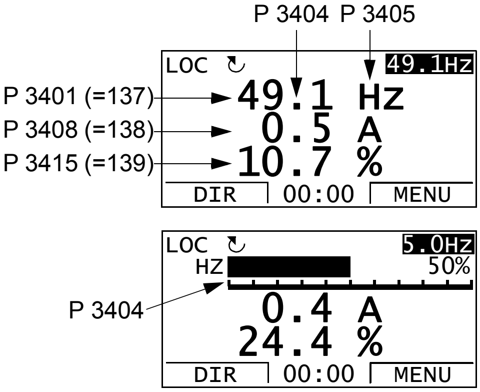
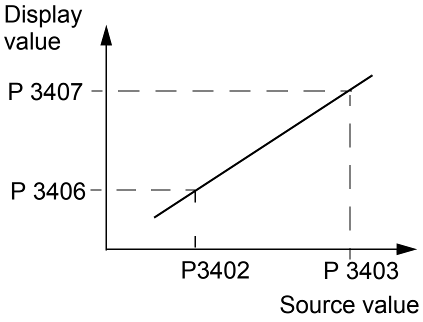
Group 33: INFORMATION

This group provides access to information about the drive's current programs: versions and test date.

Code	Description
3301	**FIRMWARE** Contains the version of the drive's firmware.
3302	**LOADING PACKAGE** Contains the version of the loading package.
3303	**TEST DATE** Contains the test date (yy.ww).
3304	**DRIVE RATING** Indicates the drive's current and voltage rating. The format is XXXY, where: • XXX = The nominal current rating of the drive in amperes. If present, an "A" indicates a decimal point in the rating for the current. For example XXX = 8A8 indicates a nominal current rating of 8.8 A. • Y = The voltage rating of the drive, where Y = : • 2 indicates a 208…240 V rating. • 4 indicates a 380…480 V rating. • 6 indicates a 500…600 V rating.
3305	**PARAMETER TABLE** Contains the version of the parameter table used in the drive.

Group 34: PANEL DISPLAY

This group defines the content for control panel display (middle area), when the control panel is in the Output mode.

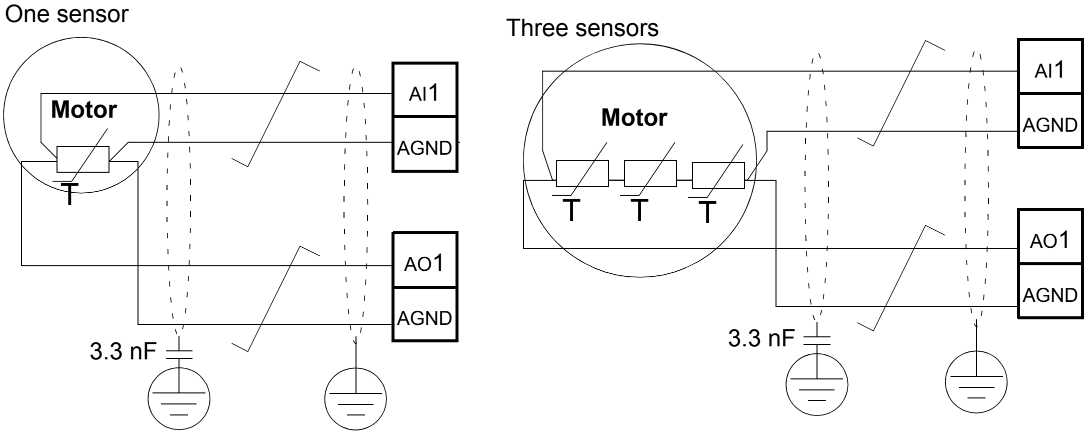
<table>
<tr><th>Code</th><th colspan="2">Description</th></tr>
<tr><td>3401</td><td>**SIGNAL1 PARAM**
Selects the first parameter (by number) displayed on the control panel.
• Definitions in this group define display content when the control panel is in the control mode.
• Any parameter number in *Group 01: OPERATING DATA* can be selected.
• Using the following parameters, the display value can be scaled, converted to convenient units and/or displayed as a bar graph.
• The figure identifies selections made by parameters in this group.
• If just one or two parameters are selected for display, that is just one or two of the values of parameters 3401 SIGNAL1 PARAM, 3408 SIGNAL2 PARAM and 3415 SIGNAL3 PARAM are other than 100 (NOT SELECTED), the number and name of each displayed parameter are shown in addition to the value.
100 = NOT SELECTED – First parameter not displayed.
101…178 – Displays parameter 0101…0178. If parameter does not exist, the display shows “n.a.”.</td><td>
</td></tr>
<tr><td>3402</td><td>**SIGNAL1 MIN**
Defines the minimum expected value for the first display parameter.
Use parameters 3402, 3403, 3406 and 3407, for example to convert a *Group 01: OPERATING DATA* parameter, such as 0102 SPEED (in rpm) to the speed of a conveyor driven by the motor (in ft/min). For such a conversion, the source values in the figure are the min. and max. motor speed, and the display values are the corresponding min. and max. conveyor speed. Use parameter 3405 to select the proper units for the display.
Note: Selecting units does not convert values. Parameter is not effective if parameter 3404 OUTPUT1 DSP FORM = 9 (DIRECT).</td><td rowspan="2">
</td></tr>
<tr><td>3403</td><td>**SIGNAL1 MAX**
Defines the maximum expected value for the first display parameter.
Note: Parameter is not effective if parameter 3404 OUTPUT1 DSP FORM = 9 (DIRECT).</td></tr>
<tr><td>3404</td><td>**OUTPUT1 DSP FORM**
Defines the decimal point location for the first display parameter.
0…7 – Defines the decimal point location.
• Enter the number of digits desired to the right of the decimal point.
• See the table for an example using pi (3.14159).
8 = BAR METER – Specifies a bar meter display.
9 = DIRECT – Decimal point location and units of measure are identical to the source signal. See *Group 01: OPERATING DATA* parameter listing in section *Complete parameter list* on page *87* for resolution (which indicates the decimal point location) and the units of measure.</td><td>
<table>
<tr><th>3404 value</th><th>Display</th><th>Range</th></tr>
<tr><td>0</td><td>± 3</td><td>-32768…+32767
(Signed)</td></tr>
<tr><td>1</td><td>± 3.1</td><td></td></tr>
<tr><td>2</td><td>± 3.14</td><td></td></tr>
<tr><td>3</td><td>± 3.142</td><td></td></tr>
<tr><td>4</td><td>3</td><td>0…65535
(Unsigned)</td></tr>
<tr><td>5</td><td>3.1</td><td></td></tr>
<tr><td>6</td><td>3.14</td><td></td></tr>
<tr><td>7</td><td>3.142</td><td></td></tr>
<tr><td>8</td><td colspan="2">Bar meter displayed.</td></tr>
<tr><td>9</td><td colspan="2">Decimal point location and units as for the source signal.</td></tr>
</table>
</td></tr>
</table>

Code	Description
3405	**OUTPUT1 UNIT** Selects the units used with the first display parameter. **Note:** Parameter is not effective if parameter 3404 OUTPUT1 DSP FORM = 9 (DIRECT). 0 = NO UNIT 1 = A 2 = V 3 = Hz 4 = % 5 = s 6 = h 7 = rpm 8 = kh 9 = °C 10 = lb ft 11 = mA 12 = mV 13 = kW 14 = W 15 = kWh 16 = °F 17 = hp 18 = MWh 19 = m/s 20 = m^3/h 21 = dm^3/s 22 = bar 23 = kPa 24 = GPM 25 = PSI 26 = CFM 27 = ft 28 = MGD 29 = inHg 30 = FPM 31 = kb/s 32 = kHz 33 = ohm 34 = ppm 35 = pps 36 = l/s 37 = l/min 38 = l/h 39 = m^3/s 40 = m^3/m 41 = kg/s 42 = kg/m 43 = kg/h 44 = mbar 45 = Pa 46 = GPS 47 = gal/s 48 = gal/m 49 = gal/h 50 = ft^3/s 51 = ft^3/m 52 = ft^3/h 53 = lb/s 54 = lb/m 55 = lb/h 56 = FPS 57 = ft/s 58 = inH$_2$O 59 = in wg 60 = ft wg 61 = lbsi 62 = ms 63 = Mrev 64 = d 65 = inWC 66 = m/min 67 = Nm 68 = Km^3/h The following units are useful for the bar display. 117 = %ref 118 = %act 119 = %dev 120 = % LD 121 = % SP 122 = %FBK 123 = Iout 124 = Vout 125 = Fout 126 = Tout 127 = Vdc
3406	**OUTPUT1 MIN** Sets the minimum value displayed for the first display parameter. **Note:** Parameter is not effective if parameter 3404 OUTPUT1 DSP FORM = 9 (DIRECT).
3407	**OUTPUT1 MAX** Sets the maximum value displayed for the first display parameter. **Note:** Parameter is not effective if parameter 3404 OUTPUT1 DSP FORM = 9 (DIRECT).
3408	**SIGNAL2 PARAM** Selects the second parameter (by number) displayed on the control panel. See parameter 3401.
3409	**SIGNAL2 MIN** Defines the minimum expected value for the second display parameter. See parameter 3402.
3410	**SIGNAL2 MAX** Defines the maximum expected value for the second display parameter. See parameter 3403.
3411	**OUTPUT2 DSP FORM** Defines the decimal point location for the second display parameter. See parameter 3404.
3412	**OUTPUT2 UNIT** Selects the units used with the second display parameter. See parameter 3405.
3413	**OUTPUT2 MIN** Sets the minimum value displayed for the second display parameter. See parameter 3406.
3414	**OUTPUT2 MAX** Sets the maximum value displayed for the second display parameter. See parameter 3407.
3415	**SIGNAL3 PARAM** Selects the third parameter (by number) displayed on the control panel. See parameter 3401.
3416	**SIGNAL3 MIN** Defines the minimum expected value for the third display parameter. See parameter 3402.
3417	**SIGNAL3 MAX** Defines the maximum expected value for the third display parameter. See parameter 3403.
3418	**OUTPUT3 DSP FORM** Defines the decimal point location for the third display parameter. See parameter 3404.
3419	**OUTPUT3 UNIT** Selects the units used with the third display parameter. See parameter 3405.
3420	**OUTPUT3 MIN** Sets the minimum value displayed for the third display parameter. See parameter 3406.

Code	Description
3421	**OUTPUT3 MAX** Sets the maximum value displayed for the third display parameter. See parameter 3407.

Group 35: MOTOR TEMP MEAS

This group defines the detection and reporting for a particular potential fault – motor overheating, as detected by a temperature sensor. Typical connections are shown below.



WARNING! IEC 60664 requires double or reinforced insulation between live parts and the surface of accessible parts of electrical equipment which are either non-conductive or conductive but not connected to the protective earth.

To fulfil this requirement, connect a thermistor (and other similar components) to the drive's control terminals using any of these alternatives:

- Separate the thermistor from live parts of the motor with double reinforced insulation.
- Protect all circuits connected to the drive's digital and analog inputs. Protect against contact, and insulate from other low voltage circuits with basic insulation (rated for the same voltage level as the drive's main circuit).
- Use an external thermistor relay. The relay insulation must be rated for the same voltage level as the drive's main circuit.

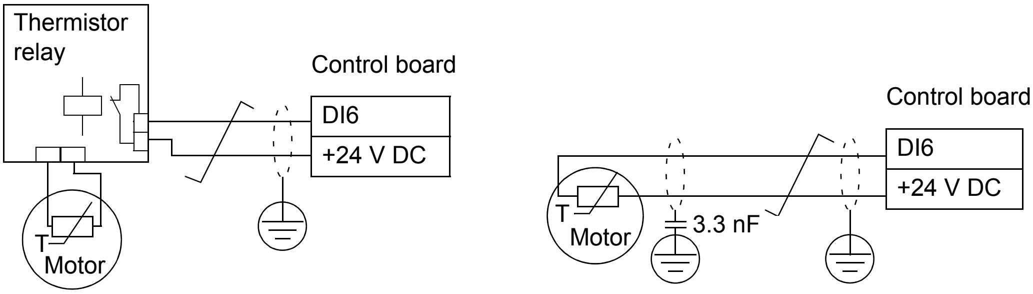
The figure below shows thermistor relay and PTC sensor connections using a digital input. At the motor end, the cable shield should be earthed through, eg a 3.3 nF capacitor. If this is not possible, leave the shield unconnected.

Thermistor relay

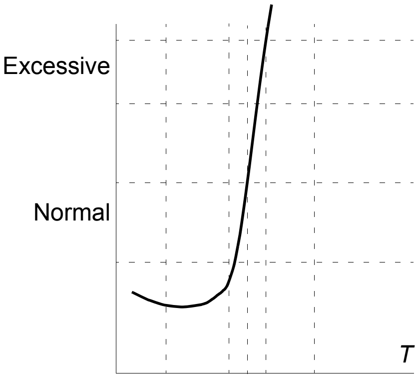
3501 SENSOR TYPE = 5 (THERM(0)) or 6 (THERM(1))

PTC sensor

3501 SENSOR TYPE = 5 (THERM(0))



For other faults, or for anticipating motor overheating using a model, see *Group 30: FAULT FUNCTIONS*.

<table>
<tr><th>Code</th><th>Description</th></tr>
<tr><td>3501</td><td>SENSOR TYPE
Identifies the type of the motor temperature sensor used, PT100 (°C), PTC (ohm) or thermistor.
See parameters 1501 AO1 CONTENT SEL and 1507 AO2 CONTENT SEL.
0 = NONE
1 = 1 x PT100 – Sensor configuration uses one PT100 sensor.
• Analog output AO1 or AO2 feeds constant current through the sensor.
• The sensor resistance increases as the motor temperature rises, as does the voltage over the sensor.
• The temperature measurement function reads the voltage through analog input AI1 or AI2 and converts it to degrees Celsius.
2 = 2 x PT100 – Sensor configuration uses two PT100 sensors.
• Operation is the same as for above 1 x PT100.
3 = 3 x PT100 – Sensor configuration uses three PT100 sensors.
• Operation is the same as for above 1 x PT100.
4 = PTC – Sensor configuration uses one PTC.
• The analog output feeds a constant current through the sensor.
• The resistance of the sensor increases sharply as the motor temperature rises over the PTC reference temperature (T_{ref}), as does the voltage over the resistor. The temperature measurement function reads the voltage through analog input AI1 and converts it into ohms.
• The table below and the graph show typical PTC sensor resistance as a function of the motor operating temperature.
<table>
<tr><th>Temperature</th><th>Resistance</th></tr>
<tr><td>Normal</td><td>< 1.5 kohm</td></tr>
<tr><td>Excessive</td><td>> 4 kohm</td></tr>
</table>


5 = THERM(0) – Sensor configuration uses a thermistor.
• Motor thermal protection is activated through a digital input. Connect either a PTC sensor or a normally closed thermistor relay to a digital input.
• When the digital input is '0', the motor is overheated.
• See the connection figure on page 155.
• The table below and the graph show the resistance requirements for a PTC sensor connected between 24 V and a digital input as a function of the motor operating temperature.
<table>
<tr><th>Temperature</th><th>Resistance</th></tr>
<tr><td>Normal</td><td>< 3 kohm</td></tr>
<tr><td>Excessive</td><td>> 28 kohm</td></tr>
</table>
6 = THERM(1) – Sensor configuration uses a thermistor.
• Motor thermal protection is activated through a digital input. Connect a normally open thermistor relay to a digital input.
• When the digital input is '1', the motor is overheated.
• See the connection figure on page 155.</td></tr>
<tr><td>3502</td><td>INPUT SELECTION
Defines the input used for the temperature sensor.
1 = AI1 – PT100 and PTC.
2 = AI2 – PT100 and PTC.
3…8 = DI1…DI6 – Thermistor and PTC</td></tr>
<tr><td>3503</td><td>ALARM LIMIT
Defines the alarm limit for motor temperature measurement.
• At motor temperatures above this limit, the drive displays an alarm (2010, MOTOR TEMP)
For thermistors or PTC connected to a digital input:
0 – de-activated
1 – activated</td></tr>
</table>

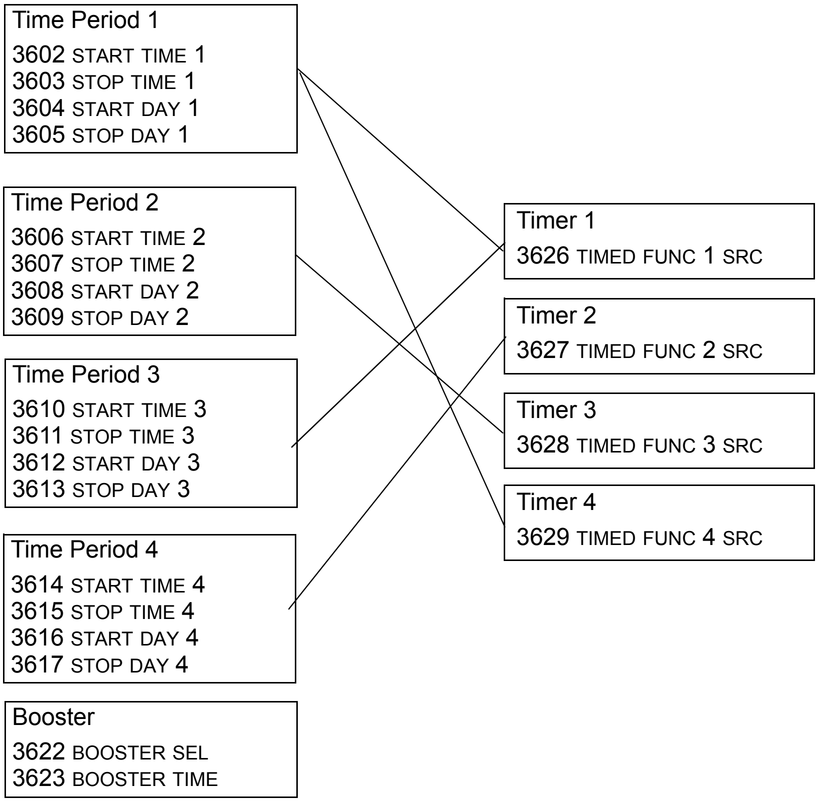
Code	Description
3504	**FAULT LIMIT** Defines the fault limit for motor temperature measurement. • At motor temperatures above this limit, the drive displays a fault (9, MOT OVERTEMP) and stops the drive. For thermistors or PTC connected to a digital input: 0 – de-activated 1 – activated

Group 36: TIMED FUNCTIONS

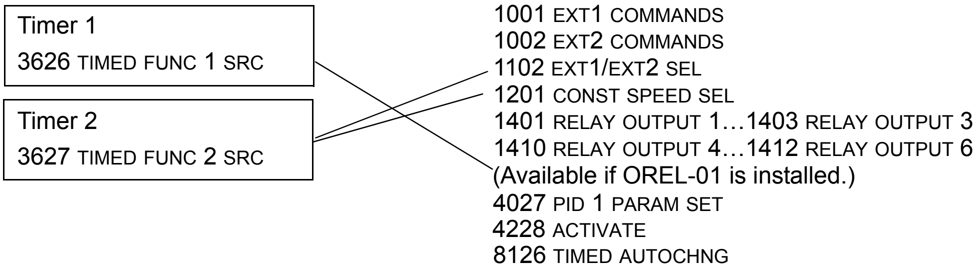
This group defines the timed functions. The timed functions include:

- four daily start and stop times
- four weekly start, stop and boost times
- four timers for collecting selected periods together.

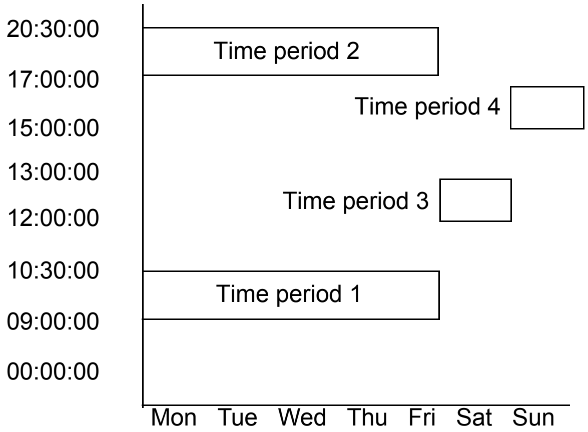
A timer can be connected to multiple time periods and a time period can be in multiple timers.

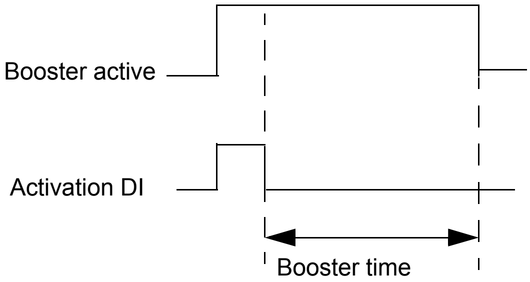


A parameter can be connected to only one timer.



You can use the Timed functions assistant for easy configuring. For more information on the assistants, see section *Assistants mode* on page 53.

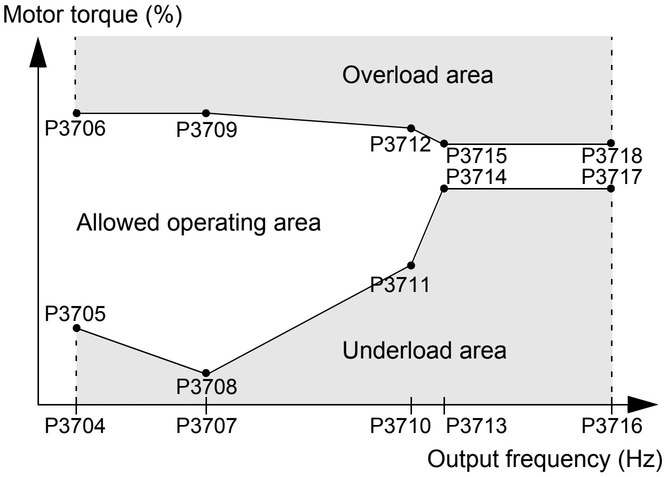
Code	Description
3601	**TIMERS ENABLE** Selects the source for the timer enable signal. 0 = NOT SEL – Timed functions are disabled. 1 = DI1 – Defines digital input DI1 as the timed function enable signal. • The digital input must be activated to enable the timed function. 2…6 = DI2…DI6 – Defines digital input DI2…DI6 as the timed function enable signal. 7 = ACTIVE – Timed functions are enabled. -1 = DI1(INV) – Defines an inverted digital input DI1 as the timed function enable signal. • This digital input must be de-activated to enable the timed function. • -2…-6 = DI2(INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as the timed function enable signal.
3602	**START TIME 1** Defines the daily start time. • The time can be changed in steps of 2 seconds. • If parameter value is 07:00:00, the timer is activated at 7 a.m. • The figure shows multiple timers on different weekdays. 
3603	**STOP TIME 1** Defines the daily stop time. • The time can be changed in steps of 2 seconds. • If the parameter value is 09:00:00, the timer is deactivated at 9 a.m.
3604	**START DAY 1** Defines the weekly start day. 1 = MONDAY…7 = SUNDAY • If parameter value is 1, timer 1 weekly is active from Monday midnight (00:00:00).
3605	**STOP DAY 1** Defines weekly stop day. 1 = MONDAY…7 = SUNDAY • If parameter value is 5, timer 1 weekly is deactivated on Friday midnight (23:59:58).
3606	**START TIME 2** Defines timer2 daily start time. • See parameter 3602.
3607	**STOP TIME 2** Defines timer 2 daily stop time. • See parameter 3603.
3608	**START DAY 2** Defines timer 2 weekly start day. • See parameter 3604.
3609	**STOP DAY 2** Defines timer 2 weekly stop day. • See parameter 3605.
3610	**START TIME 3** Defines timer 3 daily start time. • See parameter 3602.
3611	**STOP TIME 3** Defines timer 3 daily stop time. • See parameter 3603.

Code	Description
3612	**START DAY 3** Defines timer 3 weekly start day. • See parameter 3604.
3613	**STOP DAY 3** Defines timer 3 weekly stop day. • See parameter 3605.
3614	**START TIME 4** Defines timer 4 daily start time. • See parameter 3602.
3615	**STOP TIME 4** Defines timer 4 daily stop time. • See parameter 3603.
3616	**START DAY 4** Defines timer 4 weekly start day. • See parameter 3604.
3617	**STOP DAY 4** Defines timer 4 weekly stop day. • See parameter 3605.
3622	**BOOSTER SEL** Selects the source for the booster signal. 0 = NOT SEL – Booster signal is disabled. 1 = DI1 – Defines DI1 as the booster signal. 2…6 = DI2…DI6 – Defines DI2…DI6 as the booster signal. -1 = DI1(INV) – Defines an inverted digital input DI1 as the booster signal. -2…-6 = DI2(INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as the booster signal.
3623	**BOOSTER TIME** Defines the booster ON time. Time is started when booster sel signal is released. If parameter value is 01:30:00, booster is active for 1 hour and 30 minutes after activation DI is released. 
3626	**TIMED FUNC 1 SRC** Defines the time periods used by the timer. 0 = NOT SEL – No time periods have been selected. 1 = T1 – Time Period 1 selected in the timer. 2 = T2 – Time Period 2 selected in the timer. 3 = T1+T2 – Time Periods 1 and 2 selected in the timer. 4 = T3 – Time Period 3 selected in the timer. 5 = T1+T3 – Time Periods 1 and 3 selected in the timer. 6 = T2+T3 – Time Periods 2 and 3 selected in the timer. 7 = T1+T2+T3 – Time Periods 1, 2 and 3 selected in the timer. 8 = T4 – Time Period 4 selected in the timer. 9 = T1+T4 – Time Periods 1 and 4 selected in the timer. 10 = T2+T4 – Time Periods 2 and 4 selected in the timer. 11 = T1+T2+T4 – Time Periods 1, 2 and 4 selected in the timer. 12 = T3+T4 – Time Periods 3 and 4 selected in the timer. 13 = T1+T3+T4 – Time Periods 1, 3 and 4 selected in the timer. 14 = T2+T3+T4 – Time Periods 2, 3 and 4 selected in the timer. 15 = T1+T2+T3+T4 – Time Periods 1, 2, 3 and 4 selected in the timer. 16 = BOOSTER – Booster selected in the timer. 17 = T1+B – Booster and Time Period 1 selected in the timer. 18 = T2+B – Booster and Time Period 2 selected in the timer. 19 = T1+T2+B – Booster and Time Periods 1 and 2 selected in the timer. 20 = T3+B – Booster and Time Period 3 selected in the timer.

Code	Description
	21 = T1+T3+B – Booster and Time Periods 1 and 3 selected in the timer. 22 = T2+T3+B – Booster and Time Periods 2 and 3 selected in the timer. 23 = T1+T2+T3+B – Booster and Time Periods 1, 2 and 3 selected in the timer. 24 = T4+B – Booster and Time Period 4 selected in the timer. 25 = T1+T4+B – Booster and Time Periods 1 and 4 selected in the timer. 26 = T2+T4+B – Booster and Time Periods 2 and 4 selected in the timer. 27 = T1+T2+T4+B – Booster and Time Periods 1, 2 and 4 selected in the timer. 28 = T3+T4+B – Booster and Time Periods 3 and 4 selected in the timer. 29 = T1+T3+T4+B – Booster and Time Periods 1, 3 and 4 selected in the timer. 30 = T2+T3+T4+B – Booster and Time Periods 2, 3 and 4 selected in the timer. 31 = T1+2+3+4+B – Booster and Time Periods 1, 2, 3 and 4 selected in the timer.
3627	**TIMED FUNC 2 SRC** • See parameter 3626.
3628	**TIMED FUNC 3 SRC** • See parameter 3626.
3629	**TIMED FUNC 4 SRC** • See parameter 3626.

Group 37: USER LOAD CURVE

This group defines supervision of user adjustable load curves (motor torque as a function of frequency). The curve is defined by five points.

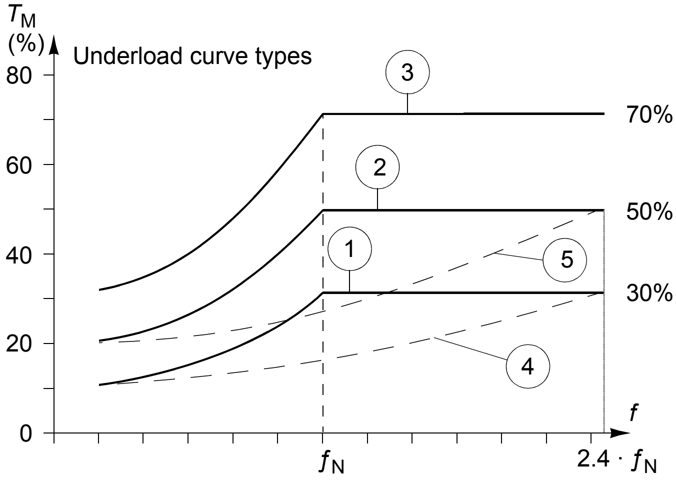
Code	Description
3701	**USER LOAD C MODE** Supervision mode for the user adjustable load curves. This functionality replaces the former underload supervision in *Group 30: FAULT FUNCTIONS*. To emulate it, see section *Correspondence with the obsolete underload supervision* on page *163*. 0 = NOT SEL – Supervision is not active. 1 = UNDERLOAD – Supervision for the torque dropping below the underload curve. 2 = OVERLOAD – Supervision for the torque exceeding the overload curve. 3 = BOTH – Supervision for the torque dropping below the underload curve or exceeding the overload curve. 
3702	**USER LOAD C FUNC** Action wanted during load supervision. 1 = FAULT – A fault is generated when the condition defined by 3701 USER LOAD C MODE has been valid longer than the time set by 3703 USER LOAD C TIME. 2 = ALARM – An alarm is generated when the condition defined by 3701 USER LOAD C MODE has been valid longer than half of the time defined by 3703 USER LOAD C TIME.
3703	**USER LOAD C TIME** Defines the time limit for generating a fault. • Half of this time is used as the limit for generating an alarm.
3704	**LOAD FREQ 1** Defines the frequency value of the first load curve definition point. • Must be smaller than 3707 LOAD FREQ 2.
3705	**LOAD TORQ LOW 1** Defines the torque value of the first underload curve definition point. • Must be smaller than 3706 LOAD TORQ HIGH 1.
3706	**LOAD TORQ HIGH 1** Defines the torque value of the first overload curve definition point.
3707	**LOAD FREQ 2** Defines the frequency value of the second load curve definition point. • Must be smaller than 3710 LOAD FREQ 3.
3708	**LOAD TORQ LOW 2** Defines the torque value of the second underload curve definition point. • Must be smaller than 3709 LOAD TORQ HIGH 2.
3709	**LOAD TORQ HIGH 2** Defines the torque value of the second overload curve definition point.
3710	**LOAD FREQ 3** Defines the frequency value of the third load curve definition point. • Must be smaller than 3713 LOAD FREQ 4.
3711	**LOAD TORQ LOW 3** Defines the torque value of the third underload curve definition point. • Must be smaller than 3712 LOAD TORQ HIGH 3.
3712	**LOAD TORQ HIGH 3** Defines the torque value of the third overload curve definition point.

Code	Description
3713	**LOAD FREQ 4** Defines the frequency value of the fourth load curve definition point. • Must be smaller than 3716 LOAD FREQ 5
3714	**LOAD TORQ LOW 4** Defines the torque value of the fourth underload curve definition point. • Must be smaller than 3715 LOAD TORQ HIGH 4.
3715	**LOAD TORQ HIGH 4** Defines the torque value of the fourth overload curve definition point.
3716	**LOAD FREQ 5** Defines the frequency value of fifth load curve definition point.
3717	**LOAD TORQ LOW 5** Defines the torque value of the fifth underload curve definition point. • Must be smaller than 3718 LOAD TORQ HIGH 5.
3718	**LOAD TORQ HIGH 5** Defines the torque value of the fifth overload curve definition point.

Correspondence with the obsolete underload supervision

The now obsolete parameter 3015 UNDERLOAD CURVE provided five selectable curves shown in the figure. The parameter characteristics were as described below.

- If the load drops below the set curve for longer than the time set by parameter 3014 UNDERLOAD TIME (obsolete), the underload protection is activated.
- Curves 1…3 reach maximum at the motor rated frequency set by parameter 9907 MOTOR NOM FREQ.
- T_M = nominal torque of the motor.
- f_N = nominal frequency of the motor.



If you want to emulate the behavior of an old underload curve with parameters as in the shaded columns, set the new parameters as in the white columns in the two tables below:

Underload supervision with parameters 3013…3015 (obsolete)	Obsolete parameters		New parameters		
	3013 UNDERLOAD FUNCTION	**3014** UNDERLOAD TIME	**3701** USER LOAD C MODE	**3702** USER LOAD C FUNC	**3703** USER LOAD C TIME
No underload functionality	0	-	0	-	-
Underload curve, fault generated	1	t	1	1	t
Underload curve, alarm generated	2	t	1	2	2 · t

Obs. par.	New parameters														
3015 UNDER LOAD CURVE	**3704** LOAD FREQ 1 (Hz)		**3705** LOAD TORQ LOW 1 (%)	**3707** LOAD FREQ 2 (Hz)		**3708** LOAD TORQ LOW 2 (%)	**3710** LOAD FREQ 3 (Hz)		**3711** LOAD TORQ LOW 3 (%)	**3713** LOAD FREQ 4 (Hz)		**3714** LOAD TORQ LOW 4 (%)	**3716** LOAD FREQ 5 (Hz)		**3717** LOAD TORQ LOW 5 (%)
	EU	US		EU	US		EU	US		EU	US		EU	US	
1	5	6	10	32	38	17	41	50	23	50	60	30	500	500	30
2	5	6	20	31	37	30	42	50	40	50	60	50	500	500	50
3	5	6	30	31	37	43	42	50	57	50	60	70	500	500	70
4	5	6	10	73	88	17	98	117	23	120	144	30	500	500	30
5	5	6	20	71	86	30	99	119	40	120	144	50	500	500	50

Group 40: PROCESS PID SET 1

This group defines a set of parameters used with the Process PID (PID1) controller.

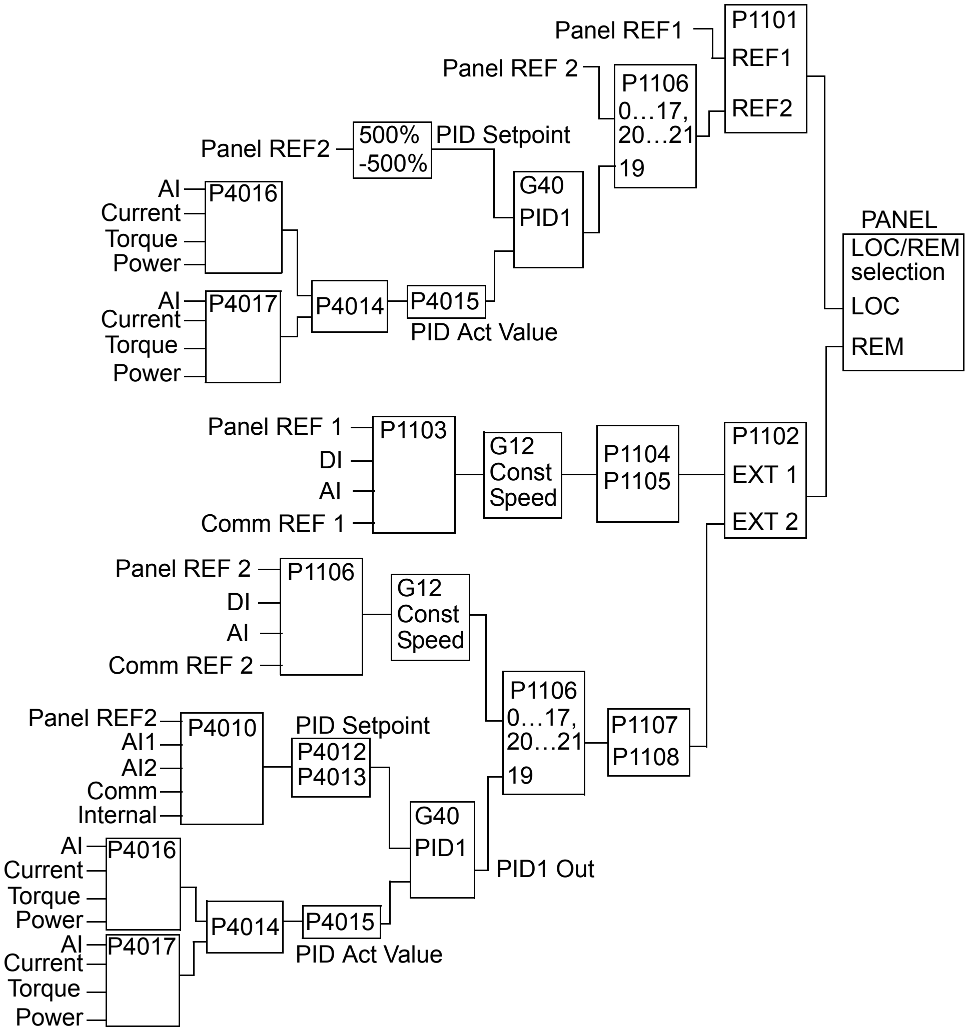
Typically only parameters in this group are needed.

PID controller – Basic set-up

In PID control mode, the drive compares a reference signal (setpoint) to an actual signal (feedback) and automatically adjusts the speed of the drive to match the two signals. The difference between the two signals is the error value.

Typically PID control mode is used, when the speed of a motor needs to be controlled based on pressure, flow or temperature. In most cases – when there is only 1 transducer signal wired to the ACS550 – only parameter group 40 is needed.

The following is a schematic of setpoint/feedback signal flow using parameter group 40.



Note: In order to activate and use the PID controller, parameter 1106 must be set to value 19.

PID controller – Advanced

The ACS550 has two separate PID controllers:

- Process PID (PID1) and
- External PID (PID2)

Process PID (PID1) has 2 separate sets of parameters:

- Process PID (PID1) SET1, defined in *Group 40: PROCESS PID SET 1* and
- Process PID (PID1) SET2, defined in *Group 41: PROCESS PID SET 2*

You can select between the two different sets by using parameter 4027.

Typically two different PID controller sets are used when the load of the motor changes considerably from one situation to another.

You can use External PID (PID2), defined in *Group 42: EXT / TRIM PID*, in two different ways:

- Instead of using additional PID controller hardware, you can set outputs of the ACS550 to control a field instrument like a damper or a valve. In this case, set parameter 4230 to value 0. (0 is the default value.)
- You can use External PID (PID2) to trim or fine-tune the speed of the ACS550.

Code	Description

4001	**GAIN**
	Defines the PID controller's gain.
	• The setting range is 0.1… 100.
	• At 0.1, the PID controller output changes one-tenth as much as the error value.
	• At 100, the PID controller output changes one hundred times as much as the error value.
	Use the proportional gain and integration time values to adjust the responsiveness of the system.
	• A low value for proportional gain and a high value for integral time ensures stable operation, but provides sluggish response.
	If the proportional gain value is too large or the integral time too short, the system can become unstable.
	Procedure:
	• Initially, set:
	  • 4001 GAIN = 0.1.
	  • 4002 INTEGRATION TIME = 20 seconds.
	• Start the system and see if it reaches the setpoint quickly while maintaining stable operation. If not, increase GAIN (4001) until the actual signal (or drive speed) oscillates constantly. It may be necessary to start and stop the drive to induce this oscillation.
	• Reduce GAIN (4001) until the oscillation stops.
	• Set GAIN (4001) to 0.4 to 0.6 times the above value.
	• Decrease the INTEGRATION TIME (4002) until the feedback signal (or drive speed) oscillates constantly. It may be necessary to start and stop the drive to induce this oscillation.
	• Increase INTEGRATION TIME (4002) until the oscillation stops.
	• Set INTEGRATION TIME (4002) to 1.15 to 1.5 times the above value.
	• If the feedback signal contains high frequency noise, increase the value of parameter 1303 FILTER AI1 or 1306 FILTER AI2 until the noise is filtered from the signal.

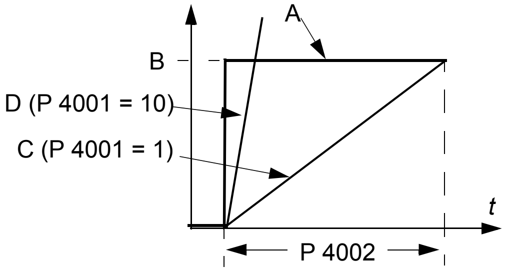
<table>
<tr><th>Code</th><th>Description</th></tr>
<tr><td>4002</td><td>

INTEGRATION TIME

Defines the PID controller's integration time.

Integration time is, by definition, the time required to increase the output by the error value:
- Error value is constant and 100%.
- Gain = 1.
- Integration time of 1 second denotes that a 100% change is achieved in 1 second.

0.0 = NOT SEL – Disables integration (I-part of controller).
0.1…3600.0 – Integration time (seconds).
- See 4001 for adjustment procedure.



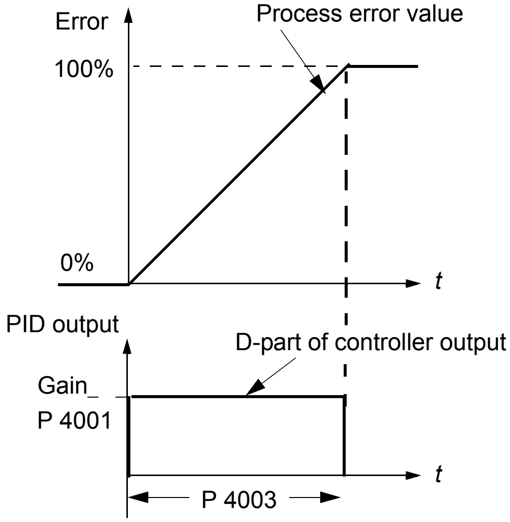
A = Error
B = Error value step
C = Controller output with Gain = 1
D = Controller output with Gain = 10

</td></tr>
<tr><td>4003</td><td>

DERIVATION TIME

Defines the PID controller's derivation time.
- You can add the derivative of the error to the PID controller output. The derivative is the error value's rate of change. For example, if the process error value changes linearly, the derivative is a constant added to the PID controller output.
- The error-derivative is filtered with a 1-pole filter. The time constant of the filter is defined by parameter 4004 PID DERIV FILTER.

0.0…10.0 – Derivation time (seconds).



</td></tr>
<tr><td>4004</td><td>

PID DERIV FILTER

Defines the filter time constant for the error-derivative part of the PID controller output.
- Before being added to the PID controller output, the error-derivative is filtered with a 1-pole filter.
- Increasing the filter time smooths the error-derivative, reducing noise.

0.0…10.0 – Filter time constant (seconds).

</td></tr>
<tr><td>4005</td><td>

ERROR VALUE INV

Selects either a normal or inverted relationship between the feedback signal and the drive speed.
0 = NO – Normal, a decrease in feedback signal increases drive speed. Error = Ref - Fbk
1 = YES – Inverted, a decrease in feedback signal decreases drive speed. Error = Fbk - Ref

</td></tr>
<tr><td>4006</td><td>

UNITS

Selects the unit for the PID controller actual values. (PID1 parameters 0128, 0130 and 0132).
- See parameter 3405 for list of available units.

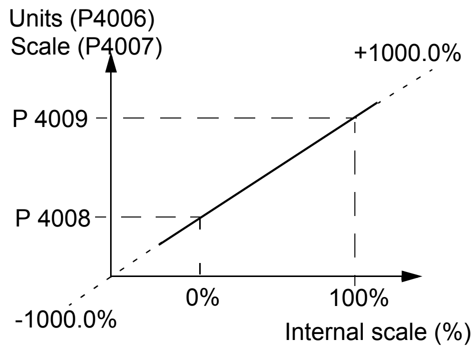
</td></tr>
<tr><td>4007</td><td>

UNIT SCALE

Defines the decimal point location in PID controller actual values.
- Enter the decimal point location counting in from the right end of the entry.
- See the table for an example using pi (3.14159).

<table>
<tr><th>4007 value</th><th>Entry</th><th>Display</th></tr>
<tr><td>0</td><td>00003</td><td>3</td></tr>
<tr><td>1</td><td>00031</td><td>3.1</td></tr>
<tr><td>2</td><td>00314</td><td>3.14</td></tr>
<tr><td>3</td><td>03142</td><td>3.142</td></tr>
<tr><td>4</td><td>31416</td><td>3.1416</td></tr>
</table>

</td></tr>
</table>

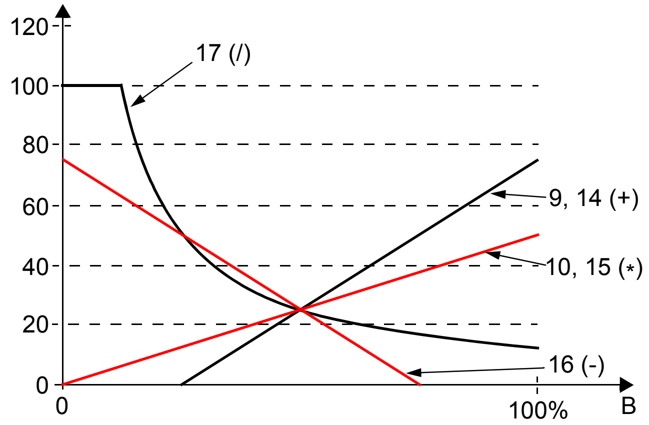
Code	Description
4008	**0% VALUE** Defines (together with the next parameter) the scaling applied to the PID controller's actual values (PID1 parameters 0128, 0130 and 0132). • Units and scale are defined by parameters 4006 and 4007. 
4009	**100% VALUE** Defines (together with the previous parameter) the scaling applied to the PID controller's actual values. • Units and scale are defined by parameters 4006 and 4007.
4010	**SET POINT SEL** Defines the reference signal source for the PID controller. • Parameter has no significance when the PID regulator is by-passed (see 8121 REG BYPASS CTRL). 0 = KEYPAD – Control panel provides reference. 1 = AI1 – Analog input 1 provides reference. 2 = AI2 – Analog input 2 provides reference. 8 = COMM – Fieldbus provides reference. 9 = COMM+AI1 – Defines a fieldbus and analog input 1 (AI1) combination as the reference source. See Analog input reference correction below. 10 = COMM*AI1 – Defines a fieldbus and analog input 1 (AI1) combination as the reference source. See Analog input reference correction below. 11 = DI3U,4D(RNC) – Digital inputs, acting as a motor potentiometer control, provide reference. • DI3 increases the speed (the U stands for "up") • DI4 decreases the reference (the D stands for "down"). • Parameter 2205 ACCELER TIME 2 controls the reference signal's rate of change. • R = Stop command resets the reference to zero. • NC = Reference value is not copied. 12 = DI3U,4D(NC) – Same as DI3U,4D(RNC) above, except: • Stop command does not reset reference to zero. At restart the motor ramps up, at the selected acceleration rate, to the stored reference. 13 = DI5U,6D(NC) – Same as DI3U,4D(NC) above, except: • Uses digital inputs DI5 and DI6. 14 = AI1+AI2 – Defines an analog input 1 (AI1) and analog input 2 (AI2) combination as the reference source. See Analog input reference correction below. 15 = AI1*AI2 – Defines an analog input 1 (AI1) and analog input 2 (AI2) combination as the reference source. See Analog input reference correction below. 16 = AI1-AI2 – Defines an analog input 1 (AI1) and analog input 2 (AI2) combination as the reference source. See Analog input reference correction below. 17 = AI1/AI2 – Defines an analog input 1 (AI1) and analog input 2 (AI2) combination as the reference source. See Analog input reference correction below. 19 = INTERNAL – A constant value set using parameter 4011 provides reference. 20 = PID2OUT – Defines PID controller 2 output (parameter 0127 PID 2 OUTPUT) as the reference source.

Code	Description
	Analog input reference correction Parameter values 9, 10 and 14…17 use the formula in the following table.

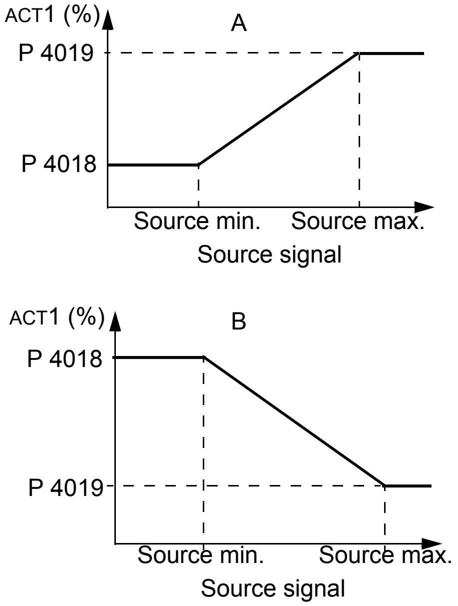
Value setting	Calculation of the AI reference
C + B	C value + (B value - 50% of reference value)
C * B	C value · (B value / 50% of reference value)
C - B	(C value + 50% of reference value) - B value
C / B	(C value · 50% of reference value) / B value

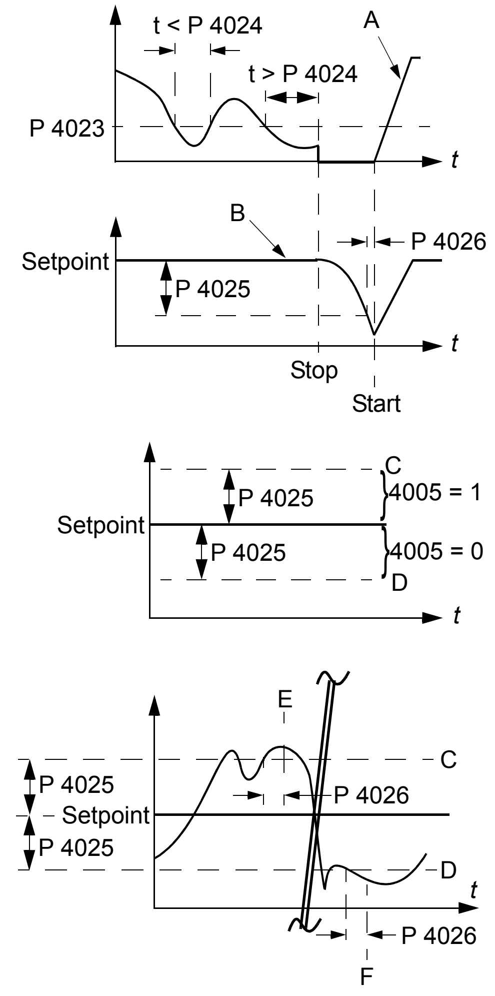
Where:
- C = Main reference value (= COMM for values 9, 10 and = AI1 for values 14…17)
- B = Correcting reference (= AI1 for values 9, 10 and = AI2 for values 14…17).

Example:
The figure shows the reference source curves for value settings 9, 10 and 14…17, where:
- C = 25%.
- P 4012 SETPOINT MIN = 0.
- P 4013 SETPOINT MAX = 0.
- B varies along the horizontal axis.



Code	Description
4011	**INTERNAL SETPNT** Sets a constant value used for the process reference. • Units and scale are defined by parameters 4006 and 4007.
4012	**SETPOINT MIN** Sets the minimum value for the reference signal source. • See parameter 4010.
4013	**SETPOINT MAX** Sets the maximum value for the reference signal source. • See parameter 4010.
4014	**FBK SEL** Defines the PID controller feedback (actual signal). • You can define a combination of two actual values (ACT1 and ACT2) as the feedback signal. • Use parameter 4016 to define the source for actual value 1 (ACT1). • Use parameter 4017 to define the source for actual value 2 (ACT2). 1 = ACT1 – Actual value 1 (ACT1) provides the feedback signal. 2 = ACT1-ACT2 – ACT1 minus ACT2 provides the feedback signal. 3 = ACT1+ACT2 – ACT1 plus ACT2 provides the feedback signal. 4 = ACT1*ACT2 – ACT1 times ACT2 provides the feedback signal. 5 = ACT1/ACT2 – ACT1 divided by ACT2 provides the feedback signal. 6 = MIN(ACT1,2) – The smaller of ACT1 or ACT2 provides the feedback signal. 7 = MAX(ACT1,2) – The greater of ACT1 or ACT2 provides the feedback signal. 8 = sqrt(ACT1-2) – Square root of the value for ACT1 minus ACT2 provides the feedback signal. 9 = sqA1+sqA2 – Square root of ACT1 plus the square root of ACT2 provides the feedback signal. 10 = sqrt(ACT1) – Square root of ACT1 provides the feedback signal. 11 = COMM FBK 1 – Signal 0158 PID COMM VALUE 1 provides the feedback signal. 12 = COMM FBK 2 – Signal 0159 PID COMM VALUE 2 provides the feedback signal. 13 = AVE(ACT1,2) – The average of ACT1 and ACT2 provides the feedback signal.
4015	**FBK MULTIPLIER** Defines an extra multiplier for the PID feedback value FBK defined by parameter 4014. • Used mainly in applications where the flow is calculated from the pressure difference. 0.000 = NOT SEL – The parameter has no effect (1.000 used as the multiplier). -32.768…32.767 – Multiplier applied to the signal defined by parameter 4014 FBK SEL. **Example:** $\mathrm{FBK} = \mathrm{Multiplier} \times \sqrt{\mathrm{A1} - \mathrm{A2}}$

<table>
<tr><th>Code</th><th colspan="2">Description</th></tr>
<tr><td>4016</td><td colspan="2">ACT1 INPUT
Defines the source for actual value 1 (ACT1). See also parameter 4018 ACT1 MINIMUM.
1 = AI1 – Uses analog input 1 for ACT1.
2 = AI2 – Uses analog input 2 for ACT1.
3 = CURRENT – Uses current for ACT1.
4 = TORQUE – Uses torque for ACT1.
5 = POWER – Uses power for ACT1.
6 = COMM ACT 1 – Uses value of signal 0158 PID COMM VALUE 1 for ACT1.
7 = COMM ACT 2 – Uses value of signal 0159 PID COMM VALUE 2 for ACT1.</td></tr>
<tr><td>4017</td><td colspan="2">ACT2 INPUT
Defines the source for actual value 2 (ACT2). See also parameter 4020 ACT2 MINIMUM.
1 = AI1 – Uses analog input 1 for ACT2.
2 = AI2 – Uses analog input 2 for ACT2.
3 = CURRENT – Uses current for ACT2.
4 = TORQUE – Uses torque for ACT2.
5 = POWER – Uses power for ACT2.
6 = COMM ACT 1 – Uses value of signal 0158 PID COMM VALUE 1 for ACT2.
7 = COMM ACT 2 – Uses value of signal 0159 PID COMM VALUE 2 for ACT2.</td></tr>
<tr><td>4018</td><td>ACT1 MINIMUM
Sets the minimum value for ACT1.
• Scales the source signal used as the actual value ACT1 (defined by parameter 4016 ACT1 INPUT). For parameter 4016 values 6 (COMM ACT 1) and 7 (COMM ACT 2) scaling is not done.
<table>
<tr><th>Par 4016</th><th>Source</th><th>Source min.</th><th>Source max.</th></tr>
<tr><td>1</td><td>Analog input 1</td><td>1301 MINIMUM AI1</td><td>1302 MAXIMUM AI1</td></tr>
<tr><td>2</td><td>Analog input 2</td><td>1304 MINIMUM AI2</td><td>1305 MAXIMUM AI2</td></tr>
<tr><td>3</td><td>Current</td><td>0</td><td>2 · nominal current</td></tr>
<tr><td>4</td><td>Torque</td><td>-2 · nominal torque</td><td>2 · nominal torque</td></tr>
<tr><td>5</td><td>Power</td><td>-2 · nominal power</td><td>2 · nominal power</td></tr>
</table>
• See the figure: A= Normal; B = Inversion (ACT1 MINIMUM > ACT1 MAXIMUM)</td><td rowspan="4">
</td></tr>
<tr><td>4019</td><td>ACT1 MAXIMUM
Sets the maximum value for ACT1.
• See 4018 ACT1 MINIMUM.</td></tr>
<tr><td>4020</td><td>ACT2 MINIMUM
Sets the minimum value for ACT2.
• See 4018 ACT1 MINIMUM.</td></tr>
<tr><td>4021</td><td>ACT2 MAXIMUM
Sets the maximum value for ACT2.
• See 4018 ACT1 MINIMUM.</td></tr>
<tr><td>4022</td><td colspan="2">SLEEP SELECTION
Defines the control for the PID sleep function.
0 = NOT SEL– Disables the PID sleep control function.
1 = DI1 – Defines digital input DI1 as the control for the PID sleep function.
• Activating the digital input activates the sleep function.
• De-activating the digital input restores PID control.
2…6 = DI2…DI6 – Defines digital input DI2…DI6 as the control for the PID sleep function.
• See DI1 above.
7 = INTERNAL – Defines the output rpm/frequency, process reference and process actual value as the control for the PID sleep function. Refer to parameters 4025 WAKE-UP DEV and 4023 PID SLEEP LEVEL.
-1 = DI1(INV) – Defines an inverted digital input DI1 as the control for the PID sleep function.
• De-activating the digital input activates the sleep function.
• Activating the digital input restores PID control.
-2…-6 = DI2(INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as the control for the PID sleep function.
• See DI1(INV) above.</td></tr>
</table>

Code	Description	
4023	**PID SLEEP LEVEL** Sets the motor speed / frequency that enables the PID sleep function – a motor speed / frequency below this level, for at least the time period 4024 PID SLEEP DELAY enables the PID sleep function (stopping the drive). • Requires 4022 = 7 (INTERNAL). • See the figure: A = PID output level; B = PID process feedback.	
4024	**PID SLEEP DELAY** Sets the time delay for the PID sleep function – a motor speed / frequency below 4023 PID SLEEP LEVEL for at least this time period enables the PID sleep function (stopping the drive). • See 4023 PID SLEEP LEVEL above.	
4025	**WAKE-UP DEV** Defines the wake-up deviation – a deviation from the setpoint greater than this value, for at least the time period 4026 WAKE-UP DELAY, re-starts the PID controller. • Parameters 4006 and 4007 define the units and scale. • Parameter 4005 = 0, Wake-up level = Setpoint - Wake-up deviation. • Parameter 4005 = 1, Wake-up level = Setpoint + Wake-up deviation. • Wake-up level can be above or below setpoint. See the figures: • C = Wake-up level when parameter 4005 = 1 • D = Wake-up level when parameter 4005 = 0 • E = Feedback is above wake-up level and lasts longer than 4026 WAKE-UP DELAY – PID function wakes up. • F = Feedback is below wake-up level and lasts longer than 4026 WAKE-UP DELAY – PID function wakes up.	
4026	**WAKE-UP DELAY** Defines the wake-up delay – a deviation from the setpoint greater than 4025 WAKE-UP DEV, for at least this time period, re-starts the PID controller.	

Code	Description
4027	**PID 1 PARAM SET** Process PID (PID1) has two separate sets of parameters, PID set 1 and PID set 2. • PID set 1 uses parameters 4001…4026. • PID set 2 uses parameters 4101…4126. PID 1 PARAM SET defines which set is selected. 0 = SET 1 – PID Set 1 (parameters 4001…4026) is active. 1 = DI1 – Defines digital input DI1 as the control for PID Set selection. • Activating the digital input selects PID Set 2. • De-activating the digital input selects PID Set 1. 2…6 = DI2…DI6 – Defines digital input DI2…DI6 as the control for PID Set selection. • See DI1 above. 7 = SET 2 – PID Set 2 (parameters 4101…4126) is active. 8…11 = TIMED FUNC 1…4 – Defines the Timed function as the control for the PID Set selection (Timed function de-activated = PID Set 1; Timed function activated = PID Set 2) • See *Group 36: TIMED FUNCTIONS*. 12 = 2-ZONE MIN – The drive calculates the difference between setpoint 1 and feedback 1 as well as setpoint 2 and feedback 2. The drive will control the zone (and select the set) that has a larger difference. • A positive difference (a setpoint higher than the feedback) is always larger than a negative difference. This keeps feedback values at or above the setpoint. • Controller does not react to the situation of feedback above setpoint if another zone's feedback is closer to its setpoint. 13 = 2-ZONE MAX – The drive calculates the difference between setpoint 1 and feedback 1 as well as setpoint 2 and feedback 2. The drive will control the zone (and select the set) that has a smaller difference. • A negative difference (a setpoint lower than the feedback) is always smaller than a positive difference. This keeps feedback values at or below the setpoint. • Controller does not react to the situation of feedback below setpoint if another zone's feedback is closer to its setpoint. 14 = 2-ZONE AVE – The drive calculates the difference between setpoint 1 and feedback 1 as well as setpoint 2 and feedback 2. In addition, it calculates the average of the deviations and uses it to control zone 1. Therefore one feedback is kept above its setpoint and another is kept as much below its setpoint. -1 = DI1(INV) – Defines an inverted digital input DI1 as the control for PID Set selection. • Activating the digital input selects PID Set 1. • De-activating the digital input selects PID Set 2. -2…-6 = DI2(INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as the control for PID Set selection. • See DI1(INV) above.

Group 41: PROCESS PID SET 2

Parameters of this group belong to PID parameter set 2. The operation of parameters 4101…4126 is analogous with set 1 parameters 4001…4026.

PID parameter set 2 can be selected by parameter 4027 PID 1 PARAM SET.

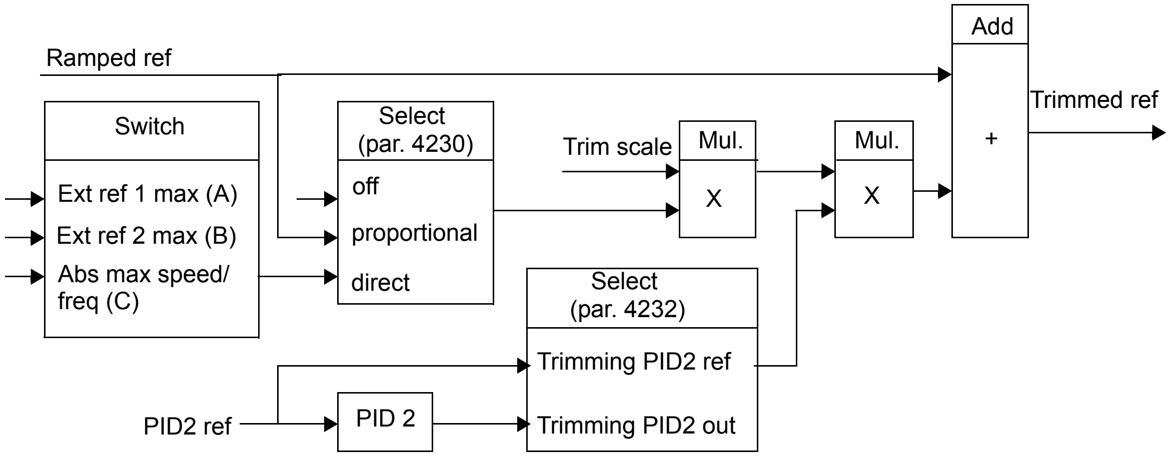
Code	Description
4101 … 4126	See 4001 …4026

Group 42: EXT / TRIM PID

This group defines the parameters used for the second PID controller (PID2), which is used for the External / Trimming PID.

The operation of parameters 4201…4221 is analogous with Process PID set 1 (PID1) parameters 4001…4021.

Code	Description
4201 … 4221	See 4001 …4021
4228	**ACTIVATE** Defines the source for enabling the external PID function. • Requires 4230 TRIM MODE = 0 (NOT SEL). 0 = NOT SEL – Disables external PID control. 1 = DI1 – Defines digital input DI1 as the control for enabling external PID control. • Activating the digital input enables external PID control. • De-activating the digital input disables external PID control. 2…6 = DI2…DI6 – Defines digital input DI2…DI6 as the control for enabling external PID control. • See DI1 above. 7 = DRIVE RUN – Defines the start command as the control for enabling external PID control. • Activating the start command (drive is running) enables external PID control. 8 = ON – Defines the power-on as the control for enabling external PID control. • Activating power to the drive enables external PID control. 9…12 = TIMED FUNC 1…4 – Defines the Timed function as the control for enabling external PID control (Timed function active enables external PID control). • See *Group 36: TIMED FUNCTIONS*. -1 = DI1(INV) – Defines an inverted digital input DI1 as the control for enabling external PID control. • Activating the digital input disables external PID control. • De-activating the digital input enables external PID control. -2…-6 = DI2(INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as the control for enabling external PID control. • See DI1(INV) above.
4229	**OFFSET** Defines the offset for the PID output. • When PID is activated, output starts from this value. • When PID is deactivated, output resets to this value. • Parameter is active when 4230 TRIM MODE = 0 (trim mode is not active).
4230	**TRIM MODE** Selects the type of trim, if any. Using the trim it is possible to combine a corrective factor to the drive reference. 0 = NOT SEL – Disables the trim function. 1 = PROPORTIONAL – Adds a trim factor that is proportional to the rpm/Hz reference. 2 = DIRECT – Adds a trim factor based on the control loop's maximum limit.
4231	**TRIM SCALE** Defines the multiplier (as a percent, plus or minus) used in the trim mode.

Code	Description
4232	**CORRECTION SRC** Defines the trimming reference for the correction source. 1 = PID2REF – Uses appropriate REF MAX (SWITCH A OR B): • 1105 REF1 MAX when REF1 is active (A). • 1108 REF2 MAX when REF2 is active (B). 2 = PID2OUTPUT – Uses the absolute maximum speed or frequency (Switch C): • 2002 MAXIMUM SPEED if 9904 MOTOR CTRL MODE = 1 (VECTOR:SPEED) or 2 (VECTOR:TORQ). • 2008 MAXIMUM FREQ if 9904 MOTOR CTRL MODE = 3 (SCALAR:FREQ). 

Group 45: ENERGY SAVING

This group defines the setup of calculation and optimization of energy savings.

Note: The values of saved energy parameters 0174 SAVED KWH, 0175 SAVED MWH, 0176 SAVED AMOUNT 1, 0177 SAVED AMOUNT 2 and 0178 SAVED CO2 are derived from subtracting the drive's energy consumed from the direct-on-line (DOL) consumption calculated on the basis of parameter 4508 PUMP POWER. As such, the accuracy of the values is dependent on the accuracy of the power estimate entered in that parameter.

Code	Description
4502	**ENERGY PRICE** Price of energy per kWh. • Used for reference when energy savings are calculated. • See parameters 0174 SAVED KWH, 0175 SAVED MWH, 0176 SAVED AMOUNT 1, 0177 SAVED AMOUNT 2 and 0178 SAVED CO2 (reduction on carbon dioxide emissions in tn).
4507	**CO2 CONV FACTOR** Conversion factor for converting energy into CO2 emissions (kg/kWh or tn/MWh). Used for multiplying the saved energy in MWh to calculate the value of parameter 0178 SAVED CO2 (reduction on carbon dioxide emissions in tn).
4508	**PUMP POWER** Pump power (as a percentage of the nominal motor power) when connected directly to supply (DOL). • Used for reference when energy savings are calculated. • See parameters 0174 SAVED KWH, 0175 SAVED MWH, 0176 SAVED AMOUNT 1, 0177 SAVED AMOUNT 2 and 0178 SAVED CO2. • It is possible to use this parameter as the reference power also for other applications than pumps. The reference power can also be some other constant power than a motor connected directly online.
4509	**ENERGY RESET** Resets energy calculators 0174 SAVED KWH, 0175 SAVED MWH, 0176 SAVED AMOUNT 1, 0177 SAVED AMOUNT 2 and 0178 SAVED CO2.

Group 50: ENCODER

This group defines the setup for encoder use:

- Sets the number of encoder pulses per shaft revolution.
- Enables the encoder operation.
- Defines how mechanical angle and revolution data is reset.

See also *User's Manual for Pulse Encoder Interface Module OTAC-01* (3AUA0000001938 [English]).

Code	Description
5001	**PULSE NR** Sets the number of pulses provided by an optional encoder for each full motor shaft revolution (ppr).
5002	**ENCODER ENABLE** Enables/disables an optional encoder. 0 = DISABLE – Drive uses speed feedback derived from the internal motor model (applies for any setting of parameter 9904 MOTOR CTRL MODE). 1 = ENABLE – Drive uses feedback from an optional encoder. This function requires the Pulse Encoder Interface Module (OTAC-01) and an encoder. Operation depends on the setting of parameter 9904 MOTOR CTRL MODE: • 9904 = 1 (VECTOR:SPEED): The encoder provides improved speed feedback and improved low speed torque accuracy. • 9904 = 2 (VECTOR:TORQ): The encoder provides improved speed feedback and improved low speed torque accuracy. • 9904 = 3 (SCALAR:SPEED): The encoder provides speed feedback. (This is not closed loop speed regulation. However, using parameter 2608 SLIP COMP RATIO and an encoder improves steady state speed accuracy.)
5003	**ENCODER FAULT** Defines the drive operation if a failure is detected in communication between the encoder and the encoder interface module, or between the module and the drive. 1 = FAULT – The drive generates fault ENCODER ERR, and the motor coasts to a stop. 2 = ALARM – The drive generates alarm ENCODER ERR and operates as if parameter 5002 ENCODER ENABLE = 0 (DISABLE), that is, speed feedback is derived from the internal motor model.
5010	**Z PLS ENABLE** Enables/disables the use of an encoder's Z-pulse to define the motor shaft's zero position. When enabled, a Z-pulse input resets parameter 0146 MECH ANGLE to zero to define the shaft's zero position. This function requires an encoder that provides Z-pulse signals. 0 = DISABLE – Z-pulse input is not present or ignored if present. 1 = ENABLE – A Z-pulse input resets parameter 0146 MECH ANGLE to zero.
5011	**POSITION RESET** Resets the encoder's position feedback. This parameter is self-clearing. 0 = DISABLE – Inactive. 1 = ENABLE – Resets the encoder position feedback. Parameters reset depends on the state of parameter 5010 Z PLS ENABLE: • 5010 = 0 (DISABLE) – Reset applies to parameters 0147 MECH REVS and 0146 MECH ANGLE. • 5010 = 1 (ENABLE) – Reset applies only to parameter 0147 MECH REVS.

Group 51: EXT COMM MODULE

This group defines set-up variables for a fieldbus adapter (FBA) communication module. For more information on these parameters, refer to the user's manual supplied with the FBA module.

Code	Description
5101	**FBA TYPE** Displays the type of the connected fieldbus adapter module. 0 = NOT DEFINED – Module not found, or not properly connected, or parameter 9802 is not set to 4 (EXT FBA). 1 = PROFIBUS-DP 21 = LONWORKS 32 = CANopen 37 = DEVICENET 101 = CONTROLNET 128 = ETHERNET 132 = PROFINET 135 = EtherCAT 136 = EPL – Ethernet POWERLINK 144 = CC-Link
5102 … 5126	**FB PAR 2…FB PAR 26** Refer to communication module documentation for more information on these parameters.
5127	**FBA PAR REFRESH** Validates any changed fieldbus parameter settings. 0 = DONE – Refreshing done. 1 = REFRESH – Refreshing. • After refreshing, the value reverts automatically to DONE.
5128	**FILE CPI FW REV** Displays the CPI firmware revision of the drive's fieldbus adapter configuration file. Format is xyz where: • x = major revision number • y = minor revision number • z = correction number **Example:** 107 = revision 1.07
5129	**FILE CONFIG ID** Displays the revision of the drive's fieldbus adapter module's configuration file identification. • File configuration information is drive application program-dependent.
5130	**FILE CONFIG REV** Contains the revision of the drive's fieldbus adapter module configuration file. **Example:** 1 = revision 1
5131	**FBA STATUS** Contains the status of the adapter module. 0 = IDLE – Adapter not configured. 1 = EXECUT INIT – Adapter is initializing. 2 = TIME OUT – A timeout has occurred in the communication between the adapter and the drive. 3 = CONFIG ERROR – Adapter configuration error. • The revision code of the adapter's CPI firmware revision is older than required CPI firmware version defined in the drive's configuration file (parameter 5132 < 5128). 4 = OFF-LINE – Adapter is off-line. 5 = ON-LINE – Adapter is on-line. 6 = RESET – Adapter is performing a hardware reset.
5132	**FBA CPI FW REV** Contains the revision of the module's CPI program. Format is xyz where: • x = major revision number • y = minor revision number • z = correction number **Example:** 107 = revision 1.07

Code	Description
5133	**FBA APPL FW REV** Contains the revision of the module's application program. Format is xyz (see parameter 5132).

Group 52: PANEL COMM

This group defines the communication settings for the control panel port on the drive. Normally, when using the supplied control panel, there is no need to change settings in this group.

In this group, parameter modifications take effect on the next power-up.

Code	Description
5201	**STATION ID** Defines the address of the drive. • Two units with the same address are not allowed on-line. • Range: 1…247
5202	**BAUD RATE** Defines the communication speed of the drive in kbits per second (kb/s). 9.6 kb/s 19.2 kb/s 38.4 kb/s 57.6 kb/s 115.2 kb/s
5203	**PARITY** Sets the character format to be used with the panel communication. 0 = 8 NONE 1 – 8 data bits, no parity, one stop bit. 1 = 8 NONE 2 – 8 data bits, no parity, two stop bits. 2 = 8 EVEN 1 – 8 data bits, even parity, one stop bit. 3 = 8 ODD 1 – 8 data bits, odd parity, one stop bit.
5204	**OK MESSAGES** Contains a count of valid Modbus messages received by the drive. • During normal operation, this counter is increasing constantly.
5205	**PARITY ERRORS** Contains a count of the characters with a parity error that is received from the bus. For high counts, check: • Parity settings of devices connected on the bus – they must not differ. • Ambient electro-magnetic noise levels – high noise levels generate errors.
5206	**FRAME ERRORS** Contains a count of the characters with a framing error that the bus receives. For high counts, check: • Communication speed settings of devices connected on the bus – they must not differ. • Ambient electro-magnetic noise levels – high noise levels generate errors.
5207	**BUFFER OVERRUNS** Contains a count of the characters received that cannot be placed in the buffer. • Longest possible message length for the drive is 128 bytes. • Received messages exceeding 128 bytes overflow the buffer. The excess characters are counted.
5208	**CRC ERRORS** Contains a count of the messages with a CRC error that the drive receives. For high counts, check: • Ambient electro-magnetic noise levels – high noise levels generate errors. • CRC calculations for possible errors.

Group 53: EFB PROTOCOL

This group defines set-up variables used for an embedded fieldbus (EFB) communication protocol. The standard EFB protocol in the ACS550 is Modbus. See chapter *Embedded fieldbus* page *199*.

Code	Description
5301	**EFB PROTOCOL ID** Contains the identification and program revision of the protocol. • Format: XXYY, where xx = protocol ID, and YY = program revision.
5302	**EFB STATION ID** Defines the node address of the RS485 link. • The node address on each unit must be unique.
5303	**EFB BAUD RATE** Defines the communication speed of the RS485 link in kbits per second (kb/s). 1.2 kb/s 2.4 kb/s 4.8 kb/s 9.6 kb/s 19.2 kb/s 38.4 kb/s 57.6 kb/s 76.8 kb/s
5304	**EFB PARITY** Defines the data length, parity and stop bits to be used with the RS485 link communication. • The same settings must be used in all on-line stations. 0 = 8 NONE 1 – 8 data bits, no parity, one stop bit. 1 = 8 NONE 2 – 8 data bits, no parity, two stop bits. 2 = 8 EVEN 1 – 8 data bits, even parity, one stop bit. 3 = 8 ODD 1 – 8 data bits, odd parity, one stop bit.
5305	**EFB CTRL PROFILE** Selects the communication profile used by the EFB protocol. 0 = ABB DRV LIM – Operation of Control/Status Words conforms to ABB Drives Profile, as used in ACS400. 1 = DCU PROFILE – Operation of Control/Status Words conforms to 32-bit DCU Profile. 2 = ABB DRV FULL – Operation of Control/Status Words conforms to ABB Drives Profile, as used in ACS600/800.
5306	**EFB OK MESSAGES** Contains a count of valid messages received by the drive. • During normal operation, this counter is increasing constantly.
5307	**EFB CRC ERRORS** Contains a count of the messages with a CRC error received by the drive. For high counts, check: • Ambient electro-magnetic noise levels – high noise levels generate errors. • CRC calculations for possible errors.
5308	**EFB UART ERRORS** Contains a count of the messages with a character error received by the drive.
5309	**EFB STATUS** Contains the status of the EFB protocol. 0 = IDLE – EFB protocol is configured, but not receiving any messages. 1 = EXECUT INIT – EFB protocol is initializing. 2 = TIME OUT – A timeout has occurred in the communication between the network master and the EFB protocol. 3 = CONFIG ERROR – EFB protocol has a configuration error. 4 = OFF-LINE – EFB protocol is receiving messages that are NOT addressed to this drive. 5 = ON-LINE – EFB protocol is receiving messages that are addressed to this drive. 6 = RESET – EFB protocol is performing a hardware reset. 7 = LISTEN ONLY – EFB protocol is in listen-only mode.
5310	**EFB PAR 10** Specifies the parameter mapped to Modbus Register 40005.

Code	Description
5311	**EFB PAR 11** Specifies the parameter mapped to Modbus Register 40006.
5312	**EFB PAR 12** Specifies the parameter mapped to Modbus Register 40007.
5313	**EFB PAR 13** Specifies the parameter mapped to Modbus Register 40008.
5314	**EFB PAR 14** Specifies the parameter mapped to Modbus Register 40009.
5315	**EFB PAR 15** Specifies the parameter mapped to Modbus Register 40010.
5316	**EFB PAR 16** Specifies the parameter mapped to Modbus Register 40011.
5317	**EFB PAR 17** Specifies the parameter mapped to Modbus Register 40012.
5318	**EFB PAR 18** For Modbus: Sets additional delay in milliseconds before the ACS550 begins transmitting response to the master request.
5319	**EFB PAR 19** ABB Drives profile (ABB DRV LIM or ABB DRV FULL) Control Word. Read only copy of the Fieldbus Control Word.
5320	**EFB PAR 20** ABB Drives profile (ABB DRV LIM or ABB DRV FULL) Status Word. Read only copy of the Fieldbus Status Word.

Group 64: LOAD ANALYZER

This group defines the load analyzer, which can be used for analyzing the customer's process and sizing the drive and the motor.

The peak value is logged at 2 ms level, and the distribution loggers are updated on 0.2 s (200 ms) time level. Three different values can be logged.

1. Amplitude logger 1: The measured current is logged continuously. The distribution as a percentage of the nominal current I_{2N} is shown in ten classes.
2. Peak value logger: One signal in group 1 can be logged for the peak (maximum) value. The peak value of the signal, peak time (time when the peak value was detected) as well the frequency, current and DC voltage at the peak time are shown.
3. Amplitude logger 2: One signal in group 1 can be logged for amplitude distribution. The base value (100% value) can be set by the user.

The first logger cannot be reset. The other two loggers can be reset by a user-defined method. They are also reset if either of the signals or the peak value filter time is changed.

Code	Description
6401	**PVL SIGNAL** Defines (by number) the signal logged for the peak value. • Any parameter number in *Group 01: OPERATING DATA* can be selected. Eg 102 = parameter 0102 SPEED. 100 = NOT SELECTED – No signal (parameter) logged for the peak value. 101…178 – Logs parameter 0101…0178.
6402	**PVL FILTER TIME** Defines the filter time for peak value logging. • 0.0…120.0 – Filter time (seconds).
6403	**LOGGERS RESET** Defines the source for the reset of peak value logger and amplitude logger 2. 0 = NOT SEL – No reset selected. 1 = DI1 – Reset loggers on the rising edge of digital input DI1. 2…6 = DI2…DI6 – Reset loggers on the rising edge of digital input DI2…DI6. 7 = RESET – Reset loggers. Parameter is set to NOT SEL. -1 = DI1(INV) – Reset loggers on the falling edge of digital input DI1. -2…-6 = DI2(INV) …DI6(INV) – Reset loggers on the falling edge of digital input DI2…DI6.
6404	**AL2 SIGNAL** Defines the signal logged for amplitude logger 2. • Any parameter number in *Group 01: OPERATING DATA* can be selected. Eg 102 = parameter 0102 SPEED. 100 = NOT SELECTED – No signal (parameter) logged for amplitude distribution (amplitude logger 2). 101…178 – Logs parameter 0101…0178.
6405	**AL2 SIGNAL BASE** Defines the base value from which the percentage distribution is calculated. • Representation and default value depends on the signal selected with parameter 6404 AL2 SIGNAL.
6406	**PEAK VALUE** Detected peak value of the signal selected with parameter 6401 PVL SIGNAL.
6407	**PEAK TIME 1** Date of the peak value detection. • Format: Date if the real time clock is operating (dd.mm.yy). / The number of days elapsed after the power-on if the real time clock is not used, or was not set (xx d).
6408	**PEAK TIME 2** Time of the peak value detection. • Format: hours:minutes:seconds.

Code	Description
6409	**CURRENT AT PEAK** Current at the moment of the peak value (amperes).
6410	**UDC AT PEAK** DC voltage at the moment of the peak value (volts).
6411	**FREQ AT PEAK** Output frequency at the moment of the peak value (herzes).
6412	**TIME OF RESET 1** Last reset date of the peak logger and amplitude logger 2. • Format: Date if the real time clock is operating (dd.mm.yy). / The number of days elapsed after the power-on if the real time clock is not used, or was not set (xx d).
6413	**TIME OF RESET 2** Last reset time of the peak logger and amplitude logger 2. • Format: hours:minutes:seconds.
6414	**AL1RANGE0TO10** Amplitude logger 1 (current in percent of nominal current I_{2N}) 0…10% distribution.
6415	**AL1RANGE10TO20** Amplitude logger 1 (current in percent of nominal current I_{2N}) 10…20% distribution.
6416	**AL1RANGE20TO30** Amplitude logger 1 (current in percent of nominal current I_{2N}) 20…30% distribution.
6417	**AL1RANGE30TO40** Amplitude logger 1 (current in percent of nominal current I_{2N}) 30…40% distribution.
6418	**AL1RANGE40TO50** Amplitude logger 1 (current in percent of nominal current I_{2N}) 40…50% distribution.
6419	**AL1RANGE50TO60** Amplitude logger 1 (current in percent of nominal current I_{2N}) 50…60% distribution.
6420	**AL1RANGE60TO70** Amplitude logger 1 (current in percent of nominal current I_{2N}) 60…70% distribution.
6421	**AL1RANGE70TO80** Amplitude logger 1 (current in percent of nominal current I_{2N}) 70…80% distribution.
6422	**AL1RANGE80TO90** Amplitude logger 1 (current in percent of nominal current I_{2N}) 80…90% distribution.
6423	**AL1RANGE90TO** Amplitude logger 1 (current in percent of nominal current I_{2N}) over 90% distribution.
6424	**AL2RANGE0TO10** Amplitude logger 2 (signal selection with parameter 6404) 0…10% distribution.
6425	**AL2RANGE10TO20** Amplitude logger 2 (signal selection with parameter 6404) 10…20% distribution.
6426	**AL2RANGE20TO30** Amplitude logger 2 (signal selection with parameter 6404) 20…30% distribution.
6427	**AL2RANGE30TO40** Amplitude logger 2 (signal selection with parameter 6404) 30…40% distribution.
6428	**AL2RANGE40TO50** Amplitude logger 2 (signal selection with parameter 6404) 40…50% distribution.
6429	**AL2RANGE50TO60** Amplitude logger 2 (signal selection with parameter 6404) 50…60% distribution.
6430	**AL2RANGE60TO70** Amplitude logger 2 (signal selection with parameter 6404) 60…70% distribution.
6431	**AL2RANGE70TO80** Amplitude logger 2 (signal selection with parameter 6404) 70…80% distribution.

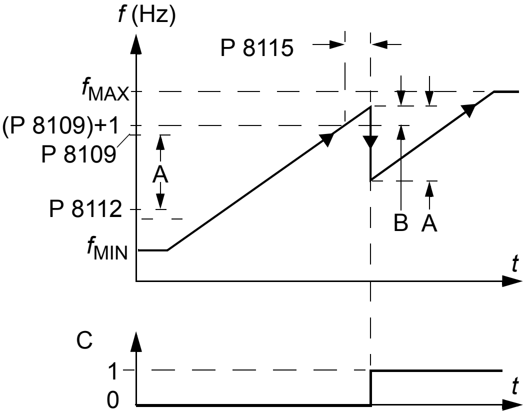
Code	Description
6432	**AL2RANGE80TO90** Amplitude logger 2 (signal selection with parameter 6404) 80…90% distribution.
6433	**AL2RANGE90TO** Amplitude logger 2 (signal selection with parameter 6404) over 90% distribution.

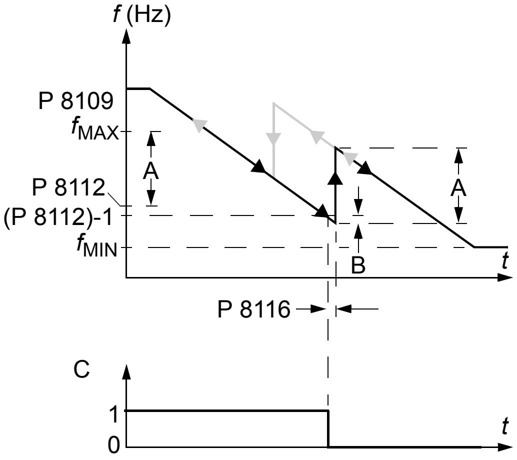
Group 81: PFC CONTROL

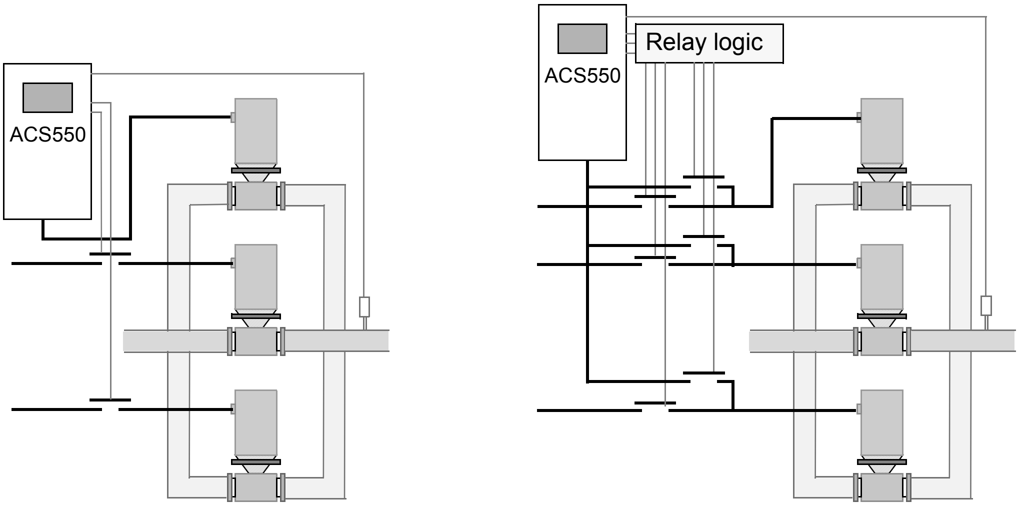
This group defines a Pump-Fan Control (PFC) mode of operation. The major features of PFC control are:

- The ACS550 controls the motor of pump no. 1, varying the motor speed to control the pump capacity. This motor is the speed regulated motor.
- Direct line connections power the motor of pump no. 2 and pump no.3, etc. The ACS550 switches pump no. 2 (and then pump no. 3, etc.) on and off as needed. These motors are auxiliary motors.
- The ACS550 PID control uses two signals: a process reference and an actual value feedback. The PID controller adjusts the speed (frequency) of the first pump such that the actual value follows the process reference.
- When demand (defined by the process reference) exceeds the first motor's capacity (user defined as a frequency limit), the PFC control automatically starts an auxiliary pump. The PFC also reduces the speed of the first pump to account for the auxiliary pump's addition to total output. Then, as before, the PID controller adjusts the speed (frequency) of the first pump such that the actual value follows the process reference. If demand continues to increase, PFC adds additional auxiliary pumps, using the same process.
- When demand drops, such that the first pump speed falls below a minimum limit (user defined by a frequency limit), the PFC control automatically stops an auxiliary pump. The PFC also increases the speed of the first pump to account for the auxiliary pump's missing output.
- An Interlock function (when enabled) identifies off-line (out of service) motors, and the PFC control skips to the next available motor in the sequence.
- An Autochange function (when enabled and with the appropriate switchgear) equalizes duty time between the pump motors. Autochange periodically increments the position of each motor in the rotation – the speed regulated motor becomes the last auxiliary motor, the first auxiliary motor becomes the speed regulated motor, etc.

Code	Description
8103	**REFERENCE STEP 1** Sets a percentage value that is added to the process reference. • Applies only when at least one auxiliary (constant speed) motor is running. • Default value is 0%. **Example:** An ACS550 operates three parallel pumps that maintain water pressure in a pipe. • 4011 INTERNAL SETPNT sets a constant pressure reference that controls the pressure in the pipe. • The speed regulated pump operates alone at low water consumption levels. • As water consumption increases, first one constant speed pump operates, then, the second. • As flow increases, the pressure at the output end of the pipe drops relative to the pressure measured at the input end. As auxiliary motors step in to increase the flow, the adjustments below correct the reference to more closely match the output pressure. • When the first auxiliary pump operates, increase the reference with parameter 8103 REFERENCE STEP 1. • When two auxiliary pumps operate, increase the reference with parameter 8103 REFERENCE STEP 1 + parameter 8104 REFERENCE STEP 2. • When three auxiliary pumps operate, increase the reference with parameter 8103 REFERENCE STEP 1 + parameter 8104 REFERENCE STEP 2 + parameter 8105 REFERENCE STEP 3.

Code	Description
8104	**REFERENCE STEP 2** Sets a percentage value that is added to the process reference. • Applies only when at least two auxiliary (constant speed) motors are running. • See parameter 8103 REFERENCE STEP 1.
8105	**REFERENCE STEP 3** Sets a percentage value that is added to the process reference. • Applies only when at least three auxiliary (constant speed) motors are running. • See parameter 8103 REFERENCE STEP 1.
8109	**START FREQ 1** Sets the frequency limit used to start the first auxiliary motor. The first auxiliary motor starts if: • No auxiliary motors are running. • ACS550 output frequency exceeds the limit: 8109 + 1 Hz. • Output frequency stays above a relaxed limit (8109 - 1 Hz) for at least the time: 8115 AUX MOT START D. After the first auxiliary motor starts: • Output frequency decreases by the value = (8109 START FREQ 1) - (8112 LOW FREQ 1). • In effect, the output of the speed regulated motor drops to compensate for the input from the auxiliary motor. See the figure, where: • A = (8109 START FREQ 1) - (8112 LOW FREQ 1) • B = Output frequency increase during the start delay. • C = Diagram showing auxiliary motor's run status as frequency increases (1 = On).  **Note:** 8109 START FREQ 1 value must be between: • 8112 LOW FREQ 1 • (2008 MAXIMUM FREQ) -1.
8110	**START FREQ 2** Sets the frequency limit used to start the second auxiliary motor. • See 8109 START FREQ 1 for a complete description of the operation. The second auxiliary motor starts if: • One auxiliary motor is running. • ACS550 output frequency exceeds the limit: 8110 + 1. • Output frequency stays above the relaxed limit (8110 - 1 Hz) for at least the time: 8115 AUX MOT START D.
8111	**START FREQ 3** Sets the frequency limit used to start the third auxiliary motor. • See 8109 START FREQ 1 for a complete description of the operation. The third auxiliary motor starts if: • Two auxiliary motors are running. • ACS550 output frequency exceeds the limit: 8111 + 1 Hz. • Output frequency stays above the relaxed limit (8111 - 1 Hz) for at least the time: 8115 AUX MOT START D.

Code	Description
8112	**LOW FREQ 1** Sets the frequency limit used to stop the first auxiliary motor. The first auxiliary motor stops if: • Only one (the first) auxiliary motor is running. • ACS550 output frequency drops below the limit: 8112 - 1. • Output frequency stays below the relaxed limit (8112 + 1 Hz) for at least the time: 8116 AUX MOT STOP D. After the first auxiliary motor stops: • Output frequency increases by the value = (8109 START FREQ 1) - (8112 LOW FREQ 1). • In effect, the output of the speed regulated motor increases to compensate for the loss of the auxiliary motor. See the figure, where: • A = (8109 START FREQ 1) - (8112 LOW FREQ 1) • B = Output frequency decrease during the stop delay. • C = Diagram showing auxiliary motor's run status as frequency decreases (1 = On). • Grey path = Shows hysteresis – if time is reversed, the path backwards is not the same. For details on the path for starting, see the diagram at 8109 START FREQ 1. **Note:** 8112 LOW FREQ 1 value must be between: • (2007 MINIMUM FREQ) +1. • 8109 START FREQ 1 
8113	**LOW FREQ 2** Sets the frequency limit used to stop the second auxiliary motor. • See 8112 LOW FREQ 1 for a complete description of the operation. The second auxiliary motor stops if: • Two auxiliary motors are running. • ACS550 output frequency drops below the limit: 8113 - 1. • Output frequency stays below the relaxed limit (8113 + 1 Hz) for at least the time: 8116 AUX MOT STOP D.
8114	**LOW FREQ 3** Sets the frequency limit used to stop the third auxiliary motor. • See 8112 LOW FREQ 1 for a complete description of the operation. The third auxiliary motor stops if: • Three auxiliary motors are running. • ACS550 output frequency drops below the limit: 8114 - 1. • Output frequency stays below the relaxed limit (8114 + 1 Hz) for at least the time: 8116 AUX MOT STOP D.
8115	**AUX MOT START D** Sets the Start Delay for the auxiliary motors. • The output frequency must remain above the start frequency limit (parameter 8109, 8110, or 8111) for this time period before the auxiliary motor starts. • See 8109 START FREQ 1 for a complete description of the operation.
8116	**AUX MOT STOP D** Sets the Stop Delay for the auxiliary motors. • The output frequency must remain below the low frequency limit (parameter 8112, 8113, or 8114) for this time period before the auxiliary motor stops. • See 8112 LOW FREQ 1 for a complete description of the operation.

Code	Description
8117	**NR OF AUX MOT** Sets the number of auxiliary motors. • Each auxiliary motor requires a relay output, which the drive uses to send start/stop signals. • The Autochange function, if used, requires an additional relay output for the speed regulated motor. • The following describes the set-up of the required relay outputs. **Relay outputs** As noted above, each auxiliary motor requires a relay output, which the drive uses to send start/stop signals. The following describes how the drive keeps track of motors and relays. • The ACS550 provides relay outputs RO1…RO3. • An external digital output module (OREL-01) can be added to provide relay outputs RO4…RO6. • Parameters 1401…1403 and 1410…1412 define, respectively, how relays RO1…RO6 are used – the parameter value 31 PFC defines the relay as used for PFC. • The ACS550 assigns auxiliary motors to relays in ascending order. If the Autochange function is disabled, the first auxiliary motor is the one connected to the first relay with a parameter setting = 31 PFC, and so on. If the Autochange function is used, the assignments rotate. Initially, the speed regulated motor is the one connected to the first relay with a parameter setting = 31 PFC, the first auxiliary motor is the one connected to the second relay with a parameter setting = 31 PFC, and so on.  Standard PFC mode PFC with Autochange mode • The fourth auxiliary motor uses the same reference step, low frequency and start frequency values as the third auxiliary motor.

Code	Description

- The table below shows the ACS550 PFC motor assignments for some typical settings in the Relay Output parameters (1401…1403 and 1410…1412), where the settings are either =31 (PFC), or =X (anything but 31), and where the Autochange function is disabled (8118 AUTOCHNG INTERV = 0.0).

Parameter setting							ACS550 Relay assignment					
							Autochange disabled					
1401	**1402**	**1403**	**1410**	**1411**	**1412**	**8117**	**RO1**	**RO2**	**RO3**	**RO4**	**RO5**	**RO6**
31	X	X	X	X	X	1	Aux.	X	X	X	X	X
31	31	X	X	X	X	2	Aux.	Aux.	X	X	X	X
31	31	31	X	X	X	3	Aux.	Aux.	Aux.	X	X	X
X	31	31	X	X	X	2	X	Aux.	Aux.	X	X	X
X	X	X	31	X	31	2	X	X	X	Aux.	X	Aux.
31	31	X	X	X	X	1*	Aux.	Aux.	X	X	X	X

* = One additional relay output for the PFC that is in use. One motor is in "sleep" when the other is rotating.

- The table below shows the ACS550 PFC motor assignments for some typical settings in the Relay Output parameters (1401…1403 and 1410…1412), where the settings are either =31 (PFC), or =X (anything but 31), and where the Autochange function is enabled (8118 AUTOCHNG INTERV = value > 0.0).

Parameter setting							ACS550 Relay assignment					
							Autochange enabled					
1401	**1402**	**1403**	**1410**	**1411**	**1412**	**8117**	**RO1**	**RO2**	**RO3**	**RO4**	**RO5**	**RO6**
31	31	X	X	X	X	1	PFC	PFC	X	X	X	X
31	31	31	X	X	X	2	PFC	PFC	PFC	X	X	X
X	31	31	X	X	X	1	X	PFC	PFC	X	X	X
X	X	X	31	X	31	1	X	X	X	PFC	X	PFC
31	31	X	X	X	X	0**	PFC	PFC	X	X	X	X

** = No auxiliary motors, but the autochange function is in use. Working as a standard PID-control.

8118 **AUTOCHNG INTERV**

Controls operation of the Autochange function and sets the interval between changes.

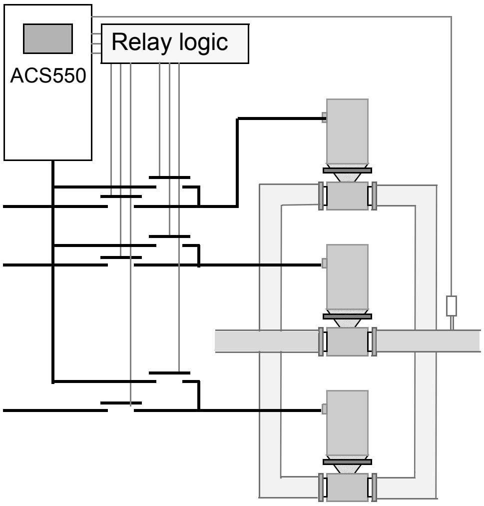
- The Autochange time interval only applies to the time when the speed regulated motor is running.
- See parameter 8119 AUTOCHNG LEVEL for an overview of the Autochange function.
- The drive always coasts to stop when autochange is performed.
- Autochange enabled requires parameter 8120 INTERLOCKS = value > 0.

-0.1 = TEST MODE – Forces the interval to value 36…48 s.

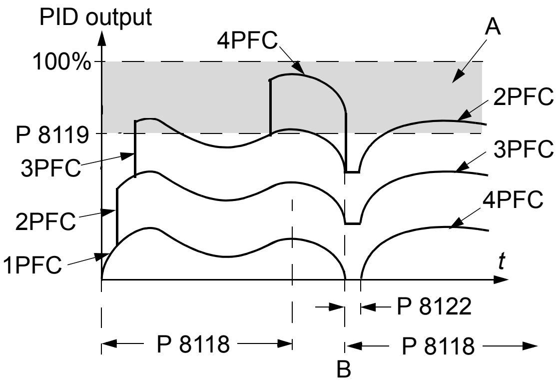
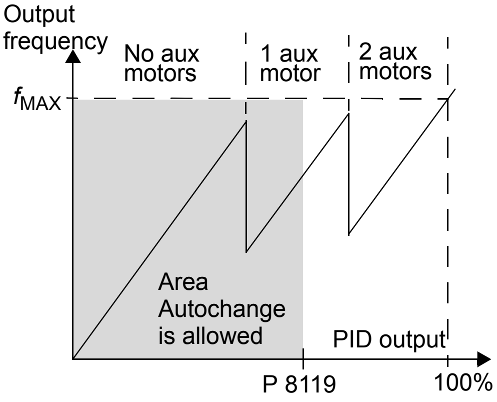
0.0 = NOT SEL – Disables the Autochange function.

0.1…336 – The operating time interval (the time when the start signal is on) between automatic motor changes.

WARNING! When enabled, the Autochange function requires the interlocks (8120 INTERLOCKS = value > 0) enabled. During autochange the power output is interrupted and the drive coasts to stop, preventing damage to the contacts.



PFC with Autochange mode

Code	Description
8119	**AUTOCHNG LEVEL** Sets an upper limit, as a percent of output capacity, for the autochange logic. When the output from the PID/PFC control block exceeds this limit, autochange is prevented. For example, use this parameter to deny autochange when the Pump-Fan system is operating near maximum capacity. **Autochange overview** The purpose of the autochange operation is to equalize duty time between multiple motors used in a system. At each autochange operation: • A different motor takes a turn connected to the ACS550 output – the speed regulated motor. • The starting order of the other motors rotates. The Autochange function requires: • External switchgear for changing the drive's output power connections. • Parameter 8120 INTERLOCKS = value > 0. Autochange is performed when: • The running time since the previous autochange reaches the time set by 8118 AUTOCHNG INTERV. • The PFC input is below the level set by this parameter, 8119 AUTOCHNG LEVEL. **Note:** The ACS550 always coasts to stop when autochange is performed. In an autochange, the Autochange function does all of the following (see the figure): • Initiates a change when the running time, since the last autochange, reaches 8118 AUTOCHNG INTERV, and PFC input is below limit 8119 AUTOCHNG LEVEL. • Stops the speed regulated motor. • Switches off the contactor of the speed regulated motor. • Increments the starting order counter, to change the starting order for the motors. • Identifies the next motor in line to be the speed regulated motor. • Switches off the above motor's contactor, if the motor was running. Any other running motors are not interrupted. • Switches on the contactor of the new speed regulated motor. The autochange switchgear connects this motor to the ACS550 power output. • Delays motor start for the time 8122 PFC START DELAY. • Starts the speed regulated motor. • Identifies the next constant speed motor in the rotation. • Switches the above motor on, but only if the new speed regulated motor had been running (as a constant speed motor) – This step keeps an equal number of motors running before and after autochange. • Continues with normal PFC operation.  A = Area above 8119 AUTOCHNG LEVEL – autochange not allowed. B = Autochange occurs. 1PFC, etc. = PID output associated with each motor. **Starting order counter** The operation of the starting-order counter: • The relay output parameter definitions (1401…1403 and 1410…1412) establish the initial motor sequence. (The lowest parameter number with a value 31 (PFC) identifies the relay connected to 1PFC, the first motor, and so on.) • Initially, 1PFC = speed regulated motor, 2PFC = 1st auxiliary motor, etc. • The first autochange shifts the sequence to: 2PFC = speed regulated motor, 3PFC = 1st auxiliary motor, …, 1PFC = last auxiliary motor. • The next autochange shifts the sequence again, and so on. • If the autochange cannot start a needed motor because all inactive motors are interlocked, the drive displays an alarm (2015, PFC I LOCK). • When ACS550 power supply is switched off, the counter preserves the current Autochange rotation positions in permanent memory. When power is restored, the Autochange rotation starts at the position stored in memory. • If the PFC relay configuration is changed (or if the PFC enable value is changed), the rotation is reset. (See the first bullet above.) 

Code	Description
8120	**INTERLOCKS** Defines operation of the Interlock function. When the Interlock function is enabled: • An interlock is active when its command signal is absent. • An interlock is inactive when its command signal is present. • The ACS550 will not start if a start command occurs when the speed regulated motor's interlock is active – the control panel displays an alarm (2015, PFC I LOCK). Wire each Interlock circuit as follows: • Wire a contact of the motor's On/Off switch to the Interlock circuit – the drive's PFC logic can then recognize that the motor is switched off and start the next available motor. • Wire a contact of the motor thermal relay (or other protective device in the motor circuit) to the Interlock input – the drive's PFC logic can then recognize that a motor fault is activated and stop the motor. 0 = NOT SEL – Disables the Interlock function. All digital inputs are available for other purposes. • Requires 8118 AUTOCHNG INTERV = 0.0 (The Autochange function must be disabled if Interlock function is disabled.) 1 = DI1 – Enables the Interlock function and assigns a digital input (starting with DI1) to the interlock signal for each PFC relay. These assignments are defined in the following table and depend on: • the number of PFC relays [number of parameters 1401…1403 and 1410…1412 with value = 31 (PFC)] • the Autochange function status (disabled if 8118 AUTOCHNG INTERV = 0.0, and otherwise enabled).

No. PFC relays	Autochange disabled (P 8118)	Autochange enabled (P 8118)
0	DI1: Speed Reg Motor DI2…DI6: Free	Not allowed
1	DI1: Speed Reg Motor DI2: First PFC Relay DI3…DI6: Free	DI1: First PFC Relay DI2…DI6: Free
2	DI1: Speed Reg Motor DI2: First PFC Relay DI3: Second PFC Relay DI4…DI6: Free	DI1: First PFC Relay DI2: Second PFC Relay DI3…DI6: Free
3	DI1: Speed Reg Motor DI2: First PFC Relay DI3: Second PFC Relay DI4: Third PFC Relay DI5…DI6: Free	DI1: First PFC Relay DI2: Second PFC Relay DI3: Third PFC Relay DI4…DI6: Free
4	DI1: Speed Reg Motor DI2: First PFC Relay DI3: Second PFC Relay DI4: Third PFC Relay DI5: Fourth PFC Relay DI6: Free	DI1: First PFC Relay DI2: Second PFC Relay DI3: Third PFC Relay DI4: Fourth PFC Relay DI5…DI6: Free
5	DI1: Speed Reg Motor DI2: First PFC Relay DI3: Second PFC Relay DI4: Third PFC Relay DI5: Fourth PFC Relay DI6: Fifth PFC Relay	DI1: First PFC Relay DI2: Second PFC Relay DI3: Third PFC Relay DI4: Fourth PFC Relay DI5: Fifth PFC Relay DI6: Free
6	Not allowed	DI1: First PFC Relay DI2: Second PFC Relay DI3: Third PFC Relay DI4: Fourth PFC Relay DI5: Fifth PFC Relay DI6: Sixth PFC Relay

<table>
<tr><th>Code</th><th>Description</th></tr>
<tr><td></td><td>
2 = DI2 – Enables the Interlock function and assigns a digital input (starting with DI2) to the interlock signal for each PFC relay. These assignments are defined in the following table and depend on:
• the number of PFC relays [number of parameters 1401…1403 and 1410…1412 with value = 31 (PFC)]
• the Autochange function status (disabled if 8118 AUTOCHNG INTERV = 0.0, and otherwise enabled).
<table>
<tr><th>No. PFC relays</th><th>Autochange disabled (P 8118)</th><th>Autochange enabled (P 8118)</th></tr>
<tr><td>0</td><td>DI1: Free
DI2: Speed Reg Motor
DI3…DI6: Free</td><td>Not allowed</td></tr>
<tr><td>1</td><td>DI1: Free
DI2: Speed Reg Motor
DI3: First PFC Relay
DI4…DI6: Free</td><td>DI1: Free
DI2: First PFC Relay
DI3…DI6: Free</td></tr>
<tr><td>2</td><td>DI1: Free
DI2: Speed Reg Motor
DI3: First PFC Relay
DI4: Second PFC Relay
DI5…DI6: Free</td><td>DI1: Free
DI2: First PFC Relay
DI3: Second PFC Relay
DI4…DI6: Free</td></tr>
<tr><td>3</td><td>DI1: Free
DI2: Speed Reg Motor
DI3: First PFC Relay
DI4: Second PFC Relay
DI5: Third PFC Relay
DI6: Free</td><td>DI1: Free
DI2: First PFC Relay
DI3: Second PFC Relay
DI4: Third PFC Relay
DI5…DI6: Free</td></tr>
<tr><td>4</td><td>DI1: Free
DI2: Speed Reg Motor
DI3: First PFC Relay
DI4: Second PFC Relay
DI5: Third PFC Relay
DI6: Fourth PFC Relay</td><td>DI1: Free
DI2: First PFC Relay
DI3: Second PFC Relay
DI4: Third PFC Relay
DI5: Fourth PFC Relay
DI6: Free</td></tr>
<tr><td>5</td><td>Not allowed</td><td>DI1: Free
DI2: First PFC Relay
DI3: Second PFC Relay
DI4: Third PFC Relay
DI5: Fourth PFC Relay
DI6: Fifth PFC Relay</td></tr>
<tr><td>6</td><td>Not allowed</td><td>Not allowed</td></tr>
</table>
</td></tr>
</table>

Code	Description

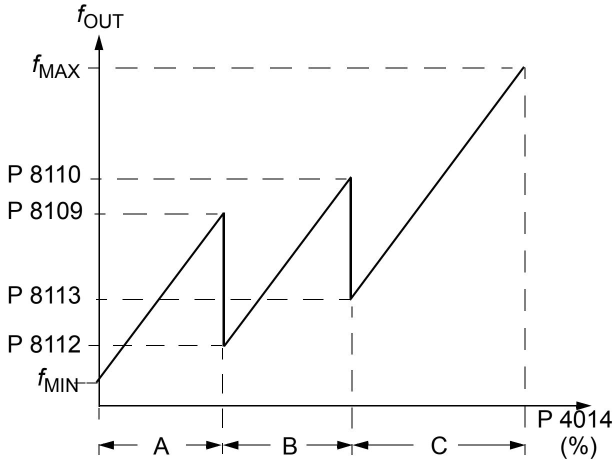
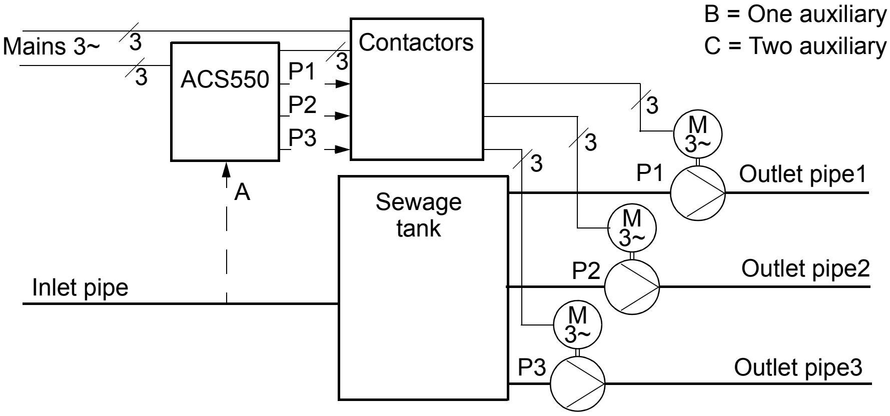
3 = DI3 – Enables the Interlocks function and assigns a digital input (starting with DI3) to the interlock signal for each PFC relay. These assignments are defined in the following table and depend on:
- the number of PFC relays [number of parameters 1401…1403 and 1410…1412 with value = 31 (PFC)]
- the Autochange function status (disabled if 8118 AUTOCHNG INTERV = 0.0, and otherwise enabled).

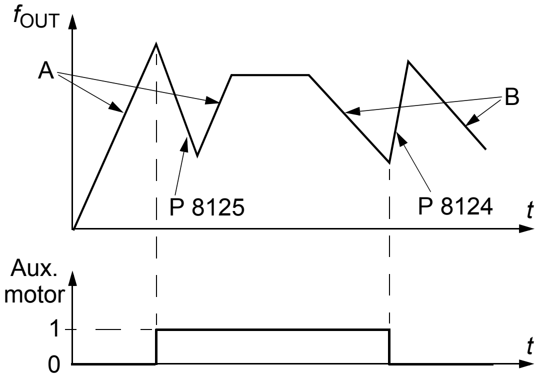
No. PFC relays	Autochange disabled (P 8118)	Autochange enabled (P 8118)
0	DI1…DI2: Free DI3: Speed Reg Motor DI4…DI6: Free	Not allowed
1	DI1…DI2: Free DI3: Speed Reg Motor DI4: First PFC Relay DI5…DI6: Free	DI1…DI2: Free DI3: First PFC Relay DI4…DI6: Free
2	DI1…DI2: Free DI3: Speed Reg Motor DI4: First PFC Relay DI5: Second PFC Relay DI6: Free	DI1…DI2: Free DI3: First PFC Relay DI4: Second PFC Relay DI5…DI6: Free
3	DI1…DI2: Free DI3: Speed Reg Motor DI4: First PFC Relay DI5: Second PFC Relay DI6: Third PFC Relay	DI1…DI2: Free DI3: First PFC Relay DI4: Second PFC Relay DI5: Third PFC Relay DI6: Free
4	Not allowed	DI1…DI2: Free DI3: First PFC Relay DI4: Second PFC Relay DI5: Third PFC Relay DI6: Fourth PFC Relay
5…6	Not allowed	Not allowed

4 = DI4 – Enables the Interlock function and assigns a digital input (starting with DI4) to the interlock signal for each PFC relay. These assignments are defined in the following table and depend on:
- the number of PFC relays [number of parameters 1401…1403 and 1410…1412 with value = 31 (PFC)]
- the Autochange function status (disabled if 8118 AUTOCHNG INTERV = 0.0, and otherwise enabled).

No. PFC relays	Autochange disabled (P 8118)	Autochange enabled (P 8118)
0	DI1…DI3: Free DI4: Speed Reg Motor DI5…DI6: Free	Not allowed
1	DI1…DI3: Free DI4: Speed Reg Motor DI5: First PFC Relay DI6: Free	DI1…DI3: Free DI4: First PFC Relay DI5…DI6: Free
2	DI1…DI3: Free DI4: Speed Reg Motor DI5: First PFC Relay DI6: Second PFC Relay	DI1…DI3: Free DI4: First PFC Relay DI5: Second PFC Relay DI6: Free
3	Not allowed	DI1…DI3: Free DI4: First PFC Relay DI5: Second PFC Relay DI6: Third PFC Relay
4…6	Not allowed	Not allowed

<table>
<tr><th>Code</th><th>Description</th></tr>
<tr><td></td><td>
5 = DI5 – Enables the Interlock function and assigns a digital input (starting with DI5) to the interlock signal for each PFC relay. These assignments are defined in the following table and depend on:
• the number of PFC relays [number of parameters 1401…1403 and 1410…1412 with value = 31 (PFC)]
• the Autochange function status (disabled if 8118 AUTOCHNG INTERV = 0.0, and otherwise enabled).
<table>
<tr><th>No. PFC relays</th><th>Autochange disabled (P 8118)</th><th>Autochange enabled (P 8118)</th></tr>
<tr><td>0</td><td>DI1…DI4: Free
DI5: Speed Reg Motor
DI6: Free</td><td>Not allowed</td></tr>
<tr><td>1</td><td>DI1…DI4: Free
DI5: Speed Reg Motor
DI6: First PFC Relay</td><td>DI1…DI4: Free
DI5: First PFC Relay
DI6: Free</td></tr>
<tr><td>2</td><td>Not allowed</td><td>DI1…DI4: Free
DI5: First PFC Relay
DI6: Second PFC Relay</td></tr>
<tr><td>3…6</td><td>Not allowed</td><td>Not allowed</td></tr>
</table>
6 = DI6 – Enables the Interlock function and assigns digital input DI6 to the interlock signal for the speed regulated motor.
• Requires 8118 AUTOCHNG INTERV = 0.0.
<table>
<tr><th>No. PFC relays</th><th>Autochange disabled</th><th>Autochange enabled</th></tr>
<tr><td>0</td><td>DI1…DI5: Free
DI6: Speed Reg Motor</td><td>Not allowed</td></tr>
<tr><td>1</td><td>Not allowed</td><td>DI1…DI5: Free
DI6: First PFC Relay</td></tr>
<tr><td>2…6</td><td>Not allowed</td><td>Not allowed</td></tr>
</table>
</td></tr>
</table>

Code	Description
8121	**REG BYPASS CTRL** Selects Regulator by-pass control. When enabled, Regulator by-pass control provides a simple control mechanism without a PID regulator. • Use Regulator by-pass control only in special applications. 0 = NO – Disables Regulator by-pass control. The drive uses the normal PFC reference: 1106 REF2 SELECT. 1 = YES – Enables Regulator by-pass control. • The process PID regulator is bypassed. Actual value of PID is used as the PFC reference (input). Normally EXT REF2 is used as the PFC reference. • The drive uses the feedback signal defined by 4014 FBK SEL (or 4114) for the PFC frequency reference. • The figure shows the relation between the control signal 4014 FBK SEL (OR 4114) and the speed regulated motor's frequency in a three-motor system. **Example:** In the diagram below, the pumping station's outlet flow is controlled by the measured inlet flow (A).  A = No auxiliary motors running B = One auxiliary motor running C = Two auxiliary motors running 
8122	**PFC START DELAY** Sets the start delay for speed regulated motors in the system. Using the delay, the drive works as follows: • Switches on the contactor of the speed regulated motor – connecting the motor to the ACS550 power output. • Delays motor start for the time 8122 PFC START DELAY. • Starts the speed regulated motor. • Starts auxiliary motors. See parameter 8115 for delay. ⚠ **WARNING!** Motors equipped with star-delta starters require a PFC Start Delay. • After the ACS550 relay output switches a motor on, the star-delta starter must switch to the star-connection and then back to the delta-connection before the drive applies power. • So, the PFC Start Delay must be longer than the time setting of the star-delta starter.
8123	**PFC ENABLE** Selects PFC control. When enabled, PFC control: • Switches in, or out, auxiliary constant speed motors as output demand increases or decreases. Parameters 8109 START FREQ 1 to 8114 LOW FREQ 3 define the switch points in terms of the drive output frequency. • Adjusts the speed regulated motor output down, as auxiliary motors are added, and adjusts the speed regulated motor output up, as auxiliary motors are taken off line. • Provides Interlock functions, if enabled. • Requires 9904 MOTOR CTRL MODE = 3 (SCALAR:FREQ). 0 = NOT SEL – Disables PFC control. 1 = ACTIVE – Enables PFC control.

<table>
<tr><th>Code</th><th colspan="2">Description</th></tr>
<tr><td>8124</td><td>ACC IN AUX STOP
Sets the PFC acceleration time for a zero-to-maximum frequency ramp. This PFC acceleration ramp:
• Applies to the speed regulated motor, when an auxiliary motor is switched off.
• Replaces the acceleration ramp defined in <i>Group 22: ACCEL/DECEL</i>.
• Applies only until the output of the regulated motor increases by an amount equal to the output of the switched off auxiliary motor. Then the acceleration ramp defined in <i>Group 22: ACCEL/DECEL</i> applies.
0 = NOT SEL.
0.1…1800 – Activates this function using the value entered as the acceleration time.</td><td rowspan="2">

• A = speed regulated motor accelerating using <i>Group 22: ACCEL/DECEL</i> parameters (2202 or 2205).
• B = speed regulated motor decelerating using <i>Group 22: ACCEL/DECEL</i> parameters (2203 or 2206).
• At aux. motor start, speed regulated motor decelerates using 8125 DEC IN AUX START.
• At aux. motor stop, speed regulated motor accelerates using 8124 ACC IN AUX STOP.</td></tr>
<tr><td>8125</td><td>DEC IN AUX START
Sets the PFC deceleration time for a maximum-to-zero frequency ramp. This PFC deceleration ramp:
• Applies to the speed regulated motor, when an auxiliary motor is switched on.
• Replaces the deceleration ramp defined in <i>Group 22: ACCEL/DECEL</i>.
• Applies only until the output of the regulated motor decreases by an amount equal to the output of the auxiliary motor. Then the deceleration ramp defined in <i>Group 22: ACCEL/DECEL</i> applies.
0 = NOT SEL.
0.1…1800 – Activates this function using the value entered as the deceleration time.</td></tr>
<tr><td>8126</td><td colspan="2">TIMED AUTOCHNG
Sets the autochange using a Timed function. See parameter 8119 AUTOCHNG LEVEL.
0 = NOT SEL.
1 = TIMED FUNC 1 – Enables autochange when Timed function 1 is active.
2…4 = TIMED FUNC 2…4 – Enables autochange when Timed function 2…4 is active.</td></tr>
<tr><td>8127</td><td colspan="2">MOTORS
Sets the actual number of PFC controlled motors (maximum 7 motors, 1 speed regulated, 3 connected direct-on-line and 3 spare motors).
• This value includes also the speed regulated motor.
• This value must be compatible with the number of relays allocated to PFC if the Autochange function is used.
• If Autochange function is not used, the speed regulated motor does not need to have a relay output allocated to PFC but it needs to be included in this value.</td></tr>
<tr><td>8128</td><td colspan="2">AUX START ORDER
Sets the start order of the auxiliary motors.
1 = EVEN RUNTIME – Time sharing is active. Evens out the cumulative run time of the auxiliary motors. The start order depends on the run time: The auxiliary motor whose cumulative run time is shortest is started first, then the motor whose cumulative run time is the second shortest etc. When the demand drops, the first motor to be stopped is the one whose cumulative run time is longest.
2 = RELAY ORDER – The start order is fixed to be the order of the relays.</td></tr>
</table>

Group 98: OPTIONS

This group configures for options, in particular, enabling serial communication with the drive.

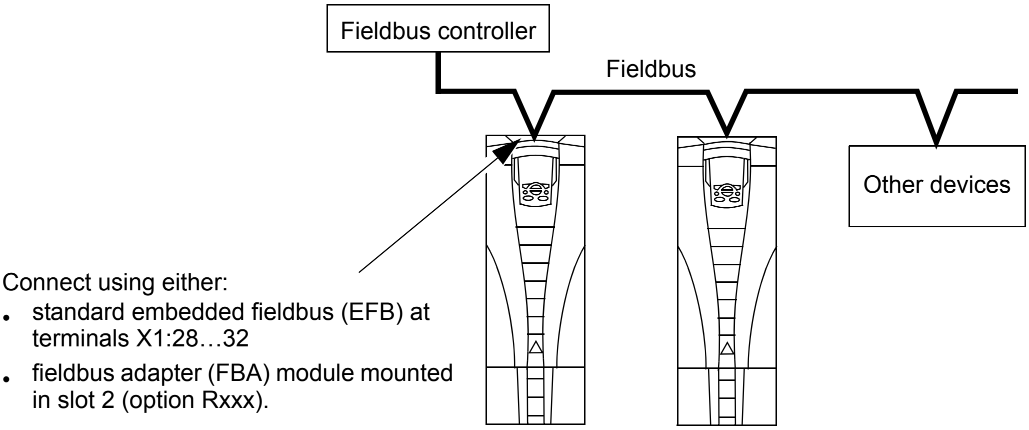
Code	Description
9802	**COMM PROT SEL** Selects the communication protocol. 0 = NOT SEL – No communication protocol selected. 1 = STD MODBUS – The drive communicates with Modbus via the RS485 channel (X1-communications, terminal). • See also *Group 53: EFB PROTOCOL*. 4 = EXT FBA – The drive communicates via a fieldbus adapter module in option slot 2 of the drive. • See also *Group 51: EXT COMM MODULE*.

Embedded fieldbus

Overview

The ACS550 can be set up to accept control from an external system using standard serial communication protocols. When using serial communication, the ACS550 can either:

- receive all of its control information from the fieldbus, or
- be controlled from some combination of fieldbus control and other available control locations, such as digital or analog inputs and the control panel.



Two basic serial communications configurations are available:

- embedded fieldbus (EFB) – Using the RS485 interface at terminals X1:28…32 on the control board, a control system can communicate with the drive using the Modbus® protocol. (For protocol and profile descriptions, see sections *Modbus protocol technical data* and *ABB control profiles technical data* later in this chapter.)
- fieldbus adapter (FBA) – See chapter *Fieldbus adapter* on page *231*.

Control interface

In general, the basic control interface between Modbus and the drive consists of:

- Output words
  - Control Word
  - Reference1
  - Reference2
- Input words
  - Status Word
  - Actual value 1
  - Actual value 2

- Actual value 3
- Actual value 4
- Actual value 5
- Actual value 6
- Actual value 7
- Actual value 8

The content of these words is defined by profiles. For details on the profiles used, sees section *ABB control profiles technical data* on page *219*.

Note: The words "output" and "input" are used as seen from the fieldbus controller point of view. For example an output describes data flow from the fieldbus controller to the drive and appears as an input from the drive point of view.

Planning

Network planning should address the following questions:

- What types and quantities of devices must be connected to the network?
- What control information must be sent down to the drives?
- What feedback information must be sent from the drives to the controlling system?

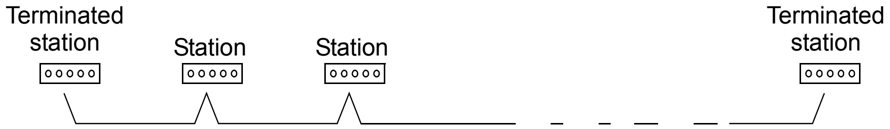
Mechanical and electrical installation – EFB

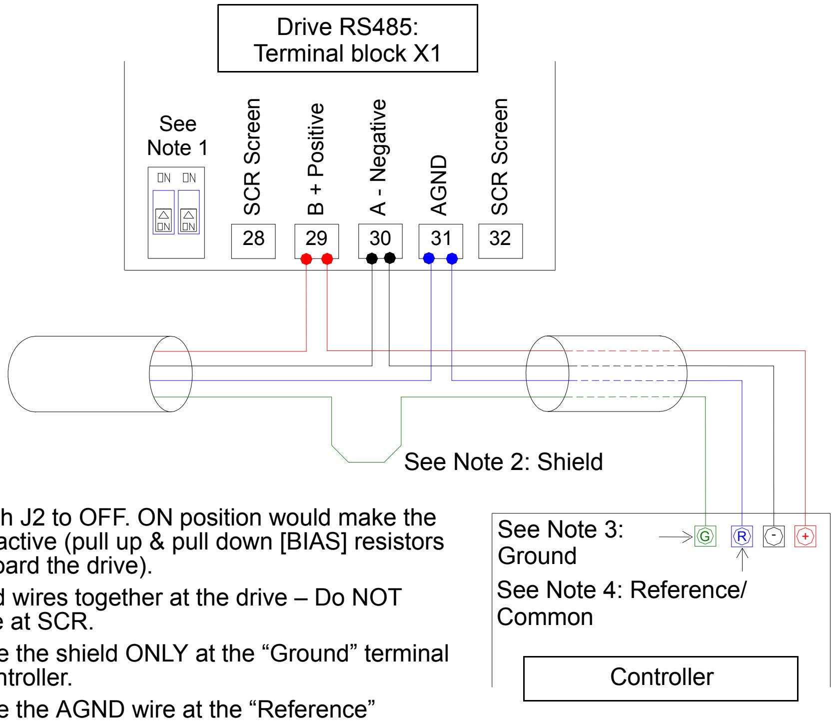
WARNING! Connections should be made only while the drive is disconnected from the power source.

Drive terminals 28...32 are for RS485 communications.

- Use Belden 9842 or equivalent. Belden 9842 is a dual twisted, shielded pair cable with a wave impedance of 120 ohm.
- Use one of these twisted shielded pairs for the RS485 link. Use this pair to connect all A (-) terminals together and all B (+) terminals together.
- Use one of the wires in the other pair for the logical ground (terminal 31), leaving one wire unused.
- Do not directly ground the RS485 network at any point. Ground all devices on the network using their corresponding earthing terminals.
- As always, the grounding wires should not form any closed loops, and all the devices should be earthed to a common ground.
- Connect the RS485 link in a daisy-chained bus, without dropout lines.

- To reduce noise on the network, terminate the RS485 network using 120 Ω resistors at both ends of the network. Use the DIP switch to connect or disconnect the termination resistors. See the following diagram.





Notes:

1. Set switch J2 to OFF. ON position would make the network active (pull up & pull down [BIAS] resistors are on board the drive).
2. Tie shield wires together at the drive – Do NOT terminate at SCR.
3. Terminate the shield ONLY at the "Ground" terminal in the controller.
4. Terminate the AGND wire at the "Reference" terminal in the controller.

- For configuration information see the following sections:
  - *Communication set-up – EFB* on page *201*
  - *Activate drive control functions – EFB* on page *203*
  - The appropriate EFB protocol specific technical data. For example, *Modbus protocol technical data* on page *211*.

Communication set-up – EFB

Serial communication selection

To activate the serial communication, set parameter 9802 COMM PROT SEL = 1 (STD MODBUS).

Note: If you cannot see the desired selection on the panel, your drive does not have that protocol software in the application memory.

Serial communication configuration

Setting 9802 automatically sets the appropriate default values in parameters that define the communication process. These parameters and descriptions are defined below. In particular, note that the station Id may require adjustment.

Code	Description	Protocol reference
		Modbus
5301	EFB PROTOCOL ID Contains the identification and program revision of the protocol.	Do not edit. Any non-zero value entered for parameter 9802 COMM PROT SEL, sets this parameter automatically. The format is: XXYY, where XX = protocol ID, and YY = program revision.
5302	EFB STATION ID Defines the node address of the RS485 link.	Set each drive on the network with a unique value for this parameter. When this protocol is selected, the default value for this parameter is: 1
	Note: For a new address to take affect, the drive power must be cycled **or** 5302 must first be set to 0 before selecting a new address. Leaving 5302 = 0 places the RS485 channel in reset, disabling communication.	
5303	EFB BAUD RATE Defines the communication speed of the RS485 link in kbits per second (kbits/s). 1.2 kb/s 2.4 kb/s 4.8 kb/s 9.6 kb/s 19.2 kb/s 38.4 kb/s 57.6 kb/s 76.8 kb/s	When this protocol is selected, the default value for this parameter is: 9.6
5304	EFB PARITY Defines the data length, parity and stop bits to be used with the RS485 communication. • The same settings must be used in all on-line stations. 0 = 8 NONE 1 – 8 data bits, no parity, one stop bit. 1 = 8 NONE 2 – 8 data bits, no parity, two stop bits. 2 = 8 EVEN 1 – 8 data bits, even parity, one stop bit. 3 = 8 ODD 1 – 8 data bits, odd parity, one stop bit.	When this protocol is selected, the default value for this parameter is: 1
5305	EFB CTRL PROFILE Selects the communication profile used by the EFB protocol. 0 = ABB DRV LIM – Operation of Control/Status Words conforms to ABB Drives Profile, as used in ACS400. 1 = DCU PROFILE – Operation of Control/Status Words conforms to 32-bit DCU Profile. 2 = ABB DRV FULL – Operation of Control/Status Words conforms to ABB Drives Profile, as used in ACS600/800.	When this protocol is selected, the default value for this parameter is: 0

Note: After any changes to the communication settings, the protocol must be reactivated by either cycling the drive power, or by clearing and then restoring the station Id (5302).

Activate drive control functions – EFB

Controlling the drive

Fieldbus control of various drive functions requires configuration to:

- tell the drive to accept fieldbus control of the function
- define as a fieldbus input, any drive data required for control
- define as a fieldbus output, any control data required by the drive.

The following sections describe, at a general level, the configuration required for each control function. For the protocol-specific details, see the document supplied with the FBA module.

Start/Stop Direction control

Using the fieldbus for start/stop/direction control of the drive requires:

- drive parameter values set as defined below
- fieldbus controller supplied command(s) in the appropriate location. (The location is defined by the Protocol Reference, which is protocol dependent.)

Drive parameter		Value	Description	Modbus[1] protocol reference	
				ABB DRV	DCU PROFILE
1001	EXT1 COMMANDS	10 (COMM)	Start/Stop by fieldbus with Ext1 selected.	40001 bits 0…3	40031 bits 0, 1
1002	EXT2 COMMANDS	10 (COMM)	Start/Stop by fieldbus with Ext2 selected.	40001 bits 0…3	40031 bits 0, 1
1003	DIRECTION	3 (REQUEST)	Direction by fieldbus.	4002/4003[2]	40031 bit 3

[1] For Modbus, the protocol reference can depend on the profile used, hence two columns in these tables. One column refers to the ABB Drives profile, selected when parameter 5305 = 0 (ABB DRV LIM) or 5305 = 2 (ABB DRV FULL). The other column refers to the DCU profile selected when parameter 5305 = 1 (DCU PROFILE). See section *ABB control profiles technical data* on page *219*.

[2] The reference provides direction control – a negative reference provides reverse rotation.

Input reference select

Using the fieldbus to provide input references to the drive requires:

- drive parameter values set as defined below
- fieldbus controller supplied reference word(s) in the appropriate location. (The location is defined by the Protocol Reference, which is protocol dependent.)

Drive parameter		**Value**	**Description**	**Modbus protocol reference**	
				ABB DRV	**DCU PROFILE**
1102	EXT1/EXT2 SEL	8 (COMM)	Reference set selection by fieldbus.	40001 bit 11	40031 bit 5
1103	REF1 SELECT	8 (COMM)	Input reference 1 by fieldbus.	40002	
1106	REF2 SELECT	8 (COMM)	Input reference 2 by fieldbus.	40003	

Reference Scaling

Where required, REFERENCES can be scaled. See the following, as appropriate:

- Modbus Register *40002* in section *Modbus protocol technical data* on page *211*
- *Reference scaling* in section *ABB control profiles technical data* on page *219*.

Miscellaneous drive control

Using the fieldbus for miscellaneous drive control requires:

- drive parameter values set as defined below
- fieldbus controller supplied command(s) in the appropriate location. (The location is defined by the Protocol Reference, which is protocol dependent.)

Drive parameter		**Value**	**Description**	**Modbus protocol reference**	
				ABB DRV	**DCU PROFILE**
1601	RUN ENABLE	7 (COMM)	Run enable by fieldbus.	40001 bit 3	40031 bit 6 (inverted)
1604	FAULT RESET SEL	8 (COMM)	Fault reset by fieldbus.	40001 bit 7	40031 bit 4
1606	LOCAL LOCK	8 (COMM)	Source for local lock selection is the fieldbus.	Does not apply	40031 bit 14
1607	PARAM SAVE	1 (SAVE)	Saves altered parameters to memory (then value returns to 0).	41607	
1608	START ENABLE 1	7 (COMM)	Source for start enable 1 is the fieldbus Command word.	Does not apply.	40032 bit 2
1609	START ENABLE 2	7 (COMM)	Source for start enable 2 is the fieldbus Command word.		40032 bit 3
2013	MIN TORQUE SEL	7 (COMM)	Source for minimum torque selection is the fieldbus.		40031 bit 15
2014	MAX TORQUE SEL	7 (COMM)	Source for maximum torque selection is the fieldbus.		
2201	ACC/DEC 1/2 SEL	7 (COMM)	Source for ramp pair selection is the fieldbus.		40031 bit 10

Relay output control

Using the fieldbus for relay output control requires:

- drive parameter values set as defined below
- fieldbus controller supplied, binary coded, relay command(s) in the appropriate location. (The location is defined by the Protocol Reference, which is protocol dependent.)

Drive parameter		**Value**	**Description**	**Modbus protocol reference**	
				ABB DRV	**DCU PROFILE**
1401	RELAY OUTPUT 1	35 (COMM)	Relay Output 1 controlled by fieldbus.	40134 bit 0 or 00033	
1402	RELAY OUTPUT 2	35 (COMM)	Relay Output 2 controlled by fieldbus.	40134 bit 1 or 00034	
1403	RELAY OUTPUT 3	35 (COMM)	Relay Output 3 controlled by fieldbus.	40134 bit 2 or 00035	
1410[1]	RELAY OUTPUT 4	35 (COMM)	Relay Output 4 controlled by fieldbus.	40134 bit 3 or 00036	
1411[1]	RELAY OUTPUT 5	35 (COMM)	Relay Output 5 controlled by fieldbus.	40134 bit 4 or 00037	
1412[1]	RELAY OUTPUT 6	35 (COMM)	Relay Output 6 controlled by fieldbus.	40134 bit 5 or 00038	

[1] More than 3 relays requires the addition of a relay extension module.

Note: Relay status feedback occurs without configuration as defined below.

Drive parameter		**Description**	**Modbus protocol reference**	
			ABB DRV	**DCU PROFILE**
0122	RO 1-3 STATUS	Relay 1…3 status.	40122	
0123	RO 4-6 STATUS	Relay 4…6 status.	40123	

Analog output control

Using the fieldbus for analog output control (e.g. PID setpoint) requires:

- drive parameter values set as defined below
- fieldbus controller supplied analog value(s) in the appropriate location. (The location is defined by the Protocol Reference, which is protocol dependent.)

Drive parameter		**Value**	**Description**	**Modbus protocol reference**	
				ABB DRV	**DCU PROFILE**
1501	AO1 CONTENT SEL	135 (COMM VALUE 1)	Analog Output 1 controlled by writing to parameter 0135.	–	
0135	COMM VALUE 1	–		40135	
1507	AO2 CONTENT SEL	136 (COMM VALUE 2)	Analog Output 2 controlled by writing to parameter 0136.	–	
0136	COMM VALUE 2	–		40136	

PID control setpoint source

Using the following settings to select the fieldbus as the setpoint source for PID loops:

Drive parameter		Value	Description	Modbus protocol reference	
				ABB DRV	DCU PROFILE
4010	SET POINT SEL (Set 1)	8 (COMM VALUE 1) 9 (COMM+AI1) 10 (COMM*AI1)	Setpoint is input reference 2 (+/-/* AI1)	40003	
4110	SET POINT SEL (Set 2)				
4210	SET POINT SEL (Ext/Trim)				

Communication fault

When using fieldbus control, specify the drive’s action if serial communication is lost.

Drive parameter		Value	Description
3018	COMM FAULT FUNC	0 (NOT SEL) 1 (FAULT) 2 (CONST SP7) 3 (LAST SPEED)	Set for appropriate drive response.
3019	COMM FAULT TIME	Set time delay before acting on a communication loss.	

Feedback from the drive – EFB

Pre-defined feedback

Inputs to the controller (drive outputs) have pre-defined meanings established by the protocol. This feedback does not require drive configuration. The following table lists a sample of feedback data. For a complete listing, see input word/point/object listings in the technical data for the appropriate protocol starting on page 211.

Drive parameter		Modbus protocol reference	
		ABB DRV	DCU PROFILE
0102	SPEED	40102	
0103	OUTPUT FREQ	40103	
0104	CURRENT	40104	
0105	TORQUE	40105	
0106	POWER	40106	
0107	DC BUS VOLTAGE	40107	
0109	OUTPUT VOLTAGE	40109	
0301	FB CMD WORD1 – bit 0 (STOP)	40301 bit 0	
0301	FB CMD WORD1 1 – bit 2 (REV)	40301 bit 2	
0118	DI 1-3 STATUS – bit 0 (DI3)	40118	

Note: With Modbus, any parameter can be accessed using the format: "4" followed by the parameter number.

Actual value scaling

The scaling of actual values can be protocol dependent. In general, for Actual Values, scale the feedback integer using the parameter's resolution. (See section *Complete parameter list* on page 87 for parameter resolutions.) For example:

Feedback integer	Parameter resolution	(Feedback integer) · (Parameter resolution) = Scaled value
1	0.1 mA	1 · 0.1 mA = 0.1 mA
10	0.1%	10 · 0.1% = 1%

Where parameters are in percent, the *Complete parameter descriptions* section specifies what parameter corresponds to 100%. In such cases, to convert from percent to engineering units, multiply by the value of the parameter that defines 100% and divide by 100%.

For example:

Feedback integer	**Parameter resolution**	**Value of the parameter that defines 100%**	**(Feedback integer) · (Parameter resolution) · (Value of 100% ref.) / 100% = Scaled value**
10	0.1%	1500 rpm[1]	10 · 0.1% · 1500 RPM / 100% = 15 rpm
100	0.1%	500 Hz[2]	100 · 0.1% · 500 Hz / 100% = 50 Hz

[1] Assuming, for the sake of this example, that the Actual Value uses parameter 9908 MOT NOM SPEED as the 100% reference and that 9908 = 1500 rpm.

[2] Assuming, for the sake of this example, that the Actual Value uses parameter 9907 MOT NOM FREQ as the 100% reference and that 9907 = 500 Hz.

Diagnostics – EFB

Fault queue for drive diagnostics

For general ACS550 diagnostics information, see chapter *Diagnostics* on page *253*. The three most recent ACS550 faults are reported to the fieldbus as defined below.

Drive parameter		**Modbus protocol reference**	
		ABB DRV	**DCU PROFILE**
0401	LAST FAULT	40401	
0412	PREVIOUS FAULT 1	40412	
0413	PREVIOUS FAULT 2	40413	

Serial communication diagnostics

Network problems can be caused by multiple sources. Some of these sources are:

- loose connections
- incorrect wiring (including swapped wires)
- bad grounding
- duplicate station numbers
- incorrect setup of drives or other devices on the network.

The major diagnostic features for fault tracing on an EFB network include *Group 53: EFB PROTOCOL* parameters 5306…5309. Section *Complete parameter descriptions* on page *102* describes these parameters in detail.

Diagnostic situations

The sub-sections below describe various diagnostic situations – the problem symptoms and corrective actions.

Normal operation

During normal network operation, 5306…5309 parameter values act as follows at each drive:

- 5306 EFB OK MESSAGES advances (advances for each message properly received and addressed to this drive).
- 5307 EFB CRC ERRORS does not advance at all (advances when an invalid message CRC is received).
- 5308 EFB UART ERRORS does not advance at all (advances when character format errors are detected, such as parity or framing errors).
- 5309 EFB STATUS value varies depending on network traffic.

Loss of communication

The ACS550 behavior, if communication is lost, was configured earlier in section *Communication fault* on page *206*. The parameters are 3018 COMM FAULT FUNC and 3019 COMM FAULT TIME. Section *Complete parameter descriptions* on page *102* describes these parameters in detail.

No master station on line

If no master station is on line: Neither the EFB OK MESSAGES nor the errors (5307 EFB CRC ERRORS and 5308 EFB UART ERRORS) increase on any of the stations.

To correct:

- Check that a network master is connected and properly programmed on the network.
- Verify that the cable is connected and that it is not cut or short circuited.

Duplicate stations

If two or more stations have duplicate numbers:

- Two or more drives cannot be addressed.
- Every time there is a read or write to one particular station, the value for 5307 EFB CRC ERRORS or 5308 EFB UART ERRORS advances.

To correct: Verify the station numbers of all stations. Change conflicting station numbers.

Swapped wires

If the communication wires are swapped (terminal A on one drive is connected to terminal B on another):

- The value of 5306 EFB OK MESSAGES does not advance.
- The values of 5307 EFB CRC ERRORS and 5308 EFB UART ERRORS are advancing.

To correct: Check that the RS-485 lines are not swapped.

Fault 28 – Serial 1 Err

If the drive's control panel shows fault code 28, SERIAL 1 ERR, check for either of the following:

- The master system is down. To correct, resolve problem with master system.
- The communication connection is bad. To correct, check communication connection at the drive.
- The time-out selection for the drive is too short for the given installation. The master is not polling the drive within the specified time-out delay. To correct, increase the time set by parameter 3019 COMM FAULT TIME.

Faults 31…33 – EFB1…EFB3

The three EFB fault codes listed for the drive in chapter *Diagnostics* on page *253* (fault codes 31…33) are not used.

Intermittent off-line occurrences

The problems described above are the most common problems encountered with ACS550 serial communication. Intermittent problems might also be caused by:

- marginally loose connections
- wear on wires caused by equipment vibrations
- insufficient grounding and shielding on both the devices and on the communication cables.

Modbus protocol technical data

Overview

The Modbus® protocol was introduced by Modicon, Inc. for use in control environments featuring Modicon programmable controllers. Due to its ease of use and implementation, this common PLC language was quickly adopted as a de-facto standard for integration of a wide variety of master controllers and slave devices.

Modbus is a serial, asynchronous protocol. Transactions are half-duplex, featuring a single Master controlling one or more Slaves. While RS232 can be used for point-to-point communication between a single Master and a single Slave, a more common implementation features a multi-drop RS485 network with a single Master controlling multiple Slaves. The ACS550 features RS485 for its Modbus physical interface.

RTU

The Modbus specification defines two distinct transmission modes: ASCII and RTU. The ACS550 supports RTU only.

Feature summary

The following Modbus function codes are supported by the ACS550.

Function	Code (Hex)	Description
Read Coil Status	0x01	Read discrete output status. For the ACS550, the individual bits of the control word are mapped to Coils 1…16. Relay outputs are mapped sequentially beginning with Coil 33 (e.g. RO1=Coil 33).
Read Discrete Input Status	0x02	Read discrete inputs status. For the ACS550, the individual bits of the status word are mapped to Inputs 1…16 or 1…32, depending on the active profile. Terminal inputs are mapped sequentially beginning with Input 33 (e.g. DI1=Input 33).
Read Multiple Holding Registers	0x03	Read multiple holding registers. For the ACS550, the entire parameter set is mapped as holding registers, as well as command, status and reference values.
Read Multiple Input Registers	0x04	Read multiple input registers. For the ACS550, the 2 analog input channels are mapped as input registers 1 & 2.
Force Single Coil	0x05	Write a single discrete output. For the ACS550, the individual bits of the control word are mapped to Coils 1…16. Relay outputs are mapped sequentially beginning with Coil 33 (e.g. RO1=Coil 33).
Write Single Holding Register	0x06	Write single holding register. For the ACS550, the entire parameter set is mapped as holding registers, as well as command, status and reference values.
Diagnostics	0x08	Perform Modbus diagnostics. Subcodes for Query (0x00), Restart (0x01) & Listen Only (0x04) are supported.
Force Multiple Coils	0x0F	Write multiple discrete outputs. For the ACS550, the individual bits of the control word are mapped to Coils 1…16. Relay outputs are mapped sequentially beginning with Coil 33 (e.g. RO1=Coil 33).
Write Multiple Holding Registers	0x10	Write multiple holding registers. For the ACS550, the entire parameter set is mapped as holding registers, as well as command, status and reference values.
Read/Write Multiple Holding Registers	0x17	This function combines functions 0x03 and 0x10 into a single command.

Mapping summary

The following table summarizes the mapping between the ACS550 (parameters and I/0) and Modbus reference space. For details, see *Modbus addressing* below.

ACS550	Modbus reference	Supported function codes
• Control Bits • Relay Outputs	Coils(0xxxx)	• 01 – Read Coil Status • 05 – Force Single Coil • 15 – Force Multiple Coils
• Status Bits • Discrete Inputs	Discrete Inputs(1xxxx)	• 02 – Read Input Status
• Analog Inputs	Input Registers(3xxxxx)	• 04 – Read Input Registers
• Parameters • Control/Status Words • References	Holding Registers(4xxxx)	• 03 – Read 4X Registers • 06 – Preset Single 4X Register • 16 – Preset Multiple 4X Registers • 23 – Read/Write 4X Registers

Communication profiles

When communicating by Modbus, the ACS550 supports multiple profiles for control and status information. Parameter 5305 EFB CTRL PROFILE selects the profile used.

- ABB DRV LIM – The primary (and default) profile is the ABB DRV LIM profile. This implementation of the ABB Drives profile standardizes the control interface with ACS400 drives. The ABB Drives profile is based on the PROFIBUS interface. It is discussed in detail in the following sections.
- DCU PROFILE – The DCU PROFILE profile extends the control and status interface to 32 bits. It is the internal interface between the main drive application and the embedded fieldbus environment.
- ABB DRV FULL – ABB DRV FULL is the implementation of the ABB Drives profile that standardizes the control interface with ACS600 and ACS800 drives. This implementation supports two control word bits not supported by the ABB DRV LIM implementation.

Modbus addressing

With Modbus, each function code implies access to a specific Modbus reference set. Thus, the leading digit is not included in the address field of a Modbus message.

Note: The ACS550 supports the zero-based addressing of the Modbus specification. Holding register 40002 is addressed as 0001 in a Modbus message. Similarly, coil 33 is addressed as 0032 in a Modbus message.

Refer again to the *Mapping summary* above. The following sections describe, in detail, the mapping to each Modbus reference set.

0xxxx Mapping – Modbus coils. The drive maps the following information to the 0xxxx Modbus set called Modbus Coils:

- bit-wise map of the CONTROL WORD (selected using parameter 5305 EFB CTRL PROFILE). The first 32 coils are reserved for this purpose.

- relay output states, numbered sequentially beginning with coil 00033.

The following table summarizes the 0xxxx reference set:

Modbus ref.	**Internal location (all profiles)**	ABB DRV LIM **(5305 = 0)**	DCU PROFILE **(5305 = 1)**	ABB DRV FULL **(5305 = 2)**
00001	CONTROL WORD – Bit 0	OFF1[1]	STOP	OFF1[1]
00002	CONTROL WORD – Bit 1	OFF2[1]	START	OFF2[1]
00003	CONTROL WORD – Bit 2	OFF3[1]	REVERSE	OFF3[1]
00004	CONTROL WORD – Bit 3	START	LOCAL	START
00005	CONTROL WORD – Bit 4	N/A	RESET	RAMP_OUT_ZERO[1]
00006	CONTROL WORD – Bit 5	RAMP_HOLD[1]	EXT2	RAMP_HOLD[1]
00007	CONTROL WORD – Bit 6	RAMP_IN_ZERO[1]	RUN_DISABLE	RAMP_IN_ZERO[1]
00008	CONTROL WORD – Bit 7	RESET	STPMODE_R	RESET
00009	CONTROL WORD – Bit 8	N/A	STPMODE_EM	N/A
00010	CONTROL WORD – Bit 9	N/A	STPMODE_C	N/A
00011	CONTROL WORD – Bit 10	N/A	RAMP_2	REMOTE_CMD[1]
00012	CONTROL WORD – Bit 11	EXT2	RAMP_OUT_0	EXT2
00013	CONTROL WORD – Bit 12	N/A	RAMP_HOLD	N/A
00014	CONTROL WORD – Bit 13	N/A	RAMP_IN_0	N/A
00015	CONTROL WORD – Bit 14	N/A	REQ_LOCALLOCK	N/A
00016	CONTROL WORD – Bit 15	N/A	TORQLIM2	N/A
00017	CONTROL WORD – Bit 16	Does not apply	FBLOCAL_CTL	Does not apply
00018	CONTROL WORD – Bit 17		FBLOCAL_REF	
00019	CONTROL WORD – Bit 18		START_DISABLE1	
00020	CONTROL WORD – Bit 19		START_DISABLE2	
00021… **0**0032	Reserved	Reserved	Reserved	Reserved
00033	RELAY OUTPUT 1	Relay Output 1	Relay Output 1	Relay Output 1
00034	RELAY OUTPUT 2	Relay Output 2	Relay Output 2	Relay Output 2
00035	RELAY OUTPUT 3	Relay Output 3	Relay Output 3	Relay Output 3
00036	RELAY OUTPUT 4	Relay Output 4	Relay Output 4	Relay Output 4
00037	RELAY OUTPUT 5	Relay Output 5	Relay Output 5	Relay Output 5
00038	RELAY OUTPUT 6	Relay Output 6	Relay Output 6	Relay Output 6

[1] = Active low

For the 0xxxx registers:

- Status is always readable.
- Forcing is allowed by user configuration of the drive for fieldbus control.
- Additional relay outputs are added sequentially.

The ACS550 supports the following Modbus function codes for coils:

Function code	Description
01	Read coil status
05	Force single coil
15 (0x0F Hex)	Force multiple coils

1xxxx Mapping – Modbus discrete inputs. The drive maps the following information to the 1xxxx Modbus set called Modbus Discrete Inputs:

- bit-wise map of the STATUS WORD (selected using parameter 5305 EFB CTRL PROFILE). The first 32 inputs are reserved for this purpose.
- discrete hardware inputs, numbered sequentially beginning with input 33.

The following table summarizes the 1xxxx reference set:

Modbus ref.	Internal location (all profiles)	ABB DRV (5305 = 0 OR 2)	DCU PROFILE (5305 = 1)
10001	STATUS WORD – Bit 0	RDY_ON	READY
10002	STATUS WORD – Bit 1	RDY_RUN	ENABLED
10003	STATUS WORD – Bit 2	RDY_REF	STARTED
10004	STATUS WORD – Bit 3	TRIPPED	RUNNING
10005	STATUS WORD – Bit 4	OFF_2_STA[1]	ZERO_SPEED
10006	STATUS WORD – Bit 5	OFF_3_STA[1]	ACCELERATE
10007	STATUS WORD – Bit 6	SWC_ON_INHIB	DECELERATE
10008	STATUS WORD – Bit 7	ALARM	AT_SETPOINT
10009	STATUS WORD – Bit 8	AT_SETPOINT	LIMIT
10010	STATUS WORD – Bit 9	REMOTE	SUPERVISION
10011	STATUS WORD – Bit 10	ABOVE_LIMIT	REV_REF
10012	STATUS WORD – Bit 11	EXT2	REV_ACT
10013	STATUS WORD – Bit 12	RUN_ENABLE	PANEL_LOCAL
10014	STATUS WORD – Bit 13	N/A	FIELDBUS_LOCAL
10015	STATUS WORD – Bit 14	N/A	EXT2_ACT
10016	STATUS WORD – Bit 15	N/A	FAULT
10017	STATUS WORD – Bit 16	Reserved	ALARM
10018	STATUS WORD – Bit 17	Reserved	REQ_MAINT
10019	STATUS WORD – Bit 18	Reserved	DIRLOCK
10020	STATUS WORD – Bit 19	Reserved	LOCALLOCK
10021	STATUS WORD – Bit 20	Reserved	CTL_MODE
10022	STATUS WORD – Bit 21	Reserved	Reserved
10023	STATUS WORD – Bit 22	Reserved	Reserved
10024	STATUS WORD – Bit 23	Reserved	Reserved
10025	STATUS WORD – Bit 24	Reserved	Reserved
10026	STATUS WORD – Bit 25	Reserved	Reserved
10027	STATUS WORD – Bit 26	Reserved	REQ_CTL

Modbus ref.	Internal location (all profiles)	ABB DRV (5305 = 0 OR 2)	DCU PROFILE (5305 = 1)
10028	STATUS WORD – Bit 27	Reserved	REQ_REF1
10029	STATUS WORD – Bit 28	Reserved	REQ_REF2
10030	STATUS WORD – Bit 29	Reserved	REQ_REF2EXT
10031	STATUS WORD – Bit 30	Reserved	ACK_STARTINH
10032	STATUS WORD – Bit 31	Reserved	ACK_OFF_ILCK
10033	DI1	DI1	DI1
10034	DI2	DI2	DI2
10035	DI3	DI3	DI3
10036	DI4	DI4	DI4
10037	DI5	DI5	DI5
10038	DI6	DI6	DI6

[1] = Active low

For the 1xxxx registers:

- Additional discrete inputs are added sequentially.

The ACS550 supports the following Modbus function codes for discrete inputs:

Function code	Description
02	Read input status

3xxxx Mapping – Modbus inputs. The drive maps the following information to the 3xxxx Modbus addresses called Modbus input registers:

- any user defined analog inputs.

The following table summarizes the input registers:

Modbus reference	ACS550 all profiles	Remarks
30001	AI1	This register shall report the level of Analog Input 1 (0…100%).
30002	AI2	This register shall report the level of Analog Input 2 (0…100%).

The ACS550 supports the following Modbus function codes for 3xxxx registers:

Function code	Description
04	Read 3xxxx input status

4xxxx Register mapping. The drive maps its parameters and other data to the 4xxxx holding registers as follows:

- 40001…40099 map to drive control and actual values. These registers are described in the table below.
- 40101…49999 map to drive parameters 0101…9999. Register addresses that do not correspond to drive parameters are invalid. If there is an attempt to read or write outside the parameter addresses, the Modbus interface returns an exception code to the controller.

The following table summarizes the 4xxxx drive control registers 40001…40099 (for 4xxxx registers above 40099, see the drive parameter list, e.g. 40102 is parameter 0102):

Modbus register		Access	Remarks
40001	CONTROL WORD	R/W	Maps directly to the profile'S CONTROL WORD. Supported only if 5305 = 0 or 2 (ABB Drives profile). Parameter 5319 holds a copy in hex format.
40002	Reference 1	R/W	Range = 0…+20000 (scaled to 0…1105 REF1 MAX), or -20000…0 (scaled to 1105 REF1 MAX…0).
40003	Reference 2	R/W	Range = 0…+10000 (scaled to 0…1108 REF2 MAX), or -10000…0 (scaled to 1108 REF2 MAX…0).
40004	STATUS WORD	R	Maps directly to the profile'S STATUS WORD. Supported only if 5305 = 0 or 2 (ABB Drives profile). Parameter 5320 holds a copy in hex format.
40005	Actual 1 (select using 5310)	R	By default, stores a copy of 0103 OUTPUT FREQ. Use parameter 5310 to select a different actual value for this register.
40006	Actual 2 (select using 5311)	R	By default, stores a copy of 0104 CURRENT. Use parameter 5311 to select a different actual value for this register.
40007	Actual 3 (select using 5312)	R	By default, stores nothing. Use parameter 5312 to select an actual value for this register.
40008	Actual 4 (select using 5313)	R	By default, stores nothing. Use parameter 5313 to select an actual value for this register.
40009	Actual 5 (select using 5314)	R	By default, stores nothing. Use parameter 5314 to select an actual value for this register.
40010	Actual 6 (select using 5315)	R	By default, stores nothing. Use parameter 5315 to select an actual value for this register.
40011	Actual 7 (select using 5316)	R	By default, stores nothing. Use parameter 5316 to select an actual value for this register.
40012	Actual 8 (select using 5317)	R	By default, stores nothing. Use parameter 5317 to select an actual value for this register.
40031	ACS550 CONTROL WORD LSW	R/W	Maps directly to the Least Significant Word of the DCU profile's CONTROL WORD. Supported only if 5305 = 1. See parameter 0301.
40032	ACS550 CONTROL WORD MSW	R	Maps directly to the Most Significant Word of the DCU profile's CONTROL WORD. Supported only if 5305 = 1. See parameter 0302.
40033	ACS550 STATUS WORD LSW	R	Maps directly to the Least Significant Word of the DCU profile's STATUS WORD. Supported only if 5305 = 1. See parameter 0303.
40034	ACS550 STATUS WORD MSW	R	Maps directly to the Most Significant Word of the DCU profile's STATUS WORD. Supported only if 5305 = 1. See parameter 0304.

For the Modbus protocol, drive parameters in *Group 53: EFB PROTOCOL* report the parameter mapping to 4xxxx Registers.

Code	Description
5310	EFB PAR 10 Specifies the parameter mapped to Modbus register 40005.
5311	EFB PAR 11 Specifies the parameter mapped to Modbus register 40006.
5312	EFB PAR 12 Specifies the parameter mapped to Modbus register 40007.
5313	EFB PAR 13 Specifies the parameter mapped to Modbus register 40008.
5314	EFB PAR 14 Specifies the parameter mapped to Modbus register 40009.
5315	EFB PAR 15 Specifies the parameter mapped to Modbus register 40010.
5316	EFB PAR 16 Specifies the parameter mapped to Modbus register 40011.
5317	EFB PAR 17 Specifies the parameter mapped to Modbus register 40012.
5318	EFB PAR 18 Sets additional delay in milliseconds before the ACS550 begins transmitting response to the master request.
5319	EFB PAR 19 Holds a copy (in hex) of the CONTROL WORD, Modbus register 40001.
5320	EFB PAR 20 Holds a copy (in hex) of the STATUS WORD, Modbus register 40004.

Except where restricted by the drive, all parameters are available for both reading and writing. The parameter writes are verified for the correct value and for a valid register addresses.

Note: Parameter writes through standard Modbus are always volatile i.e. modified values are not automatically stored to permanent memory. Use parameter 1607 PARAM SAVE to save all altered values.

The ACS550 supports the following Modbus function codes for 4xxxx registers:

Function code	Description
03	Read holding 4xxxx registers
06	Preset single 4xxxx register
16 (0x10 Hex)	Preset multiple 4xxxx registers
23 (0x17 Hex)	Read/write 4xxxx registers

Actual values

The contents of the register addresses 40005…40012 are ACTUAL VALUES and are:

- specified using parameters 5310…5317
- Read-only values containing information on the operation of the drive
- 16-bit words containing a sign bit and a 15-bit integer
- when negative values, written as the two's complement of the corresponding positive value
- scaled as described earlier in section *Actual value scaling* on page *207*.

Exception codes

Exception codes are serial communication responses from the drive. The ACS550 supports the standard Modbus exception codes defined below.

Exception code	**Name**	**Meaning**
01	ILLEGAL FUNCTION	Unsupported Command
02	ILLEGAL DATA ADDRESS	The data address received in the query is not allowable. It is not a defined parameter/group.
03	ILLEGAL DATA VALUE	A value contained in the query data field is not an allowable value for the ACS550, because it is one of the following: • Outside min. or max. limits. • Parameter is read-only. • Message is too long. • Parameter write not allowed when start is active. • Parameter write not allowed when factory macro is selected.

ABB control profiles technical data

Overview

ABB Drives profile

The ABB Drives profile provides a standard profile that can be used on multiple protocols, including Modbus and the protocols available on the FBA module. Two implementations of the ABB Drives profile are available:

- ABB DRV FULL – This implementation standardizes the control interface with ACS600 and ACS800 drives.
- ABB DRV LIM – This implementation standardizes the control interface with ACS400 drives. This implementation does not support two control word bits supported by ABB DRV FULL.

Except as noted, the following "ABB Drives Profile" descriptions apply to both implementations.

DCU profile

The DCU profile extends the control and status interface to 32 bits. It is the internal interface between the main drive application and the embedded fieldbus environment.

Control Word

The CONTROL WORD is the principal means for controlling the drive from a fieldbus system. The fieldbus master station sends the CONTROL WORD to the drive. The drive switches between states according to the bit-coded instructions in the CONTROL WORD. Using the CONTROL WORD requires that:

- The drive is in remote (REM) control.
- The serial communication channel is defined as the source for controlling commands (set using parameters such as 1001 EXT1 COMMANDS, 1002 EXT2 COMMANDS and 1102 EXT1/EXT2 SEL).
- The serial communication channel used is configured to use an ABB control profile. For example, to use the control profile ABB DRV FULL requires both parameter 9802 COMM PROT SEL = 1 (STD MODBUS) and parameter 5305 EFB CTRL PROFILE = 2 (ABB DRV FULL).

ABB Drives profile

The following table and the state diagram later in this sub-section describe the CONTROL WORD content for the ABB Drives profile.

ABB Drives profile CONTROL WORD (See parameter 5319)

Bit	Name	Value	Commanded state	Comments
0	OFF1 CONTROL	1	READY TO OPERATE	Enter READY TO OPERATE
		0	EMERGENCY OFF	Drive ramps to stop according to currently active deceleration ramp (2203 or 2205) Normal command sequence: • Enter OFF1 ACTIVE • Proceed to READY TO SWITCH ON, unless other interlocks (OFF2, OFF3) are active.
1	OFF2 CONTROL	1	OPERATING	Continue operation (OFF2 inactive)
		0	EMERGENCY OFF	Drive coasts to stop. Normal command sequence: • Enter OFF2 ACTIVE • Proceed to SWITCHON INHIBITED
2	OFF3 CONTROL	1	OPERATING	Continue operation (OFF3 inactive)
		0	EMERGENCY STOP	Drive stops within time specified by parameter 2208. Normal command sequence: • Enter OFF3 ACTIVE • Proceed to SWITCH ON INHIBITED ⚠ **WARNING!** Be sure motor and driven equipment can be stopped using this mode.
3	INHIBIT OPERATION	1	OPERATION ENABLED	Enter OPERATION ENABLED (Note the Run enable signal must be active. See 1601. If 1601 is set to COMM, this bit also actives the Run Enable signal.)
		0	OPERATION INHIBITED	Inhibit operation. Enter OPERATION INHIBITED
4	Unused (**ABB DRV LIM**)			
	RAMP_OUT_ ZERO (**ABB DRV FULL**)	1	NORMAL OPERATION	Enter RAMP FUNCTION GENERATOR: ACCELERATION ENABLED
		0	RFG OUT ZERO	Force ramp function generator output to Zero. Drive ramps to stop (current and DC voltage limits in force).
5	RAMP_HOLD	1	RFG OUT ENABLED	Enable ramp function. Enter RAMP FUNCTION GENERATOR: ACCELERATOR ENABLED
		0	RFG OUT HOLD	Halt ramping (Ramp Function Generator output held)
6	RAMP_IN_ ZERO	1	RFG INPUT ENABLED	Normal operation. Enter OPERATING
		0	RFG INPUT ZERO	Force Ramp Function Generator input to zero.

ABB Drives profile CONTROL WORD (See parameter 5319)

Bit	Name	Value	Commanded state	Comments
7	RESET	0=>1	RESET	Fault reset if an active fault exists (Enter SWITCH-ON INHIBITED). Effective if 1604 = COMM.
		0	OPERATING	Continue normal operation
8…9	Unused			
10	Unused (**ABB DRV LIM**)			
	REMOTE_CMD (**ABB DRV FULL**)	1		Fieldbus control enabled.
		0		• CW ≠ 0 or Ref ≠ 0: Retain last CW and Ref. • CW = 0 and Ref = 0: Fieldbus control enabled. • Ref and deceleration/acceleration ramp are locked.
11	EXT CTRL LOC	1	EXT2 SELECT	Select external control location 2 (EXT2). Effective if 1102 = COMM.
		0	EXT1 SELECT	Select external control location 1 (EXT1). Effective if 1102 = COMM.
12…15	Unused			

DCU Profile

The following tables describe the CONTROL WORD content for the DCU profile.

DCU profile CONTROL WORD (See parameter 0301)

Bit	Name	Value	Command/Req.	Comments
0	STOP	1	Stop	Stops according to either the stop mode parameter or the stop mode requests (bits 7 and 8). Simultaneous STOP and START commands result in a stop command.
		0	(no op)	
1	START	1	Start	
		0	(no op)	
2	REVERSE	1	Reverse direction	This bit XOR'd with the sign of the reference defines direction.
		0	Forward direction	
3	LOCAL	1	Local mode	When the fieldbus sets this bit, it steals control and the drive moves to fieldbus local control mode.
		0	External mode	
4	RESET	-> 1	Reset	Edge sensitive.
		other	(no op)	
5	EXT2	1	Switch to EXT2	
		0	Switch to EXT1	
6	RUN_DISABLE	1	Run disable	Inverted run enable.
		0	Run enable on	
7	STPMODE_R	1	Normal ramp stop mode	
		0	(no op)	

DCU profile CONTROL WORD (See parameter 0301)				
Bit	**Name**	**Value**	**Command/Req.**	**Comments**
8	STPMODE_EM	1	Emergency ramp stop mode	
		0	(no op)	
9	STPMODE_C	1	Coast stop mode	
		0	(no op)	
10	RAMP_2	1	Ramp pair 2	
		0	Ramp pair 1	
11	RAMP_OUT_0	1	Ramp output to 0	
		0	(no op)	
12	RAMP_HOLD	1	Ramp freeze	
		0	(no op)	
13	RAMP_IN_0	1	Ramp input to 0	
		0	(no op)	
14	RREQ_LOCALLOC	1	Local mode lock	In lock, drive will not switch to local mode.
		0	(no op)	
15	TORQLIM2	1	Torque limit pair 2	
		0	Torque limit pair 1	

DCU profile CONTROL WORD (See parameter 0302)				
Bit	**Name**	**Value**	**Function**	**Comments**
16…26	Reserved			
27	REF_CONST	1	Constant speed ref.	These bits are only for supervision purposes.
		0	(no op)	
28	REF_AVE	1	Average speed ref.	
		0	(no op)	
29	LINK_ON	1	Master is detected in link	
		0	Link is down	
30	REQ_STARTINH	1	Start inhibit request is pending	
		0	Start inhibit request is OFF	
31	OFF_INTERLOCK	1	Panel OFF button pressed	For the control panel (or PC tool) this is the OFF button interlock.
		0	(no op)	

Status Word

The contents of the STATUS WORD is status information, sent by the drive to the master station.

ABB Drives profile

The following table and the state diagram later in this sub-section describe the STATUS WORD content for the ABB Drives profile.

ABB Drives profile (EFB) STATUS WORD (See parameter 5320)			
Bit	**Name**	**Value**	**Description (Correspond to states/boxes in the state diagram)**
0	RDY_ON	1	READY TO SWITCH ON
		0	NOT READY TO SWITCH ON
1	RDY_RUN	1	READY TO OPERATE
		0	OFF1 ACTIVE
2	RDY_REF	1	OPERATION ENABLED
		0	OPERATION INHIBITED
3	TRIPPED	0…1	FAULT
		0	No fault
4	OFF_2_STA	1	OFF2 INACTIVE
		0	**OFF2 ACTIVE**
5	OFF_3_STA	1	OFF3 INACTIVE
		0	**OFF3 ACTIVE**
6	SWC_ON_INHIB	1	SWITCH-ON INHIBIT ACTIVE
		0	SWITCH-ON INHIBIT NOT ACTIVE
7	ALARM	1	Alarm (See section *Alarm listing* on page *261* for details on alarms.)
		0	No alarm
8	AT_SETPOINT	1	OPERATING**.** Actual value equals (within tolerance limits) the reference value.
		0	Actual value is outside tolerance limits (not equal to reference value).
9	REMOTE	1	Drive control location: REMOTE (EXT1 or EXT2)
		0	Drive control location: LOCAL
10	ABOVE_LIMIT	1	Supervised parameter's value ≥ supervision high limit. Bit remains "1" until supervised parameter's value < supervision low limit. See *Group 32: SUPERVISION*.
		0	Supervised parameter's value < supervision low limit. Bit remains "0" until supervised parameter's value > supervision high limit. See *Group 32: SUPERVISION*.
11	EXT CTRL LOC	1	External control location 2 (EXT2) selected
		0	External control location 1 (EXT1) selected
12	EXT RUN ENABLE	1	External Run Enable signal received
		0	No External Run Enable signal received
13… 15	Unused		

DCU profile

The following tables describe the STATUS WORD content for the DCU profile.

DCU profile STATUS WORD (See parameter 0303)

Bit	Name	Value	Status
0	READY	1	Drive is ready to receive start command.
		0	Drive is not ready.
1	ENABLED	1	External run enable signal received.
		0	No external run enable signal received.
2	STARTED	1	Drive has received start command.
		0	Drive has not received start command.
3	RUNNING	1	Drive is modulating.
		0	Drive is not modulating.
4	ZERO_SPEED	1	Drive is at zero speed.
		0	Drive has not reached zero speed.
5	ACCELERATE	1	Drive is accelerating.
		0	Drive is not accelerating.
6	DECELERATE	1	Drive is decelerating.
		0	Drive is not decelerating.
7	AT_SETPOINT	1	Drive is at setpoint.
		0	Drive has not reached setpoint.
8	LIMIT	1	Operation is limited by *Group 20: LIMITS* settings.
		0	Operation is within *Group 20: LIMITS* settings.
9	SUPERVISION	1	A supervised parameter (*Group 32: SUPERVISION*) is outside its limits.
		0	All supervised parameters are within limits.
10	REV_REF	1	Drive reference is in reverse direction.
		0	Drive reference is in forward direction.
11	REV_ACT	1	Drive is running in reverse direction.
		0	Drive is running in forward direction.
12	PANEL_LOCAL	1	Control is in control panel (or PC tool) local mode.
		0	Control is not in control panel local mode.
13	FIELDBUS_LOCAL	1	Control is in fieldbus local mode (steals control panel local).
		0	Control is not in fieldbus local mode.
14	EXT2_ACT	1	Control is in EXT2 mode.
		0	Control is in EXT1 mode.
15	FAULT	1	Drive is in a fault state.
		0	Drive is not in a fault state.

DCU profile STATUS WORD (See parameter 0304)			
Bit	**Name**	**Value**	**Status**
16	ALARM	1	An alarm is on.
		0	No alarms are on.
17	REQ_MAINT	1	A maintenance request is pending.
		0	No maintenance request is pending.
18	DIRLOCK	1	Direction lock is ON. (Direction change is locked out.)
		0	Direction lock is OFF.
19	LOCALLOCK	1	Local mode lock is ON. (Local mode is locked out.)
		0	Local mode lock is OFF.
20	CTL_MODE	1	Drive is in vector control mode.
		0	Drive is in scalar control mode.
21…25	Reserved		
26	REQ_CTL	1	Copy the control word
		0	(no op)
27	REQ_REF1	1	Reference 1 requested in this channel.
		0	Reference 1 is not requested in this channel.
28	REQ_REF2	1	Reference 2 requested in this channel.
		0	Reference 2 is not requested in this channel.
29	REQ_REF2EXT	1	External PID reference 2 requested in this channel.
		0	External PID reference 2 is not requested in this channel.
30	ACK_STARTINH	1	A start inhibit from this channel is granted.
		0	A start inhibit from this channel is not granted.
31	ACK_OFF_ILCK	1	Start inhibit due to OFF button
		0	Normal operation

State diagram

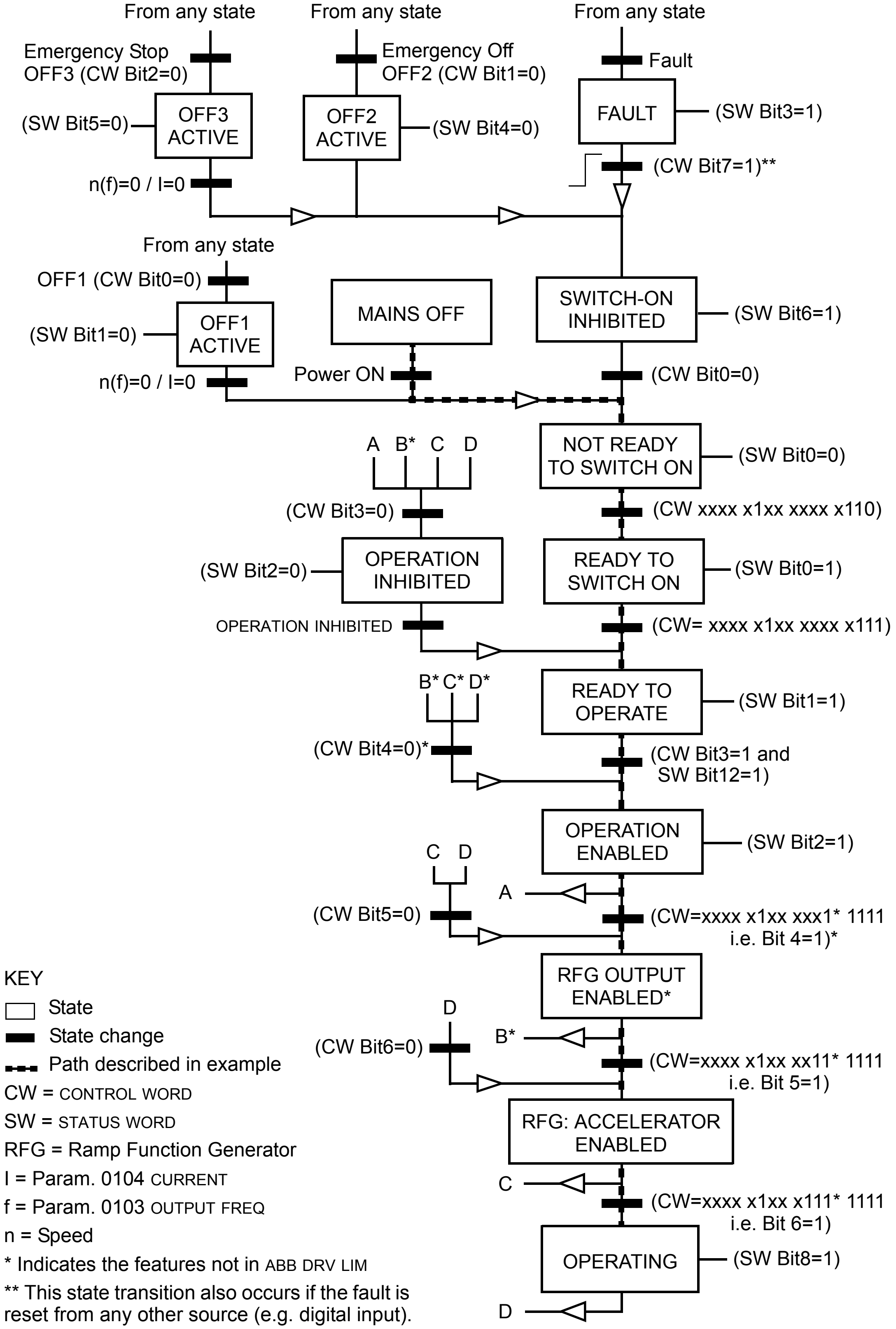
ABB Drives profile

To illustrate the operation of the state diagram, the following example (ABB DRV LIM implementation of the ABB Drives profile) uses the control word to start the drive:

- First, the requirements for using the CONTROL WORD must be met. See above.
- When the power is first connected, the state of the drive is not ready to switch on. See dotted lined path (╍╍) in the state diagram below.
- Use the CONTROL WORD to step through the state machine states until the OPERATING state is reached, meaning that the drive is running and follows the given reference. See the table below.

Step	CONTROL WORD **Value**	**Description**
1	CW = 0000 0000 0000 0110 I I bit 15 bit 0	This CW value changes the drive state to READY TO SWITCH ON.
2		Wait at least 100 ms before proceeding.
3	CW = 0000 0000 0000 0111	This CW value changes the drive state to READY TO OPERATE.
4	CW = 0000 0000 0000 1111	This CW value changes the drive state to OPERATION ENABLED. The drive starts, but will not accelerate.
5	CW = 0000 0000 0010 1111	This CW value releases the ramp function generator (RFG) output and changes the drive state to RFG: ACCELERATOR ENABLED.
6	CW = 0000 0000 0110 1111	This CW value releases the ramp function generator (RFG) output and changes the drive state to OPERATING. The drive accelerates to the given reference and follows the reference.

The state diagram below describes the start-stop function of CONTROL WORD (CW) and STATUS WORD (SW) bits for the ABB Drives profile.



Reference scaling

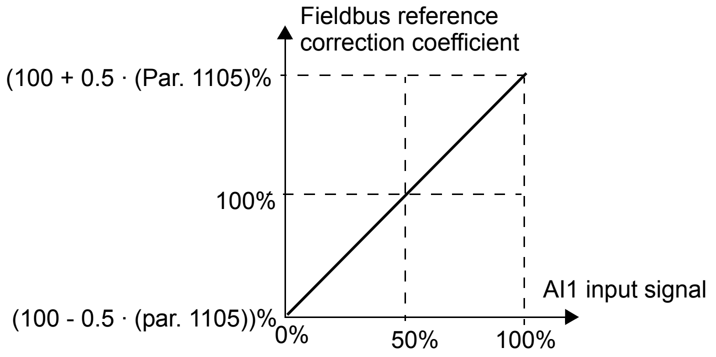
ABB Drives and DCU profiles

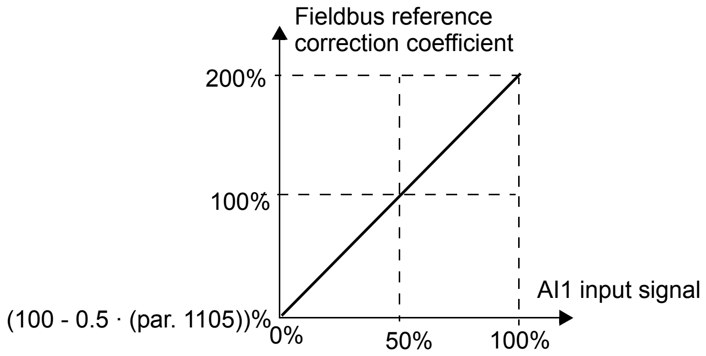
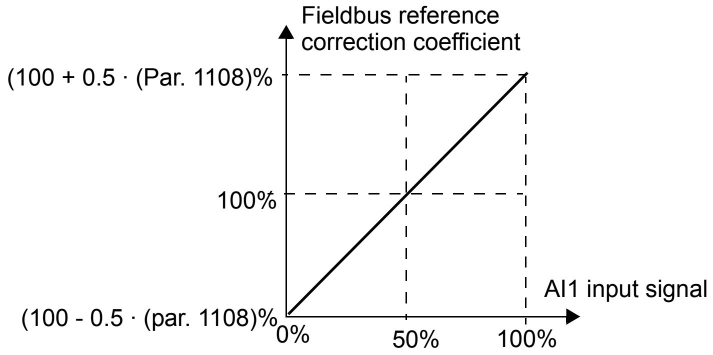
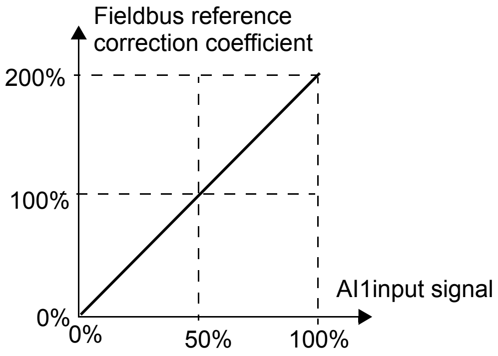
The following table describes REFERENCE scaling for the ABB Drives and DCU profiles.

ABB Drives and DCU profiles				
Reference	**Range**	**Reference type**	**Scaling**	**Remarks**
REF1	-32767 … +32767	Speed or frequency	-20000 = -**(par. 1105)** 0 = 0 +20000 = **(par. 1105)** (20000 corresponds to 100%)	Final reference limited by 1104/1105. Actual motor speed limited by 2001/2002 (speed) or 2007/2008 (frequency).
REF2	-32767 … +32767	Speed or frequency	-10000 = -**(par. 1108)** 0 = 0 +10000 = **(par. 1108)** (10000 corresponds to 100%)	Final reference limited by 1107/1108. Actual motor speed limited by 2001/2002 (speed) or 2007/2008 (frequency).
		Torque	-10000 = -**(par. 1108)** 0 = 0 +10000 = **(par. 1108)** (10000 corresponds to 100%)	Final reference limited by 2015/2017 (torque1) or 2016/ 2018 (torque2).
		PID Reference	-10000 = -**(par. 1108)** 0 = 0 +10000 = **(par. 1108)** (10000 corresponds to 100%)	Final reference limited by 4012/4013 (PID set1) or 4112/4113 (PID set2).

Note: The setting of parameter 1104 REF1 MIN and 1107 REF2 MIN has no effect on the scaling of references.

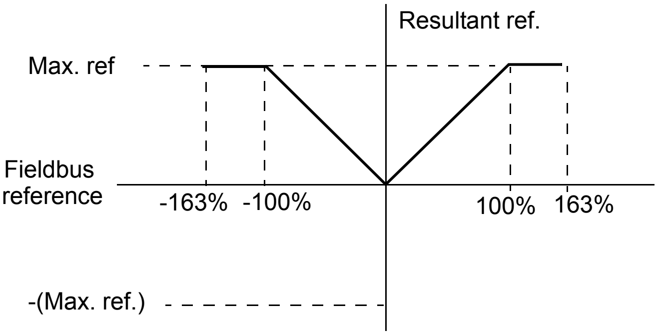
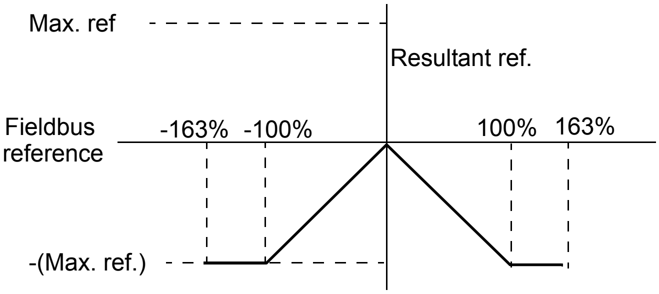
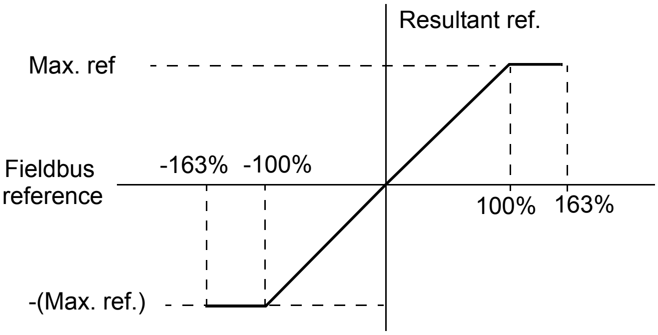
When parameter 1103 REF1 SELECT or 1106 REF2 SELECT is set to COMM+AI1 or COMM*AI1, the reference is scaled as follows:

ABB Drives and DCU profiles		
Reference	**Value setting**	**AI reference scaling**
REF1	COMM+AI1	COMM (%) +(AI (%) - 0.5 · REF1 MAX (%)) 

<table>
<tr><th colspan="3">ABB Drives and DCU profiles</th></tr>
<tr><th>Reference</th><th>Value setting</th><th>AI reference scaling</th></tr>
<tr><td>REF1</td><td>COMM*AI1</td><td>COMM (%) · (AI (%) / 0.5 · REF1 MAX (%))

</td></tr>
<tr><td>REF2</td><td>COMM+AI1</td><td>COMM (%) + (AI (%) - 0.5 · REF2 MAX (%))

</td></tr>
<tr><td>REF2</td><td>COMM*AI1</td><td>COMM (%) · (AI (%) / 0.5 · REF2 MAX (%))

</td></tr>
</table>

Reference handling

Use *Group 10: START/STOP/DIR* parameters to configure for control of rotation direction for each control location (EXT1 and EXT2). The following diagrams illustrate how group 10 parameters and the sign of the fieldbus reference interact to produce REFERENCE values (REF1 and REF2). Note, fieldbus references are bipolar, that is they can be positive or negative.

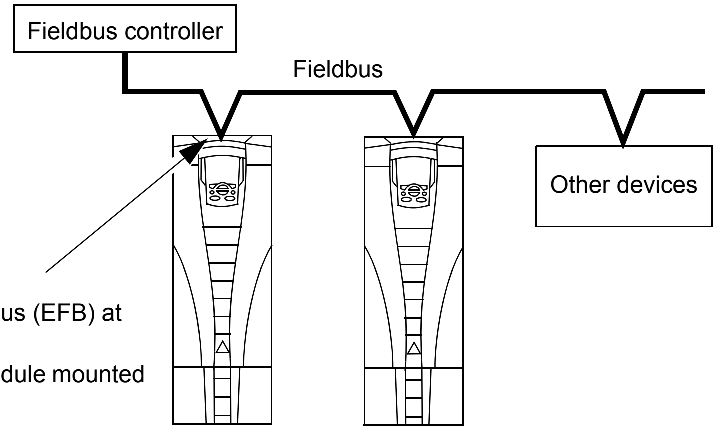
ABB Drives profile		
Parameter	**Value setting**	**AI reference scaling**
1003 DIRECTION	1 (FORWARD)	
1003 DIRECTION	2 (REVERSE)	
1003 DIRECTION	3 (REQUEST)	

Fieldbus adapter

Overview

The ACS550 can be set up to accept control from an external system using standard serial communication protocols. When using serial communication, the ACS550 can either:

- receive all of its control information from the fieldbus, or
- be controlled from some combination of fieldbus control and other available control locations, such as digital or analog inputs and the control panel.



Connect using either:
- standard embedded fieldbus (EFB) at terminals X1:28…32
- fieldbus adapter (FBA) module mounted in slot 2 (option Rxxx)

Two basic serial communications configurations are available:

- embedded fieldbus (EFB) – See chapter *Embedded fieldbus* on page *199*.
- fieldbus adapter (FBA) – With one of the optional FBA modules in the drive's expansion slot 2, the drive can communicate to a control system using one of the following protocols:
  - PROFIBUS DP
  - LONWORKS®
  - Ethernet (Modbus/TCP, EtherNet/IP™, EtherCAT, PROFINET IO, POWERLINK)
  - CANopen
  - DeviceNet™
  - ControlNet™
  - CC-Link.

The ACS550 detects automatically which communication protocol is used by the plug-in fieldbus adapter. The default settings for each protocol assume that the profile used is the protocol's industry-standard drive profile (e.g. PROFIdrive for PROFIBUS, AC/DC Drive for DeviceNet). All of the FBA protocols can also be configured for the ABB Drives profile.

Configuration details depend on the protocol and profile used.These details are provided in a user's manual supplied with the FBA module.

Details for the ABB Drives profile (which apply for all protocols) are provided in section *ABB Drives profile technical data* on page *242*.

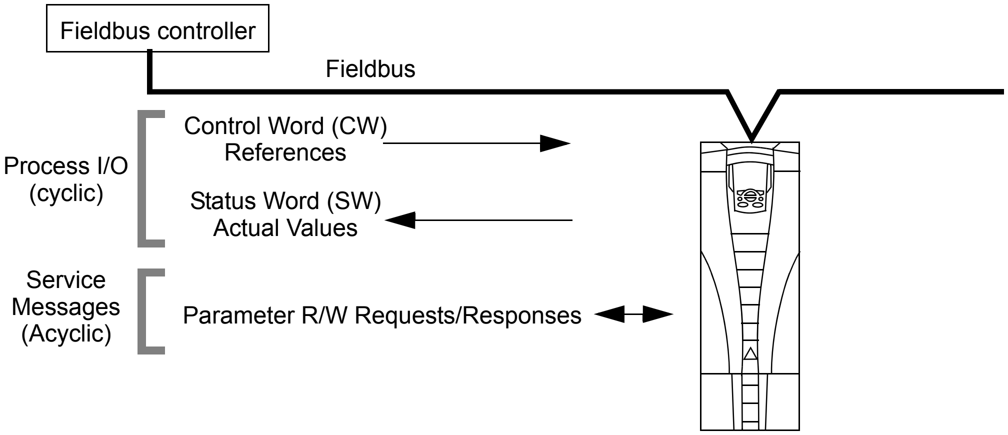
Control interface

In general, the basic control interface between the fieldbus system and the drive consists of:

- Output Words:
  - CONTROL WORD
  - REFERENCE (speed or frequency)
  - Others: The drive supports a maximum of 15 output words. Protocols limits may further restrict the total.
- Input Words:
  - STATUS WORD
  - Actual Value (speed or frequency)
  - Others: The drive supports a maximum of 15 input words. Protocols limits may further restrict the total.

Note: The words "output" and "input" are used as seen from the fieldbus controller point of view. For example an output describes data flow from the fieldbus controller to the drive and appears as an input from the drive point of view.

The meanings of the controller interface words are not restricted by the ACS550. However, the profile used may set particular meanings.



Control Word

The CONTROL WORD is the principal means for controlling the drive from a fieldbus system. The fieldbus controller sends the CONTROL WORD to the drive. The drive switches between states according to the bit-coded instructions in the CONTROL WORD. Using the CONTROL WORD requires that:

- The drive is in remote (REM) control.

- The serial communication channel is defined as the source for controlling commands from EXT1 (set using parameters 1001 EXT1 COMMANDS and 1102 EXT1/EXT2 SEL).
- The external plug-in fieldbus adapter is activated:
  - Parameter 9802 COMM PROT SEL = 4 (EXT FBA).
  - The external plug-in fieldbus adapter is configured to use the drive profile mode or drive profile objects.

The content of the CONTROL WORD depends on the protocol/profile used. See the user's manual provided with the FBA module and/or section *ABB Drives profile technical data* on page *242*.

Status Word

The STATUS WORD is a 16-bit word containing status information, sent by the drive to the fieldbus controller. The content of the STATUS WORD depends on the protocol/ profile used. See the user's manual provided with the FBA module and/or section *ABB Drives profile technical data* on page *242*.

Reference

The contents of each REFERENCE word:

- can be used, as speed or frequency reference
- is a 16-bit word comprised of a sign bit and a 15-bit integer
- Negative references (indicating reversed rotation direction) are indicated by the two's complement of the corresponding positive reference value.

The use of a second reference (REF2) is supported only when a protocol is configured for the ABB Drives profile.

Reference scaling is fieldbus type specific. See the user's manual provided with the FBA module and/or the following sections as appropriate:

- *Reference scaling* on page *246* (*ABB Drives profile technical data*)
- *Reference scaling* on page *250* (*Generic profile technical data*).

Actual Values

Actual Values are 16-bit words containing information on selected operations of the drive. Drive Actual Values (for example, *Group 10: START/STOP/DIR* parameters) can be mapped to Input Words using *Group 51: EXT COMM MODULE* parameters (protocol-dependent, but typically parameters 5104…5126).

Planning

Network planning should address the following questions:

- What types and quantities of devices must be connected to the network?
- What control information must be sent down to the drives?
- What feedback information must be sent from the drives to the controlling system?

Mechanical and electrical installation – FBA

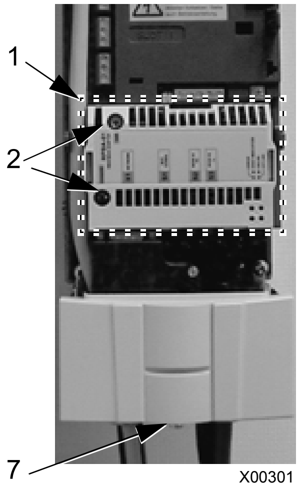
WARNING! Connections should be made only while the drive is disconnected from the power source.

Overview

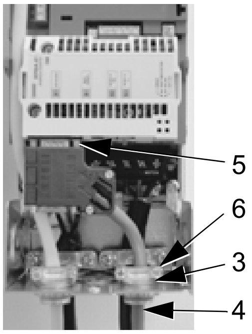
The FBA (fieldbus adapter) is a plug-in module that fits in the drive's expansion slot 2. The module is held in place with plastic retaining clips and two screws. The screws also ground the shield for the module cable and connect the module GND signals to the drive control board.

On installation of the module, electrical connection to the drive is automatically established through the 34-pin connector.

Mounting procedure



X00301



X00302

Note: Install the input power and motor cables first.

1. Insert the module carefully into the drive expansion slot 2 until the retaining clips lock the module into position.
2. Fasten the two screws (included) to the stand-offs.

Note: Correct installation of the screws is essential for fulfilling the EMC requirements and for proper operation of the module.

3. Open the appropriate knockout in the conduit box and install the cable clamp for the network cable.
4. Route the network cable through the cable clamp.
5. Connect the network cable to the module's network connector.
6. Tighten the cable clamp.
7. Install the conduit box cover (1 screw).
8. For configuration information see the following:
    - section *Communication set-up – FBA* on page *235*
    - section *Activate drive control functions – FBA* on page *235*
    - The protocol specific documentation provided with the module.

Communication set-up – FBA

Serial communication selection

To activate the serial communication, use parameter 9802 COMM PROT SEL. Set 9802 = 4 (EXT FBA).

Serial communication configuration

Setting 9802, together with mounting a particular FBA module, automatically sets the appropriate default values in parameters that define the communication process. These parameters and descriptions are defined in the user's manual supplied with the FBA module.

- Parameter 5101 is automatically configured.
- Parameters 5102…5126 are protocol-dependent and define, for example, the profile used and additional I/O words. These parameters are referred to as the fieldbus configuration parameters. See the user's manual provided with the FBA module for details on the fieldbus configuration parameters.
- Parameter 5127 forces the validation of changes to parameters 5102…5126. If parameter 5127 is not used, changes to parameters 5102…5126 take affect only after the drive power is cycled.
- Parameters 5128…5133 provide data about the FBA module currently installed (e.g. component versions and status).

See *Group 51: EXT COMM MODULE* for parameter descriptions.

Activate drive control functions – FBA

Fieldbus control of various drive functions requires configuration to:

- tell the drive to accept fieldbus control of the function
- define as a fieldbus input, any drive data required for control
- define as a fieldbus output, any control data required by the drive.

The following sections describe, at a general level, the configuration required for each control function. The last column in each table below is deliberately blank. See the user's manual supplied with the FBA module for the appropriate entry.

Start/Stop Direction control

Using the fieldbus for start/stop/direction control of the drive requires:

- drive parameter values set as defined below
- fieldbus controller supplied command(s) in the appropriate location. (The location is defined by the Protocol Reference, which is protocol dependent.)

Drive parameter		Value	Description	Protocol reference
1001	EXT1 COMMANDS	10 (COMM)	Start/Stop controlled by fieldbus with Ext1 selected.	

Drive parameter		Value	Description	Protocol reference
1002	EXT2 COMMANDS	10 (COMM)	Start/Stop by controlled fieldbus with Ext2 selected.	
1003	DIRECTION	3 (REQUEST)	Direction controlled by fieldbus.	

Input reference select

Using the fieldbus to provide input reference to the drive requires:

- drive parameter value set as defined below
- fieldbus controller supplied reference word(s) in the appropriate location. (The location is defined by the Protocol Reference, which is protocol dependent.)

Drive parameter		Value	Description	Protocol reference
1102	EXT1/EXT2 SEL	8 (COMM)	Ref. selected by fieldbus. (Required only if 2 references used.)	
1103	REF1 SELECT	8 (COMM) 9 (COMM+AI1) 10 (COMM∗AI1)	Input reference 1supplied by fieldbus.	
1106	REF2 SELECT	8 (COMM) 9 (COMM+AI) 10 (COMM∗AI)	Input reference 2 supplied by fieldbus. (Required only if 2 references used.)	

Note: Multiple references are supported only when using the ABB Drives profile.

Scaling

Where required, REFERENCES can be scaled. See the following sections, as appropriate:

- *Reference scaling* on page *246* (*ABB Drives profile technical data*)
- *Reference scaling* on page *250* (*Generic profile technical data*).

System control

Using the fieldbus for miscellaneous drive control requires:

- drive parameter values set as defined below
- fieldbus controller command(s) in the appropriate location. (The location is defined by the Protocol Reference, which is protocol dependent.)

Drive parameter		Value	Description	Protocol reference
1601	RUN ENABLE	7 (COMM)	Run enable by fieldbus.	
1604	FAULT RESET SEL	8 (COMM)	Fault reset by fieldbus.	
1607	PARAM SAVE	1 (SAVE)	Saves altered parameters to memory (then value returns to 0).	

Relay output control

Using the fieldbus for relay output control requires:

- drive parameter values set as defined below
- fieldbus controller supplied, binary coded, relay command(s) in the appropriate location. (The location is defined by the Protocol Reference, which is protocol dependent.)

Drive parameter		Value	Description	Protocol reference
1401	RELAY OUTPUT 1	35 (COMM) 36 (COMM(-1))	Relay Output 1 controlled by fieldbus.	
1402	RELAY OUTPUT 2		Relay Output 2 controlled by fieldbus.	
1403	RELAY OUTPUT 3		Relay Output 3 controlled by fieldbus.	
1410[1]	RELAY OUTPUT 4		Relay Output 4 controlled by fieldbus.	
1411[1]	RELAY OUTPUT 5		Relay Output 5 controlled by fieldbus.	
1412[1]	RELAY OUTPUT 6		Relay Output 6 controlled by fieldbus.	

[1] More than 3 relays requires the addition of a relay extension module.

Note: Relay status feedback occurs without configuration as defined below.

Drive parameter		Value	Protocol reference
0122	RO 1-3 STATUS	Relay 1…3 status.	
0123	RO 4-6 STATUS	Relay 4…6 status.	

Analog output control

Using the fieldbus for analog output control (e.g. PID setpoint) requires:

- drive parameter values set as defined below
- fieldbus controller supplied analog value(s) in the appropriate location. (The location is defined by the Protocol Reference, which is protocol dependent.)

Drive parameter		Value	Description	Protocol reference
1501	AO1 CONTENT SEL	135 (COMM VALUE 1)	Analog Output 1 controlled by writing to parameter 0135.	–
0135	COMM VALUE 1	–		
1502 … 1505	AO1 CONTENT MIN … MAXIMUM AO1	Set appropriate values.	Used for scaling	–
1506	FILTER AO1		Filter time constant for AO1.	–
1507	AO2 CONTENT SEL	136 (COMM VALUE 2)	Analog Output 2 controlled by writing to parameter 0136.	–
0136	COMM VALUE 2	–		
1508 … 1511	AO2 CONTENT MIN … MAXIMUM AO2	Set appropriate values.	Used for scaling	–
1512	FILTER AO2		Filter time constant for AO2.	–

PID Control setpoint source

Using the following settings to select the fieldbus as the setpoint source for PID loops:

Drive parameter		Value	Setting	Protocol reference
4010	SET POINT SEL (Set 1)	8 (COMM VALUE 1) 9 (COMM+AI1) 10 (COMM*AI1)	Setpoint is input reference 2 (+/-/* AI1)	
4110	SET POINT SEL (Set 2)			
4210	SET POINT SEL (Ext/Trim)			

Communication fault

When using fieldbus control, specify the drive's action if serial communication is lost.

Drive parameter		Value	Description
3018	COMM FAULT FUNC	0 (NOT SEL) 1 (FAULT) 2 (CONST SP7) 3 (LAST SPEED)	Set for appropriate drive response.
3019	COMM FAULT TIME	Set time delay before acting on a communication loss.	

Feedback from the drive – FBA

Inputs to the controller (drive outputs) have pre-defined meanings established by the protocol. This feedback does not require drive configuration. The following table lists a sample of feedback data. For a complete listing, see all parameters listed in section *Complete parameter descriptions* on page *102*.

Drive parameter		Protocol reference
0102	SPEED	
0103	OUTPUT FREQ	
0104	CURRENT	
0105	TORQUE	
0106	POWER	
0107	DC BUS VOLTAGE	
0109	OUTPUT VOLTAGE	
0301	FB CMD WORD 1 – bit 0 (STOP)	
0301	FB CMD WORD 1 – bit 2 (REV)	
0118	DI 1-3 STATUS – bit 0 (DI3)	

Scaling

To scale the drive parameter values see the following sections, as appropriate:

- *Actual Value scaling* on page *249* (*ABB Drives profile technical data*)
- *Actual Value scaling* on page *251* (*Generic profile technical data*).

Diagnostics – FBA

Fault handling

The ACS550 provides fault information as follows:

- The control panel display shows a fault code and text. See chapter *Diagnostics* on page *253* for a complete description.
- Parameters 0401 LAST FAULT, 0412 PREVIOUS FAULT1 and 0413 PREVIOUS FAULT2 store the most recent faults.
- For fieldbus access, the drive reports faults as a hexadecimal value, assigned and coded according to the DRIVECOM specification. See the table below. Not all profiles support requesting fault codes using this specification. For profiles that support this specification, the profile documentation defines the proper fault request process.

Drive fault code		Fieldbus fault code (DRIVECOM specification)
1	OVERCURRENT	2310h
2	DC OVERVOLT	3210h
3	DEV OVERTEMP	4210h
4	SHORT CIRC	2340h
5	Reserved	FF6Bh
6	DC UNDERVOLT	3220h
7	AI1 LOSS	8110h
8	AI2 LOSS	8110h
9	MOT OVERTEMP	4310h
10	PANEL LOSS	5300h
11	ID RUN FAIL	FF84h
12	MOTOR STALL	7121h
14	EXT FAULT 1	9000h
15	EXT FAULT 2	9001h
16	EARTH FAULT	2330h
17	Obsolete	FF6Ah
18	THERM FAIL	5210h
19	OPEX LINK	7500h
20	OPEX PWR	5414h
21	CURR MEAS	2211h
22	SUPPLY PHASE	3130h
23	ENCODER ERR	7301h
24	OVERSPEED	7310h
25	Reserved	FF80h
26	DRIVE ID	5400h

Drive fault code		**Fieldbus fault code (DRIVECOM specification)**
27	CONFIG FILE	630Fh
28	SERIAL 1 ERR	7510h
29	EFB CON FILE	6306h
30	FORCE TRIP	FF90h
31	EFB 1	FF92h
32	EFB 2	FF93h
33	EFB 3	FF94h
34	MOTOR PHASE	FF56h
35	OUTP WIRING	FF95h
36	INCOMPATIBLE SW	630Fh
37	CB OVERTEMP	4110h
38	USER LOAD CURVE	FF6Bh
101	SERF CORRUPT	FF55h
102	Reserved	FF55h
103	SERF MACRO	FF55h
104	Reserved	FF55h
105	Reserved	FF55h
201	DSP T1 OVERLOAD	6100h
202	DSP T2 OVERLOAD	6100h
203	DSP T3 OVERLOAD	6100h
204	DSP STACK ERROR	6100h
205	Reserved (obsolete)	5000h
206	CB ID ERROR	5000h
207	EFB LOAD ERROR	6100h
1000	PAR HZRPM	6320h
1001	PAR PFC REF NEG	6320h
1002	Reserved (obsolete)	6320h
1003	PAR AI SCALE	6320h
1004	PAR AO SCALE	6320h
1005	PAR PCU 2	6320h
1006	PAR EXT RO	6320h
1007	PAR FIELDBUS MISSING	6320h
1008	PAR PFC MODE	6320h
1009	PAR PCU 1	6320h
1012	PAR PFC IO 1	6320h
1013	PAR PFC IO 2	6320h
1014	PAR PFC IO 3	6320h
1016	PAR USER LOAD C	6320h

Serial communication diagnostics

Besides the drive fault codes, the FBA module has diagnostic tools. Refer to the user's manual supplied with the FBA module.

ABB Drives profile technical data

Overview

The ABB Drives profile provides a standard profile that can be used on multiple protocols, including protocols available on the FBA module. This section describes the ABB Drives profile implemented for FBA modules.

Control Word

As described earlier in section *Control interface* on page 232, the CONTROL WORD is the principal means for controlling the drive from a fieldbus system.

The following table and the state diagram later in this sub-section describe the CONTROL WORD content for the ABB Drives profile.

ABB Drives profile (FBA) CONTROL WORD

Bit	Name	Value	Commanded state	Comments
0	OFF1 CONTROL	1	READY TO OPERATE	Enter READY TO OPERATE
		0	EMERGENCY OFF	Drive ramps to stop according to currently active deceleration ramp (2203 or 2205) Normal command sequence: • Enter OFF1 ACTIVE • Proceed to READY TO SWITCH ON, unless other interlocks (OFF2, OFF3) are active.
1	OFF2 CONTROL	1	OPERATING	Continue operation (OFF2 inactive)
		0	EMERGENCY OFF	Drive coasts to stop. Normal command sequence: • Enter OFF2 ACTIVE • Proceed to SWITCHON INHIBITED
2	OFF3 CONTROL	1	OPERATING	Continue operation (OFF3 inactive)
		0	EMERGENCY STOP	Drive stops within in time specified by parameter 2208. Normal command sequence: • Enter OFF3 ACTIVE • Proceed to SWITCH ON INHIBITED ⚠ **WARNING!** Be sure motor and driven equipment can be stopped using this mode.
3	INHIBIT OPERATION	1	OPERATION ENABLED	Enter OPERATION ENABLED (Note the Run enable signal must be active. See 1601. If 1601 is set to COMM, this bit also actives the Run Enable signal.)
		0	OPERATION INHIBITED	Inhibit operation. Enter OPERATION INHIBITED
4	RAMP_OUT_ ZERO	1	NORMAL OPERATION	Enter RAMP FUNCTION GENERATOR: ACCELERATION ENABLED
		0	RFG OUT ZERO	Force ramp function generator output to Zero. Drive ramps to stop (current and DC voltage limits in force).

ABB Drives profile (FBA) CONTROL WORD				
Bit	**Name**	**Value**	**Commanded state**	**Comments**
5	RAMP_HOLD	1	RFG OUT ENABLED	Enable ramp function. Enter RAMP FUNCTION GENERATOR: ACCELERATOR ENABLED
		0	RFG OUT HOLD	Halt ramping (Ramp Function Generator output held)
6	RAMP_IN_ ZERO	1	RFG INPUT ENABLED	Normal operation. Enter OPERATING
		0	RFG INPUT ZERO	Force Ramp Function Generator input to zero.
7	RESET	0=>1	RESET	Fault reset if an active fault exists (Enter SWITCH-ON INHIBITED). Effective if 1604 = COMM.
		0	OPERATING	Continue normal operation
8…9	Unused			
10	REMOTE_CMD	1		Fieldbus control enabled
		0		• CW ≠ 0 or Ref ≠ 0: Retain last CW and Ref. • CW = 0 and Ref = 0: Fieldbus control enabled. • Ref and deceleration/acceleration ramp are locked.
11	EXT CTRL LOC	1	EXT2 SELECT	Select external control location 2 (EXT2). Effective if 1102 = COMM.
		0	EXT1 SELECT	Select external control location 1 (EXT1). Effective if 1102 = COMM.
12…15	Unused			

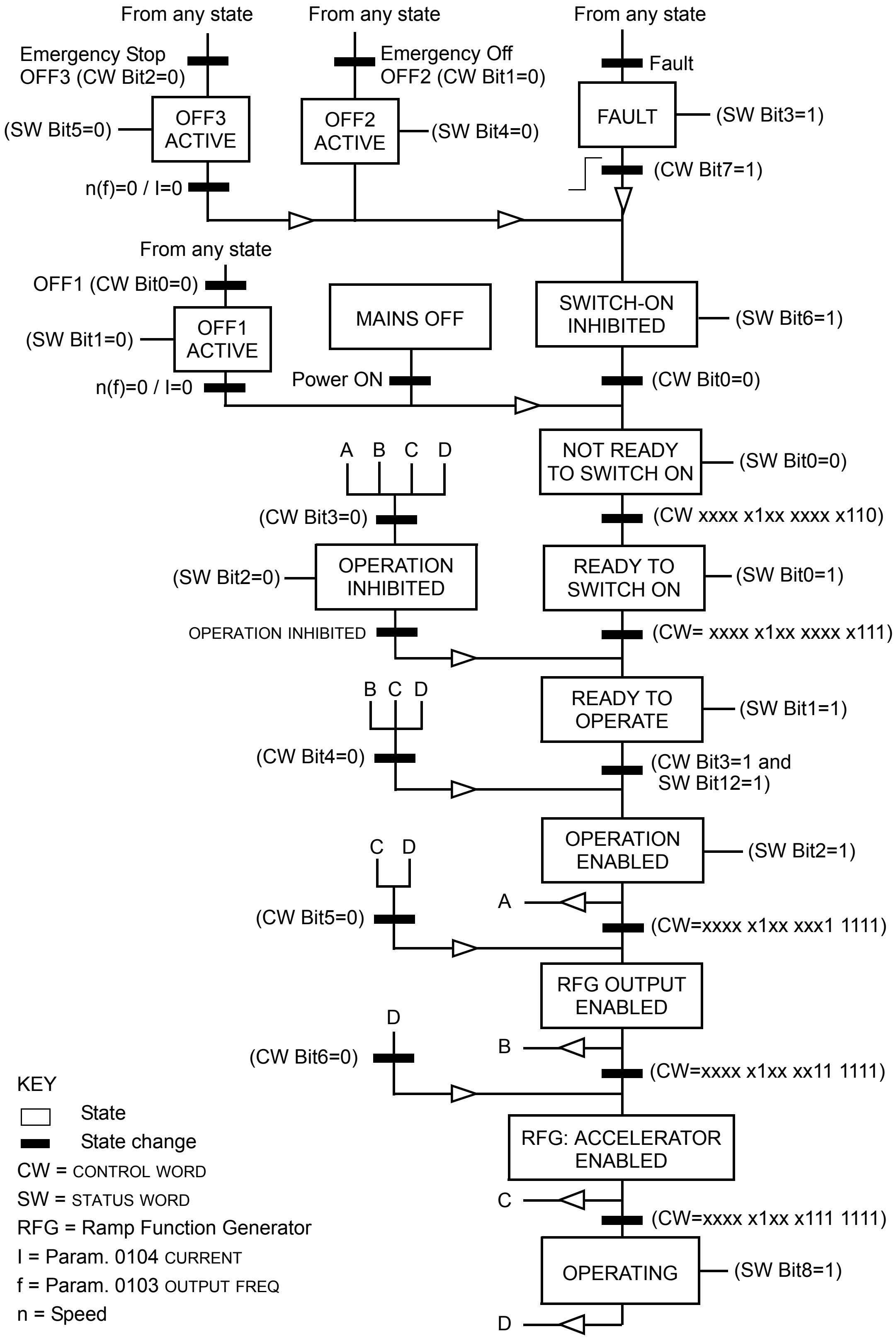
Status Word

As described earlier in section *Control interface* on page 232, the contents of the STATUS WORD is status information, sent by the drive to the master station. The following table and the state diagram later in this sub-section describe the status word content.

ABB Drives profile (FBA) STATUS WORD			
Bit	**Name**	**Value**	**Description (Correspond to states/boxes in the state diagram)**
0	RDY_ON	1	READY TO SWITCH ON
		0	NOT READY TO SWITCH ON
1	RDY_RUN	1	READY TO OPERATE
		0	OFF1 ACTIVE
2	RDY_REF	1	OPERATION ENABLED
		0	OPERATION INHIBITED
3	TRIPPED	0…1	FAULT
		0	No fault

ABB Drives profile (FBA) STATUS WORD			
Bit	**Name**	**Value**	**Description (Correspond to states/boxes in the state diagram)**
4	OFF_2_STA	1	OFF2 inactive
		0	**OFF2 ACTIVE**
5	OFF_3_STA	1	OFF3 inactive
		0	**OFF3 ACTIVE**
6	SWC_ON_INHIB	1	SWITCH-ON INHIBIT ACTIVE
		0	SWITCH-ON INHIBIT NOT ACTIVE
7	ALARM	1	Alarm (See section *Alarm listing* on page *261* for details on alarms.)
		0	No alarm
8	AT_SETPOINT	1	OPERATING**.** Actual value equals (within tolerance limits) the reference value.
		0	Actual value is outside tolerance limits (not equal to reference value).
9	REMOTE	1	Drive control location: REMOTE (EXT1 or EXT2)
		0	Drive control location: LOCAL
10	ABOVE_LIMIT	1	Supervised parameter's value ≥ supervision high limit. Bit remains "1" until supervised parameter's value < supervision low limit. See *Group 32: SUPERVISION*.
		0	Supervised parameter's value < supervision low limit. Bit remains "0" until supervised parameter's value > supervision high limit. See *Group 32: SUPERVISION*.
11	EXT CTRL LOC	1	External control location 2 (EXT2) selected
		0	External control location 1 (EXT1) selected
12	EXT RUN ENABLE	1	External Run Enable signal received
		0	No External Run Enable signal received
13… 15	Unused		

The state diagram below describes the start-stop function of CONTROL WORD (CW) and STATUS WORD (SW) bits.



Reference

As described earlier in section *Control interface* on page 232, the REFERENCE word is a speed or frequency reference.

Reference scaling

The following table describes REFERENCE scaling for the ABB Drives profile.

ABB Drives Profile (FBA)				
Reference	**Range**	**Reference type**	**Scaling**	**Remarks**
REF1	-32767… +32767	Speed or frequency	-20000 = -**(par. 1105)** 0 = 0 +20000 = **(par. 1105)** (20000 corresponds to 100%)	Final reference limited by 1104/1105. Actual motor speed limited by 2001/2002 (speed) or 2007/2008 (frequency).
REF2	-32767… +32767	Speed or frequency	-10000 = -**(par. 1108)** 0 = 0 +10000 = **(par. 1108)** (10000 corresponds to 100%)	Final reference limited by 1107/1108. Actual motor speed limited by 2001/2002 (speed) or 2007/2008 (frequency).
		Torque	-10000 = -**(par. 1108)** 0 = 0 +10000 = **(par. 1108)** (10000 corresponds to 100%)	Final reference limited by 2015/2017 (torque1) or 2016/2018 (torque2).
		PID Reference	-10000 = -**(par. 1108)** 0 = 0 +10000 = **(par. 1108)** (10000 corresponds to 100%)	Final reference limited by 4012/4013 (PID set1) or 4112/4113 (PID set2).

Note: The setting of parameter 1104 REF1 MIN and 1107 REF2 MIN has no effect on the scaling of references.

When parameter 1103 REF1 SELECT or 1106 REF2 SELECT is set to COMM+AI1 or COMM*AI1, the reference is scaled as follows:

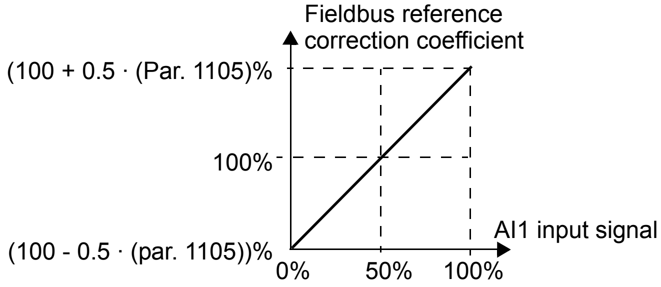
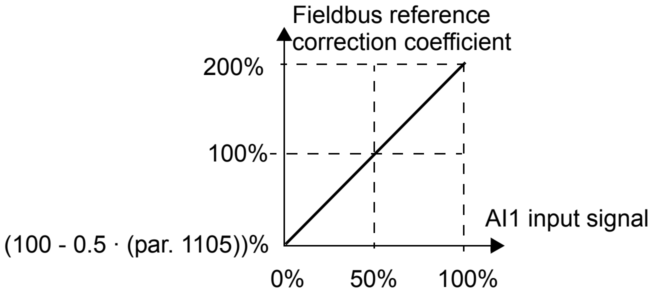
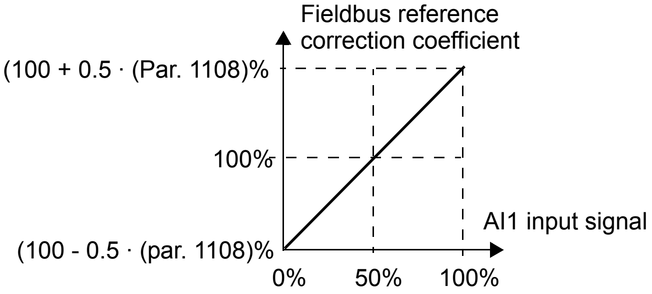
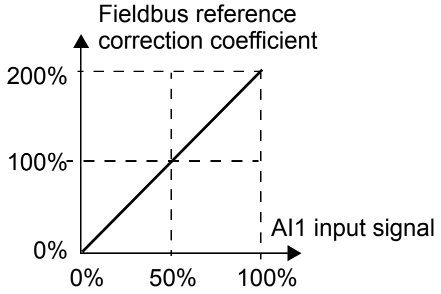
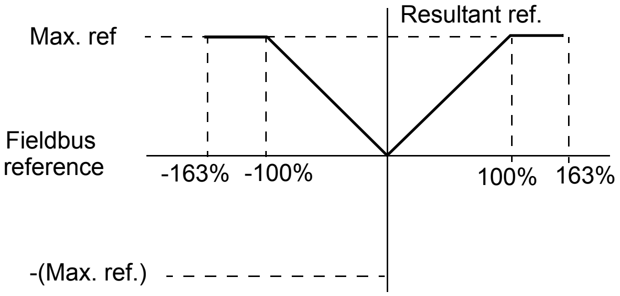
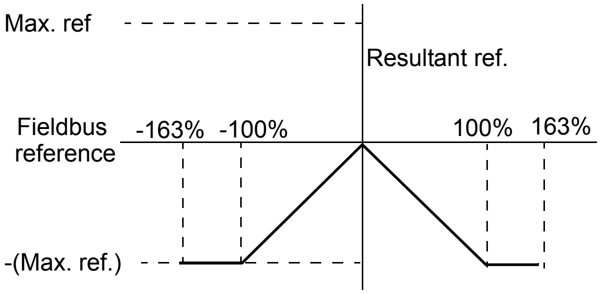
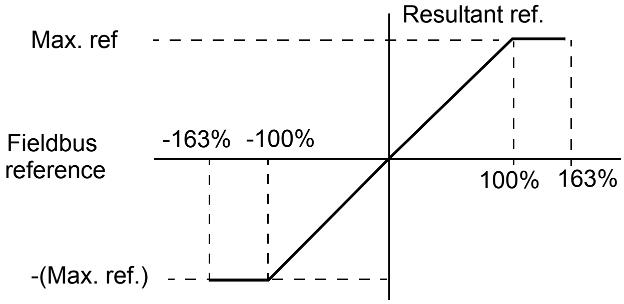
ABB Drives profile (FBA)		
Reference	**Value setting**	**AI reference scaling**
REF1	COMM+AI1	COMM (%) + (AI (%) - 0.5 · REF1 MAX (%)) 

ABB Drives profile (FBA)		
Reference	**Value setting**	**AI reference scaling**
REF1	COMM*AI1	COMM (%) · (AI (%) / 0.5 · REF1 MAX (%)) 
REF2	COMM+AI1	COMM (%) + (AI (%) - 0.5 · REF2 MAX (%)) 
REF2	COMM*AI1	COMM (%) · (AI (%) / 0.5 · REF2 MAX (%)) 

Reference handling

Use *Group 10: START/STOP/DIR* parameters to configure for control of rotation direction for each control location (EXT1 and EXT2). The following diagrams illustrate how group 10 parameters and the sign of the fieldbus reference interact to produce REFERENCE values (REF1 and REF2). Note, fieldbus references are bipolar, that is they can be positive or negative.

ABB Drives profile		
Parameter	**Value setting**	**AI reference scaling**
1003 DIRECTION	1 (FORWARD)	
1003 DIRECTION	2 (REVERSE)	
1003 DIRECTION	3 (REQUEST)	

Actual Value

As described earlier in section *Control interface* on page 232, Actual Values are words containing drive values.

Actual Value scaling

The scaling of the integers sent to the fieldbus as Actual Values depends on the resolution of the selected drive parameter. Except as noted for ACT1 and ACT2 below, scale the feedback integer using the resolution listed for the parameter in section *Complete parameter list* on page 87. For example:

Feedback integer	Parameter resolution	Scaled Value
1	0.1 mA	1 · 0.1 mA = 0.1 mA
10	0.1%	10 · 0.1% = 1%

Data words 5 and 6 are scaled as follows:

ABB Drives profile		
	Contents	**Scaling**
ACT1	ACTUAL SPEED	-20000 … +20000 = -(par. 1105) … +(par. 1105)
ACT2	TORQUE	-10000 … +10000 = -100% … +100%

Virtual addresses of the drive control

The virtual address area of the drive control is allocated as follows:

1	Control Word
2	Reference 1 (REF1)
3	Reference 2 (REF2)
4	Status Word
5	Actual Value 1 (ACT1)
6	Actual Value 2 (ACT2)

Generic profile technical data

Overview

The generic profile aims to fulfill the industry-standard drive profile for each protocol (e.g. PROFIdrive for PROFIBUS, AC/DC Drive for DeviceNet).

Control Word

As described earlier in section *Control interface* on page 232, the CONTROL WORD is the principal means for controlling the drive from a fieldbus system. For specific CONTROL WORD content, see the user's manual provided with the FBA module.

Status Word

As described earlier in section *Control interface* on page 232, the contents of the STATUS WORD is status information, sent by the drive to the master station. For specific STATUS WORD content, see the user's manual provided with the FBA module.

Reference

As described earlier in section *Control interface* on page 232, the REFERENCE word is a speed or frequency reference.

Note: REF2 is not supported by the Generic Drive profiles.

Reference scaling

REFERENCE scaling is fieldbus type specific. However, at the drive, the meaning of a 100% REFERENCE value is fixed as described in the table below. For a detailed description on the range and scaling of the REFERENCE, see the user's manual supplied with the FBA module.

Generic profile				
Reference	**Range**	**Reference type**	**Scaling**	**Remarks**
REF	Fieldbus specific	Speed	-100% = -**(par. 9908)** 0 = 0 +100 = **(par. 9908)**	Final reference limited by 1104/1105. Actual motor speed limited by 2001/2002 (speed).
		Frequency	-100% = -**(par. 9907)** 0 = 0 +100 = **(par. 9907)**	Final reference limited by 1104/1105. Actual motor speed limited by 2007/2008 (frequency).

Actual Values

As described earlier in section *Control interface* on page 232, Actual Values are words containing drive values.

Actual Value scaling

For Actual Values, scale the feedback integer using the parameter's resolution. (See section *Complete parameter list* on page *87* for parameter resolutions.) For example:

Feedback integer	**Parameter resolution**	**(Feedback integer) · (Parameter resolution) = Scaled Value**
1	0.1 mA	1 · 0.1 mA = 0.1 mA
10	0.1%	10 · 0.1% = 1%

Where parameters are in percent, the *Complete parameter list* section specifies what parameter corresponds to 100%. In such cases, to convert from percent to engineering units, multiply by the value of the parameter that defines 100% and divide by 100%. For example:

Feedback integer	**Parameter resolution**	**Value of the parameter that defines 100%**	**(Feedback integer) · (Parameter resolution) · (Value of 100% ref.) / 100% = Scaled Value**
10	0.1%	1500 rpm[1]	10 · 0.1% · 1500 RPM / 100% = 15 rpm
100	0.1%	500 Hz[2]	100 · 0.1% · 500 Hz / 100% = 50 Hz

[1] Assuming, for the sake of this example, that the Actual Value uses parameter 9908 MOT NOM SPEED as the 100% reference and that 9908 = 1500 rpm.

[2] Assuming, for the sake of this example, that the Actual Value uses parameter 9907 MOT NOM FREQ as the 100% reference and that 9907 = 500 Hz.

Actual Value mapping

See the user's manual supplied with the FBA module.

Diagnostics

WARNING! Do not attempt any measurement, parts replacement or other service procedure not described in this manual. Such action will void the warranty, may endanger correct operation and increase downtime and expense.

WARNING! All electrical installation and maintenance work described in this chapter should only be undertaken by qualified service personnel. The safety instructions in chapter *Safety* on page *5* must be followed.

Diagnostic displays

The drive detects error situations and reports them using:

- the green and red LED on the body of the drive
- the status LED on the control panel (if an Assistant Control Panel is attached to the drive)
- the control panel display (if a control panel is attached to the drive)
- the Fault Word and Alarm Word parameter bits (parameters 0305 to 0309). See *Group 03: FB ACTUAL SIGNALS* on page *108* for the bit definitions.

The form of the display depends on the severity of the error. You can specify the severity for many errors by directing the drive to:

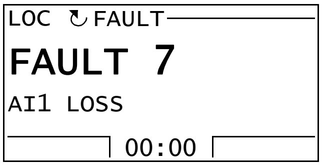
- ignore the error situation
- report the situation as an alarm
- report the situation as a fault.

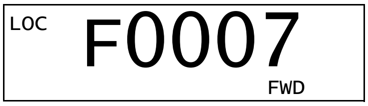
Red – Faults

The drive signals that it has detected a severe error, or fault, by:

- enabling the red LED on the drive (LED is either steady on or blinking)
- showing the steady red status LED on the control panel (if attached to the drive)
- setting an appropriate bit in a Fault Word parameter (0305 to 0307)
- overriding the control panel display with the display of a fault code in the Fault mode (figures on the right)
- stopping the motor (if it was on).

The fault code on the control panel display is temporary. Pressing any of the following keys removes the fault message: MENU, ENTER, UP, or DOWN key.


LOC ↻ FAULT
FAULT 7
AI1 LOSS
00:00


LOC
F0007
FWD

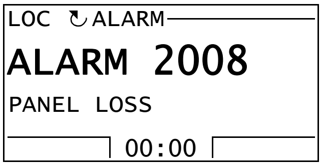
The message reappears after a few seconds if the control panel is not touched and the fault is still active.

Flashing green – Alarms

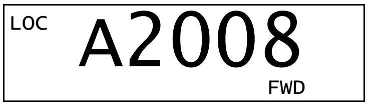
For less severe errors, called alarms, the diagnostic display is advisory. For these situations, the drive is simply reporting that it had detected something "unusual." In these situations, the drive:

- flashes the green LED on the drive (does not apply to alarms that arise from control panel operation errors)
- flashes the green LED on the control panel (if attached to the drive)
- sets an appropriate bit in an Alarm Word parameter (0308 or 0309). See *Group 03: FB ACTUAL SIGNALS* on page *108* for the bit definitions
- overrides the control panel display with the display of an alarm code and/or name in the Fault mode (figures on the right).

Alarm messages disappear from the control panel display after a few seconds. The message returns periodically as long as the alarm condition exists.



```
LOC ↻ALARM
ALARM 2008
PANEL LOSS
00:00
```



```
LOC A2008
FWD
```

Correcting faults

The recommended corrective action for faults is:

- Use the table in section *Fault listing* below to find and address the root cause of the problem.
- Reset the drive. See section *Fault resetting* on page *259*.

Fault listing

The following table lists the faults by code number and describes each. The fault name is the long form shown in the Fault mode of the Assistant Control Panel when the fault occurs. The fault names shown (for Assistant Control Panel only) in the Fault Logger mode (see page *57*) and the fault names for parameter 0401 LAST FAULT may be shorter.

Fault code	Fault name in panel	Description and recommended corrective action
1	OVERCURRENT	Output current is excessive. Check for and correct: • Excessive motor load. • Insufficient acceleration time (parameters 2202 ACCELER TIME 1 and 2205 ACCELER TIME 2). • Faulty motor, motor cables or connections.

Fault code	Fault name in panel	Description and recommended corrective action
2	DC OVERVOLT	Intermediate circuit DC voltage is excessive. Check for and correct: • Static or transient overvoltages in the input power supply. • Insufficient deceleration time (parameters 2203 DECELER TIME 1 and 2206 DECELER TIME 2). • Undersized brake chopper (if present). • Verify that overvoltage controller is ON (using parameter 2005).
3	DEV OVERTEMP	Drive heatsink is overheated. Temperature is at or above limit. R1…R4: 115 °C (239 °F) R5, R6: 125 °C (257 °F) Check for and correct: • Fan failure. • Obstructions in the air flow. • Dirt or dust coating on the heat sink. • Excessive ambient temperature. • Excessive motor load.
4	SHORT CIRC	Fault current. Check for and correct: • A short-circuit in the motor cable(s) or motor. • Supply disturbances.
5	RESERVED	Not used.
6	DC UNDERVOLT	Intermediate circuit DC voltage is not sufficient. Check for and correct: • Missing phase in the input power supply. • Blown fuse. • Undervoltage on mains.
7	AI1 LOSS	Analog input 1 loss. Analog input value is less than AI1 FAULT LIMIT (3021). Check for and correct: • Source and connection for analog input. • Parameter settings for AI1 FAULT LIMIT (3021) and 3001 AI<MIN FUNCTION.
8	AI2 LOSS	Analog input 2 loss. Analog input value is less than AI2 FAULT LIMIT (3022). Check for and correct: • Source and connection for analog input. • Parameter settings for AI2 FAULT LIMIT (3022) and 3001 AI<MIN FUNCTION.
9	MOT OVERTEMP	Motor is too hot, based on either the drive's estimate or on temperature feedback. • Check for overloaded motor. • Adjust the parameters used for the estimate (3005…3009). • Check the temperature sensors and *Group 35: MOTOR TEMP MEAS* parameters.
10	PANEL LOSS	Panel communication is lost and either: • Drive is in local control mode (the control panel displays LOC), or • Drive is in remote control mode (REM) and is parameterized to accept start/stop, direction or reference from the control panel. To correct check: • Communication lines and connections. • Parameter 3002 PANEL COMM ERR. • Parameters in *Group 10: START/STOP/DIR* and *Group 11: REFERENCE SELECT* (if drive operation is REM).

Fault code	Fault name in panel	Description and recommended corrective action
11	ID RUN FAIL	The Motor ID Run was not completed successfully. Check for and correct: • Motor connections. • Motor parameters 9905…9909.
12	MOTOR STALL	Motor or process stall. Motor is operating in the stall region. Check for and correct: • Excessive load. • Insufficient motor power. • Parameters 3010…3012.
13	RESERVED	Not used.
14	EXT FAULT 1	Digital input defined to report first external fault is active. See parameter 3003 EXTERNAL FAULT 1.
15	EXT FAULT 2	Digital input defined to report second external fault is active. See parameter 3004 EXTERNAL FAULT 2.
16	EARTH FAULT	Possible ground fault detected in the motor or motor cables. The drive monitors for ground faults while the drive is running and while the drive is not running. Detection is more sensitive when the drive is not running and can produce false positives. Possible corrections: • Check for/correct faults in the input wiring. • Verify that motor cable does not exceed maximum specified length. • A delta grounded input power supply and motor cables with high capacitance may result in erroneous error reports during non-running tests. To disable response to fault monitoring when the drive is not running, use parameter 3023 WIRING FAULT. To disable response to all ground fault monitoring, use parameter 3017 EARTH FAULT. **Note:** Disabling earth fault (ground fault) may void the warranty.
17	OBSOLETE	Not used.
18	THERM FAIL	Internal fault. The thermistor measuring the internal temperature of the drive is open or shorted. Contact your local ABB representative.
19	OPEX LINK	Internal fault. A communication-related problem has been detected on the fiber optic link between the control and OINT boards. Contact your local ABB representative.
20	OPEX PWR	Internal fault. Exceptionally low voltage detected on the OINT power supply. Contact your local ABB representative.
21	CURR MEAS	Internal fault. Current measurement is out of range. Contact your local ABB representative.
22	SUPPLY PHASE	Ripple voltage in the DC link is too high. Check for and correct: • Missing mains phase. • Blown fuse.

Fault code	Fault name in panel	Description and recommended corrective action
23	ENCODER ERR	The drive is not detecting a valid encoder signal. Check for and correct: • Encoder presence and proper connection (reverse wired = channel A connected to terminal of channel B or vice versa, loose connection or short circuit). • Voltage logic levels are outside of the specified range. • A working and properly connected Pulse Encoder Interface Module, OTAC-01. • Wrong value entered in parameter 5001 PULSE NR. A wrong value will only be detected if the error is such that the calculated slip is greater than 4 times the rated slip of the motor. • Encoder is not being used, but parameter 5002 ENCODER ENABLE = 1 (ENABLE).
24	OVERSPEED	Motor speed is greater than 120% of the larger (in magnitude) of 2001 MINIMUM SPEED or 2002 MAXIMUM SPEED. Check for and correct: • Parameter settings for 2001 and 2002. • Adequacy of motor braking torque. • Applicability of torque control. • Brake chopper and resistor.
25	RESERVED	Not used.
26	DRIVE ID	Internal fault. Configuration Block Drive ID is not valid. Contact your local ABB representative.
27	CONFIG FILE	Internal configuration file has an error. Contact your local ABB representative.
28	SERIAL 1 ERR	Fieldbus communication has timed out. Check for and correct: • Fault setup (3018 COMM FAULT FUNC and 3019 COMM FAULT TIME). • Communication settings (*Group 51: EXT COMM MODULE* or *Group 53: EFB PROTOCOL* as appropriate). • Poor connections and/or noise on line.
29	EFB CON FILE	Error in reading the configuration file for the embedded fieldbus.
30	FORCE TRIP	Fault trip forced by the fieldbus. See the fieldbus User's Manual.
31	EFB 1	Fault code reserved for the embedded fieldbus (EFB) protocol application. The meaning is protocol dependent.
32	EFB 2	
33	EFB 3	
34	MOTOR PHASE	Fault in the motor circuit. One of the motor phases is lost. Check for and correct: • Motor fault. • Motor cable fault. • Thermal relay fault (if used). • Internal fault.
35	OUTP WIRING	Possible power wiring error detected. When the drive is not running it monitors for an improper connection between the drive input power and the drive output. Check for and correct: • Proper input wiring – line voltage is NOT connected to drive output. • The fault can be erroneously declared if the input power is a delta grounded system and motor cable capacitance is large. This fault can be disabled using parameter 3023 WIRING FAULT.

Fault code	Fault name in panel	Description and recommended corrective action
36	INCOMPATIBLE SW	The drive cannot use the software. • Internal fault. • The loaded software is not compatible with the drive. • Call support representative.
37	CB OVERTEMP	Drive control board is overheated. The fault trip limit is 88 °C. Check for and correct: • Excessive ambient temperature. • Fan failure. • Obstructions in the air flow. Not for drives with an OMIO control board.
38	USER LOAD CURVE	Condition defined by parameter 3701 USER LOAD C MODE has been valid longer than the time defined by 3703 USER LOAD C TIME.
101…199	SYSTEM ERROR	Error internal to the drive. Contact your local ABB representative and report the error number.
201…299	SYSTEM ERROR	Error in the system. Contact your local ABB representative and report the error number.
-	UNKNOWN DRIVE TYPE: ACS550 SUPPORTED DRIVES: X	Wrong type of panel, i.e. panel that supports drive X but not the ACS550, has been connected to the ACS550.

Faults that indicate conflicts in the parameter settings are listed below.

Fault code	Fault name in panel	Description and recommended corrective action
1000	PAR HZRPM	Parameter values are inconsistent. Check for any of the following: • 2001 MINIMUM SPEED > 2002 MAXIMUM SPEED. • 2007 MINIMUM FREQ > 2008 MAXIMUM FREQ. • 2001 MINIMUM SPEED / 9908 MOTOR NOM SPEED is outside proper range (> 50). • 2002 MAXIMUM SPEED / 9908 MOTOR NOM SPEED is outside proper range (> 50). • 2007 MINIMUM FREQ / 9907 MOTOR NOM FREQ is outside proper range (> 50). • 2008 MAXIMUM FREQ / 9907 MOTOR NOM FREQ is outside proper range (> 50).
1001	PAR PFC REF NEG	Parameter values are inconsistent. Check for the following: • 2007 MINIMUM FREQ is negative, when 8123 PFC ENABLE is active.
1002	RESERVED	Not used.
1003	PAR AI SCALE	Parameter values are inconsistent. Check for any of the following: • 1301 MINIMUM AI1 > 1302 MAXIMUM AI1. • 1304 MINIMUM AI2 > 1305 MAXIMUM AI2.
1004	PAR AO SCALE	Parameter values are inconsistent. Check for any of the following: • 1504 MINIMUM AO1 > 1505 MAXIMUM AO1. • 1510 MINIMUM AO2 > 1511 MAXIMUM AO2.

Fault code	Fault name in panel	Description and recommended corrective action
1005	PAR PCU 2	Parameter values for power control are inconsistent: Improper motor nominal kVA or motor nominal power. Check for the following: • 1.1 ≤ (9906 MOTOR NOM CURR · 9905 MOTOR NOM VOLT · 1.73 / P_N) ≤ 3.0 where: P_N = 1000 · 9909 MOTOR NOM POWER (if units are kW) or P_N = 746 · 9909 MOTOR NOM POWER (if units are hp, e.g. in US)
1006	PAR EXT RO	Parameter values are inconsistent. Check for the following: • Extension relay module not connected and • 1410…1412 RELAY OUTPUTS 4…6 have non-zero values.
1007	PAR FIELDBUS MISSING	Parameter values are inconsistent. Check for and correct: • A parameter is set for fieldbus control (e.g. 1001 EXT1 COMMANDS = 10 (COMM)), but 9802 COMM PROT SEL = 0.
1008	PAR PFC MODE	Parameter values are inconsistent – 9904 MOTOR CTRL MODE must be = 3 (SCALAR:FREQ), when 8123 PFC ENABLE is activated.
1009	PAR PCU 1	Parameter values for power control are inconsistent: Improper motor nominal frequency or speed. Check for both of the following: • 1 ≤ (60 · 9907 MOTOR NOM FREQ / 9908 MOTOR NOM SPEED ≤ 16 • 0.8 ≤ 9908 MOTOR NOM SPEED / (120 · 9907 MOTOR NOM FREQ / Motor Poles) ≤ 0.992
1010/ 1011	RESERVED	Not used.
1012	PAR PFC IO 1	IO configuration is not complete – not enough relays are parameterized to PFC. Or, a conflict exists between *Group 14: RELAY OUTPUTS*, parameter 8117 NR OF AUX MOT and parameter 8118 AUTOCHNG INTERV.
1013	PAR PFC IO 2	IO configuration is not complete – the actual number of PFC motors (parameter 8127, MOTORS) does not match the PFC motors in *Group 14: RELAY OUTPUTS* and parameter 8118 AUTOCHNG INTERV.
1014	PAR PFC IO 3	IO configuration is not complete – the drive is unable to allocate a digital input (interlock) for each PFC motor (parameters 8120 INTERLOCKS and 8127 MOTORS).
1015	RESERVED	Not used.
1016	PAR USER LOAD C	Parameter values for the user load curve are inconsistent. Check that the following conditions are met: • 3704 LOAD FREQ 1 ≤ 3707 LOAD FREQ 2 ≤ 3710 LOAD FREQ 3 ≤ 3713 LOAD FREQ 4 ≤ 3716 LOAD FREQ 5. • 3705 LOAD TORQ LOW 1 ≤ 3706 LOAD TORQ HIGH 1. • 3708 LOAD TORQ LOW 2 ≤ 3709 LOAD TORQ HIGH 2. • 3711 LOAD TORQ LOW 3 ≤ 3712 LOAD TORQ HIGH 3. • 3714 LOAD TORQ LOW 4 ≤ 3715 LOAD TORQ HIGH 4. • 3717 LOAD TORQ LOW 5 ≤ 3718 LOAD TORQ HIGH 5.

Fault resetting

The ACS550 can be configured to automatically reset certain faults. Refer to parameter *Group 31: AUTOMATIC RESET*.

WARNING! If an external source for start command is selected and it is active, the ACS550 may start immediately after fault reset.

Flashing red LED

To reset the drive for faults indicated by a flashing red LED:

- Turn the power off for 5 minutes.

Red LED

To reset the drive for faults indicated by a red LED (on, not flashing), correct the problem and do one of the following:

- Press RESET from the control panel.
- Turn the power off for 5 minutes.

Depending on the value of 1604 FAULT RESET SEL, the following could also be used to reset the drive:

- digital input
- serial communication.

When the fault has been corrected, the motor can be started.

History

For reference, the last three fault codes are stored into parameters 0401, 0412, 0413. For the most recent fault (identified by parameter 0401), the drive stores additional data (in parameters 0402…0411) to aid in troubleshooting a problem. For example, parameter 0404 stores the motor speed at the time of the fault.

The Assistant Control Panel provides additional information about the fault history. See section *Fault Logger mode* on page *57* for more information.

To clear the fault history (all of the *Group 04: FAULT HISTORY* parameters):

1. Using the control panel in the Parameters mode, select parameter 0401.
2. Press EDIT (or ENTER on the Basic Control Panel).
3. Press UP and DOWN at the same time.
4. Press SAVE.

Correcting alarms

The recommended corrective action for alarms is:

- Determine if the alarm requires any corrective action (action is not always required).
- Use the table in section *Alarm listing* below to find and address the root cause of the problem.

Alarm listing

The following table lists the alarms by code number and describes each.

Alarm code	Display	Description
2001	OVERCURRENT	Current limiting controller is active. Check for and correct: • Excessive motor load. • Insufficient acceleration time (parameters 2202 ACCELER TIME 1 and 2205 ACCELER TIME 2). • Faulty motor, motor cables or connections.
2002	OVERVOLTAGE	Overvoltage controller is active. Check for and correct: • Static or transient overvoltages in the input power supply. • Insufficient deceleration time (parameters 2203 DECELER TIME 1 and 2206 DECELER TIME 2).
2003	UNDERVOLTAGE	Undervoltage controller is active. Check for and correct: • Undervoltage on mains.
2004	DIR LOCK	The change in direction being attempted is not allowed. Either: • Do not attempt to change the direction of motor rotation, or • Change parameter 1003 DIRECTION to allow direction change (if reverse operation is safe).
2005	IO COMM	Fieldbus communication has timed out. Check for and correct: • Fault setup (3018 COMM FAULT FUNC and 3019 COMM FAULT TIME). • Communication settings (*Group 51: EXT COMM MODULE* or *Group 53: EFB PROTOCOL* as appropriate). • Poor connections and/or noise on line.
2006	AI1 LOSS	Analog input 1 is lost, or value is less than the minimum setting. Check: • Input source and connections. • Parameter that sets the minimum (3021). • Parameter that sets the alarm/fault operation (3001),
2007	AI2 LOSS	Analog input 2 is lost, or value is less than the minimum setting. Check: • Input source and connections. • Parameter that sets the minimum (3022). • Parameter that sets the alarm/fault operation (3001).
2008	PANEL LOSS	Panel communication is lost and either: • Drive is in local control mode (the control panel displays LOC), or • Drive is in remote control mode (REM) and is parameterized to accept start/stop, direction or reference from the control panel. To correct check: • Communication lines and connections. • Parameter 3002 PANEL COMM ERR. • Parameters in *Group 10: START/STOP/DIR* and *Group 11: REFERENCE SELECT* (if drive operation is REM).

Alarm code	Display	Description
2009	DEVICE OVERTEMP	Drive heatsink is hot. This alarm warns that a DEVICE OVERTEMP fault may be near. R1…R4: 100 °C (212 °F) R5, R6: 110 °C (230 °F) Check for and correct: • Fan failure. • Obstructions in the air flow. • Dirt or dust coating on the heat sink. • Excessive ambient temperature. • Excessive motor load.
2010	MOTOR TEMP	Motor is hot, based on either the drive's estimate or on temperature feedback. This alarm warns that a MOT OVERTEMP fault trip may be near. Check: • Check for overloaded motor. • Adjust the parameters used for the estimate (3005…3009). • Check the temperature sensors and *Group 35: MOTOR TEMP MEAS*.
2011	RESERVED	Not used.
2012	MOTOR STALL	Motor is operating in the stall region. This alarm warns that a MOTOR STALL fault trip may be near.
2013 (Note 1)	AUTORESET	This alarm warns that the drive is about to perform an automatic fault reset, which may start the motor. • To control automatic reset, use *Group 31: AUTOMATIC RESET*.
2014 (Note 1)	AUTOCHANGE	This alarm warns that the PFC autochange function is active. • To control PFC, use *Group 81: PFC CONTROL* and the *PFC macro* on page *80*.
2015	PFC I LOCK	This alarm warns that the PFC interlocks are active, which means that the drive cannot start the following: • Any motor (when Autochange is used). • The speed regulated motor (when Autochange is not used).
2016/ 2017	RESERVED	Not used.
2018 (Note 1)	PID SLEEP	This alarm warns that the PID sleep function is active, which means that the motor could accelerate when the PID sleep function ends. • To control PID sleep, use parameters 4022…4026 or 4122…4126.
2019	ID RUN	Performing ID Run.
2020	RESERVED	Not used.
2021	START ENABLE 1 MISSING	This alarm warns that the Start Enable 1 signal is missing. • To control Start Enable 1 function, use parameter 1608. To correct, check: • Digital input configuration. • Communication settings.
2022	START ENABLE 2 MISSING	This alarm warns that the Start Enable 2 signal is missing. • To control Start Enable 2 function, use parameter 1609. To correct, check: • Digital input configuration. • Communication settings.

Alarm code	Display	Description
2023	EMERGENCY STOP	Emergency stop activated.
2024	ENCODER ERROR	The drive is not detecting a valid encoder signal. Check for and correct: • Encoder presence and proper connection (reverse wired, loose connection,or short circuit). • Voltage logic levels are outside of the specified range. • A working and properly connected Pulse Encoder Interface Module, OTAC-01. • Wrong value entered in parameter 5001 PULSE NR. A wrong value will only be detected if the error is such that the calculated slip is greater than 4 times the rated slip of the motor. • Encoder is not being used, but parameter 5002 ENCODER ENABLE = 1 (ENABLE).
2025	FIRST START	Signals that a the drive is performing a First Start evaluation of motor characteristics. This is normal the first time the motor is run after motor parameters are entered or changed. See parameter 9910 ID RUN for a description of motor models.
2026	RESERVED	Not used.
2027	USER LOAD CURVE	This alarm warns that the condition defined by parameter 3701 USER LOAD C MODE has been valid longer than half of the time defined by 3703 USER LOAD C TIME.
2028	START DELAY	Shown during the Start delay. See parameter 2113 START DELAY.

Note 1. Even when the relay output is configured to indicate alarm conditions (e.g. parameter 1401 RELAY OUTPUT 1 = 5 (ALARM) or 16 (FLT/ALARM)), this alarm is not indicated by a relay output.

Alarm codes (Basic Control Panel)

The Basic Control Panel indicates control panel alarms with a code, A5xxx. The following table lists the alarm codes and descriptions.

Code	Description
5001	Drive is not responding.
5002	The communication profile is incompatible with the drive.
5010	The panel's parameter backup file is corrupted.
5011	Drive is controlled from another source.
5012	Rotation direction is locked.
5013	Button is disabled, because start is inhibited.
5014	Button is disabled, because drive is faulted.
5015	Button is disabled, because local mode lock is on.
5018	Parameter default value can't be found.
5019	Writing a non-zero value is prohibited (can only write a zero value).
5020	Group or parameter does not exist or parameter value is inconsistent.
5021	Group or parameter is hidden.
5022	Group or parameter is write protected.
5023	Modification is not allowed while the drive is running.

Code	Description
5024	Drive is busy, try again.
5025	Write is not allowed while upload or download is in progress.
5026	Value is at or below low limit.
5027	Value is at or above high limit.
5028	Value is invalid – doesn't match any values in the discrete values list.
5029	Memory is not ready, try again.
5030	Request is invalid.
5031	Drive is not ready, e.g due to low DC voltage.
5032	Parameter error was detected.
5040	Selected parameter set can’t be found in the current parameter backup.
5041	Parameter backup doesn't fit into memory.
5042	Selected parameter set can’t be found in the current parameter backup.
5043	No start inhibit was granted.
5044	Parameter backup versions do not match.
5050	Parameter upload was aborted.
5051	File error was detected.
5052	Parameter upload attempt has failed.
5060	Parameter download was aborted.
5062	Parameter download attempt has failed.
5070	Panel backup memory write error was detected.
5071	Panel backup memory read error was detected.
5080	Operation is not allowed, because the drive is not in local mode.
5081	Operation is not allowed, because a fault is active.
5083	Operation is not allowed, because parameter lock is not open.
5084	Operation is not allowed, because drive is busy, try again.
5085	Download is not allowed, because drive types are incompatible.
5086	Download is not allowed, because drive models are incompatible.
5087	Download is not allowed, because parameter sets do not match.
5088	Operation failed, because a drive memory error was detected.
5089	Download failed, because a CRC error was detected.
5090	Download failed, because a data processing error was detected.
5091	Operation failed, because a parameter error was detected.
5092	Download failed, because parameter sets do not match.

Maintenance

WARNING! Read chapter *Safety* on page *5* before performing any maintenance on the equipment. Ignoring the safety instructions can cause injury or death.

Maintenance intervals

If installed in an appropriate environment, the drive requires very little maintenance. This table lists the routine maintenance intervals recommended by ABB.

Maintenance	Interval	Instruction
Heatsink temperature check and cleaning	Depends on the dustiness of the environment (every 6…12 months)	See *Heatsink* on page *265*.
Main cooling fan replacement	Every six years	See *Main fan replacement* on page *266*.
Internal enclosure cooling fan replacement (IP54 / UL type 12 drives)	Every three years.	See *Internal enclosure fan replacement* on *268*.
Capacitor reforming	Every year when stored	See *Reforming* on page *269*.
Capacitor replacement (frame sizes R5 and R6)	Every nine years	See *Replacement* on page *269*.
Replace battery in the Assistant Control Panel	Every ten years	See *Battery* on page *269*.

Consult your local ABB Service representative for more details on the maintenance. On the Internet, go to www.abb.com/drive and select *Drive Services – Maintenance and Field Services*.

Heatsink

The heatsink fins accumulate dust from the cooling air. Since a dusty heatsink is less efficient at cooling the drive, overtemperature faults become more likely. In a "normal" environment (not dusty, not clean) check the heatsink annually, in a dusty environment check more often.

Clean the heatsink as follows (when necessary):

1. Remove power from the drive.
2. Remove the cooling fan (see section *Main fan replacement* on page *266*).
3. Blow clean compressed air (not humid) from bottom to top and simultaneously use a vacuum cleaner at the air outlet to trap the dust.

Note: If there is a risk of the dust entering adjoining equipment, perform the cleaning in another room.

4. Reinstall the cooling fan.
5. Restore power.

Main fan replacement

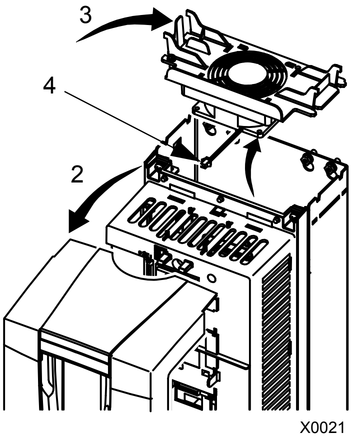
The drive's main cooling fan has a life span of about 60 000 operating hours at maximum rated operating temperature and drive load. The expected life span doubles for each 10 °C (18 °F) drop in the fan temperature (fan temperature is a function of ambient temperatures and drive loads).

Fan failure can be predicted by the increasing noise from fan bearings and the gradual rise in the heatsink temperature in spite of heatsink cleaning. If the drive is operated in a critical part of a process, fan replacement is recommended once these symptoms start appearing. Replacement fans are available from ABB. Do not use other than ABB specified spare parts.

Frame sizes R1...R4

To replace the fan:

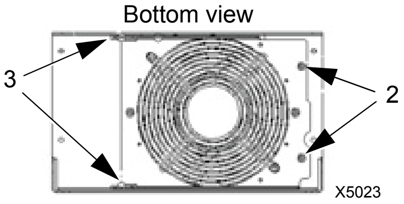
1. Remove power from the drive.
2. Remove drive cover.
3. For frame size:
   - R1, R2: Press together the retaining clips on the fan cover sides, and lift.
   - R3, R4: Press in on the lever located on the left side of the fan mount, and rotate the fan up and out.
4. Disconnect the fan cable.
5. Reinstall the fan in reverse order.
6. Restore power.



Frame size R5

To replace the fan:

1. Remove power from drive.
2. Remove the screws attaching the fan.
3. Remove the fan: Swing the fan out on its hinges.
4. Disconnect the fan cable.
5. Reinstall the fan in reverse order.
6. Restore power.

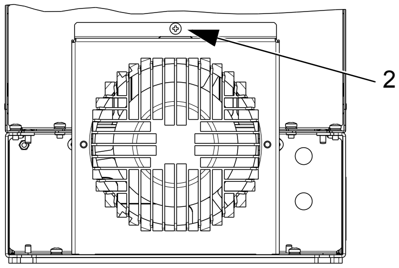


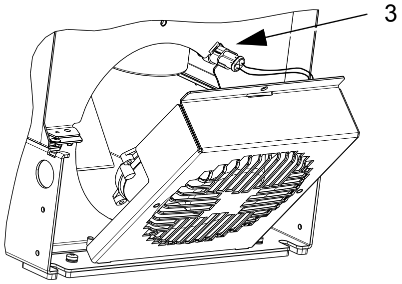
Arrows in the fan show the directions of the rotation and air flow.

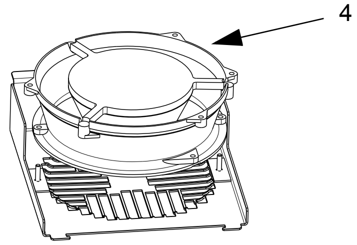
Frame size R6

To replace the fan:

1. Remove power from the drive.
2. Remove the screw attaching the fan casing and let the casing lean down against the limiters.
3. Slide out the cable connector and disconnect it.
4. Take off the casing and replace the fan onto the casing's pins.
5. Reinstall the casing in reverse order.
6. Restore power.







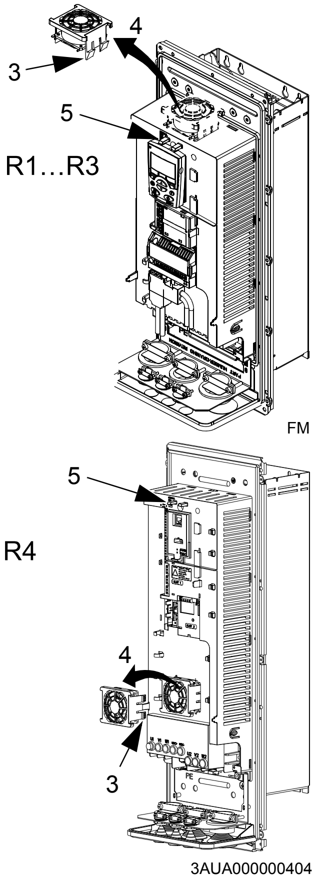
Internal enclosure fan replacement

IP54 / UL type 12 enclosures have an additional internal fan to circulate air inside the enclosure.

Frame sizes R1…R4

To replace the internal enclosure fan in frame sizes R1 to R3 (located at the top of the drive) and R4 (located in front of the drive):

1. Remove power from the drive.
2. Remove the front cover.
3. The housing that holds the fan in place has barbed retaining clips at each corner. Press all four clips toward the center to release the barbs.
4. When the clips/barbs are free, pull the housing up to remove from the drive.
5. Disconnect the fan cable.
6. Install the fan in reverse order, noting that:
   - The fan air flow is up (refer to the arrow on fan).
   - The fan wire harness is toward the front.
   - The notched housing barb is located in the right-rear corner.
   - The fan cable connects just forward of the fan at the top of the drive.



Frame sizes R5 and R6

To replace the internal enclosure fan in frame sizes R5 or R6:

1. Remove power from the drive.
2. Remove the front cover.
3. Lift the fan out and disconnect the cable.
4. Install the fan in reverse order.
5. Restore power.

Capacitors

Reforming

The drive DC link capacitors need to be reformed (re-aged) if the drive has been non-operational for more than one year. Without reforming, capacitors may be damaged when the drive starts to operate. It is therefore recommended to reform the capacitors once a year. See section *Serial number* on page *13* for how to check the date of manufacture from the serial number shown on the drive labels.

For information on reforming the capacitors, refer to *Guide for Capacitor Reforming in ACS50, ACS55, ACS150, ACS310, ACS320, ACS350, ACS550 and ACH550* (3AFE68735190 [English]), available on the Internet (go to www.abb.com and enter the code in the Search field).

Replacement

The drive intermediate circuit employs several electrolytic capacitors. Their life span is from 35 000...90 000 hours depending on drive loading and ambient temperature. Capacitor life can be prolonged by lowering the ambient temperature.

It is not possible to predict a capacitor failure. Capacitor failure is usually followed by a input power fuse failure or a fault trip. Contact ABB if capacitor failure is suspected. Replacements for frame size R5 and R6 are available from ABB. Do not use other than ABB specified spare parts.

Control panel

Cleaning

Use a soft damp cloth to clean the control panel. Avoid harsh cleaners which could scratch the display window.

Battery

A battery is only used in Assistant Control Panels that have the clock function available and enabled. The battery keeps the clock operating in memory during power interruptions.

The expected life for the battery is greater than ten years. To remove the battery, use a coin to rotate the battery holder on the back of the control panel. Replace the battery with type CR2032.

Note: The battery is NOT required for any control panel or drive function, except the clock.

Technical data

Ratings

By type designation, the table below provides ratings for the ACS550 adjustable speed AC drive, including:

- IEC ratings
- NEMA ratings (shaded columns)
- frame size.

Ratings, 208…240 V drives

Abbreviated column headers are described in section *Symbols* on page *273*.

Type	**Normal use**			**Heavy-duty use**			**Frame size**
ACS550-x1- see below	**I_{2N} A**	**P_N kW**	**P_N hp**	**I_{2hd} A**	**P_{hd} kW**	**P_{hd} hp**	
Three-phase supply voltage, 208…240 V							
-04A6-2	4.6	0.75	1	3.5	0.55	0.75	R1
-06A6-2	6.6	1.1	1.5	4.6	0.75	1	R1
-07A5-2	7.5	1.5	2	6.6	1.1	1.5	R1
-012A-2	11.8	2.2	3	7.5	1.5	2	R1
-017A-2	16.7	4	5	11.8	2.2	3	R1
-024A-2	24.2	5.5	7.5	16.7	4	5	R2
-031A-2	30.8	7.5	10	24.2	5.5	7.5	R2
-046A-2	46.2	11	15	30.8	7.5	10	R3
-059A-2	59.4	15	20	46.2	11	15	R3
-075A-2	74.8	18.5	25	59.4	15	20	R4
-088A-2	88.0	22	30	74.8	18.5	25	R4
-114A-2	114	30	40	88.0	22	30	R4
-143A-2	143	37	50	114	30	40	R6
-178A-2	178	45	60	150	37	50	R6
-221A-2	221	55	75	178	45	60	R6
-248A-2	248	75	100	192	55	75	R6

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Ratings, 380…480 V drives

Abbreviated column headers are described in section *Symbols* on page *273*.

Type	Normal use			Heavy-duty use			Frame size
ACS550-x1- see below	I_{2N} A	P_N kW	P_N hp	I_{2hd} A	P_{hd} kW	P_{hd} hp	
Three-phase supply voltage, **380**…**480 V**							
-03A3-4	3.3	1.1	1.5	2.4	0.75	1	R1
-04A1-4	4.1	1.5	2	3.3	1.1	1.5	R1
-05A4-4	5.4	2.2	Note 1	4.1	1.5	Note 1	R1
-06A9-4	6.9	3	3	5.4	2.2	3	R1
-08A8-4	8.8	4	5	6.9	3	3	R1
-012A-4	11.9	5.5	7.5	8.8	4	5	R1
-015A-4	15.4	7.5	10	11.9	5.5	7.5	R2
-023A-4	23	11	15	15.4	7.5	10	R2
-031A-4	31	15	20	23	11	15	R3
-038A-4	38	18.5	25	31	15	20	R3
-045A-4	45	22	30	38	18.5	25	R3
-059A-4	59	30	40	44	22	30	R4
-072A-4	72	37	50	59	30	40	R4
-078A-4	77	Note 2	60	72	Note 2	50	R4
-087A-4	87	45	Note 1	72	37	Note 1	R4
-097A-4	97	Note 2	75	77	Note 2	60	R4
-125A-4	125	55	Note 1	87	45	Note 1	R5
-125A-4	125	Note 2	100	96	Note 2	75	R5
-157A-4	157	75	125	124	55	100	R6
-180A-4	180	90	150	156	75	125	R6
-195A-4	205	110	Note 1	162	90	Note 1	R6
-246A-4	246	132	200	192	110	150	R6
-290A-4	290	160	Note 1	246	132	200	R6

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1. Not available in ACS550-U1 series.
2. Not available in ACS550-01 series.

Ratings, 500…600 V drives

Abbreviated column headers are described in section *Symbols* on page *273*.

Type	**Normal use**			**Heavy-duty use**			**Frame size**
ACS550-U1- see below	I_{2N} **A**	P_N **kW**	P_N **hp**	I_{2hd} **A**	P_{hd} **kW**	P_{hd} **hp**	
Three-phase supply voltage, **500**…**600 V** (Note 1)							
-02A7-6	2.7	1.5	2	2.4	1.1	1.5	R2
-03A9-6	3.9	2.2	3	2.7	1.5	2	R2
-06A1-6	6.1	4	5	3.9	2.2	3	R2
-09A0-6	9.0	5.5	7.5	6.1	4	5	R2
-011A-6	11	7.5	10	9.0	5.5	7.5	R2
-017A-6	17	11	15	11	7.5	10	R2
-022A-6	22	15	20	17	11	15	R3
-027A-6	27	18.5	25	22	15	20	R3
-032A-6	32	22	30	27	18.5	25	R4
-041A-6	41	30	40	32	22	30	R4
-052A-6	52	37	50	41	30	40	R4
-062A-6	62	45	60	52	37	50	R4
-077A-6	77	55	75	62	45	60	R6
-099A-6	99	75	100	77	55	75	R6
-125A-6	125	90	125	99	75	100	R6
-144A-6	144	110	150	125	90	125	R6

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1. Not available in ACS550-01 series.

Symbols

Typical ratings:
Normal use (10% overload capability)

I_{2N}	continuous rms current. 10% overload is allowed for one minute in ten minutes.
P_N	typical motor power in normal use. The kilowatt power ratings apply to most IEC, 4-pole motors. The horsepower ratings apply to most 4-pole NEMA motors.

Heavy-duty use (50% overload capability)

I_{2hd}	continuous rms current. 50% overload is allowed for one minute in ten minutes.
P_{hd}	typical motor power in heavy duty use. The kilowatt power ratings apply to most IEC, 4-pole motors. The horsepower ratings apply to most 4-pole NEMA motors.

Sizing

The current ratings are the same regardless of the supply voltage within one voltage range. To achieve the rated motor power given in the table, the rated current of the drive must be higher than or equal to the rated motor current. Also note that:

- the ratings apply for ambient temperature of 40 °C (104 °F)
- the maximum allowed motor shaft power is limited to $1.5 \cdot P_{hd}$. If the limit is exceeded, motor torque and current are automatically restricted. The function protects the input bridge of the drive against overload.

In multimotor systems, the output current of the drive must be equal to or greater than the calculated sum of the input currents of all motors.

Derating

The load capacity (current and power) decreases for certain situations, as defined below. In such situations, where full motor power is required, oversize the drive so that the derated value provides sufficient capacity.

For example, if your application requires 15.4 A of motor current and a 8 kHz switching frequency, calculate the appropriate drive size requirement as follows:

The minimum size required = 15.4 A / 0.80 = 19.25 A

Where: 0.80 is the derating for 8 kHz switching frequency (see section *Switching frequency derating* on page *274*).

Referring to I_{2N} in the ratings tables (starting from page *271*), the following drives exceed the I_{2N} requirement of 19.25 A: ACS550-x1-023A-4, or ACS550-x1-024A-2.

Temperature derating

In the temperature range +40 °C...50 °C (+104 °F...122 °F), the rated output current is decreased 1% for every 1 °C (1.8 °F) above +40 °C (+104 °F). Calculate the output current by multiplying the current given in the rating table by the derating factor.

Example If the ambient temperature is 50 °C (+122 °F), the derating factor is 100% - 1%/°C · 10 °C = 90% or 0.90.
The output current is then 0.90 · I_{2N} or 0.90 · I_{2hd}.

Altitude derating

In altitudes 1000...4000 m (3300...13,200 ft) above sea level, the derating is 1% for every 100 m (330 ft). If the installation site is higher than 2000 m (6600 ft) above sea level, please contact your local ABB distributor or office for further information.

Single phase supply derating

For 208…240 V series drives, a single phase supply can be used. In that case, the derating is 50%.

Switching frequency derating

When using the 8 kHz switching frequency (parameter 2606),

- derate all rated currents and powers (including drive's overload currents) to 80%.

When using the 12 kHz switching frequency (parameter 2606),

- derate all rated currents and powers (including drive's overload currents) to 65% (to 50% for 600 V, R4 frame sizes, that is for ACS550-U1-032A-6 … ACS550-U1-062A-6),
- derate ambient temperature maximum to 30 °C (86 °F).
- Note: The continuous maximum current is limited to I_{2hd}.

Note: Setting parameter 2607 SWITCH FREQ CTRL = 1 (ON) allows the drive to reduce the switching frequency if/when the drive's internal temperature exceeds 80 °C (with 12 kHz switching frequency) or 90 °C (with 8 kHz switching frequency). See the parameter description for 2607 for details.

Input power connections

WARNING! Do not operate the drive outside the nominal input line voltage range. Overvoltage can result in permanent damage to the drive.

Input power specifications

Input power (mains) connection specifications	
Voltage (U_1)	208/220/230/240 V AC 3-phase (or 1-phase) -15%…+10% for ACS550-x1-xxxx-2. 380/400/415/440/460/480 V AC 3-phase -15%…+10% for ACS550-x1-xxxx-4. 500/525/575/600 V AC 3-phase -15%…+10% for ACS550-U1-xxxx-6.
Prospective short-circuit current (IEC 629)	Maximum allowed prospective short-circuit current in the supply is 100 kA providing that the input power cable of the drive is protected with appropriate fuses. US: 100 000 AIC.
Frequency	48…63 Hz
Imbalance	Max. ± 3% of nominal phase to phase input voltage
Fundamental power factor (cos phi_1)	0.98 (at nominal load)
Cable temperature rating	90 °C (194 °F) rating minimum

Disconnecting device for isolation

Install a hand-operated input disconnecting device (disconnecting means) between the AC power source and the drive. The disconnecting device must be of a type that can be locked to the open position for installation and maintenance work.

- **Europe**: To meet the European Union Directives, according to standard EN 60204-1, Safety of Machinery, the disconnecting device must be one of the following types:
  - a switch-disconnector of utilization category AC-23B (EN 60947-3)
  - a disconnector having an auxiliary contact that in all cases causes switching devices to break the load circuit before the opening of the main contacts of the disconnector (EN 60947-3)
  - a circuit breaker suitable for isolation in accordance with EN 60947-2.
- **Other regions**: The disconnecting device must conform to the applicable safety regulations.

Fuses

Branch circuit protection must be provided by the end user and sized per national and local electric codes. The following tables provide fuse recommendations for short circuit protection on the drive's input power.

The rated fuse currents given in the tables are the maximums for the mentioned fuse types. If smaller fuse ratings are used, check that the fuse rms current rating is larger than the input current.

Check that the operating time of the fuse is below 0.5 seconds. The operating time depends on the fuse type, the supply network impedance as well as the cross-sectional area, material and length of the supply cable. In case the 0.5 seconds operating time is exceeded with the gG or T fuses, ultra rapid (aR) fuses will in most cases reduce the operating time to an acceptable level.

Fuses, 208…240 V drives

ACS550-x1- see below	Input current A	Input power (mains) fuses		
		IEC 60269 gG (A)	**UL Class T (A)**	**Bussmann type**
-04A6-2	4.6	10	10	JJS-10
-06A6-2	6.6			
-07A5-2	7.5			
-012A-2	11.8	16	15	JJS-15
-017A-2	16.7	25	25	JJS-25
-024A-2	24.2		30	JJS-30
-031A-2	30.8	40	40	JJS-40
-046A-2	46.2	63	60	JJS-60
-059A-2	59.4		80	JJS-80
-075A-2	74.8	80	100	JJS-100
-088A-2	88.0	100	110	JJS-110
-114A-2	114	125	150	JJS-150
-143A-2	143	200	200	JJS-200
-178A-2	178	250	250	JJS-250
-221A-2	221	315	300	JJS-300
-248A-2	248		350	JJS-350

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Fuses, 380…480 V drives

ACS550-x1- see below	Input current A	Input power (mains) fuses		
		IEC 60269 gG (A)	**UL Class T (A)**	**Bussmann type**
-03A3-4	3.3	10	10	JJS-10
-04A1-4	4.1			
-05A4-4	5.4			
-06A9-4	6.9			
-08A8-4	8.8		15	JJS-15
-012A-4	11.9	16		
-015A-4	15.4		20	JJS-20
-023A-4	23	25	30	JJS-30
-031A-4	31	35	40	JJS-40
-038A-4	38	50	50	JJS-50
-045A-4	45		60	JJS-60
-059A-4	59	63	80	JJS-80
-072A-4	72	80	90	JJS-90
-078A-4	77		100	JJS-100

ACS550-x1- see below	Input current A	Input power (mains) fuses		
		IEC 60269 gG (A)	UL Class T (A)	Bussmann type
-087A-4	87	125	125	JJS-125
-097A-4	97			
-125A-4	125	160	175	JJS-175
-157A-4	157	200	200	JJS-200
-180A-4	180	250	250	JJS-250
-195A-4	205			
-246A-4	246	315	350	JJS-350
-290A-4	290			

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Fuses, 500…600 V drives

ACS550-U1- see below	Input current A	Input power (mains) fuses		
		IEC 60269 gG (A)	UL Class T (A)	Bussmann type
-02A7-6	2.7	10	10	JJS-10
-03A9-6	3.9			
-06A1-6	6.1			
-09A0-6	9.0	16	15	JJS-15
-011A-6	11			
-017A-6	17	25	25	JJS-25
-022A-6	22			
-027A-6	27	35	40	JJS-40
-032A-6	32			
-041A-6	41	50	50	JJS-50
-052A-6	52	60	60	JJS-60
-062A-6	62	80	80	JJS-80
-077A-6	77		100	JJS-100
-099A-6	99	125	150	JJS-150
-125A-6	125	160	175	JJS-175
-144A-6	144	200	200	JJS-200

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Emergency stop devices

The overall design of the installation must include emergency stop devices and any other safety equipment that may be needed. Pressing STOP on the drive's control panel does NOT:

- generate an emergency stop of the motor
- separate the drive from dangerous potential.

Input power cables/wiring

Input wiring can be any of:

- a four conductor cable (three phases and ground/protective earth). Shielding is not required.
- four insulated conductors routed through conduit.

Size wiring according to local safety regulations, appropriate input voltage and the drive's load current. In any case, the conductor must be less than the maximum limit defined by the terminal size (see section *Drive's power connection terminals* on page *280*).

The table below lists copper and aluminium cable types for different load currents. These recommendations apply only for the conditions listed at the top of the table.

<table>
<tr><th colspan="5">IEC</th><th colspan="2">NEC</th></tr>
<tr><td colspan="5">Based on:
• EN 60204-1 and IEC 60364-5-2/2001
• PVC insulation
• 30 °C (86 °F) ambient temperature
• 70 °C (158 °F) surface temperature
• cables with concentric copper shield
• not more than nine cables laid on cable ladder side by side.</td><td colspan="2">Based on:
• NEC Table 310-16 for copper wires
• 90 °C (194 °F) wire insulation
• 40 °C (104 °F) ambient temperature
• not more than three current-carrying conductors in raceway or cable, or earth (directly buried)
• copper cables with concentric copper shield.</td></tr>
<tr><th>Max. load current A</th><th>Cu cable mm²</th><td rowspan="17"></td><th>Max. load current A</th><th>Al cable mm²</th><th>Max. load current A</th><th>Cu wire size AWG/kcmil</th></tr>
<tr><td>14</td><td>3×1.5</td><td colspan="2" rowspan="7">Aluminium cable cannot be used with frame sizes R1…R5 because of its lower capacity.</td><td>22.8</td><td>14</td></tr>
<tr><td>20</td><td>3×2.5</td><td>27.3</td><td>12</td></tr>
<tr><td>27</td><td>3×4</td><td>36.4</td><td>10</td></tr>
<tr><td>34</td><td>3×6</td><td>50.1</td><td>8</td></tr>
<tr><td>47</td><td>3×10</td><td>68.3</td><td>6</td></tr>
<tr><td>62</td><td>3×16</td><td>86.5</td><td>4</td></tr>
<tr><td>79</td><td>3×25</td><td>100</td><td>3</td></tr>
<tr><td>98</td><td>3×35</td><td>91</td><td>3×50</td><td>118</td><td>2</td></tr>
<tr><td>119</td><td>3×50</td><td>117</td><td>3×70</td><td>137</td><td>1</td></tr>
<tr><td>153</td><td>3×70</td><td>143</td><td>3×95</td><td>155</td><td>1/0</td></tr>
<tr><td>186</td><td>3×95</td><td>165</td><td>3×120</td><td>178</td><td>2/0</td></tr>
<tr><td>215</td><td>3×120</td><td>191</td><td>3×150</td><td>205</td><td>3/0</td></tr>
<tr><td>249</td><td>3×150</td><td>218</td><td>3×185</td><td>237</td><td>4/0</td></tr>
<tr><td>284</td><td>3×185</td><td>257</td><td>3×240</td><td>264</td><td>250 MCM or 2 × 1</td></tr>
<tr><td>330</td><td>3×240</td><td>274</td><td>3× (3×50)</td><td>291</td><td>300 MCM or 2 × 1/0</td></tr>
<tr><td></td><td></td><td>285</td><td>2× (3×95)</td><td>319</td><td>350 MCM or 2 × 2/0</td></tr>
</table>

Ground connections

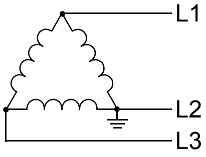
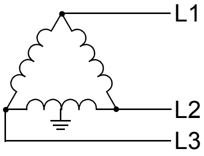
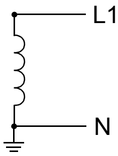
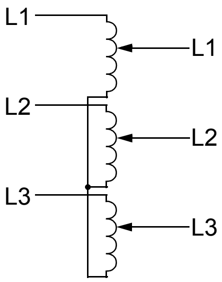
For personnel safety, proper operation and reduction of electromagnetic emission/ pick-up, the drive and the motor must be grounded at the installation site.

- Conductors must be adequately sized as required by safety regulations.
- Power cable shields must be connected to the drive PE terminal in order to meet safety regulations.
- Power cable shields are suitable for use as equipment grounding conductors only when the shield conductors are adequately sized as required by safety regulations.
- In multiple drive installations, do not connect drive terminals in series.

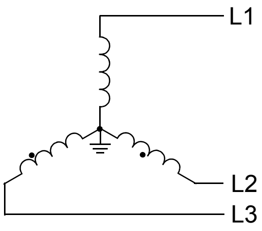
Corner grounded TN systems

WARNING! Do not attempt to install or remove the EMC filter screws EM1, EM3, F1 or F2 while power is applied to the drive's input terminals.

Corner grounded TN systems are defined in the following table. In such systems, disconnect the internal ground connection through the EMC filter capacitors (do this also if the grounding configuration of the system is unknown), see section *Disconnecting the internal EMC filter* on page 23.

Corner grounded TN systems – EMC filter must be disconnected			
Grounded at the corner of the delta		Grounded at the mid point of a delta leg	
Single phase, grounded at an end point		Three phase "Variac" without solidly grounded neutral	

The EMC filter capacitors make an internal ground connection that reduces electro-magnetic emission. Where EMC (electro-magnetic compatibility) is a concern, and the system is symmetrically grounded, the EMC filter may be connected. For reference, the diagram on the right illustrates a symmetrically grounded TN system (TN-S system).



IT systems

WARNING! Do not attempt to install or remove the EMC filter screws EM1, EM3, F1 or F2 while power is applied to the drive's input terminals.

For IT systems (an ungrounded power system or a high-resistance-grounded [over 30 ohm] power system):

- Disconnect the ground connection to the internal EMC filter, see section *Disconnecting the internal EMC filter* on page 23.
- Where EMC requirements exist, check for excessive emission propagated to neighboring low voltage networks. In some cases, the natural suppression in transformers and cables is sufficient. If in doubt, use a supply transformer with static screening between the primary and secondary windings.
- Do NOT install an external RFI/EMC filter. Using an EMC filter grounds the input power through the filter capacitors, which could be dangerous and could damage the drive.

Drive's power connection terminals

The following table provides specifications for the drive's power connection terminals.

Frame size	U1, V1, W1 U2, V2, W2 BRK±, UDC± terminals						Earthing PE terminal			
	Minimum wire size		Maximum wire size		Tightening torque		Maximum wire size		Tightening torque	
	mm^2	AWG	mm^2	AWG	N·m	lb·ft	mm^2	AWG	N·m	lb·ft
R1[1]	0.75	18	10	8	1.4	1	10	8	1.4	1
R2[1]	0.75	18	10	8	1.4	1	10	8	1.4	1
R3[1]	2.5	14	25	3	2.5	1.8	16	6	1.8	1.3
R4[1]	6	10	50	1/0	5.6	4	25	3	2	1.5
R5[1]	6	10	70	2/0	15	11	70	2/0	15	11
R6[2]	95[3]	3/0[3]	240	350 MCM	40	30	95	3/0	8	6

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[1] Aluminium cable cannot be used with frame sizes R1…R5 because of its lower capacity.

[2] Aluminium cable cannot be used with type ACS550-01-290A-4 because of the terminal size.

[3] See section *Power terminal considerations – R6 frame size* on page 281.

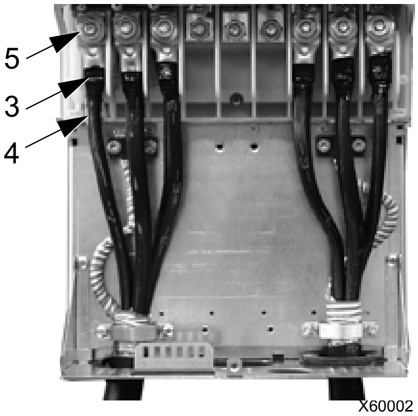
Note: See the recommended cable sizes for different load currents in section *Input power cables/wiring* on page 278.

Power terminal considerations – R6 frame size

WARNING! For R6 power terminals, if screw-on terminal lugs are supplied, they can only be used for wire sizes that are 95 mm^2 (3/0 AWG) or larger. Smaller wires will loosen and may damage the drive. They require crimp-on ring lugs as described below.

Crimp-on ring lugs

On the R6 frame size, if screw-on terminal lugs are supplied but the cable size used is less than 95 mm^2 (3/0 AWG), or if no screw-on terminal lugs are supplied at all, use crimp-on ring lugs according to the following procedure.



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1. Select appropriate ring lugs from the following table.
2. Remove the screw-on terminal lugs, if supplied.
3. Attach the ring lugs to the drive end of the cables.
4. Isolate the ends of the ring lugs with insulating tape or shrink tubing.
5. Attach the ring lugs to the drive.

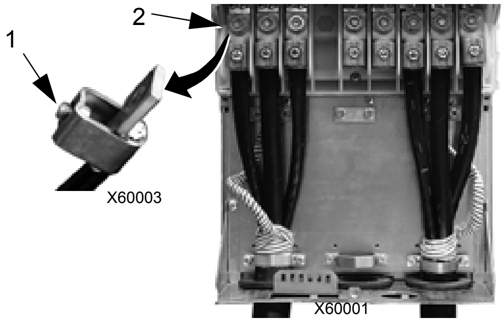
Wire size		Manufacturer	Ring lug	Crimping tool	No. of crimps
mm^2	**kcmil/ AWG**				
16	**6**	Burndy	YAV6C-L2	MY29-3	1
		Ilsco	CCL-6-38	ILC-10	2
25	**4**	Burndy	YA4C-L4BOX	MY29-3	1
		Ilsco	CCL-4-38	MT-25	1
35	**2**	Burndy	YA2C-L4BOX	MY29-3	2
		Ilsco	CRC-2	IDT-12	1
		Ilsco	CCL-2-38	MT-25	1
50	**1**	Burndy	YA1C-L4BOX	MY29-3	2
		Ilsco	CRA-1-38	IDT-12	1
		Ilsco	CCL-1-38	MT-25	1
		Thomas & Betts	54148	TBM-8	3
55	**1/0**	Burndy	YA25-L4BOX	MY29-3	2
		Ilsco	CRB-0	IDT-12	1
		Ilsco	CCL-1/0-38	MT-25	1
		Thomas & Betts	54109	TBM-8	3

Wire size		Manufacturer	Ring lug	Crimping tool	No. of crimps
mm^2	kcmil/ AWG				
70	**2/0**	Burndy	YAL26T38	MY29-3	2
		Ilsco	CRA-2/0	IDT-12	1
		Ilsco	CCL-2/0-38	MT-25	1
		Thomas & Betts	54110	TBM-8	3
95	**3/0**	Burndy	YAL27T38	MY29-3	2
		Ilsco	CRA-3/0	IDT-12	1
		Ilsco	CCL-3/0-38	MT-25	1
		Thomas & Betts	54111	TBM-8	3
95	**3/0**	Burndy	YA28R4	MY29-3	2
		Ilsco	CRA-4/0	IDT-12	1
		Ilsco	CCL-4/0-38	MT-25	2
		Thomas & Betts	54112	TBM-8	4

Screw-on terminal lugs

Use the following procedure to attach cables if screw-on terminal lugs are supplied and the cable size is 95 mm^2 (3/0 AWG) or larger.

1. Attach the supplied screw-on lugs to the drive end of the cables.
2. Attach screw-on lugs to the drive.



Motor connections

WARNING! Never connect line power to the drive output terminals: U2, V2 or W2. Line voltage applied to the output can result in permanent damage to the drive. If frequent bypassing is required, use mechanically interlocked switches or contactors.

WARNING! Do not connect any motor with a nominal voltage less than one half of the drive's nominal input voltage.

WARNING! Disconnect the drive before conducting any voltage tolerance (Hi-Pot) test or insulation resistance (Megger) test on the motor or motor cables. Do not conduct these tests on the drive.

Motor connection specifications

<table>
<tr><th colspan="2">Motor connection specifications</th></tr>
<tr><td>Voltage (U_2)</td><td>0…U_1, 3-phase symmetrical, U_{max} at the field weakening point</td></tr>
<tr><td>Frequency</td><td>0…500 Hz</td></tr>
<tr><td>Frequency resolution</td><td>0.01 Hz</td></tr>
<tr><td>Current</td><td>See section <i>Ratings</i> on page <i>271</i>.</td></tr>
<tr><td>Field weakening point</td><td>10…500 Hz</td></tr>
<tr><td>Switching frequency</td><td>Selectable. See the availability in the table below.
<table>
<tr><th></th><th>1, 2, 4 and 8 kHz</th><th>12 kHz</th></tr>
<tr><td>208…240 V</td><td>All types</td><td>Frame sizes R1…R4 in scalar control mode</td></tr>
<tr><td>380…480 V</td><td>All types</td><td>Frame sizes R1…R4 (except ACS550-01-097A-4) in scalar control mode</td></tr>
<tr><td>500…600 V</td><td>All types</td><td>Frame sizes R2…R4 in scalar control mode</td></tr>
</table></td></tr>
<tr><td>Cable temperature rating</td><td>90 °C (194 °F) rating minimum.</td></tr>
<tr><td>Maximum motor cable length</td><td>See section <i>Motor cable lengths</i> on page <i>283</i>.</td></tr>
</table>

Motor cable lengths

Maximum motor cable lengths for 400 V and 600 V drives are given in the sections below.

In multimotor systems, the calculated sum of all motor cable lengths must not exceed the maximum motor cable length given in the appropriate table below.

Motor cable length for 400 V drives

The table below shows the maximum motor cable lengths for 400 V drives with different switching frequencies. Examples for using the table are also given.

Maximum cable length for 400 V drives																				
Frame size	**EMC limits**												**Operational limits**							
	Second environment (category C3[1])						**First environment (category C2[1])**						**Basic unit**				**With du/dt filters**	
	1 kHz		**4 kHz**		**8 kHz**		**1 kHz**		**4 kHz**		**8 kHz**		**1/4 kHz**		**8/12 kHz**			
	m	**ft**	**m**	**ft**	**m**	**ft**	**m**	**ft**	**m**	**ft**	**m**	**ft**	**m**	**ft**	**m**	**ft**	**m**	**ft**
R1	300	980	300	980	300	980	300	980	300	980	300	980	100	330	100	330	150	490
R2	300	980	300	980	300	980	300	980	100	330	30	98	200	660	100	330	250	820
R3	300	980	300	980	300	980	300	980	75	245	75	245	200	660	100	330	250	820
R4	300	980	300	980	300	980	300	980	75	245	75	245	200	660	100	330	300	980
R5	100	330	100	330	100	330	100	330	100	330	100	330	300	980	150[2]	490[2]	300	980
R6	100	330	100	330	[3]	[3]	100	330	100	330	[3]	[3]	300	980	150[2]	490[2]	300	980

[1] See the new terms in section *IEC/EN 61800-3 (2004) Definitions* on page 305.

[2] 12 kHz switching frequency is not available.

[3] Not tested.

Sine filters further extend the cable lengths.

Under heading "Operational limits", the "Basic unit" columns define the cable lengths with which the basic drive unit works without problems within the drive specification, without installing any further options. Column "With du/dt filters" defines the cable lengths when an external du/dt filter is used.

The columns under heading "EMC limits" show the maximum cable lengths with which the units have been tested for EMC emissions. The factory guarantees that these cable lengths meet the EMC standard requirements.

If external sine filters are installed, longer cable lengths can be used. With sine filters the limiting factors are the voltage drop of the cable, which has to be taken into account in engineering, as well as the EMC limits (where applicable).

The default switching frequency is 4 kHz.

WARNING! Using a motor cable longer than specified in the table above may cause permanent damage to the drive.

Examples for using the table:

Requirements	**Checking and conclusions**
R1 frame size, 8 kHz fsw, Category C2, 150 m (490 ft) cable	Check operational limits for R1 and 8 kHz -> for a 150 m (490 ft) cable a du/dt filter is needed. Check EMC limits -> EMC requirements for Category C2 are met with a 150 m (490 ft) cable.

Requirements	Checking and conclusions
R3 frame size, 4 kHz fsw, Category C3, 300 m (980 ft) cable	Check operational limits for R3 and 4 kHz -> a 300 m (980 ft) cable cannot be used even with a du/dt filter. A sine filter must be used and the voltage drop of the cable must be taken into account in the installation. Check EMC limits -> EMC requirements for Category C3 are met with a 300 m (980 ft) cable.
R5 frame size, 8 kHz fsw, Category C3, 150 m (490 ft) cable	Check operational limits for R5 and 8 kHz -> for a 150 m (490 ft) cable the basic unit is sufficient. Check EMC limits -> EMC requirements for Category C3 cannot be met with a 300 m (980 ft) cable. The installation configuration is not possible. An EMC plan is recommended to overcome the situation.
R6 frame size, 4 kHz fsw, EMC limits not applicable, 150 m (490 ft) cable	Check operational limits for R6 and 4 kHz -> for a 150 m (490 ft) cable the basic unit is sufficient. EMC limits do not need to be checked as there are no EMC requirements.

Motor cable length for 600 V drives

The table below shows the maximum motor cable lengths for 600 V drives with different switching frequencies. As the 600 V drives are not CE approved, cable lengths for EMC limits are not given.

Maximum cable length for 600 V drives				
Frame size	**Operational limits**			
	1/4 kHz		**8/12 kHz**	
	m	**ft**	**m**	**ft**
R2	100	330	100	330
R3…R4	200	660	100	330
R6	300	980	150[2]	490[2]

[2] 12 kHz switching frequency is not available.

WARNING! Using a motor cable longer than specified in the table above may cause permanent damage to the drive.

Motor thermal protection

According to regulations, the motor must be protected against thermal overload and the current must be switched off when overload is detected. The drive includes a motor thermal protection function that protects the motor and switches off the current when necessary. Depending on a drive parameter value (see parameter 3501 SENSOR TYPE), the function either monitors a calculated temperature value (based on a motor thermal model, see parameters 3005 MOT THERM PROT … 3009 BREAK POINT FREQ) or an actual temperature indication given by motor temperature sensors (see *Group 35: MOTOR TEMP MEAS*). The user can tune the thermal model further by feeding in additional motor and load data.

The most common temperature sensors are:

- motor sizes IEC180…225: thermal switch (e.g. Klixon)
- motor sizes IEC200…250 and larger: PTC or PT100.

Ground fault protection

ACS550 internal fault logic detects ground faults in the drive, motor, or motor cable. This fault logic:

- is NOT a personal safety or fire protection feature
- can be disabled using parameter 3017 EARTH FAULT

  Note: Disabling earth fault (ground fault) may void the warranty.
- could be tripped by leakage currents (input power to ground) associated with long high capacitance motor cables.

Grounding and routing

Motor cable shielding

Motor cables require shielding using conduit, armored cable or shielded cable.

- Conduit – When using conduit:
  - Bridge joints with a ground conductor bonded to the conduit on each side of the joint.
  - Bond conduit run to the drive enclosure.
  - Use a separate conduit run for motor cables (also separate input power and control cables).
  - Use a separate conduit run for each drive.
- Armored cable – When using armored cable:
  - Use six-conductor (3 phases and 3 grounds), type MC continuous corrugated aluminium armor cable with symmetrical grounds.
  - Armored motor cable can share a cable tray with input power cables, but not with control cables.
- Shielded cable – For shielded cable details, see section *Motor cable requirements for CE & C-Tick compliance* on page *287*.

Grounding

See section *Ground connections* on page *279*.

For CE compliant installations and installations where EMC emissions must be minimized, see section *Effective motor cable shields* on page *288*.

Drive's motor connection terminals

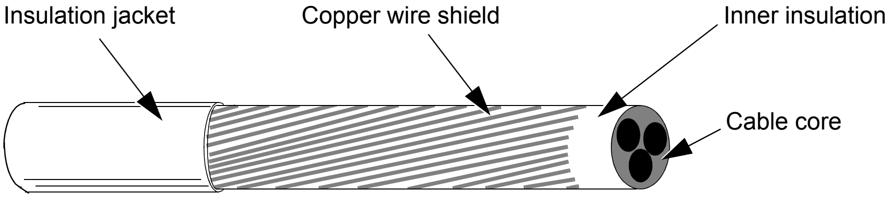
The drive's motor and input power terminals have the same specifications. See section *Drive's power connection terminals* on page *280*.

Motor cable requirements for CE & C-Tick compliance

The requirements in this section apply for CE or C-Tick compliance.

Minimum requirement (CE & C-Tick)

The motor cable must be a symmetrical three conductor cable with a concentric PE conductor or a four conductor cable with a concentric shield, however, a symmetrical constructed PE conductor is always recommended. The following figure shows the minimum requirement for the motor cable shield (for example, MCMK, Draka NK Cables).

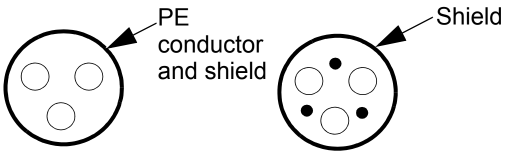


Recommendation for conductor layout

The following figure compares conductor layout features in motor cables.

Recommended (CE & C-Tick)

Symmetrical shielded cable: three phase conductors and a concentric or otherwise symmetrically constructed PE conductor, and a shield

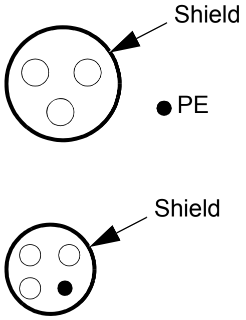


Not allowed for motor cables (CE & C-Tick)

A four-conductor system: three phase conductors and a protective conductor, without a shield.

Allowed (CE & C-Tick)

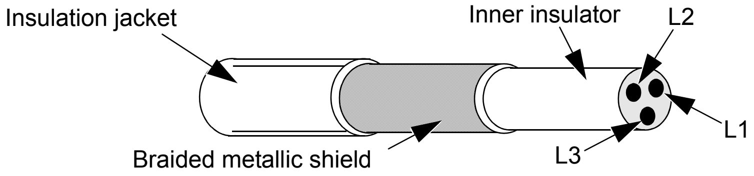
A separate PE conductor is required if the conductivity of the cable shield is < 50% of the conductivity of the phase conductor.



Allowed for motor cables with phase conductor cross section up to 10 mm^2.

Effective motor cable shields

The general rule for cable shield effectiveness is: the better and tighter the cable's shield, the lower the radiated emission level. The following figure shows an example of an effective construction (for example Ölflex-Servo-FD 780 CP, Lappkabel or MCCMK, NK Cables).



EN 61800-3 compliant motor cables

The most efficient EMC filtering can be achieved by following these rules:

- Motor cables must have an effective shield as described in section *Effective motor cable shields* on page *288*.
- Motor cable shield wires must be twisted together into a bundle (pig-tail) – the bundle length must be less than five times its width – and connected to the terminal marked ⏚ (at the bottom right-hand corner of the drive).
- At the motor end, the motor cable shield must be earthed 360 degrees with an EMC cable gland, or the shield wires must be twisted together into a bundle (pig-tail) not longer than five times its width and connected to the PE terminal of the motor.
- See section *Motor cable length for 400 V drives*, columns "*EMC limits*" on page *284* to check the maximum motor cable lengths and the need for filters for 400 V drives for IEC/EN 61800-3 compliance.

WARNING! Do not use RFI/EMC filters on IT systems.

Brake components

Availability

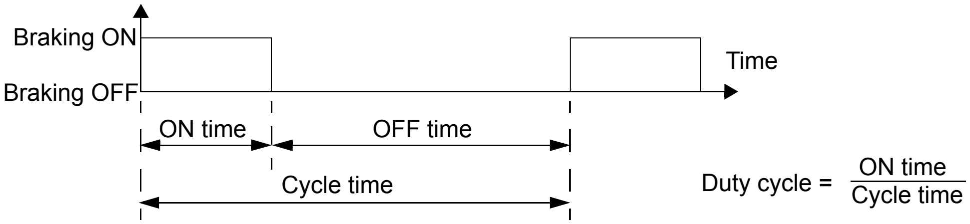
Braking availability for ACS550 drives, by frame size is:

- R1 and R2 – a built-in brake chopper is standard equipment. Add appropriate resistor, as determined using the following section. Resistors are available from ABB.
- R3…R6 – does not include an internal brake chopper. Connect a chopper and a resistor, or a brake unit to the DC link terminals on the drive. Contact your ABB representative for appropriate parts.

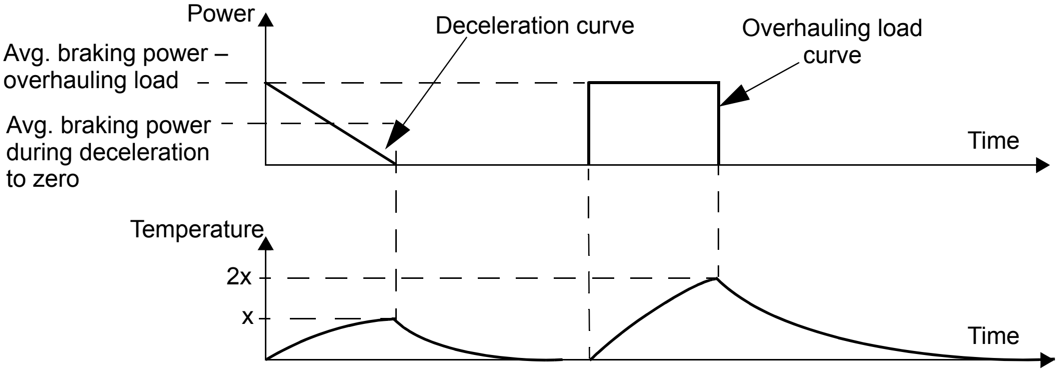
Selecting the braking resistors (frame sizes R1 and R2)

Braking resistor must meet three requirements:

- Resistance must be always higher than the minimum value R_{MIN} defined for the drive type in the following tables. Never use resistance below this value.
- Resistance must be low enough to be able to produce the desired braking torque. To achieve the maximum braking torque (the larger of 150% of heavy duty or 110% of nominal duty), the resistance must not exceed R_{MAX}. If maximum braking torque is not necessary, resistor values can exceed R_{MAX}.
- The resistor power rating must be high enough to dissipate the braking power. This requirement involves many factors:
  - the maximum continuous power rating for the resistor(s)
  - the rate at which the resistor changes temperature (resistor thermal time constant)
  - maximum braking time ON – If the regeneration (braking) power is larger than the resistor rated power, there is a limit to the ON time, or the resistor overheats before the OFF period begins.
  - minimum braking time OFF – If the regeneration (braking) power is larger than the resistor rated power, the OFF time must be large enough for the resistor to cool between ON periods.



  - the peak braking power requirement
  - type of braking (deceleration to zero vs. overhauling load) – During deceleration to zero, the generated power steadily decreases, averaging half of the peak power. For an overhauling load, the braking is countering an external force (gravity for example) and the braking power is constant. The total heat generated from an overhauling load is double the heat generated from deceleration to zero speed (for the same peak torque and ON time).



The many variables in the last requirement above are most easily dealt with using the following tables.

- First, determine your maximum braking time ON (ON_{MAX}), minimum braking time OFF (OFF_{MIN}) and load type (deceleration or overhauling load).
- Calculate duty cycle:

$$\text{Duty cycle} = \frac{ON_{MAX}}{(ON_{MAX} + OFF_{MIN})} \cdot 100\%$$

- In the appropriate table, find the column that best matches your data:
  - $ON_{MAX} \leq$ column specification and
  - Duty cycle $\leq$ column specification
- Find the row that matches your drive.
- The minimum power rating for deceleration to zero is the value in the selected row/column.
- For overhauling loads, double the rating in the selected row/column, or use the “Continuous ON” column.

208…240 V drives

Type ACS550-01/U1- see below	**Resistance**		**Resistor[1] minimum continuous power rating**				
			Deceleration-to-zero rating				**P_{rcont}** Continuous ON > 60 s ON > 25% Duty
	R_{MAX}	**R_{MIN}**	**P_{r3}** ≤ 3 s ON ≥ 27 s OFF ≤ 10% Duty	**P_{r10}** ≤ 10 s ON ≥ 50 s OFF ≤ 17% Duty	**P_{r30}** ≤ 30 s ON ≥ 180 s OFF ≤ 14% Duty	**P_{r60}** ≤ 60 s ON ≥ 180 s OFF ≤ 25% Duty	
	ohm	**ohm**	**W**	**W**	**W**	**W**	**W**
Three-phase supply voltage, **208…240 V**							
-04A6-2	234	80	45	80	120	200	1100
-06A6-2	160	80	65	120	175	280	1500
-07A5-2	117	44	85	160	235	390	2200
-012A-2	80	44	125	235	345	570	3000
-017A-2	48	44	210	390	575	950	4000
-024A-2	32	30	315	590	860	1425	5500
-031A-2	23	22	430	800	1175	1940	7500

[1] Resistor time constant specification must be ≥ 85 seconds.

380…480 V drives

Type ACS550-01/U1- see below	**Resistance**		**Resistor[1] minimum continuous power rating**				
			Deceleration-to-zero rating				P_{rcont} Continuous ON > 60 s ON > 25% Duty
	R_{MAX}	R_{MIN}	P_{r3} ≤ 3 s ON ≥ 27 s OFF ≤ 10% Duty	P_{r10} ≤ 10 s ON ≥ 50 s OFF ≤ 17% Duty	P_{r30} ≤ 30 s ON ≥ 180 s OFF ≤ 14% Duty	P_{r60} ≤ 60 s ON ≥ 180 s OFF ≤ 25% Duty	
	ohm	**ohm**	**W**	**W**	**W**	**W**	**W**
Three-phase supply voltage, **380**…**480 V**							
-03A3-4	641	120	65	120	175	285	1100
-04A1-4	470	120	90	160	235	390	1500
-05A4-4	320	120	125	235	345	570	2200
-06A9-4	235	80	170	320	470	775	3000
-08A8-4	192	80	210	400	575	950	4000
-012A-4	128	80	315	590	860	1425	5500
-015A-4	94	63	425	800	1175	1950	7500
-023A-4	64	63	625	1175	1725	2850	11000

[1] Resistor time constant specification must be ≥ 85 seconds.

500…600 V drives

Type ACS550-U1- see below	**Resistance**		**Resistor[1] minimum continuous power rating**				
			Deceleration-to-zero rating				P_{rcont} Continuous ON > 60 s ON > 25% Duty
	R_{MAX}	R_{MIN}	P_{r3} ≤ 3 s ON ≥ 27 s OFF ≤ 10% Duty	P_{r10} ≤ 10 s ON ≥ 50 s OFF ≤ 17% Duty	P_{r30} ≤ 30 s ON ≥ 180 s OFF ≤ 14% Duty	P_{r60} ≤ 60 s ON ≥ 180 s OFF ≤ 25% Duty	
	ohm	**ohm**	**W**	**W**	**W**	**W**	**W**
Three-phase supply voltage, **500…600 V**							
-02A7-6	548	80	93	175	257	425	1462
-03A9-6	373	80	137	257	377	624	2144
-06A1-6	224	80	228	429	629	1040	3573
-09A0-6	149	80	342	643	943	1560	5359
-011A-6	110	60	467	877	1286	2127	7308
-017A-6	75	60	685	1286	1886	3119	10718

[1] Resistor time constant specification must be ≥ 85 seconds.

WARNING! Never use a brake resistor with a resistance below the minimum value specified for the particular drive. The drive and the internal chopper are not able to handle the overcurrent caused by the low resistance.

Symbols

R_{MIN} **–** Minimum allowed resistance of the braking resistor.

R_{MAX} **–** Maximum resistance allowed if maximum braking torque is necessary.

P_{rx} – Duty-cycle based resistor power rating in deceleration braking, where "x" is ON_{MAX} time.

Installing and wiring resistors

All resistors must be installed outside the drive module in a place where they can dissipate heat.

WARNING! The surface temperature of the resistor is very high, and air flowing from the resistor is very hot. Materials near the brake resistor must be non-flammable. Provide protection from accidental contact with the resistor.

To ensure that the input fuses protect the resistor cable, use resistor cables with the same rating as used for the power input to the drive.

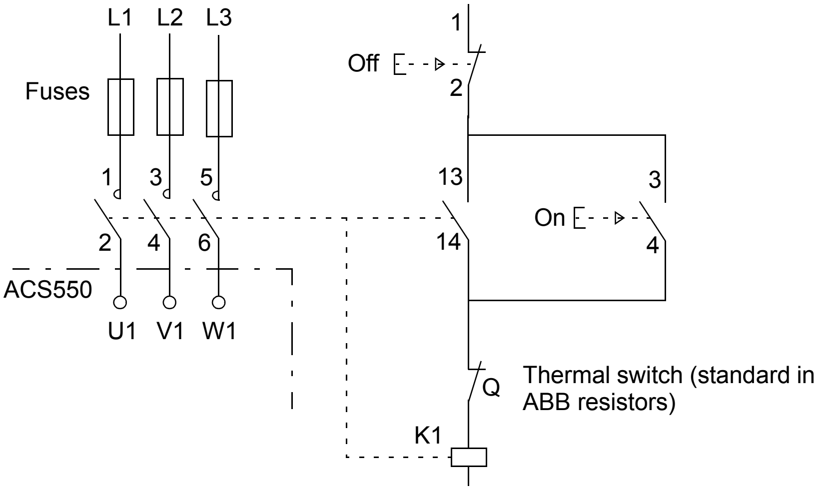
The maximum length of the resistor cable(s) is 10 m (33 ft). See section *Power connection diagrams* on page *21* for the resistor cable connection points.

Mandatory circuit protection

The following setup is essential for safety – it interrupts the main supply in fault situations involving chopper shorts:

- Equip the drive with a main contactor.
- Wire the contactor so that it opens if the resistor thermal switch opens (an overheated resistor opens the contactor).

Below is a simple wiring diagram example.



Parameter set-up

To enable dynamic braking, switch off the drive's overvoltage control [Set parameter 2005 = 0 (DISABLE)].

Control connections

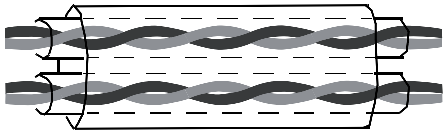
Control connection specifications

Control connection specifications	
Analog inputs and outputs	See section *Control terminals table* on page *24*.
Digital inputs	Digital input impedance 1.5 kohm. Maximum voltage for digital inputs is 30 V.
Relays (digital outputs)	• Max. contact voltage: 30 V DC, 250 V AC • Max. contact current / power: 6 A, 30 V DC; 1500 VA, 250 V AC • Max. continuous current: 2 A rms (cos φ = 1), 1 A rms (cos φ = 0.4) • Minimum load: 500 mW (12 V, 10 mA) • Contact material: Silver-nickel (AgN) • Isolation between relay digital outputs, test voltage: 2.5 kV rms, 1 minute
Cable specifications	See section *Control terminals table* on page *24*.

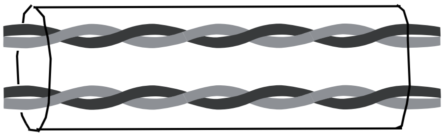
Control cables

General recommendations

Use multi-core cables with a braided copper wire shield, temperature rated at 60 °C (140 °F) or above:



Double shielded
Example: JAMAK by Draka NK Cables



Single shielded
Example: NOMAK by Draka NK Cables

For digital and analog I/O cables, twist the shield together into a bundle (pig-tail) not longer than five times its width and connect it to terminal X1-1 at the drive end. Leave the other end of the cable shield unconnected.

For connecting the shield wires of the RS485 cable, see the instructions (and notes) in section *Mechanical and electrical installation – EFB* on page *200*.

Route control cables to minimize radiation to the cable:

- Route as far away as possible from the input power and motor cables (at least 20 cm [8 in]).
- Where control cables must cross power cables, make sure they are at an angle as near 90° as possible.
- Stay at least 20 cm (8 in) from the sides of the drive.

Use care in mixing signal types on the same cable:

- Do not mix relay-controlled signals using more than 30 V and other control signals in the same cable.
- Run relay-controlled signals as twisted pairs (especially if voltage > 48 V). Relay-controlled signals using less than 48 V can be run in the same cables as digital input signals.

Note: Never mix 24 V DC and 115/230 V AC signals in the same cable.

Analog cables

Recommendations for analog signal runs:

- Use double shielded, twisted pair cable.
- Use one individually shielded pair for each signal.
- Do not use a common return for different analog signals.

Digital cables

Recommendation for digital signal runs: A double shielded cable is the best alternative, but single-shielded, twisted, multi-pair cable is also usable.

Control panel cable

If the control panel is connected to the drive with a cable, use only Category 5 Patch ethernet cable. The maximum length that is tested to meet EMC specifications is 3 m (9.8 ft). Longer cables are susceptible to electromagnetic noise and must be user-tested to verify that EMC requirements are met. Where long runs are required (especially for runs longer than about 12 m [40 ft]), use a RS232/RS485 converter at each end and run RS485 cable.

Drive's control connection terminals

The following table provides specifications for the drive's control terminals

Frame size	**Control**			
	Maximum wire size [1]		**Tightening torque**	
	mm^2	**AWG**	**N·m**	**lb·ft**
All	1.5	16	0.4	0.3

[1] Values given for solid wires.
For stranded wires, the maximum size is 1 mm^2.

Efficiency

Approximately 98% at nominal power level.

Cooling

Cooling specifications	
Method	Internal fan, flow direction from bottom to top.
Requirement	Free space above and below the ACS550 drive: 200 mm (8 in). Free space is not required on the drive's sides – ACS550 drives can be mounted side-by-side.

Air flow, 208…240 V drives

The following table lists heat loss and air flow data for 208…240 V drives.

Drive		Heat loss		Air flow	
ACS550-x1-	**Frame size**	**W**	**BTU/hr**	**m^3/h**	**ft^3/min**
-04A6-2	R1	55	189	44	26
-06A6-2	R1	73	249	44	26
-07A5-2	R1	81	276	44	26
-012A-2	R1	118	404	44	26
-017A-2	R1	161	551	44	26
-024A-2	R2	227	776	88	52
-031A-2	R2	285	973	88	52
-046A-2	R3	420	1434	134	79
-059A-2	R3	536	1829	134	79
-075A-2	R4	671	2290	280	165
-088A-2	R4	786	2685	280	165
-114A-2	R4	1014	3463	280	165
-143A-2	R6	1268	4431	405	238
-178A-2	R6	1575	5379	405	238
-221A-2	R6	1952	6666	405	238
-248A-2	R6	2189	7474	405	238

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Air flow, 380…480 V drives

The following table lists heat loss and air flow data for 380…480 V drives.

Drive		Heat loss		Air flow	
ACS550-x1-	**Frame size**	**W**	**BTU/hr**	**m^3/h**	**ft^3/min**
-03A3-4	R1	40	137	44	26
-04A1-4	R1	52	178	44	26
-05A4-4	R1	73	249	44	26
-06A9-4	R1	97	331	44	26
-08A8-4	R1	127	434	44	26
-012A-4	R1	172	587	44	26
-015A-4	R2	232	792	88	52
-023A-4	R2	337	1151	88	52

Drive		Heat loss		Air flow	
ACS550-x1-	Frame size	W	BTU/hr	m³/h	ft³/min
-031A-4	R3	457	1561	134	79
-038A-4	R3	562	1919	134	79
-045A-4	R3	667	2278	134	79
-059A-4	R4	907	3098	280	165
-072A-4	R4	1120	3825	280	165
-078A-4	R4	1295	4423	250	147
-087A-4	R4	1440	4918	280	165
-097A-4	R4	1440	4918	280	165
-125A-4	R5	1940	6625	350	205
-157A-4	R6	2310	7889	405	238
-180A-4	R6	2810	9597	405	238
-195A-4	R6	3050	10416	405	238
-246A-4	R6	3260	11134	405	238
-290A-4	R6	3850	13125	405	238

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Air flow, 500…600 V drives

The following table lists heat loss and air flow data for 500…600 V drives.

Drive		Heat loss		Air flow	
ACS550-U1-	Frame size	W	BTU/hr	m³/h	ft³/min
-02A7-6	R2	52	178	88	52
-03A9-6	R2	73	249	88	52
-06A1-6	R2	127	434	88	52
-09A0-6	R2	172	587	88	52
-011A-6	R2	232	792	88	52
-017A-6	R2	337	1151	88	52
-022A-6	R3	457	1561	134	79
-027A-6	R3	562	1919	134	79
-032A-6	R4	667	2278	280	165
-041A-6	R4	907	3098	280	165
-052A-6	R4	1117	3815	280	165
-062A-6	R4	1357	4634	280	165
-077A-6	R6	2310	7889	405	238
-099A-6	R6	2310	7889	405	238
-125A-6	R6	2310	7889	405	238
-144A-6	R6	2310	7889	405	238

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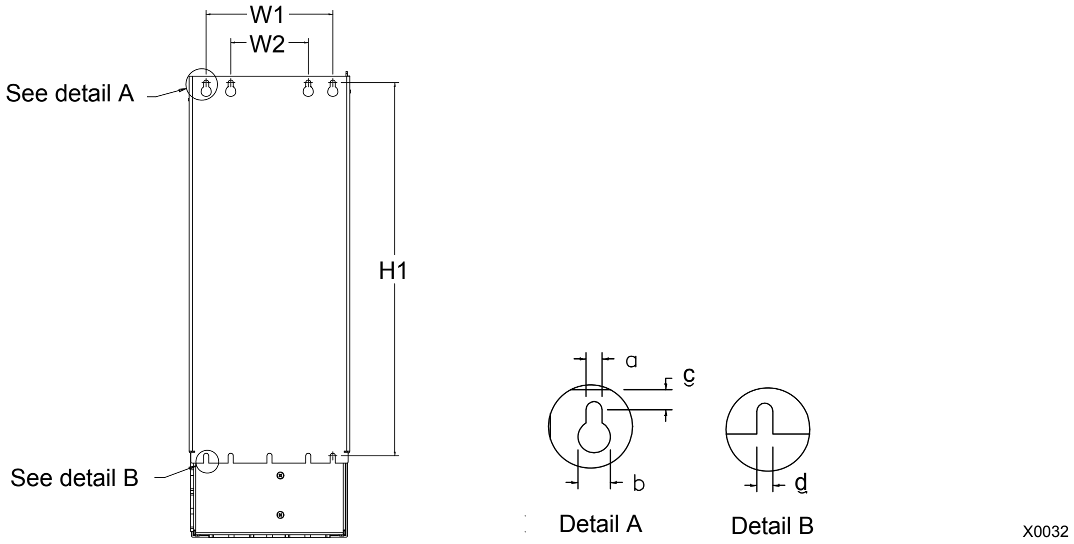
Dimensions and weights

The dimensions and mass for the ACS550 depend on the frame size and enclosure type. If unsure of the frame size, first, find the "Type" designation on the drive labels (see sections *Type designation* on page *13* and *Drive labels* on page *12*). Then look up that type designation in the rating tables (see chapter *Technical data*, page *271*), to determine the frame size.

Mounting dimensions

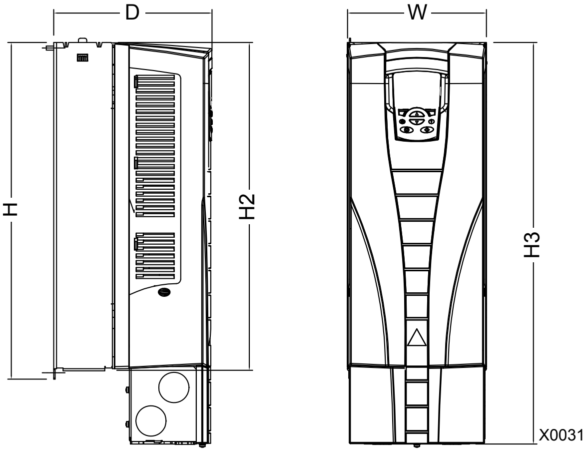


IP21 / UL type 1 and IP54 / UL type 12 – Dimensions for each frame size												
Ref.	**R1**		**R2**		**R3**		**R4**		**R5**		**R6**	
	mm	**in**	**mm**	**in**	**mm**	**in**	**mm**	**in**	**mm**	**in**	**mm**	**in**
W1[1]	98.0	3.9	98.0	3.9	160	6.3	160	6.3	238	9.4	263	10.4
W2[1]	--	--	--	--	98.0	3.9	98.0	3.9	--	--	--	--
H1[1]	318	12.5	418	16.4	473	18.6	578	22.8	588	23.2	675	26.6
a	5.5	0.2	5.5	0.2	6.5	0.25	6.5	0.25	6.5	0.25	9.0	0.35
b	10.0	0.4	10.0	0.4	13.0	0.5	13.0	0.5	14.0	0.55	18.0	0.71
c	5.5	0.2	5.5	0.2	8.0	0.3	8.0	0.3	8.5	0.3	8.5	0.3
d	5.5	0.2	5.5	0.2	6.5	0.25	6.5	0.25	6.5	0.25	9.0	0.35

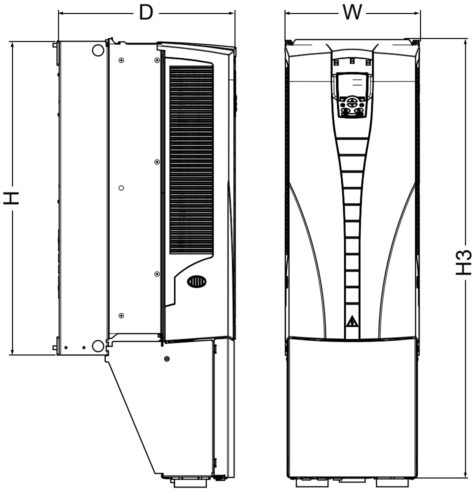
[1] Center to center dimension.

Outside dimensions

Drives with IP21 / UL type 1 enclosures



Types ACS550-x1-246A-4 and
ACS550-01-290A-4, frame size R6



IP21 / UL type 1 – dimensions for each frame size												
Ref.	**R1**		**R2**		**R3**		**R4**		**R5**		**R6**	
	mm	**in**	**mm**	**in**	**mm**	**in**	**mm**	**in**	**mm**	**in**	**mm**	**in**
W	125	4.9	125	4.9	203	8.0	203	8.0	265	10.4	302	11.9
H	330	13.0	430	16.9	490	19.3	596	23.5	602	23.7	700	27.6
H2	315	12.4	415	16.3	478	18.8	583	23.0	578	22.8	698	27.5
H3	369	14.5	469	18.5	583	23.0	689	27.1	736	29.0	888[1]	35.0[1]
D	212	8.3	222	8.7	231	9.1	262	10.3	286	11.3	400	15.8

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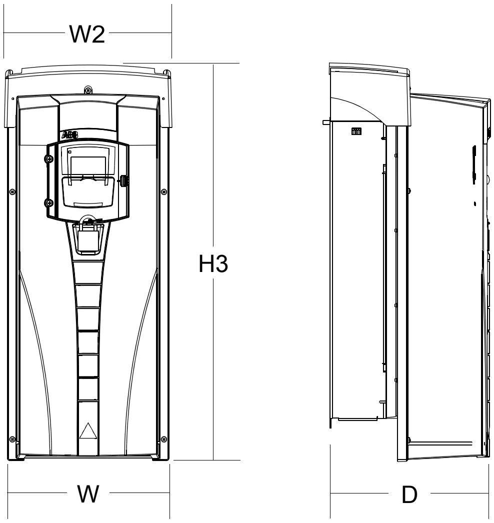
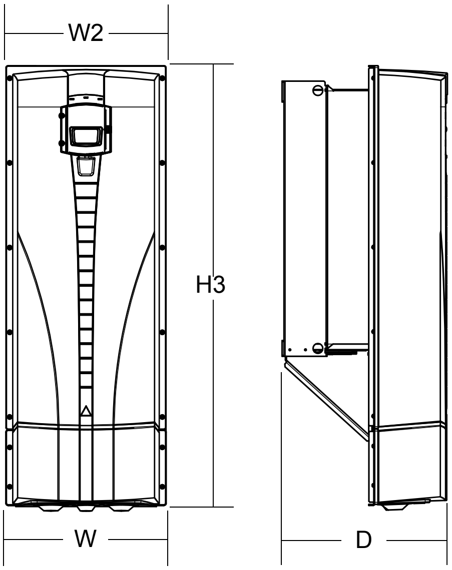
[1] ACS550-x1-246A-4 and ACS550-01-290A-4: 979 mm / 38.5 in.

Drives with IP54 / UL type 12 enclosures



Type ACS550-01-290A-4, IP54
(UL type 12 not available), frame size R6



IP54 / UL type 12 – Dimensions for each frame size												
Ref.	**R1**		**R2**		**R3**		**R4**		**R5**		**R6**[2]	
	mm	**in**	**mm**	**in**	**mm**	**in**	**mm**	**in**	**mm**	**in**	**mm**	**in**
W	213	8.4	213	8.4	257	10.1	257	10.1	369	14.5	410	16.1
W2	222	8.8	222	8.8	267	10.5	267	10.5	369	14.5	410	16.1
H3	461	18.2	561	22.1	629	24.8	760	29.9	775	30.5	924[1]	36.4[1]
D	234	9.2	245	9.7	254	10.0	284	11.2	309	12.2	423	16.7

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1. ACS550-01-290A-4: 1119 mm / 44.1 in.
2. UL type 12 not available for ACS550-01-290A-4.

Weight

The following table lists typical maximum weights for each frame size. Variations within each frame size (due to components associated with voltage/current ratings and options) are minor.

Enclosure	**Weight**											
	R1		**R2**		**R3**		**R4**		**R5**		**R6**	
	kg	**lb**	**kg**	**lb**	**kg**	**lb**	**kg**	**lb**	**kg**	**lb**	**kg**	**lb**
IP21 / UL type 1	6.5	14.3	9.0	19.8	16	35	24	53	34	75	69[1]	152[1]
IP54 / UL type 12	8.0	17.6	11.0	24.3	17.0	37.5	26.0	57.3	42.0	93.0	86.0[2]	190[2]

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1. ACS550-x1-246A-4, IP21 / UL type 1: 70 kg / 154 lb
   ACS550-01-290A-4, IP21 / UL type 1: 80 kg / 176 lb.
2. ACS550-x1-246A-4, IP54 / UL type 12: 80 kg / 176 lb
   ACS550-01-290A-4, IP54: 90 kg / 198 lb (UL type 12 not available).

Degrees of protection

Available enclosures:

- IP21 / UL type 1 enclosure. The site must be free of airborne dust, corrosive gases or liquids, and conductive contaminants such as condensation, carbon dust and metallic particles.
- IP54 / UL type 12 enclosure. This enclosure provides protection from airborne dust and light sprays or splashing water from all directions.

  Note: UL type 12 enclosure is not available for type ACS550-01-290A-4.

Compared to the IP21 / UL type 1 enclosure, the IP54 / UL type 12 enclosure has:

- the same internal plastic shell as the IP21 enclosure
- a different outer plastic cover
- an additional internal fan to improve cooling
- larger dimensions
- the same rating (does not require a derating).

Ambient conditions

The following table lists the ACS550 environmental requirements.

Ambient environment requirements		
	Installation site	**Storage and transportation in the protective package**
Altitude	• 0…1000 m (0…3 300 ft) • 1000…2000 m (3 300…6 600 ft) if P_N and I_{2N} derated 1% every 100 m above 1000 m (300 ft above 3 300 ft)	
Ambient temperature	• Min. -15 °C (5 °F) – no frost allowed • Max. (fsw = 1 or 4) 40 °C (104 °F); 50 °C (122 °F) if P_N and I_{2N} derated to 90% • Max. (fsw = 8) 40 °C (104 °F) if P_N and I_{2N} derated to 80% • Max. (fsw = 12) 30 °C (86 °F) if P_N and I_{2N} derated to 65% (to 50% for 600 V, R4 frame sizes, that is for ACS550-U1-032A-6 … ACS550-U1-062A-6)	-40…70 °C (-40…158 °F)
Relative humidity	5…95%, no condensation allowed	

Ambient environment requirements		
	Installation site	**Storage and transportation in the protective package**
Contamination levels (IEC 721-3-3)	• No conductive dust allowed. • The ACS550 should be installed in clean air according to enclosure classification. • Cooling air must be clean, free from corrosive materials and free from electrically conductive dust. • Chemical gases: Class 3C2 • Solid particles: Class 3S2	Storage • No conductive dust allowed. • Chemical gases: Class 1C2 • Solid particles: Class 1S2 Transportation • No conductive dust allowed. • Chemical gases: Class 2C2 • Solid particles: Class 2S2

The following table lists the standard stress testing that the ACS550 passes.

Stress tests		
	Without shipping package	**Inside shipping package**
Sinusoidal vibration	Mechanical conditions: In accordance with IEC 60721-3-3, Class 3M4 • 2…9 Hz 3.0 mm (0.12 in) • 9…200 Hz 10 m/s^2 (33 ft/s^2)	In accordance with ISTA 1A and 1B specifications.
Shock	Not allowed	In accordance with IEC 68-2-29: max. 100 m/s^2 (330 ft/s^2), 11ms
Free fall	Not allowed	• 76 cm (30 in), frame size R1 • 61cm (24 in), frame size R2 • 46 cm (18 in), frame size R3 • 31 cm (12 in), frame size R4 • 25 cm (10 in), frame size R5 • 15 cm (6 in), frame size R6

Materials

Material specifications	
Drive enclosure	• PC/ABS 2.5 mm, color NCS 1502-Y or NCS 7000-N • Hot-dip zinc coated steel sheet 1.5…2 mm, thickness of coating 20 micrometers. If the surface is painted, the total thickness of the coating (zinc and paint) is 80…100 micrometers. • Cast aluminium AlSi • Extruded aluminium AlSi
Package	Corrugated board, expanded polystyrene, plywood, raw wood (heat dried). Package wrap consists of one or more of the following: PE-LD plastic wrap, PP or steel bands.

<table>
<tr><th colspan="2">Material specifications</th></tr>
<tr><td>Disposal</td><td>The drive contains raw materials that should be recycled to preserve energy and natural resources. The package materials are environmentally compatible and recyclable. All metal parts can be recycled. The plastic parts can either be recycled or burned under controlled circumstances, according to local regulations. Most recyclable parts are marked with recycling marks.
If recycling is not feasible, all parts excluding electrolytic capacitors and printed circuit boards can be landfilled. The DC capacitors contain electrolyte and, if the drive is not provided with the RoHS marking, the printed circuit boards contain lead, both of which are classified as hazardous waste within the EU. They must be removed and handled according to local regulations.
For further information on environmental aspects and more detailed recycling instructions, please contact your local ABB distributor.</td></tr>
</table>

Applicable standards

Drive compliance with the following standards is identified by the standard "marks" on the type designation label.

Mark	Applicable standards	
CE	EN 50178 (1997)	Electronic equipment for use in power installations
	IEC/EN 60204-1 (2005)	Safety of machinery. Electrical equipment of machines. Part 1: General requirements. *Provisions for compliance:* The final assembler of the machine is responsible for installing: • an emergency-stop device • a supply disconnecting device.
	IEC/EN 60529 (2004)	Degrees of protection provided by enclosures (IP code)
	IEC 60664-1 (2002)	Insulation coordination for equipment within low-voltage systems. Part 1: Principles, requirements and tests
	IEC/EN 61800-5-1 (2003)	Adjustable speed electrical power drive systems. Part 5-1: Safety requirements. Electrical, thermal and energy
	IEC/EN 61800-3 (2004)	Adjustable speed electrical power drive systems. Part 3: EMC requirements and specific test methods
	IEC/EN 61000-3-12	Electromagnetic compatibility (EMC). Part 3-12: Limits - Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current > 16 A and = 75 A per phase
✓	IEC/EN 61800-3 (2004)	Adjustable speed electrical power drive systems. Part 3: EMC requirements and specific test methods
c UL us LISTED	UL 508C	UL Standard for Safety, Power Conversion Equipment, third edition
CSA	C22.2 No. 14	CSA Standard for Industrial Control Equipment (for ACS550-U1 drives only)

CE marking

A CE mark is attached to the drive to verify that the drive follows the provisions of the European Low Voltage and EMC Directives.

Note: The 600 V ACS550-U1 drives are not CE approved.

Compliance with the EMC Directive

The Directive defines the requirements for immunity and emissions of electrical equipment used within the European Union. The EMC product standard (IEC/EN 61800-3 [2004]) covers requirements stated for drives.

Compliance with IEC/EN 61800-3 (2004)

See page 305.

C-Tick marking

The drive carries C-Tick marking.

C-Tick marking is required in Australia and New Zealand. A C-Tick mark is attached to the drive to verify compliance with the relevant standard (IEC 61800-3 (2004) – Adjustable speed electrical power drive systems – Part 3: EMC product standard including specific test methods), mandated by the Trans-Tasman Electromagnetic Compatibility Scheme.

The Trans-Tasman Electromagnetic Compatibility Scheme (EMCS) was introduced by the Australian Communication Authority (ACA) and the Radio Spectrum Management Group (RSM) of the New Zealand Ministry of Economic Development (NZMED) in November 2001. The aim of the scheme is to protect the radio frequency spectrum by introducing technical limits for emission from electrical/ electronic products.

Compliance with IEC/EN 61800-3 (2004)

See page *305*.

UL/CSA markings

An UL mark is attached to ACS550 drives to verify that the drive follows the provisions of UL 508C.

A CSA mark is attached to ACS550-**U1** type drives to verify that the drive follows the provisions of C22.2 NO. 14.

The ACS550 is suitable for use in a circuit capable of delivering not more than 100 kA RMS symmetrical amperes, 600 V maximum. The ampere rating is based on tests done according to UL 508.

Branch circuit protection must be provided in accordance with local codes.

The ACS550 has an electronic motor protection feature that complies with the requirements of UL 508C and, for ACS550-U1, C22.2 No. 14. When this feature is selected and properly adjusted, additional overload protection is not required unless more than one motor is connected to the drive or unless additional protection is required by applicable safety regulations. See parameters 3005 (MOT THERM PROT) and 3006 (MOT THERM RATE).

The drives are to be used in a controlled environment. See section *Ambient conditions* on page *300* for specific limits.

Note: For open type enclosures, i.e. drives without the conduit box and/or cover for IP21 / UL type 1 drives, or without the conduit plate and/or hood for IP54 / UL type 12 drives, the drive must be mounted inside an enclosure in accordance with National Electric Code and local electrical codes.

Brake choppers, when applied with appropriately sized brake resistors, will allow the drive to dissipate regenerative energy (normally associated with quickly decelerating a motor). Frame sizes R1 and R2 have a built-in brake chopper as standard equipment. For frame sizes R3…R6, contact your ABB representative for appropriate parts. See section *Brake components* on page *289*.

IEC/EN 61800-3 (2004) Definitions

EMC stands for **E**lectro**m**agnetic **C**ompatibility. It is the ability of electrical/electronic equipment to operate without problems within an electromagnetic environment. Likewise, the equipment must not disturb or interfere with any other product or system within its locality.

First environment includes establishments connected to a low-voltage network which supplies buildings used for domestic purposes.

Second environment includes establishments connected to a network not directly supplying domestic premises.

Drive of category C2: drive of rated voltage less than 1000 V and intended to be installed and commissioned only by a professional when used in the first environment.

Note: A professional is a person or organisation having necessary skills in installing and/or commissioning power drive systems, including their EMC aspects.

Category C2 has the same EMC emission limits as the earlier class first environment restricted distribution. EMC standard IEC/EN 61800-3 does not any more restrict the distribution of the drive, but the using, installation and commissioning are defined.

Drive of category C3: drive of rated voltage less than 1000 V, intended for use in the second environment and not intended for use in the first environment.

Category C3 has the same EMC emission limits as the earlier class second environment unrestricted distribution.

Compliance with the IEC/EN 61800-3 (2004)

The immunity performance of the drive complies with the demands of IEC/EN 61800-3, category C2 (see page *305* for IEC/EN 61800-3 definitions). The emission limits of IEC/EN 61800-3 are complied with the provisions described below.

First environment (drives of category C2)

1. The internal EMC filter is connected.
2. The motor and control cables are selected as specified in this manual.
3. The drive is installed according to the instructions given in this manual.
4. The motor cable length does not exceed the allowed maximum length specified in section *Motor cable length for 400 V drives* on page *284* for the frame size and switching frequency in use.

   WARNING! In a domestic environment, this product may cause radio inference, in which case supplementary mitigation measures may be required.

Second environment (drives of category C3)

1. The internal EMC filter is connected.
2. The motor and control cables are selected as specified in this manual.
3. The drive is installed according to the instructions given in this manual.

4. The motor cable length does not exceed the allowed maximum length specified in section *Motor cable length for 400 V drives* on page *284* for the frame size and switching frequency in use.

   WARNING! A drive of category C3 is not intended to be used on a low-voltage public network which supplies domestic premises. Radio frequency interference is expected if the drive is used on such a network.

Note: It is not allowed to install a drive with the internal EMC filter connected on IT (ungrounded) systems. The supply network becomes connected to ground potential through the EMC filter capacitors, which may cause danger or damage the drive.

Note: It is not allowed to install a drive with the internal EMC filter connected to a corner grounded TN system as this would damage the drive.

Product protection in the USA

This product is protected by one or more of the following US patents:

4,920,306 5,301,085 5,463,302 5,521,483 5,532,568 5,589,754
5,612,604 5,654,624 5,799,805 5,940,286 5,942,874 5,952,613
6,094,364 6,147,887 6,175,256 6,184,740 6,195,274 6,229,356
6,252,436 6,265,724 6,305,464 6,313,599 6,316,896 6,335,607
6,370,049 6,396,236 6,448,735 6,498,452 6,552,510 6,597,148
6,600,290 6,741,059 6,774,758 6,844,794 6,856,502 6,859,374
6,922,883 6,940,253 6,934,169 6,956,352 6,958,923 6,967,453
6,972,976 6,977,449 6,984,958 6,985,371 6,992,908 6,999,329
7,023,160 7,034,510 7,036,223 7,045,987 7,057,908 7,059,390
7,067,997 7,082,374 7,084,604 7,098,623 7,102,325 7,109,780
7,164,562 7,176,779 7,190,599 7,215,099 7,221,152 7,227,325
7,245,197 7,250,739 7,262,577 7,271,505 7,274,573 7,279,802
7,280,938 7,330,095 7,349,814 7,352,220 7,365,622 7,372,696
7,388,765 D503,931 D510,319 D510,320 D511,137 D511,150
D512,026 D512,696 D521,466 D541,743S D541,744S D541,745S
D548,182S D548,183S

Other patents pending.

Index

Further information

Product and service inquiries

Address any inquiries about the product to your local ABB representative, quoting the type designation and serial number of the unit in question. A listing of ABB sales, support and service contacts can be found by navigating to www.abb.com/drives and selecting *Sales, Support and Service Network*.

Product training

For information on ABB product training, navigate to www.abb.com/drives and select *Training courses*.

Providing feedback on ABB Drives manuals

Your comments on our manuals are welcome. Go to www.abb.com/drives and select *Document Library – Manuals feedback form (LV AC drives)*.

Document library on the Internet

You can find manuals and other product documents in PDF format on the Internet. Go to www.abb.com/drives and select *Document Library*. You can browse the library or enter selection criteria, for example a document code, in the search field.

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3AFE64804588 (3AUA0000001418) Rev G / EN
EFFECTIVE: 2009-07-07
SUPERSEDES: 3AFE64804588 (3AUA0000001418) Rev F 2007-04-16

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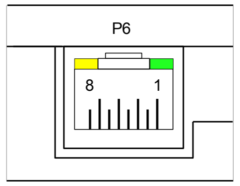
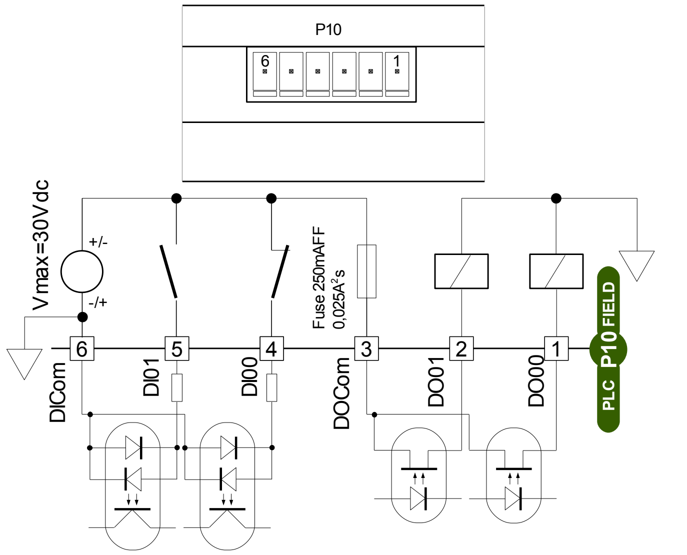
1 Porta Ethernet
Ethernet port



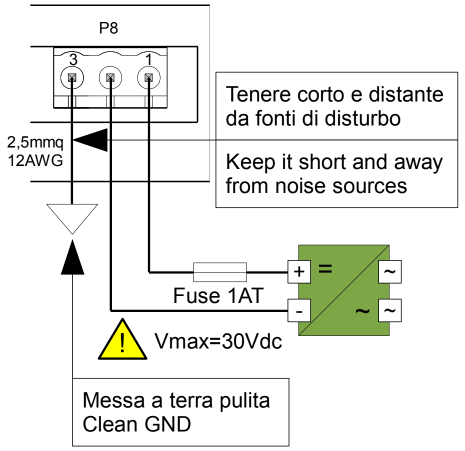
Ethernet (P6)			
Pin	**Signal**	**Pin**	**Signal**
1	ETH1	5	N.C.
2	ETH2	6	ETH6
3	ETH3	7	N.C.
4	N.C.	8	N.C.
LED Yellow	Link activity		
LED Green	Speed 100Mb/s		

Default IP Address: **192.168.0.122**, netmask 255.255.255.0

2 I/O Digitali
Digital I/Os



3 Alimentazione
Power Supply



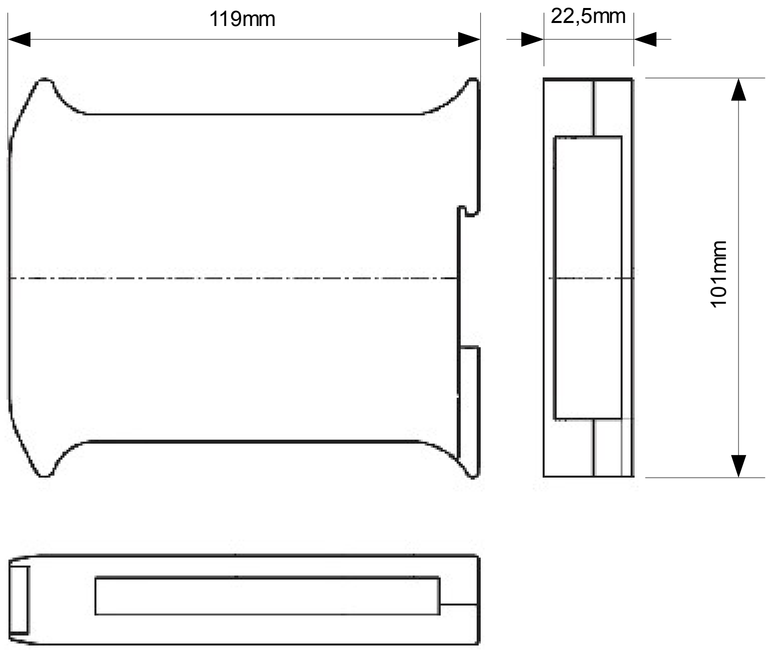
Tenere corto e distante da fonti di disturbo

Keep it short and away from noise sources

Vmax=30Vdc

Messa a terra pulita
Clean GND

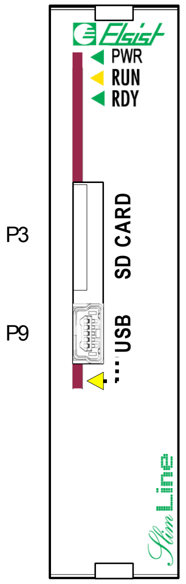
4 Dimensioni
Dimensions

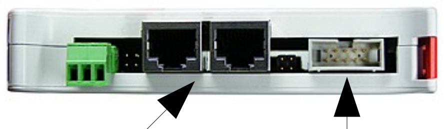


5 Stato CPU – USB – SD Card
CPU Status – USB – SD Card

CPU Status	
LED	**Function**
PWR (Green)	ON=Power OK OFF= Power fault
RUN (Yellow)	Regular Blink = System OK
RDY (Green)	ON=System Ready OFF=System Stopped

USB (P9)	
Pin	**Signal**
1	Sense
2	D-
3	D+
4	N.C.
5	GND
LED	**Function**
USB	USB Activity

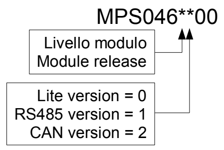




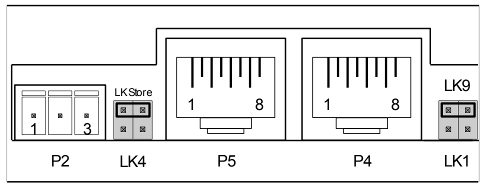
6 Identificazione prodotto
Product identification

LBL052E000

Code: **MPS046**00**
Serial Nr: **00256**



7 Porte RS232 e bus di campo
RS232 Ports and Field bus

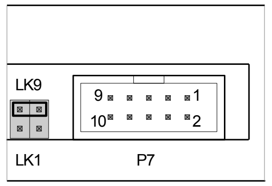


Mode	LK9/LK1
Normal operation	LK9 LK1
Firmware upgrade	LK9 LK1
⚠ **Not allowed!**	LK9 LK1

Field Bus (P2)			
CAN		**RS485**	
Pin	**Signal**	**Pin**	**Signal**
1	CAN H	1	D+
2	CAN L	2	D-
3	Field GND	3	Field GND
LK4	ON= Line Terminated (120 Ohm)		

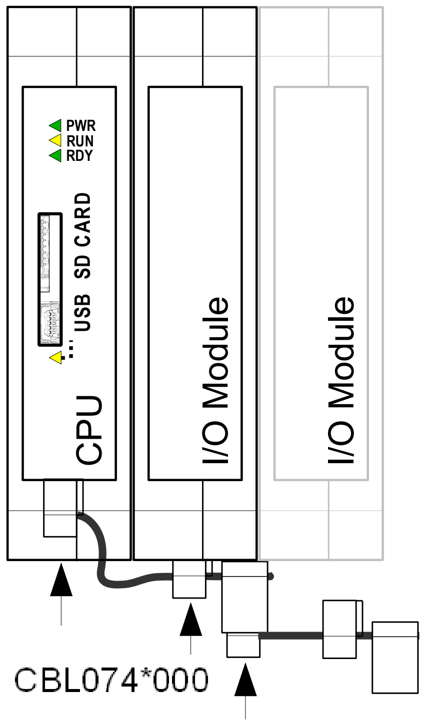
RS232 (COM0 P4, COM1 P5)			
Pin	**Signal**	**Pin**	**Signal**
1	Not connected	6	TX
2	Not connected	7	CTS
3	DTR	8	RTS
4	GND		
5	RX		

8 Bus di estensione
Extension bus



BUS I2C (P7)			
Pin	**Signal**	**Pin**	**Signal**
1	+5Vdc	6	GND
2	+5Vdc	7	SCL
3	+5V (Aux)	8	GND
4	+5V (Aux)	9	SDA
5	RDYO-N	10	GND

9 Collegamento moduli di estensione
Extension modules connection



CE

SlimLine
ARM7 CPU
Module
Hardware
Manual

Mnl149b100

Elsist
Via G. Brodolini, 15 (Z.I.) 15033 CASALE M.TO (AL) ITALY
Phone +39-0142-451987 Fax +39-0142-451988
Internet: http://www.elsist.it email: elsist@elsist.it

Connessioni

La CPU SlimLine ARM7 è dotata di morsetti estraibili per la connessione dell'alimentazione, I/O e Bus di campo, connettore IDC per il collegamento dei moduli di estensione, connettori RJ45 per il collegamento delle porte RS232 e della porta Ethernet, e di un connettore miniUSB-B.

Alimentazione (Fig. 3)

Il modulo può essere alimentato con una tensione continua compresa nell'intervallo 10-30V. La connessione della alimentazione deve essere effettuata in accordo alla Fig. 2.

La presenza della tensione di alimentazione è segnalata dal LED verde "PWR".

⚠ **ATTENZIONE! Il superamento del valore massimo di tensione indicato può provocare il danneggiamento irreversibile dell'apparato.**

Collegamento di terra (Fig. 2)

Il dispositivo deve essere collegato direttamente a terra mediante l'apposito morsetto del connettore di alimentazione (Fig. 2).

Il collegamento deve essere eseguito mediante una cordina avente sezione di **almeno di 2.5 mmq**, ad una barra equipotenziale di rame di adeguata sezione.

Al fine di garantire una buona rejezione ai disturbi, è necessario che questo collegamento sia mantenuto **il più corto possibile e non venga fatto passare con altri cavi**.

I/O Digitali (Fig. 2)

Il modulo è provvisto di 2 ingressi digitali e 2 uscite digitali, galvanicamente isolati dal sistema.

Sia gli ingressi che le uscite possono essere indifferentemente di tipo PNP o NPN.

L'ingresso DI00 può essere utilizzato come counter con Fmax=10KHz.

⚠ **ATTENZIONE! Eventuali cortocircuiti sulle uscite digitali possono provocare il danneggiamento irreversibile dell'apparato. E' consigliabile inserire un fusibile extra rapido 200mAFF in serie al comune. Out, (es. Ferraz G084002P).**

Bus di estensione (Fig. 8)

Il bus di comunicazione con i moduli di estensione sfrutta l'interfaccia I^2C^{TM} Fast Speed ed è disponibile su connettore IDC 10 poli (P7). I moduli di estensione devono essere collegati in cascata tramite gli appositi cavetti CBL074*000 (da ordinare separatamente). In figura 9 è schematizzato il collegamento dei moduli di estensione.

Al modulo CPU possono essere collegati fino a 16 moduli di estensione (previa verifica assorbimenti massimi).

⚠ **ATTENZIONE! Prima di collegare al modulo CPU i moduli di estensione, accertarsi che questo non sia alimentato. In caso contrario i dispositivi potrebbero essere irrimediabilmente danneggiati.**

Porte seriali RS232 (Fig. 7)

Il modulo dispone di due porte seriali di tipo "DTE" (Data Terminal Equipment). Il collegamento con altri dispositivi DTE, quali personal computer o terminali operatore in genere, deve essere eseguito con un cavo di tipo Null-Modem della lunghezza massima di 15 mt, come prescritto dalle specifiche EIA.

Le porte RS232, non sono galvanicamente isolate dal sistema, quindi è opportuno verificare, prima di collegare tra di loro dispositivi RS232 diversi, che il loro potenziale di massa sia lo stesso.

⚠ **ATTENZIONE! Differenze di potenziale eccessive tra punti di massa diversi, possono causare danneggiamenti irreversibili ai dispositivi.**

Bus di campo (Fig. 7)

Il modulo può essere dotato di bus di campo RS485 o Can Bus (vedi identificazione prodotto Fig. 6), in entrambe i casi il bus è isolato galvanicamente dal sistema. Per il collegamento del bus attenersi alla figura a lato.

Attraverso il jumper LK4 può essere inserita la resistenza di terminazione 120 Ohm o meno.

Porta Ethernet (Fig. 1)

Il modulo può essere dotato di una porta ethernet 10/100-Base T(x) disponibile sul connettore RJ45 P6; le connessioni, evidenziate in Figura 1, sono compatibili con lo standard ethernet IEEE 802.3 100-Base T. Per l'inserimento in una rete ethernet devono essere utilizzati cavi UDP Cat. 5 RJ45 ed un concentratore (HUB) od uno switch, mentre, per un collegamento punto-punto, è sufficiente utilizzare un cavo patch RJ45 senza utilizzo di altri dispositivi. Il dispositivo è Auto-MDIX, quindi non è necessario disporre di cavo cross per il collegamento diretto a PC.

Su P6 sono disponibili due LED di segnalazione stato della connessione ethernet:

Il LED Verde segnala, quando acceso, che la rete sta funzionando a 100Mb/s.

Il LED Giallo segnala l'attività del link ethernet.

Il modulo viene fornito con indirizzo IP di default 192.168.0.122, e netmask 255.255.255.0.

Porta USB B (Fig. 5)

Il modulo è dotato di una porta mini USB di tipo B Client. L'attività USB è segnalata dall'apposito LED.

Slot SD Card (Fig. 5)

Il modulo può essere dotato di uno slot mini-SD Card. La card può essere utilizzata sia per funzioni di archiviazione del programma utente, che per funzioni di storicizzazione dati durante il funzionamento. La card deve essere ordinata separatamente.

Segnalazioni stato (Fig. 5)

Il modulo è dotato di LED per la segnalazione dello stato di funzionamento, in particolare è segnalato lo stato di:

- PWR (LED Verde)
  Indica la presenza dell'alimentazione
- RUN (LED Giallo)
  Lampeggiante regolare indica che il sistema è in funzione,
- RDY (LED Verde)
  Acceso indica che il sistema è pronto e gestisce i moduli I/O. La mancanza di RDY resetta lo stato delle uscite dei moduli di estensione eventualmente connessi al sistema.

Compatibilità elettromagnetica

Il dispositivo è conforme alla direttiva compatibilità elettromagnetica in accordo con la norma **CEI EN 50081-2** (Norma generica sull'emissione riguardante ambienti residenziali) e con la norma **CEI EN 50082.2** (Norma generica sull'immunità riguardante gli ambienti industriali).

I^2C^{TM} è un marchio registrato di NXP Semiconductors

Connections

The SlimLine ARM7 CPU module is provided of extractable TB to connect Power, I/Os and Field bus, IDC connector to connect the extension modules, RJ45 connectors for RS232 COM ports and the Ethernet port, and one miniUSB-B connector.

Power supply (Fig. 3)

The module can be powered with a DC source within the range 10-30Vdc. The power connection must be done according to the Fig. 2.

The power is signalized by the green LED "PWR".

⚠ **WARNING! Values greater than the maximum allowed may damage the device seriously.**

Ground connection (Fig. 2)

The device must be connected directly to Ground using the terminal block on the power supply connector (Fig. 2).

The connection must be performed through a wire with section at **least of 2.5mm2**, to a copper equipotential bar of adequate section.

To guarantee a good noise rejection, keep this connection **as short as possible** and take care to place it **far away to the other cables**.

Digital I/Os (Fig. 2)

The module is provided of 2 digital input and 2 digital output, galvanically insulated from the system.

Input and outputs may be PNP or NPN type as for your convenience.

The digital Input DI00 may be used as a counter input with Fmax=10KHz.

⚠ **WARNING! Shorts on the outputs may damage permanently the device. It's suitable to place an extra rapid fuse 200mAFF in series of the output common (i.e. Ferraz G084002P).**

Extension bus (Fig. 8)

The communication bus with the extension modules uses the Fast I2C™ interface and it's available on the IDC10 connector (P7). The extension modules must be cascade connected through the special cables CBL074*000 (to be ordered separately).

The Fig. 9 in an example of extension modules connection.

Up to 16 extension modules may be connected to the CPU. (after checking the maximum current needed)

⚠ **WARNING! Before to connect the extension modules to the system, be sure that it's powered off. Missing this rule may produce failures in the modules.**

RS232 Serial ports (Fig. 7)

The device is provided of two serial ports DTE (Data Terminal Equipment). The connection between DTEs, such as Personal Computers, Operator Terminals etc., must be done through a Null-modem cable of maximum cable length of 15 mt, according to EIA specifications.

These ports aren't galvanically insulated from the system, it is recommended to verify, before to connect together different devices, the difference of potential on the ground.

⚠ **WARNING! An excess of difference of potential on ground loop may cause damages to the devices.**

Field bus (Fig. 7)

The module may be provided of a RS485 or CAN field bus (see product identification Fig. 6), in both cases the bus is galvanically insulated from the system. To connect the field bus please see Figure on side.

Through the LK4 jumper may be connected or not the 120 Ohm termination resistor.

Ethernet port (Fig. 1)

The module may be provided of an Ethernet 10/100-Base T(x) available on the RJ45 connector P6; the connection, shown in Fig. 1, are compatible with the standard Ethernet IEEE 802.3 100-Base T.

To connect the device in an Ethernet network must be used UDP Cat. 5 cables RJ45, connected to an HUB or a switch, while to made a point to point connection it's enough to use an RJ45 patch cable without HUBs. The device is Auto-MDIX, so no cross cable is needed to connect it to a PC directly.

On P6 are available two LED for Ethernet status signaling:

The green LED signals, when on, that the network is running at 100Mb/s speed.

The yellow LED signals the Ethernet link activity.

The module is factory set with IP Address 192.168.0.122, and netmask 255.255.255.0.

USB B Port(Fig. 5)

The module is provided of a mini USB B port Client. The USB activity is signaled by its LED.

Slot SD Card (Fig. 5)

The module may be provided of a slot mini-SD Card. The card may be used for archive functions or for data history functions during normal running. The card must be ordered separately.

Status signaling (Fig. 5)

The device is provided of some LEDs to signal its status, particularly is signaled:

- PWR (Green LED)
  Indicates that device is powered
- RUN (Yellow LED)
  Regularly blinking indicates that the system is running,
- RDY (Green LED)
  When light indicates that the system is ready and it manages the I/O modules according to the user program. When it's off it resets the output status on extension modules eventually connected to the system.

Electromagnetic Compatibility

The device meets the EMC directive in reference to the standards CEI EN 50081-1 (generic standard on the issue regarding residential environments, commercial and of the light industry) and CEI EN 50082-2 (generic standard on immunity regarding the industrial environments).

I^2C^{TM} is a trade mark of NXP Semiconductors

Technical Specifications

CPU Version	**Lite**	**RS485**	**CAN**
Power Supply	10-30Vdc 1.4W	10-30Vdc 2W	
Processor	NXP LPC2387 (ARM7TDMI)		
Program memory	Flash EPROM 512KBytes (64KBytes User Program)		
Mass memory	EEPROM 128KBytes (106KBytes User data)		
Data backup memory	FRAM 8KBytes (3KBytes User data)		
Data memory	SRAM 96KBytes (12KBytes User data)		
Real Time Clock	Yes, with auto Day Light Saving Time Power off functionality by means of lithium backup battery (endurance 10years typical)		
USB I/F	Yes, on mini-USB B connectors (device mode)		
Digital Input	2 Optoisolated PNP/NPN 10-30Vdc, 5mA@24V (one may be used as a counter input with Fmax=10KHz)		
Digital Output	2 photo MOS 0.25A@40Vdc/ac (TOn=0,75mS max, TOff=0,2mS max)		
Ethernet I/F	None	RJ45 10/100base-T(x) Auto-MDIX	
Field bus	None	Insulated RS485	Insulated CAN Bus
Expansion bus	I2C™ Fast Speed		
RS232 I/F	2 * DTE on RJ45 connectors		
Status indicators	Power, RUN, READY, USB activity		
SD-Card Slot	None	Yes, micro SD (card is optional)	
Environment	Operating temperature : from -20 to +70°C		
	Storage temperature: from -40° to +80°C		
	Relative Humidity: Max. 90%		
Dimensions and weight	Dimensions: 22.5 mm L x 101 mm W x 120 mm H		
	Weight: 150g		
Approvals	CEI EN50081-1, CEI EN50082-2		

Collegamento Bus di campo
Field bus connection

Collegamento Half-Duplex (solo RS485)

- La distanza massima tra il primo e l'ultimo dei dispositivi **non deve superare i 1200 mt** (RS485)
- La resistenza di terminazione deve essere sempre inserita sul primo e sull'ultimo dei dispositivi.
- Il cavo **deve essere schermato e twistato**.

Note tecniche per connessione CAN

Le specifiche del Bus CAN sono regolate dalla norma ISO 11898. La velocità max di trasmissione è pari ad 1Mbit/s riferita ad un cavo di lunghezza max. 40mt. Nella tabella sotto sono riportate le velocità max in funzione della lunghezza del cavo.

Half-Duplex connection (RS485 only)

- The maximum distance between the first and the last device **does not exceed 4000 feet** (RS485).
- The termination resistor must be always connected on the first and on the last device.
- The cable **must be shielded and twisted paired**.

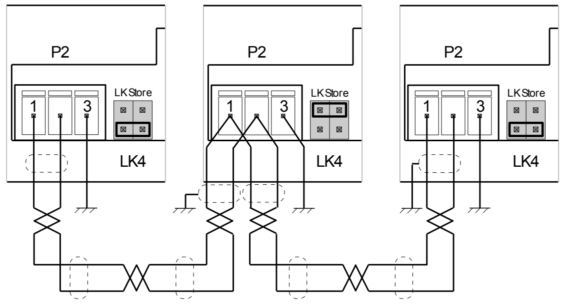
Technical notes for CAN connection

The technical specification for CAN bus are given by the ISO 11898 Standard. The maximum bus speed is 1Mbit/s for a cable length of 130ft. In the table below are listed the allowed speed function of cable length.

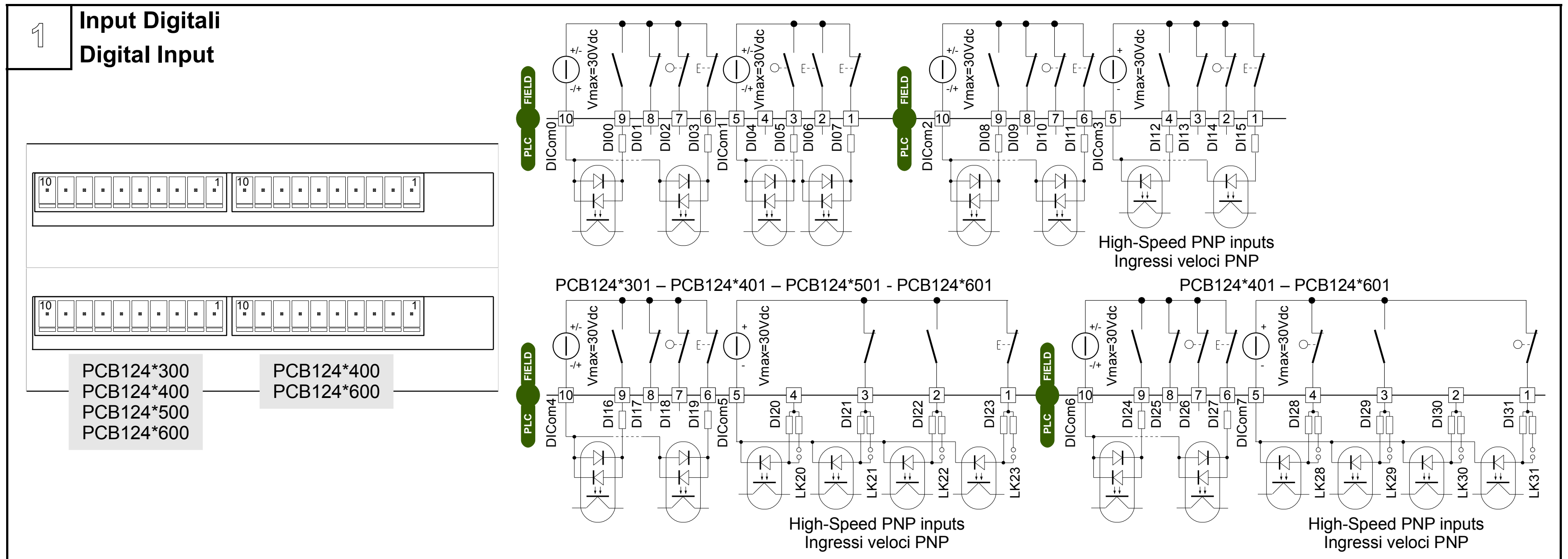
Massima velocità in funzione della lunghezza bus (CAN)
Max speed function of bus length (CAN)

Lunghezza del bus Bus Length	**Velocità trasmissione Transmission speed**	**Lunghezza del bus Bus Length**	**Velocità trasmissione Transmission speed**
100 meters (330 ft)	500 kbit/s	500 meters (1600 ft)	125 kbit/s
200 meters (650 ft)	250 kbit/s	6 kilometers (20000 ft)	10 kbit/s

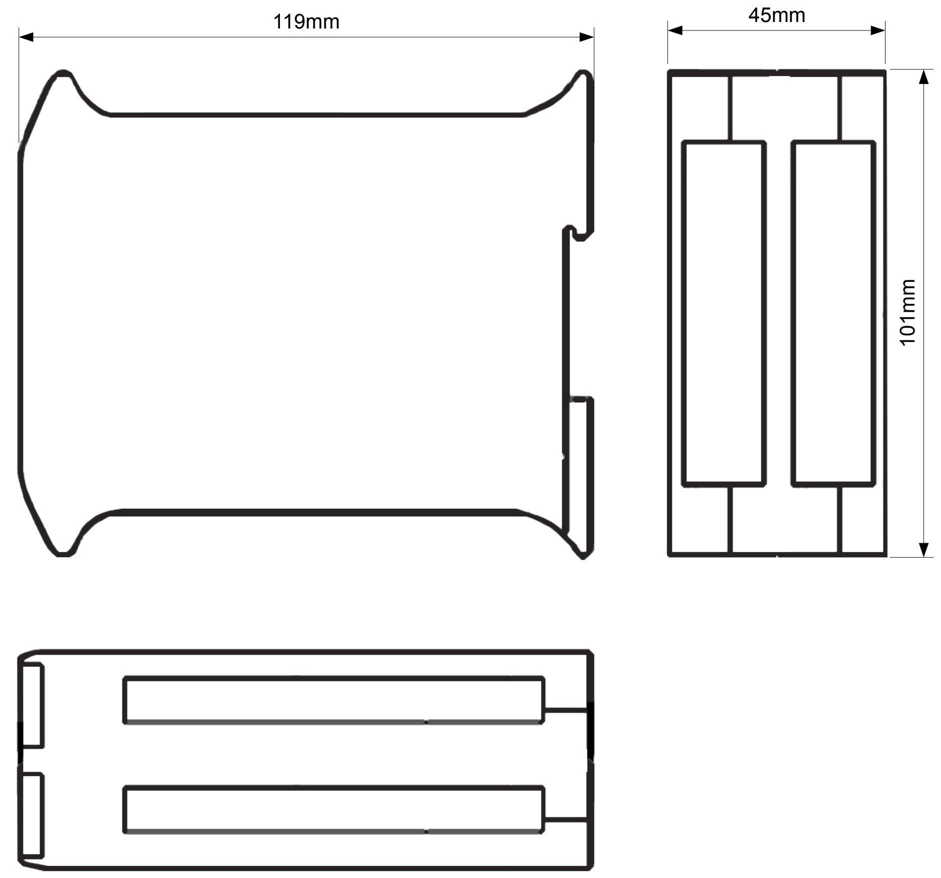
Schema di connessione
Drawing connection



1 Input Digitali
Digital Input



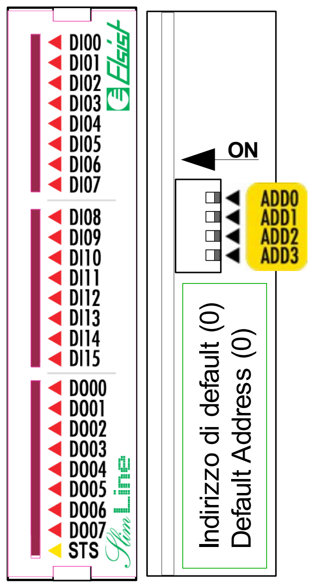
4 Dimensioni
Dimensions

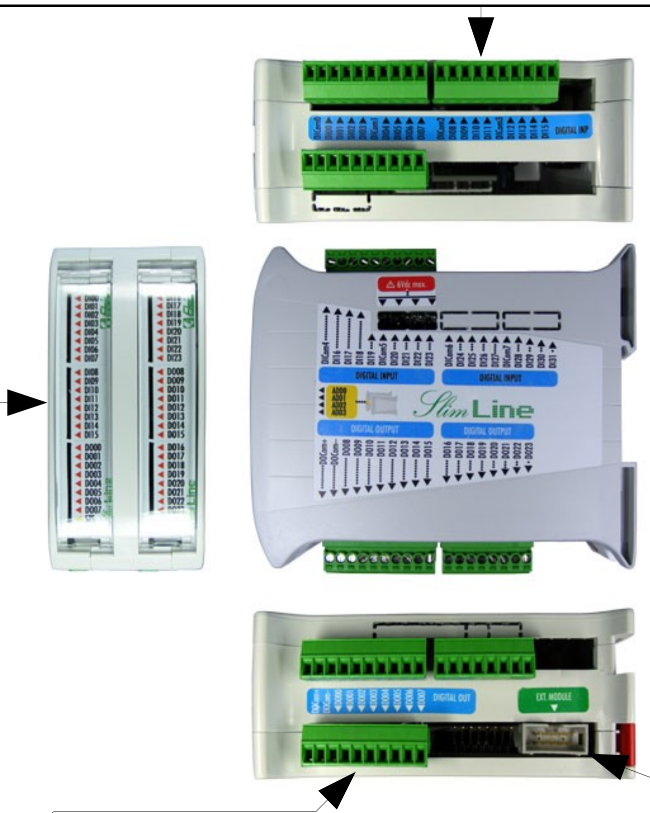


5 Stato Modulo I/O e indirizzi
Module I/O Status and Address

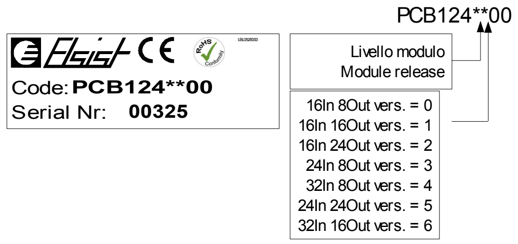
Module Status	
LED	**Function**
STS	Reg. blink= Mod OK
DIXX	Input XX Status
DOXX	Out XX Status

Module Address				
ADD0	**ADD1**	**ADD2**	**ADD3**	**Address**
OFF	**OFF**	**OFF**	**OFF**	**0**
ON	OFF	OFF	OFF	1
OFF	ON	OFF	OFF	2
ON	ON	OFF	OFF	3
OFF	OFF	ON	OFF	4
ON	OFF	ON	OFF	5
OFF	ON	ON	OFF	6
ON	ON	ON	OFF	7
OFF	OFF	OFF	ON	8
ON	ON	ON	ON	15





6 Identificazione prodotto
Product identification



PCB124**00

Code: **PCB124**00**
Serial Nr: **00325**

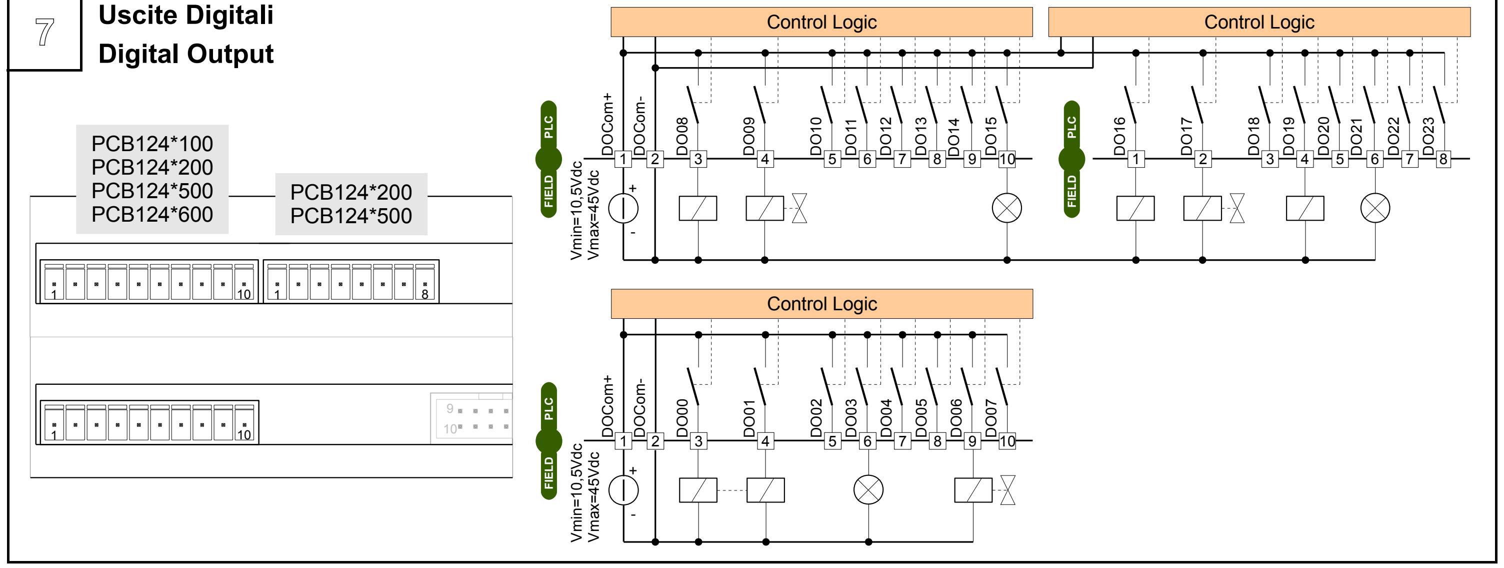
Livello modulo
Module release

16In 8Out vers. = 0
16In 16Out vers. = 1
16In 24Out vers. = 2
24In 8Out vers. = 3
32In 8Out vers. = 4
24In 24Out vers. = 5
32In 16Out vers. = 6

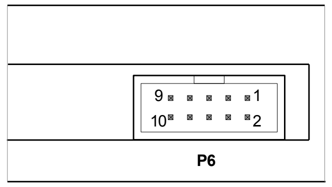
SlimLine
Static I/O
Module
Hardware
Manual

Mnl155b100

7 Uscite Digitali
Digital Output

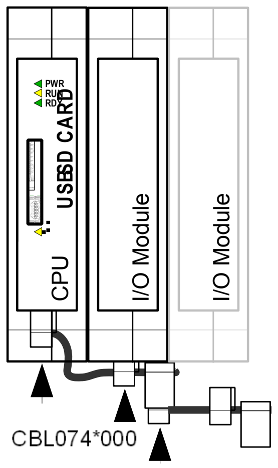


9 Bus di estensione
Extension bus



BUS I2C (P6)			
Pin	**Signal**	**Pin**	**Signal**
1	+5Vdc	6	GND
2	+5Vdc	7	SCL
3	+5V (Aux)	8	GND
4	+5V (Aux)	9	SDA
5	RDY-N	10	GND

10 Coll. mod. estensione
Ext. modules conn.



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Connessioni

Il modulo di I/O Statici SlimLine è dotato di morsetti estraibili per la connessione degli I/O e di connettore IDC per il collegamento al bus di sistema.

Alimentazione

Il modulo è alimentato attraverso il bus di sistema.

Ingressi Digitali (Fig. 1)

Il modulo è dotato di n ingressi digitali (vedi tabella caratteristiche) optoisolati attivabili con segnali compresi nel range 10-30Vdc. E' previsto un comune ogni 4 ingressi come illustrato in Fig. 1. Gli ingressi DI00-DI11 (12 Input) possono essere sia di tipo PNP che NPN, gli ingressi DI12-15 (4 input) sono solo PNP.

Gli ingressi DI16-DI19 (4 input)(laddove previsti) possono essere sia di tipo PNP che NPN.

Gli ingressi DI20-DI23 (4 input)(laddove previsti) sono solo PNP e, attraverso l'inserimento dei rispettivi jumpers, possono acquisire segnali digitali a 5Vdc.

Gli ingressi DI24-DI27 (4 input)(laddove previsti) possono essere sia di tipo PNP che NPN.

Gli ingressi DI28-DI31 (4 input)(laddove previsti) sono solo PNP e, attraverso l'inserimento dei rispettivi jumpers, possono acquisire segnali digitali a 5Vdc.

Lo stato di ogni ingresso è visualizzato tramite LED posto sul frontale del dispositivo.

⚠ **ATTENZIONE! Non applicare tensioni superiori a 6V sugli ingressi settati a 5Vdc.**

Uscite Digitali (Fig. 7)

Il modulo è dotato di n uscite digitali statiche PNP (vedi tabella caratteristiche). Le uscite sono protette da cortocircuito/sovraccarico ed autoripristinanti. Per la portata commutabile riferirsi alla tabella caratteristiche tecniche. Lo stato di ogni uscita è visualizzato tramite LED.

Le uscite vengono forzate a 0 all'accensione del sistema, e comunque ogni qualvolta lo stato del LED "RDY" è 0 (Fig. 5).

Le uscite sono galvanicamente isolate dal sistema.

⚠ **ATTENZIONE! Usare sempre i soppressori in parallelo ai carichi induttivi, la mancata osservanza di questa prescrizione può produrre alterazioni funzionali e ridurre la vita dei componenti interni dell'apparecchio.**

Bus di estensione (Fig. 9)

Il bus di comunicazione con i moduli di estensione sfrutta l'interfaccia I^{2}C^{TM} Fast Speed ed è disponibile su connettore IDC 10 poli (P6). I moduli di estensione devono essere collegati in cascata tramite gli appositi cavetti CBL074*000 (da ordinare separatamente). In figura 9 è schematizzato il collegamento dei moduli di estensione.

Al modulo CPU possono essere collegati fino a 16 moduli di estensione (previa verifica degli assorbimenti massimi).

⚠ **ATTENZIONE! Prima di collegare al modulo CPU i moduli di estensione, accertarsi che questo non sia alimentato. In caso contrario i dispositivi potrebbero essere irrimediabilmente danneggiati.**

Settaggio indirizzo (Fig. 5)

Il modulo viene fornito settato con indirizzo 0, predisposto per essere usato come primo modulo di estensione della CPU.

All'interno del modulo, accessibile con la rimozione del frontale anteriore, è presente il DIP switch di settaggio dell'indirizzo. Nella tabella di cui alla Fig. 5 sono elencate le posizioni del DIP per ottenere i possibili indirizzi dei moduli.

La figura sotto indica le modalità per la rimozione ed il rimontaggio del frontalino.

⚠ **ATTENZIONE! Non utilizzare lo stesso indirizzo su più di un modulo.**

Segnalazioni stato (Fig. 5)

Il modulo è dotato di LED per la segnalazione dello stato di funzionamento, in particolare è segnalato lo stato di:

- STS (LED Giallo)
  Lampeggiante regolare indica che il modulo è in funzione,
- DIXX (LED Rossi)
  Indicano lo stato degli ingressi digitali
- DOXX (LED Rossi)
  Indicano lo stato delle uscite digitali

Compatibilità elettromagnetica

Il dispositivo è conforme alla direttiva compatibilità elettromagnetica in accordo con la norma **<u>CEI EN 50081-2</u>** (Norma generica sull'emissione riguardante ambienti residenziali) e con la norma **<u>CEI EN 50082.2</u>** (Norma generica sull'immunità riguardante gli ambienti industriali).

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Connections

The SlimLine Static I/O module is provided of extractable TB to connect I/Os and IDC connector to connect the system bus.

Power supply

The module is powered from system bus.

Digital Inputs (Fig. 1)

The device is equipped with n optoisolated digital inputs (see the features table) to be activated with signals in the range 10-30Vdc. A common every 4 inputs is provided as described in Fig. 1. The inputs DI00-DI11 (12 Input) may be either PNP or NPN, the inputs DI12-15 (4 input) are PNP only.

The inputs DI16-DI19 (4 input) (where provided) may be either PNP or NPN.

The inputs DI20-DI23 (4 input) (where provided) are PNP only. and, through plugging their jumpers, may acquire 5Vdc digital signals.

The inputs DI24-DI27 (4 input) (where provided) may be either PNP or NPN.

The inputs DI28-DI31 (4 input) (where provided) are PNP only. and, through plugging their jumpers, may acquire 5Vdc digital signals.

The state of each input is displayed with LED on front of the device.

⚠ **WARNING! Do not apply voltages greater than 6V on input set for 5V operation.**

Digital Outputs (Fig. 7)

The module is provided of n PNP static outputs (see the features table). The outputs are protected against short/overload and auto-reset. Please refer to the Technical specs table for the maximum switching loads. The state of each output is displayed by LED.

All outputs are reset at each system power on, and however each time the state of the "RDY" LED on the CPU module is off.

⚠ **WARNING! Interference suppressors must be connected in parallel to inductive loads, according to manufacturer suggestions. Missing this rule may produce functional anomalies and reduce the expected life of internal components.**

Extension bus (Fig. 9)

The communication bus with the extension modules uses the Fast I2C™ interface and it's available on the IDC10 connector (P7). The extension modules must be cascade connected through the special cables CBL074*000 (to be ordered separately).

The Fig. 9 in an example of extension modules connection.

Up to 16 extension modules may be connected to the CPU (prior verify the maximum current needed).

⚠ **WARNING! Before to connect the extension modules to the system, be sure that it's off. Missing this rule may produce failures on the devices.**

Address setting (Fig. 5)

The module is supplied set to address 0, ready to be used as CPU first extension module.

Inside of the module, easily accessible removing the front panel, there is a DIP switch for address setting. In the table in Fig. 5 are listed the DIP positions to obtain the possible address of the modules.

The figure below explains the mode to remove and reassemble the front panel..

⚠ **WARNING! Never use the same address on more than one module.**

Status signaling (Fig. 5)

The device is provided of some LEDs to signal its status, particularly is signaled:

- STS (Yellow LED)
  Regularly blinking indicates that the system is running,
- DIXX (Red LED)
  Indicate the Digital Inputs status
- DOXX (Red LED)
  Indicate the Digital Outputs status

Electromagnetic Compatibility

The device meets the EMC directive in reference to the standards CEI EN 50081-1 (generic standard on the issue regarding residential environments, commercial and of the light industry) and CEI EN 50082-2 (generic standard on immunity regarding the industrial environments).

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Technical Specifications

Module Version		PCB124*100	PCB124*200	PCB124*300	PCB124*400	PCB124*500	PCB124*600
Power Supply Requirements	From I2C bus 5Vdc	200mA	250mA	180mA	215mA	230mA	265mA
Digital Input	Optoisolated, 10-30Vdc, 5mA@24V	16	16	24	32	24	32
	PNP only (High-speed)	4	4	8	12	8	12
	Nr of which settable for 5Vdc	0	0	4	8	4	8
Digital Output	Optoisolated Static PNP Overload and short circuit protected, self reset	16	24	8	8	24	16
	Min. Switching voltage:	10,5Vdc					
	Max. Switching voltage:	45Vdc					
	Max. Switching time ON:	100uS (24Vdc 47Ohm Load)					
	Max Switching time OFF:	200uS (24Vdc 47Ohm Load)					
Expansion bus		I2C™ Fast Speed					
Status indicators		Module Status, DI status, DO status					
Environment	Operating temperature:	from -20 to +70°C					
	Storage temperature:	from -40° to +80°C					
	Relative Humidity:	Max. 90%					
Dimensions		45 mm L x 101mm W x 120 mm H					
Weight		150g					
Approvals		CEI EN50081-1 CEI EN50082-2					

Smontaggio e rimontaggio del frontalino

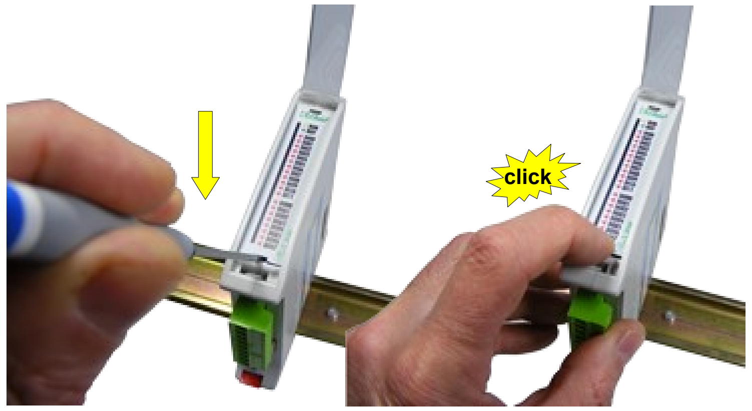
Front panel removing and reassembling

Nella figura sottostante sono indicate le operazioni da seguire per lo smontaggio ed il successivo rimontaggio del frontalino anteriore.

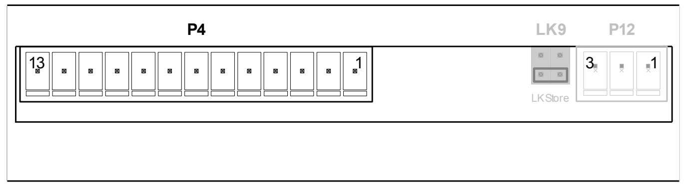
- Aprire il coperchio anteriore,
- Far leva nella parte sottostante con un cacciavite
- Settare il DIP switch interno per l'indirizzo desiderato
- Rimontare il frontalino inserendolo prima nella parte in alto e, successivamente, premere nella parte in basso fino allo scatto.

In the figure below are shown the operations to follow to remove and remount the front panel.

- Open the front cover
- Insert a screwdriver in the bottom hole of the front panel and move as indicated.
- Set-up the internal DIP switch according to the desired address
- Reassemble the front panel inserting the top first and then, press on the bottom until the click.

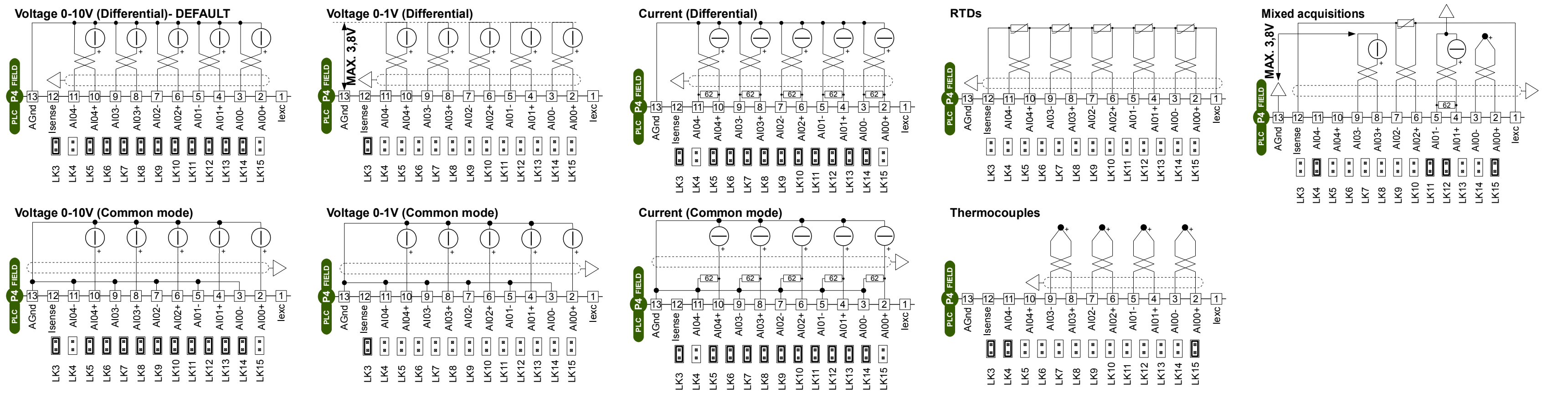


1 Ingressi Analogici (A)
Analog Input (A)

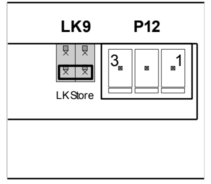


LK	ON	OFF
LK3	No Iexc required	When Iexc required
LK4 and LK15	Thermocouple acquisition (if any)	Other acquisitions (no TC)
LK5-14 (1)	Input signal > 1,17V	Input signal <= 1,17V

(1) Vedi Tabella 1 per i dettagli - See Table 1 for details



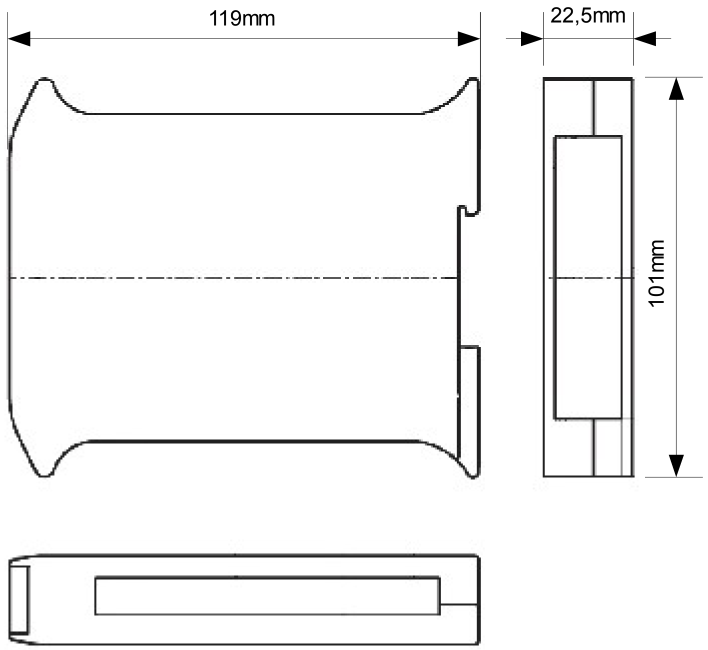
2 Bus di campo
Field bus



Field Bus (P12)

CAN		RS485	
Pin	Signal	Pin	Signal
1	CAN H	1	D+
2	CAN L	2	D-
3	Field GND	3	Field GND
LK9	ON= Line Terminated (120 Ohm)		

3 Dimensioni
Dimensions



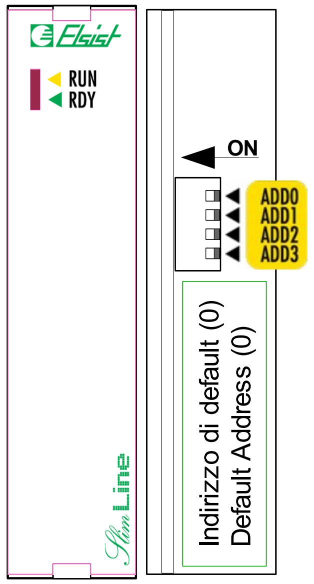
4 Stato Modulo I/O e indirizzi
Module I/O Status and Address

Module Status

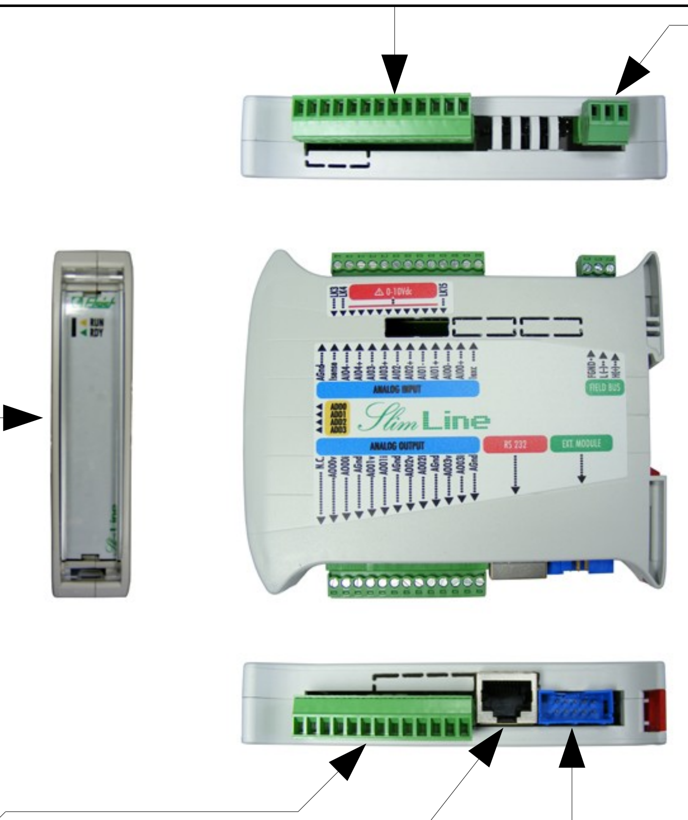
LED	Function
RUN (Yellow)	Reg. blink= Mod OK
RDY (Green)	ON = System ready

Module Address

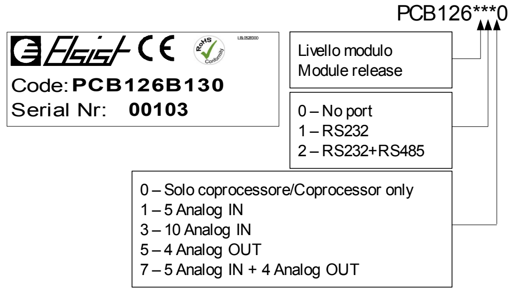
ADD0	ADD1	ADD2	ADD3	Address
OFF	OFF	OFF	OFF	0
ON	OFF	OFF	OFF	1
OFF	ON	OFF	OFF	2
ON	ON	OFF	OFF	3
OFF	OFF	ON	OFF	4
ON	OFF	ON	OFF	5
OFF	ON	ON	OFF	6
ON	ON	ON	OFF	7
OFF	OFF	OFF	ON	8
ON	ON	ON	ON	15



Vedi retro per ulteriori informazioni.
See back to further instructions.

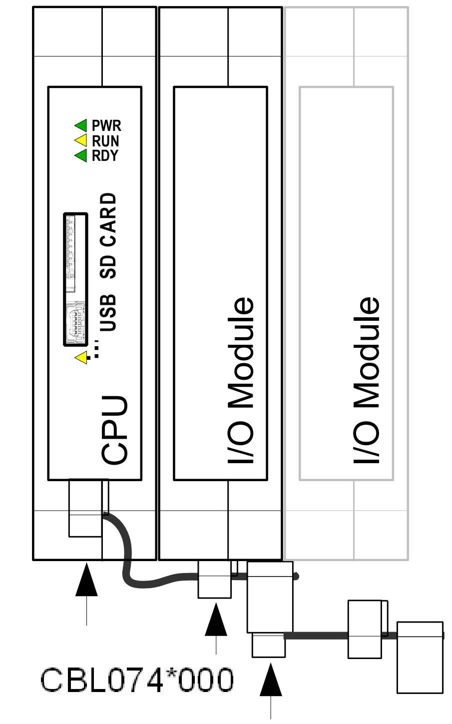


5 Identificazione prodotto
Product identification



Code: **PCB126B130**
Serial Nr: **00103**

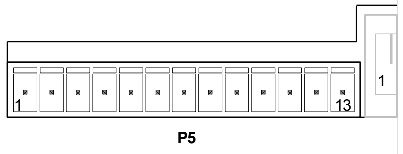
9 Collegamento moduli di estensione
Extension modules connection

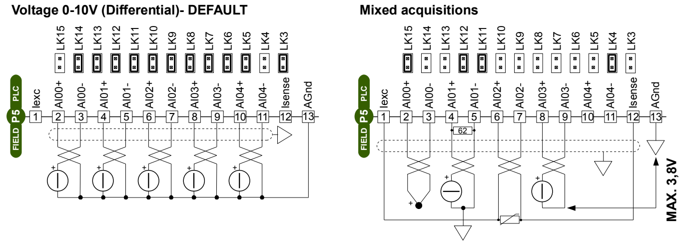


SlimLine Analog I/O Module Hardware Manual

MNL159A100

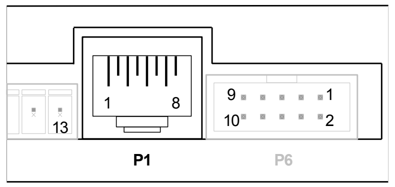
6 Ingressi Analogici (B)
Analog Input (B)





Vedi la Fig. 1 per le acquisizioni non riportate qui
See Fig. 1 for acquisitions not drawn here.

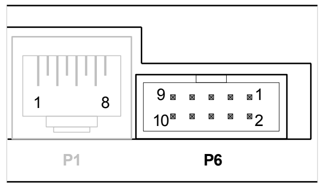
7 Porta RS232
RS232 Port



RS232 (COM0 P1)

Pin	Signal	Pin	Signal
1	N.C.	6	TX
2	N.C.	7	CTS
3	DTR	8	RTS
4	GND		
5	RX		

8 Bus di estensione
Extension bus



BUS I2C (P6)

Pin	Signal	Pin	Signal
1	+5Vdc	6	GND
2	+5Vdc	7	SCL
3	+5V (Aux)	8	GND
4	+5V (Aux)	9	SDA
5	RDY-N	10	GND

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Connessioni

Il modulo di I/O Analogico SlimLine è dotato di morsetti estraibili per la connessione degli I/O e di connettore IDC per il collegamento al bus di sistema.

Alimentazione

Il modulo è alimentato attraverso il bus di sistema.

Ingressi Analogici (Fig. 1/6)

Il modulo è dotato di 10 (5 per banco) ingressi analogici(1) differenziali di tipo *Front-end*, cioè in grado di acquisire segnali provenienti direttamente dal campo. In particolare il modulo è in grado di acquisire segnali 0-10Vdc/0-1Vdc, 0-20mA/4-20mA, PT100, PT1000, Ni1000 e Termocoppie.

Gli ingressi sono galvanicamente isolati dal sistema.

⚠ **ATTENZIONE! Non applicare tensioni superiori a 30Vdc sugli ingressi analogici.**

⚠ **Utilizzare SEMPRE cavi schermati per il collegamento degli ingressi analogici.**

Porta seriale RS232 (Fig. 7)

Il modulo può disporre di una porta seriale di tipo "DTE" (Data Terminal Equipment). Il collegamento con altri dispositivi DTE, quali personal computer o terminali operatore in genere, deve essere eseguito con un cavo di tipo Null-Modem della lunghezza massima di 15 mt, come prescritto dalle specifiche EIA.

La porta RS232, non è galvanicamente isolata dal sistema, quindi è opportuno verificare, prima di collegare tra di loro dispositivi RS232 diversi, che il loro potenziale di massa sia lo stesso.

⚠ **ATTENZIONE! Differenze di potenziale eccessive tra punti di massa diversi, possono causare danneggiamenti irreversibili ai dispositivi.**

Bus di campo (Fig. 2)

Il modulo può essere dotato di bus di campo RS485 o CAN Bus (vedi identificazione prodotto Fig. 5), in entrambe i casi il bus è isolato galvanicamente dal sistema.

Attraverso il jumper LK9 può essere inserita la resistenza di terminazione 120 Ohm o meno.

Bus di estensione (Fig. 8)

Il bus di comunicazione con i moduli di estensione sfrutta l'interfaccia I^{2}C™ Fast Speed ed è disponibile su connettore IDC 10 poli (P6). I moduli di estensione devono essere collegati in cascata tramite gli appositi cavetti CBL074*000 (da ordinare separatamente). In Fig. 9 è schematizzato il collegamento dei moduli di estensione.

Al modulo CPU possono essere collegati fino a 16 moduli di estensione (previa verifica degli assorbimenti massimi).

⚠ **ATTENZIONE! Prima di collegare al modulo CPU i moduli di estensione, accertarsi che questo non sia alimentato. In caso contrario i dispositivi potrebbero essere irrimediabilmente danneggiati.**

Settaggio indirizzo (Fig. 4)

Il modulo viene fornito settato con indirizzo 0, predisposto per essere usato come primo modulo di estensione della CPU.

All'interno del modulo, accessibile con la rimozione del frontale anteriore, è presente il DIP switch di settaggio dell'indirizzo. Nella tabella di cui alla Fig. 4 sono elencate le posizioni del DIP per ottenere i possibili indirizzi dei moduli.

La figura sotto indica le modalità per la rimozione ed il rimontaggio del frontalino.

⚠ **ATTENZIONE! Non utilizzare lo stesso indirizzo su più di un modulo.**

Segnalazioni stato (Fig. 4)

Il modulo è dotato di LED per la segnalazione dello stato di funzionamento, in particolare:

- RUN (LED Giallo)
  Lampeggiante regolare indica che il modulo è in funzione,
- RDY (LED Verde)
  Acceso indica che il modulo è pronto e gestisce gli I/O.

Compatibilità elettromagnetica

Il dispositivo è conforme alla direttiva compatibilità elettromagnetica in accordo con la norma **CEI EN 50081-2** (Norma generica sull'emissione riguardante ambienti residenziali) e con la norma **CEI EN 50082.2** (Norma generica sull'immunità riguardante gli ambienti industriali).

I^{2}C™ è un marchio registrato di NXP Semiconductors

Note:

(1) Diventano 4 per banco se vengono acquisite una o più termocoppie.

Tabella 1 - Settaggio range segnale ingresso

<table>
<tr><th></th><th>ON
Input signal > 1V</th><th>OFF
Input signal <= 1V</th></tr>
<tr><td>LK5</td><td colspan="2" rowspan="2">AIN04</td></tr>
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<tr><td>LK9</td><td colspan="2" rowspan="2">AIN02</td></tr>
<tr><td>LK10</td></tr>
<tr><td>LK11</td><td colspan="2" rowspan="2">AIN01</td></tr>
<tr><td>LK12</td></tr>
<tr><td>LK13</td><td colspan="2" rowspan="2">AIN00</td></tr>
<tr><td>LK14</td></tr>
</table>

Tabella 2 - Corrispondenza tra canali hardware-software

Banco	Ingresso analogico	Canale software
A	AIN00	0
A	AIN01	1
A	AIN02	2
A	AIN03	3
A	AIN04	4
B	AIN00	5
B	AIN01	6
B	AIN02	7
B	AIN03	8
B	AIN04	9

Connections

The SlimLine Analog I/O module is provided of extractable TB to connect I/Os and IDC connector to connect the system bus.

Power supply

The module is powered from system bus.

Analog Inputs (Fig. 1/6)

The module is provided of 10 (5 per bank) differential *Front-end* analog inputs(1), this means that it's able to acquire signals from field directly. Mainly it's able to acquire signals 0-10Vdc/0-1Vdc, 0-20mA/4-20mA, PT100, PT1000, Ni1000 and Thermocouples.

Inputs are galvanically insulated from the system.

⚠ **WARNING! Do not apply voltages greater than 30Vdc on analog inputs.**

⚠ **WARNING! Analog inputs must be connected using shielded cables ALWAYS.**

RS232 Serial port (Fig. 7)

The device may be provided of one serial port DTE (Data Terminal Equipment). The connection between DTEs, such as Personal Computers, Operator Terminals etc., must be done through a Null-modem cable of maximum cable length of 15 mt, according to EIA specifications.

The RS232 port is not galvanically insulated from the system, it is recommended to verify, before to connect together different devices, the difference of potential on the ground.

⚠ **WARNING! An excess of difference of potential on ground loop may cause damages to the devices.**

Field bus (Fig. 2)

The module may be provided of a RS485 or CAN field bus (see product identification Fig. 5), in both cases the bus is galvanically insulated from the system.

Through the LK9 jumper may be connected or not the 120 Ohm termination resistor.

Extension bus (Fig. 8)

The communication bus with the extension modules uses the Fast I2C™ interface and it's available on the IDC10 connector (P6). The extension modules must be cascade connected through the special cables CBL074*000 (to be ordered separately).

The Fig. 9 is an example of extension modules connection.

Up to 16 extension modules may be connected to the CPU (prior verify the maximum current needed).

⚠ **WARNING! Before to connect the extension modules to the system, be sure that it's off. Missing this rule may produce failures on the devices.**

Address setting (Fig. 4)

The module is supplied set to address 0, ready to be used as CPU first extension module.

Inside of the module, easily accessible removing the front panel, there is a DIP switch for address setting. In the table in Fig. 4 are listed the DIP positions to obtain the possible address of the modules.

The figure below explains the mode to remove and reassemble the front panel.

⚠ **WARNING! Never use the same address on more than one module.**

Status signaling (Fig. 4)

The device is provided of some LEDs to signal its status, particularly is signaled:

- RUN (Yellow LED)
  Regularly blinking indicates that the system is running,
- RDY (Green LED)
  When light indicates that the module is ready and it manages the I/O modules according to the user program.

Electromagnetic Compatibility

The device meets the EMC directive in reference to the standards CEI EN 50081-1 (generic standard on the issue regarding residential environments, commercial and of the light industry) and CEI EN 50082-2 (generic standard on immunity regarding the industrial environments).

I^{2}C™ is a trade mark of NXP Semiconductors

Note:

(1) Becomes 4 per bank if are acquired one or more thermocouples.

Table 1 – Input range settings

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<tr><td>LK12</td></tr>
<tr><td>LK13</td><td colspan="2" rowspan="2">AIN00</td></tr>
<tr><td>LK14</td></tr>
</table>

Table 2 - Correspondence between physical and software channels

Bank	Physical analog Input	Software channel
A	AIN00	0
A	AIN01	1
A	AIN02	2
A	AIN03	3
A	AIN04	4
B	AIN00	5
B	AIN01	6
B	AIN02	7
B	AIN03	8
B	AIN04	9

Technical Specifications

<table>
<tr><th colspan="3"></th><th>PCB126*130</th></tr>
<tr><td colspan="3">Power Supply Requirements
(from Expansion bus)</td><td>5V 70mA (1)</td></tr>
<tr><td rowspan="9">Analog Inputs</td><td colspan="2">Number of channels</td><td>10 differential
8 (4 per bank) in case of TC</td></tr>
<tr><td colspan="2">Acquisition modes</td><td>0-10Vdc, 0-1.17Vdc, 0-20mA, PT100, PT1000, Ni1000, Thermocouples B, E, J, K, N, R, S, T</td></tr>
<tr><td rowspan="3">Resolution</td><td>V/mA</td><td>19.5bit</td></tr>
<tr><td>RTD</td><td>0,002 °C</td></tr>
<tr><td>TC</td><td>20bit</td></tr>
<tr><td colspan="2">Input impedance
(Current/0-10 Voltage modes)</td><td>11.3KOhm</td></tr>
<tr><td colspan="2">Galvanic Insulation</td><td>2.5KVrms</td></tr>
<tr><td rowspan="2">Acquisition frequency</td><td>V/mA</td><td>62Hz</td></tr>
<tr><td>°C</td><td>16.7Hz</td></tr>
<tr><td colspan="3">Expansion bus</td><td>I2C™ Fast Speed</td></tr>
<tr><td colspan="3">Status indicators</td><td>RUN, Ready</td></tr>
<tr><td colspan="3" rowspan="3">Environment</td><td>Operating temperature : from -20 to +70°C</td></tr>
<tr><td>Storage temperature: from -40° to +80°C</td></tr>
<tr><td>Relative Humidity: Max. 90%</td></tr>
<tr><td colspan="3" rowspan="2">Dimensions and weight</td><td>Dimensions: 22,5 mm L x 101mm W x 120 mm H</td></tr>
<tr><td>Weight: 150g</td></tr>
<tr><td colspan="3">Approvals</td><td>CEI EN50081-1
CEI EN50082-2</td></tr>
<tr><td colspan="3">Notes</td><td>(1) Worst case</td></tr>
</table>

Settaggio indirizzo modulo

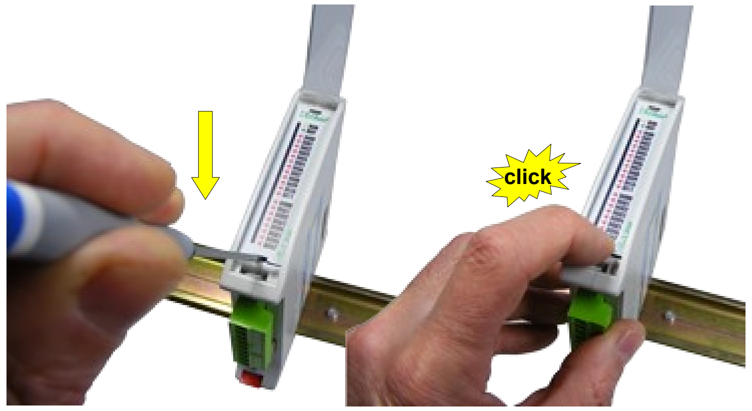
Module address setting

Nella figura sottostante sono indicate le operazioni da seguire per lo smontaggio ed il successivo rimontaggio del frontalino anteriore.

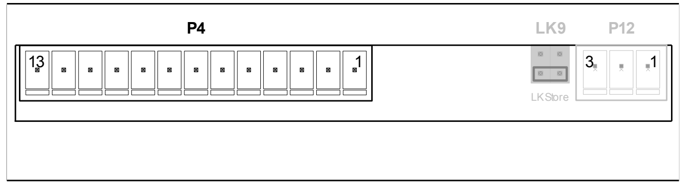
- Aprire il coperchio anteriore,
- Far leva nella parte sottostante con un cacciavite
- Settare il DIP switch interno per l'indirizzo desiderato
- Rimontare il frontalino inserendolo prima nella parte in alto e, successivamente, premere nella parte in basso fino allo scatto.

In the figure below are shown the operations to follow to remove and remount the front panel.

- Open the front cover
- Insert a screwdriver in the bottom hole of the front panel and move as indicated.
- Set-up the internal DIP switch according to the desired address
- Reassemble the front panel inserting the top first and then, press on the bottom until the click.

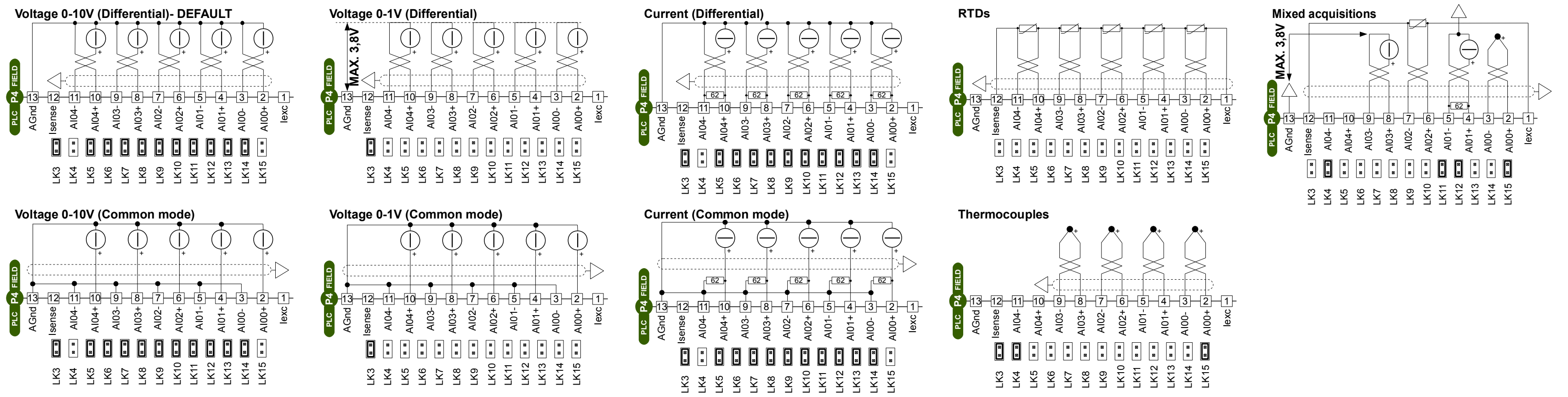


1 Ingressi Analogici
Analog Input

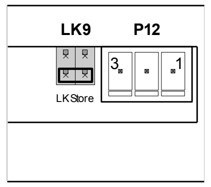


LK	ON	OFF
LK3	No Iexc required	When Iexc required
LK4 and LK15	Thermocouple acquisition (if any)	Other acquisitions (no TC)
LK5-14 (1)	Input signal > 1,17V	Input signal <= 1,17V

(1) Vedi Tabella 1 per i dettagli - See Table 1 for details



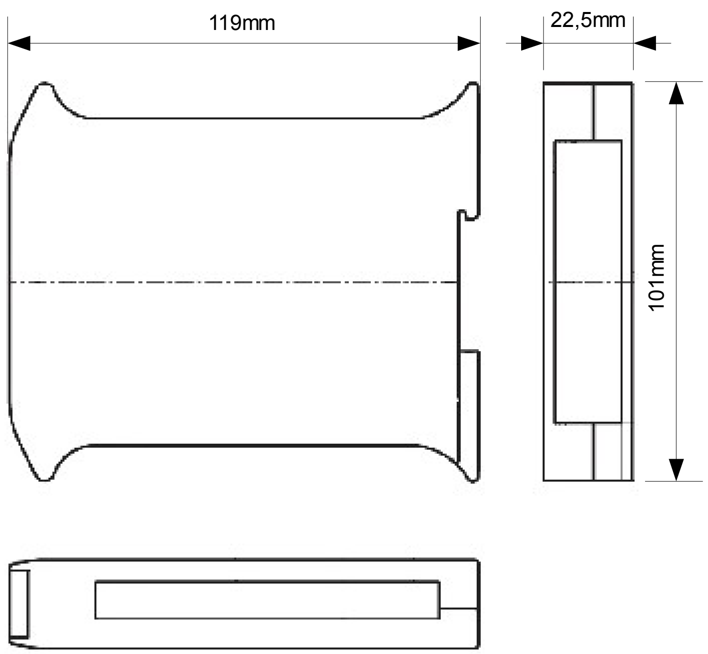
2 Bus di campo
Field bus



Field Bus (P12)

CAN		RS485	
Pin	Signal	Pin	Signal
1	CAN H	1	D+
2	CAN L	2	D-
3	Field GND	3	Field GND
LK9	ON= Line Terminated (120 Ohm)		

3 Dimensioni
Dimensions



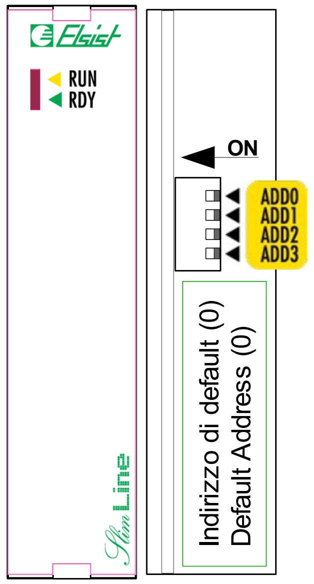
4 Stato Modulo I/O e indirizzi
Module I/O Status and Address

Module Status

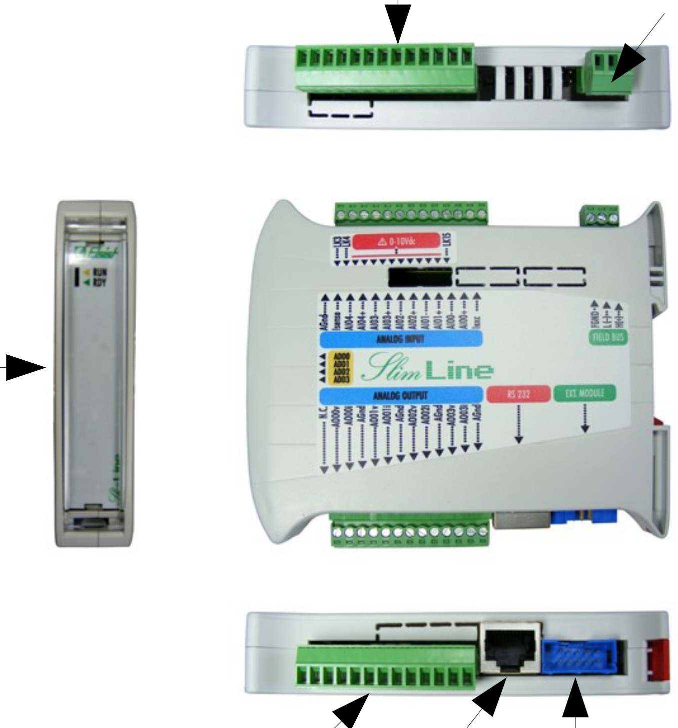
LED	Function
RUN (Yellow)	Reg. blink= Mod OK
RDY (Green)	ON = System ready

Module Address

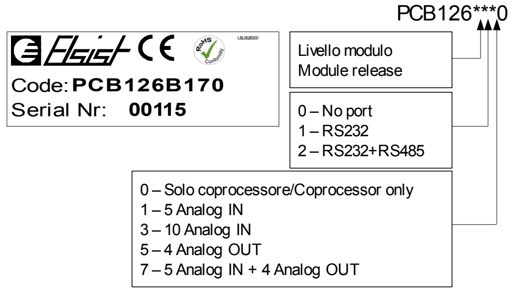
ADD0	ADD1	ADD2	ADD3	Address
OFF	OFF	OFF	OFF	0
ON	OFF	OFF	OFF	1
OFF	ON	OFF	OFF	2
ON	ON	OFF	OFF	3
OFF	OFF	ON	OFF	4
ON	OFF	ON	OFF	5
OFF	ON	ON	OFF	6
ON	ON	ON	OFF	7
OFF	OFF	OFF	ON	8
ON	ON	ON	ON	15



Vedi retro per ulteriori informazioni.
See back to further instructions.



5 Identificazione prodotto
Product identification


PCB126***0

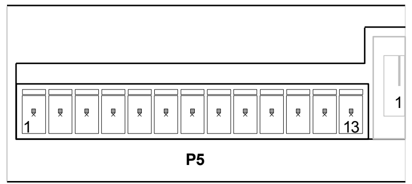
Code: **PCB126B170**
Serial Nr: **00115**

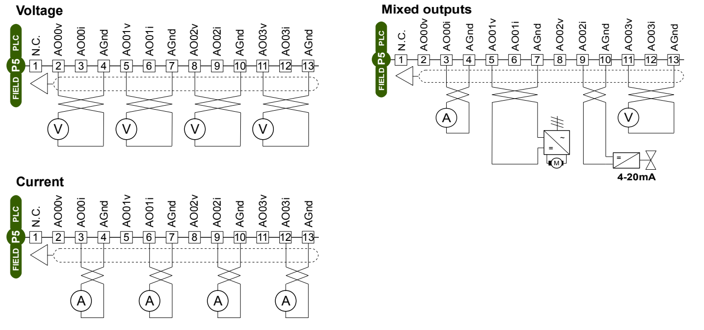
Livello modulo
Module release

0 – No port
1 – RS232
2 – RS232+RS485

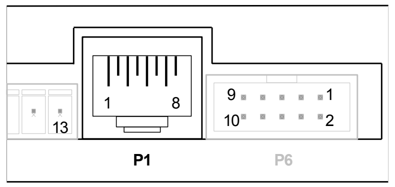
0 – Solo coprocessore/Coprocessor only
1 – 5 Analog IN
3 – 10 Analog IN
5 – 4 Analog OUT
7 – 5 Analog IN + 4 Analog OUT

6 Uscite Analogiche
Analog Output





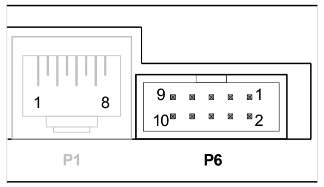
7 Porta RS232
RS232 Port



RS232 (COM0 P1)

Pin	Signal	Pin	Signal
1	N.C.	6	TX
2	N.C.	7	CTS
3	DTR	8	RTS
4	GND		
5	RX		

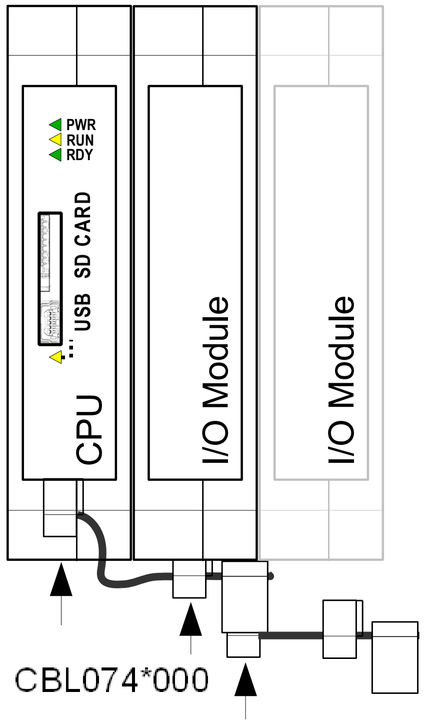
8 Bus di estensione
Extension bus



BUS I2C (P6)

Pin	Signal	Pin	Signal
1	+5Vdc	6	GND
2	+5Vdc	7	SCL
3	+5V (Aux)	8	GND
4	+5V (Aux)	9	SDA
5	RDY-N	10	GND

9 Collegamento moduli di estensione
Extension modules connection



SlimLine
Analog I/O
Module
Hardware
Manual

MNL158B100

Via G. Brodolini, 15 (Z.I.) 15033 CASALE M.TO (AL) ITALY
Phone +39-0142-451987 Fax +39-0142-451988
Internet: http://www.elsist.it email: elsist@elsist.it

Connessioni

Il modulo di I/O Analogico SlimLine è dotato di morsetti estraibili per la connessione degli I/O e di connettore IDC per il collegamento al bus di sistema.

Alimentazione

Il modulo è alimentato attraverso il bus di sistema.

Ingressi Analogici (Fig. 1)

Il modulo è dotato di 5 ingressi analogici(1) differenziali di tipo *Front-end*, cioè in grado di acquisire segnali provenienti direttamente dal campo. In particolare il modulo è in grado di acquisire segnali 0-10Vdc/0-1Vdc, 0-20mA/4-20mA, PT100, PT1000, Ni1000 e Termocoppie.

Gli ingressi sono galvanicamente isolati dal sistema.

⚠ **ATTENZIONE! Non applicare tensioni superiori a 30Vdc sugli ingressi analogici.**

⚠ **Utilizzare SEMPRE cavi schermati per il collegamento degli ingressi analogici.**

Uscite Analogiche (Fig. 6)

Il modulo può essere dotato di 4 uscite analogiche in tensione/corrente. In particolare il modulo è in grado di fornire tensioni nel range +/-10Vdc e correnti nel range 0-20 (o 4-20mA)

Le uscite vengono forzate a 0V/0mA all'accensione del sistema.

Le uscite sono galvanicamente isolate dal sistema.

⚠ **ATTENZIONE! Utilizzare SEMPRE cavi schermati per il collegamento delle uscite analogiche.**

Porta seriale RS232 (Fig. 7)

Il modulo può disporre di una porta seriale di tipo "DTE" (Data Terminal Equipment). Il collegamento con altri dispositivi DTE, quali personal computer o terminali operatore in genere, deve essere eseguito con un cavo di tipo Null-Modem della lunghezza massima di 15 mt, come prescritto dalle specifiche EIA.

La porta RS232, non è galvanicamente isolata dal sistema, quindi è opportuno verificare, prima di collegare tra di loro dispositivi RS232 diversi, che il loro potenziale di massa sia lo stesso.

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Bus di campo (Fig. 2)

Il modulo può essere dotato di bus di campo RS485 o CAN Bus (vedi identificazione prodotto Fig. 5), in entrambe i casi il bus è isolato galvanicamente dal sistema.

Attraverso il jumper LK9 può essere inserita la resistenza di terminazione 120 Ohm o meno.

Bus di estensione (Fig. 8)

Il bus di comunicazione con i moduli di estensione sfrutta l'interfaccia I^{2}C^{TM} Fast Speed ed è disponibile su connettore IDC 10 poli (P6). I moduli di estensione devono essere collegati in cascata tramite gli appositi cavetti CBL074*000 (da ordinare separatamente). In Fig. 9 è schematizzato il collegamento dei moduli di estensione.

Al modulo CPU possono essere collegati fino a 16 moduli di estensione (previa verifica degli assorbimenti massimi).

⚠ **ATTENZIONE! Prima di collegare al modulo CPU i moduli di estensione, accertarsi che questo non sia alimentato. In caso contrario i dispositivi potrebbero essere irrimediabilmente danneggiati.**

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Il modulo viene fornito settato con indirizzo 0, predisposto per essere usato come primo modulo di estensione della CPU.

All'interno del modulo, accessibile con la rimozione del frontale anteriore, è presente il DIP switch di settaggio dell'indirizzo. Nella tabella di cui alla Fig. 4 sono elencate le posizioni del DIP per ottenere i possibili indirizzi dei moduli.

La figura sotto indica le modalità per la rimozione ed il rimontaggio del frontalino.

⚠ **ATTENZIONE! Non utilizzare lo stesso indirizzo su più di un modulo.**

Segnalazioni stato (Fig. 4)

Il modulo è dotato di LED per la segnalazione dello stato di funzionamento, in particolare:

- RUN (LED Giallo)
  Lampeggiante regolare indica che il modulo è in funzione,
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  Acceso indica che il modulo è pronto e gestisce gli I/O.

Compatibilità elettromagnetica

Il dispositivo è conforme alla direttiva compatibilità elettromagnetica in accordo con la norma **CEI EN 50081-2** (Norma generica sull'emissione riguardante ambienti residenziali) e con la norma **CEI EN 50082.2** (Norma generica sull'immunità riguardante gli ambienti industriali).

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LK5	AIN04	
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LK7	AIN03	
LK8		
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LK10		
LK11	AIN01	
LK12		
LK13	AIN00	
LK14		

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Inputs are galvanically insulated from the system.

⚠ **WARNING! Do not apply voltages greater than 30Vdc on analog inputs.**

⚠ **WARNING! Analog inputs must be connected using shielded cables ALWAYS.**

Analog Outputs (Fig. 6)

The module can be equipped with 4 analog output voltage/current. Mainly the module is capable of providing voltages in the range +/-10Vdc and current in the range 0-20mA (or 4-20mA).

The outputs are forced to 0V/0mA at the power on of the system.

The outputs are galvanically insulated from the system.

⚠ **WARNING! Analog outputs must be connected using shielded cables ALWAYS.**

RS232 Serial port (Fig. 7)

The device may be provided of one serial port DTE (Data Terminal Equipment). The connection between DTEs, such as Personal Computers, Operator Terminals etc., must be done through a Null-modem cable of maximum cable length of 15 mt, according to EIA specifications.

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I^{2}C^{TM} is a trade mark of NXP Semiconductors

Note:

(1) Becomes 4 if are acquired one or more thermocouples.

Table 1 – Input range settings

	ON **Input signal > 1V**	**OFF** **Input signal <= 1V**
LK5	AIN04	
LK6		
LK7	AIN03	
LK8		
LK9	AIN02	
LK10		
LK11	AIN01	
LK12		
LK13	AIN00	
LK14		

Technical Specifications

			PCB126*110	**PCB126*150**	**PCB126*170**
Power Supply Requirements (from Expansion bus)			5V 50mA (1)	5V 155mA (1) 5V 370mA (2)	5V 175mA (1) 5V 380mA (2)
Analog Inputs	Number of channels		5 differential 4 (in case of TC)	none	5 differential 4 (in case of TC)
	Acquisition modes		0-10Vdc, 0-1.17Vdc, 0-20mA, PT100, PT1000, Ni1000, Thermocouples	N/A	0-10Vdc, 0-1.17Vdc, 0-20mA, PT100, PT1000, Ni1000, Thermocouples
	Resolution	V/mA	19.5bit	N/A	19,5bit
		RTD	0,002 °C		0,002 °C
		TC	20bit		20bit
	Input impedance (Current/0-10 Voltage modes)		11.3KOhm	N/A	11.3KOhm
	Galvanic Insulation		2.5KVrms		2.5KVrms
	Acquisition frequency	V/mA	62Hz		62Hz
		°C	16.7Hz		16.7Hz
Analog Output	Number of channels		none	4 voltage/current mode	
	Range Vout		N/A	0-5Vdc, 0-10Vdc, +/-5Vdc, +/-10Vdc (10mA max)	
	Range Iout		N/A	4-20mA, 0-20mA (Max load impedance 400 Ohm)	
	Resolution		N/A	12bit	
	Galvanic Insulation		N/A	1.5KVdc	
Expansion bus			I2C™ Fast Speed		
Status indicators			RUN, Ready		
Environment			Operating temperature : from -20 to +70°C		
			Storage temperature: from -40° to +80°C		
			Relative Humidity: Max. 90%		
Dimensions and weight			Dimensions: 22,5 mm L x 101mm W x 120 mm H		
			Weight: 150g		
Approvals			CEI EN50081-1 CEI EN50082-2		
Notes			(1) Worst case, (2) Worst Case, with max load on current output (4*20mA)		

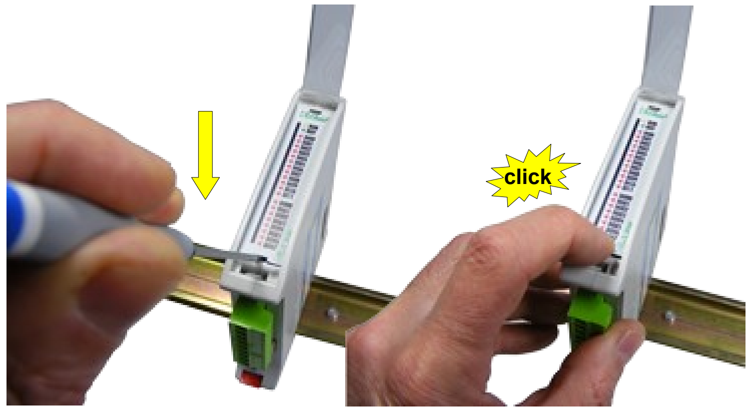
Settaggio indirizzo modulo
Module address setting

Nella figura sottostante sono indicate le operazioni da seguire per lo smontaggio ed il successivo rimontaggio del frontalino anteriore.

- Aprire il coperchio anteriore,
- Far leva nella parte sottostante con un cacciavite
- Settare il DIP switch interno per l'indirizzo desiderato
- Rimontare il frontalino inserendolo prima nella parte in alto e, successivamente, premere nella parte in basso fino allo scatto.

In the figure below are shown the operations to follow to remove and remount the front panel.

- Open the front cover
- Insert a screwdriver in the bottom hole of the front panel and move as indicated.
- Set-up the internal DIP switch according to the desired address
- Reassemble the front panel inserting the top first and then, press on the bottom until the click.



filsa
controladores de nivel
para sólidos y líquidos

Controlador de nivel a palas rotativas para materiales a granel tipo:

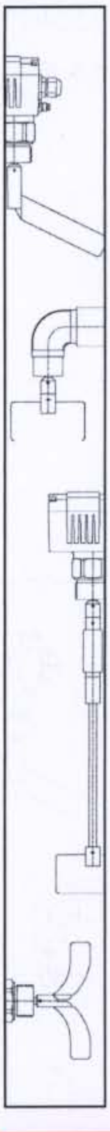
FDF

ATEX certificado

para uso en Atmósferas Potencialmente Explosivas

según la normativa ATEX, Directiva 94/9/CE

Índice



Lea Usted primero estas indicaciones de seguridad y observe las instrucciones de funcionamiento.

Indicaciones de seguridad

1. **La instalación, la puesta en servicio y el mantenimiento deberán llevarse a cabo únicamente por personal cualificado.**

2. **Sólamente se permite realizar la unión de cada uno de los componentes como por ejemplo la brida, unión flexible, prolongación, tubo de protección y la pala con los pasadores correspondientes.**

3. **Al efectuar la conexión eléctrica observen las disposiciones locales y legales.**

4. **Antes de efectuar la conexión eléctrica comparen los datos de la placa de características que coincidan con la de conexión.**

5. **La alimentación eléctrica debe estar protejida con un fusible (máx. 4A).**

6. **Protejan los contactos del interruptor de maniobra en las cargas inductivas.**

7. **La conexión a la toma de tierra del aparato se debe efectuar con toda seguridad.**

8. **Coloquen la tapa antes de poner el aparato en funcionamiento.**

Peligro, tensión

9. **Antes de abrir el aparato desconecte la alimentación eléctrica.**

En el montaje de este aparato en zonas con riesgo de explosión:

10. **Observen las instrucciones y datos técnicos de protección contra explosiones y las "Condiciones especiales, instrucciones y advertencias para un empleo seguro", contenidas en ella.**

11. **Observen las exigencias de la Norma DIN EN 50281-1-2, en especial en lo que se refiere a las concentraciones de polvo y temperaturas y cumplan las correspondientes disposiciones.**

Datos Técnicos

Material	Caja **A1**	Aluminio fundido a presión
	A2	Inoxidable 1.4401 (AISI 316)
	A3	Aluminio AlMgSi0.5
	A4	Inoxidable 1.4401 (AISI 316)
Pintura	**A1**	RAL 7001
	A2	sin
	A3	RAL 7001
	A4	sin
Material	Racor de conexión	Aluminio u opcionalmente Inoxidable 1.4301 (AISI 304)
Material	Ejes	Inoxidable 1.4301 (AISI 304)
	Cable	Inoxidable 1.4408 (AISI 316)
	Pala	Inoxidable 1.4301 (AISI 304)
	Tubo de alargamiento	Inoxidable 1.4301 (AISI 304)
	Tubo de protección	Acero, galvanizado ó 1.4301
Soporte del eje		Rodamiento radial estanco al polvo
	en el **FDF27**	1 Rodamiento radial y 1 Axial
Estanqueidad del eje		Retenes especiales
Material	Retén **R0**	NBR, negro (Estándar)
	R1	Teflón/Vitón, anillo soporte a base de Inoxidable 1.4301 (AISI 304)
	R2	NBR, blanco
	R3	EPDM, negro
	R4	EPDM, blanco
	R5	Teflón
Lubricación	Retenes	conforme FDA **R1** y **R5** - sin lubricación
Estanqueidad FDF31...32		Por fuelle sin retén, absolutamente estanco
Protección del engranaje		Embrague protector del par de giro
Revoluciones de la pala		1 r.p.m. (Estándar)
	U5	5 r.p.m.
	U8	8 r.p.m.
Retardo en la reacción		aprox. 1,20 seg. (Estándar)
	U5	aprox. 0,24 seg.
	U8	aprox. 0,15 seg.
Sensibilidad		Ajuste en tres posiciones y según el tipo de la pala
Control automático	**D1**	Control de rotación
	D2	Control de la tensión
Tolerancia de la longitud		L± 10 mm
Clase de protección	Caja	
	A1 y A2	IP66 según DIN EN 60529
	A3 y A4	a prueba de presión "d"
Clase de protección	Caja	Con piloto y conector
	A1 y A2	IP66 según DIN EN 60529

Características Eléctricas

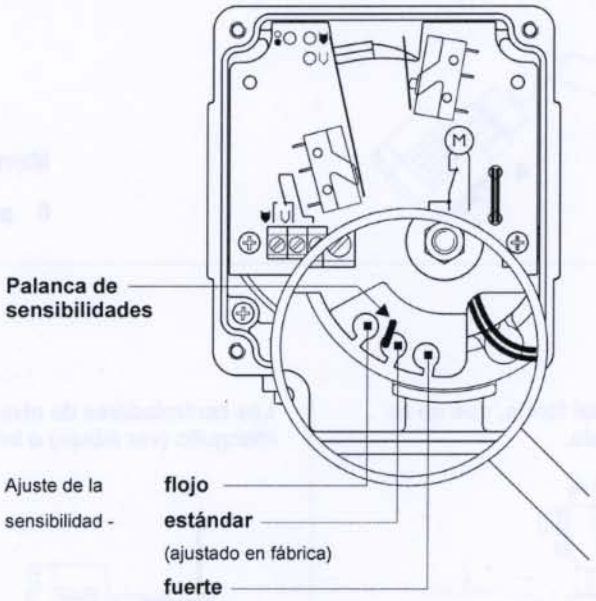
Tensión de alimentación	**C1**	220...240 V ~ 50-60 Hz (AC)
	C2	110...120 V ~ 50-60 Hz (AC)
	C3	48 V ~ 50-60 Hz (AC)
	C4	24 V ~ 50-60 Hz (AC)
	C5	24 V ⎓ (DC) +10%/-15%
Consumo	**AC**	4 VA
	DC	4 W
Bornes de conexión		máx. 1,5 mm²
Entrada de cables		Prensaestopas M20x1,5
Interruptor de control		Micro-ruptor inversor unipolar libre de potencial 1 mA/4 V mínimo hasta 2A máximo. Se recomiendan las mismas condiciones eléctricas de trabajo en toda su utilización.
Averías del sistema de rotación Control de rotación, Opción **D1** Control de voltaje, Opción **D2**		Con señal externa en caso de avería (falta de tensión o rotación del motor); hasta 2 A/240 V ~
Temporización Opción **D3,D4**		Temporización de la señal de vaciado o llenado.
Clase de protección		I puesta a ⏚
Indicación de funcionamiento	**H1**	LED, 3 mm (opción en **FDF11**)
Con tensión en el aparato		amarillo
Depósito lleno		verde (arriba)
Depósito vacío		verde (abajo)
Control de rotación		rojo (activado)
Pilotos	**H2**	LED, 5 mm
en **FDF11**		verde = lleno, amarillo = vacío
en **FDF21...FDF32**		verde, lleno o vacío (reversible mediante un selector)
Pilotos grandes	**H8**	LED verde, 360° lleno o vacío (reversible mediante un selector)

Datos de Aplicación

Temperaturas del producto	**E0**	-25°C...+80°C (Estándar)
	E1	-25°C...+150°C
	E2	-25°C...+200°C
	E3	-25°C...+260°C
	E4	-25°C...+500°C
con calefactor	**E7**	...-35°C
Depresiones y Sobrepresiones en el depósito	**P0**	- 0,5...1 bar
	P1	- 0,5...10 bar
	P2	- 0,1...10 bar (ATEX)
	P5	- 0,9...1 bar (ATEX)
	P6	- 0,9...10 bar
	P7	- 0,9...1 bar (ATEX)
Mantenimiento		ningún mantenimiento específico

Ajuste de la sensibilidad

Mediante una palanca y según su posición, se dispone de tres variantes.



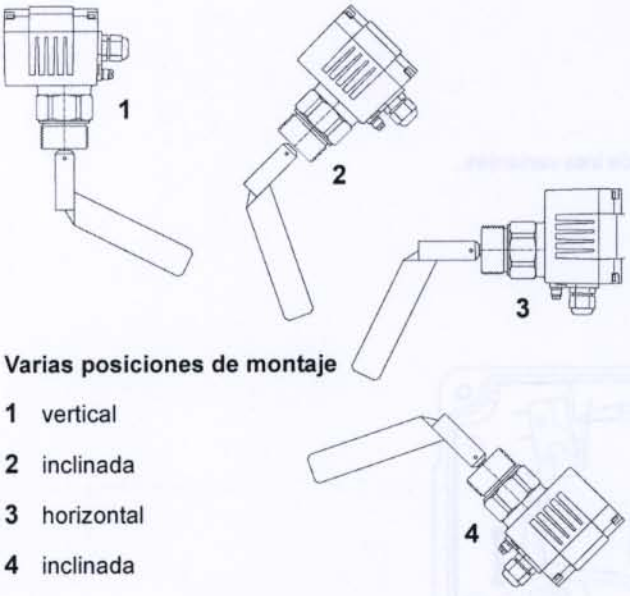
Para cambiar la posición de la palanca, mediante unos alicates desplazar la citada hasta la posición deseada:

1. **flojo** para productos de baja densidad
2. **mediano** para la mayoría de productos
3. **fuerte** para productos pesados

Variar la posición de la palanca únicamente en caso de necesidad.

Posiciones de montaje

Según el tipo, vertical, horizontal o inclinada.



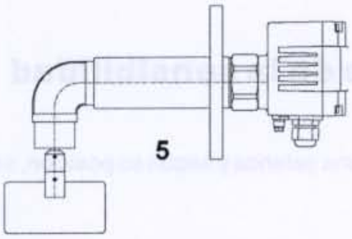
Varias posiciones de montaje

1 vertical

2 inclinada

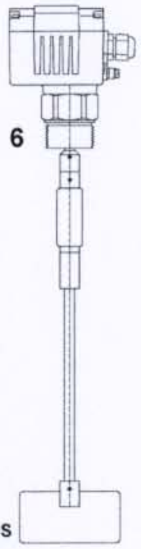
3 horizontal

4 inclinada



Montaje horizontal

5 para montajes laterales

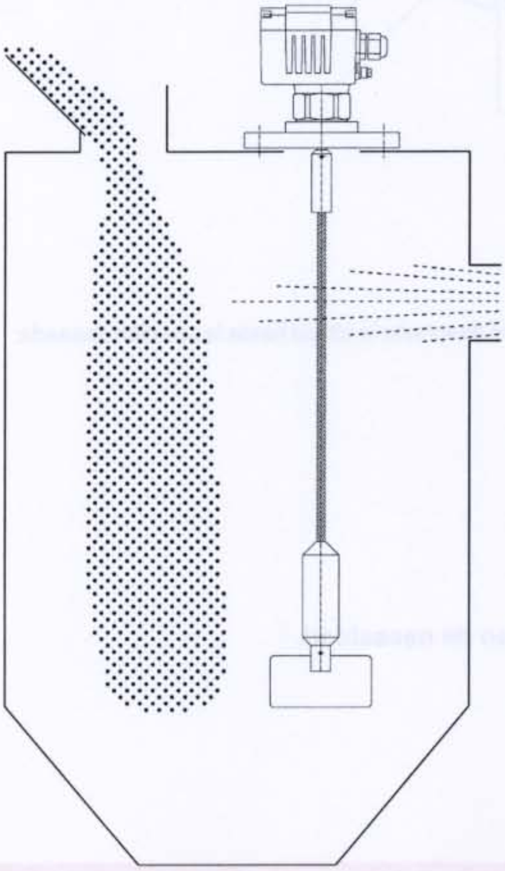


Montaje vertical

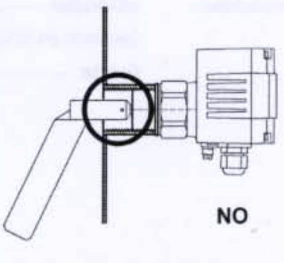
6 para montajes verticales

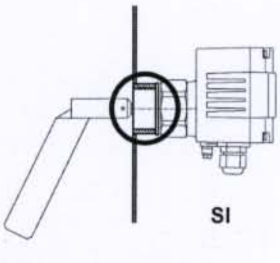
Montaje

Montar los controladores de nivel de tal forma, que no se vea afectado por la corriente de llenado.



Los controladores de nivel pueden fijarse al silo mediante manguito (ver dibujo) o brida





Es conveniente que el manguito junto con la chapa del silo tenga una longitud máxima de 22mm, para evitar acumulaciones de producto.

Cabezal orientable en 360º

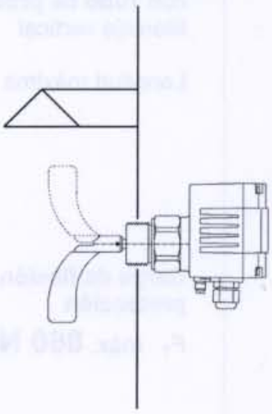
Es conveniente después de haber fijado el controlador posicionar la entrada de cables hacia abajo, para evitar la posible entrada de humedad y además se favorece su funcionamiento.

Indicaciones para su aplicación

FDF11

(con pala de plástico)

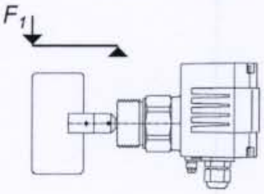
aplicaciones sencillas
Varias posiciones de montaje



En el empleo como nivel minimo se recomienda cortar una de las dos partes de la pala por la marca y también es recomendable la instalación de un tejadillo protector.

FDF21 y FDF22

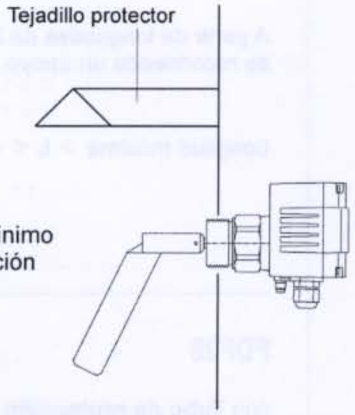
ámplio campo de aplicación



Capacidad de carga de la pala

F_1 máx. **50 Nm**

Tejadillo protector

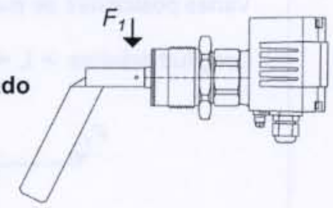


En el empleo como nivel minimo es recomendable la instalación de un tejadillo protector.

Si no se utiliza tejadillo se recomienda emplear los **FDF23 / FDF24**

FDF23 y FDF24

utilización de un eje reforzado



Capacidad de carga del eje

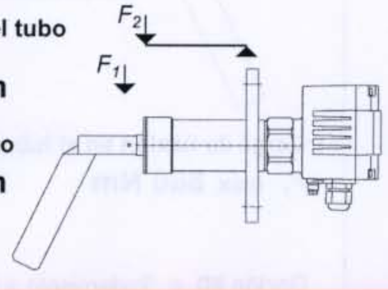
F_1 máx. **390 Nm**

Capacidad de carga del tubo de apoyo

F_2 máx. **1650 Nm**

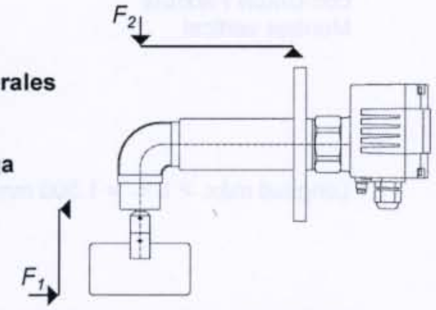
Con nervios de refuerzo

F_2 máx. **6220 Nm**



FDF25

Para montajes laterales



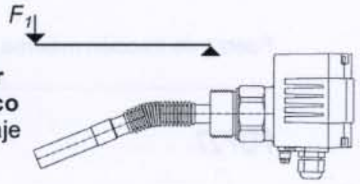
Capacidad de carga de la pala

F_1 máx. **50 Nm**

Capacidad de carga del tubo de apoyo F_2 máx. **1650 Nm**

Con nervios de refuerzo F_2 máx. **6220 Nm**

FDF31...FDF33

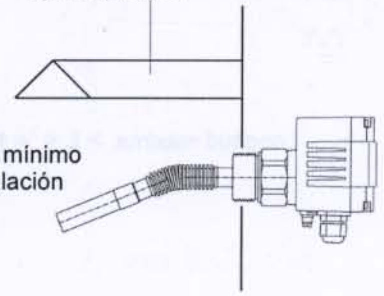


Sistema de detección por desplazamiento excéntrico
varias posiciones de montaje

Capacidad de carga del sistema de detección

F_1 máx. **20 Nm**

Tejadillo protector



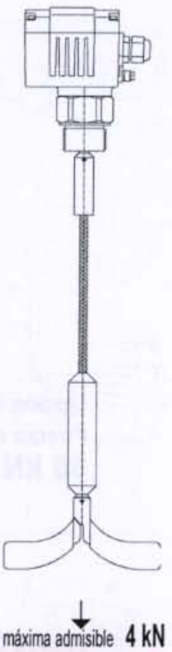
En el empleo como nivel minimo es recomendable la instalación de un tejadillo protector.

FDF11

con **Unión Flexible**
montaje vertical

Fuerza de tracción máxima admisible **400 N**

con **Cable**
montaje vertical

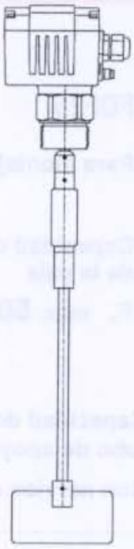


Fuerza de tracción máxima admisible **4 kN**

Indicaciones para su aplicación

FDF26

con **Unión Flexible**
Montaje vertical



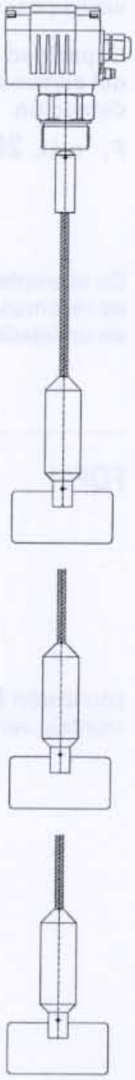
Longitud máx. > L < = 1.500 mm

Opción A3, A4, B1 y B2 = ATEX
Con fuerza de tracción máxima admisible **4 kN**

Fuerza de tracción máxima admisible **300 N ↓**

FDF27

con **Cable**
Montaje vertical



Longitud máxima > L < = 10.000 mm

Nivel alto

Nivel medio

Opción Z3 = cojinete axial reforzado
Fuerza de tracción máxima admisible
50 kN

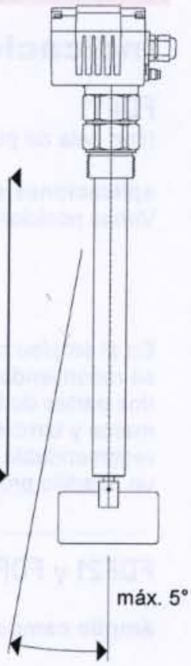
Nivel bajo

Fuerza de tracción máxima admisible **4 kN ↓**

FDF28

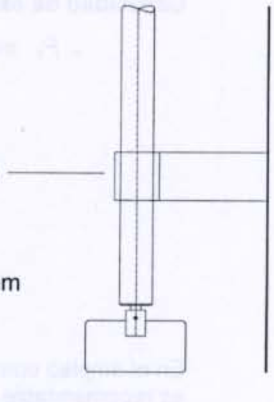
con **Tubo de protección**
Montaje vertical

Longitud máxima hasta 1.500mm



Carga de flexión en el tubo de protección

F_1 máx. **860 Nm**



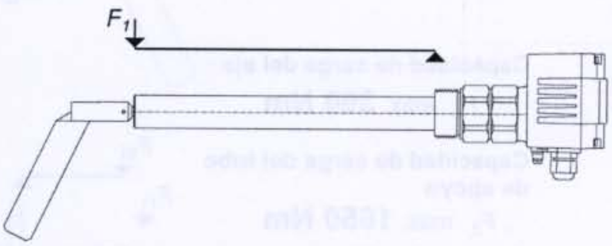
A partir de longitudes de 2.000 mm se recomienda un apoyo.

Longitud máxima > L < = 6.000 mm

FDF28

con **Tubo de protección**
Varias posiciones de montaje con opción KD

Longitud máxima > L < = 1.500 mm



Carga de flexión en el tubo de protección

F_1 máx. **860 Nm**

Opción KD = Rodamiento a bolas y retén al final del tubo

Lógica de función, Indicación de estado y pilotos

Simbología

○● = Tensión	● = LED "Apagado"
▼ = Lleno	☼ = LED "Encendido"
∪ = Vacío	☒ = Relé activado
(!) = Control de rotación	⧄ = Relé sin tensión

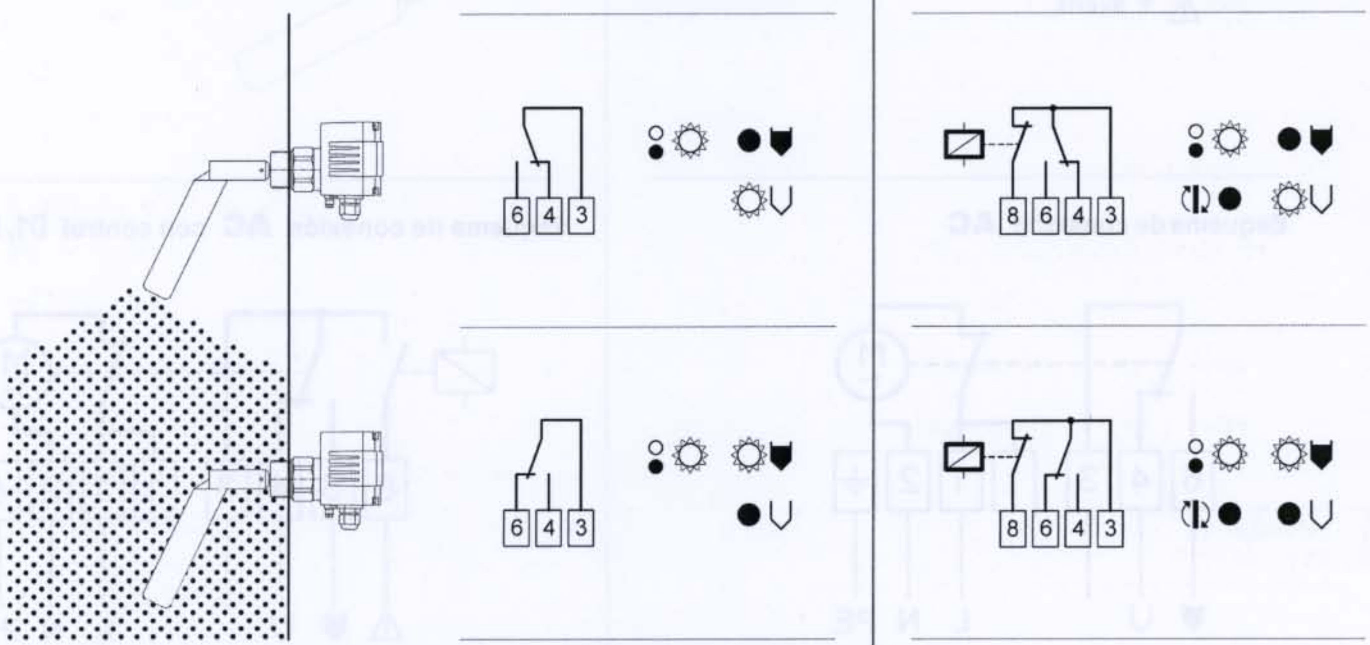
Disposición y colores de los LED's

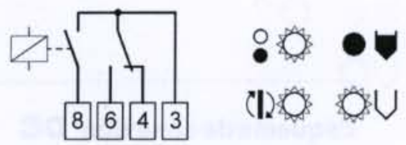
Amarillo	○●	●	●▼	Verde
Rojo	(!)	●	●∪	Verde

Indicación de los diferentes estados

Estándar
Opción **H5** y **H6** en **FDF11**

Control de rotación
Opción **D1**, **H1** y **H3**



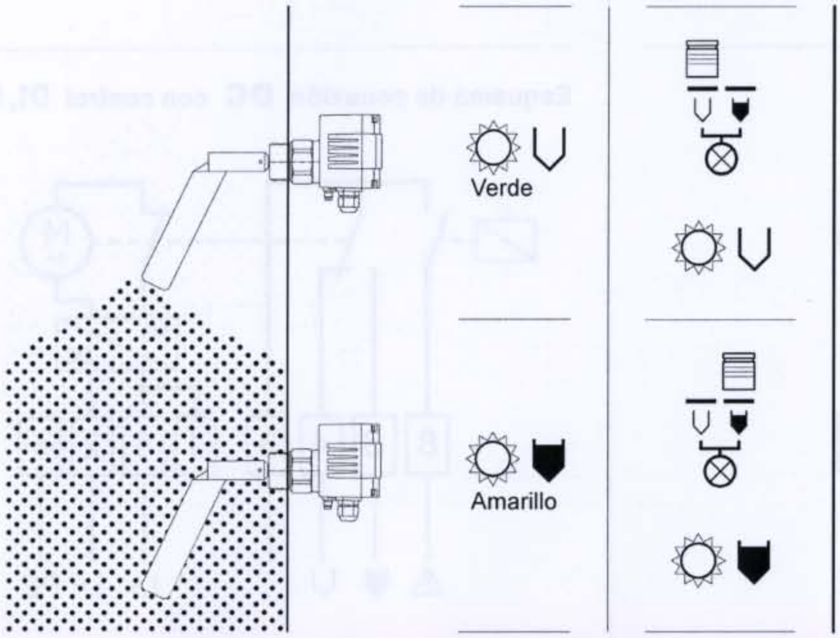


En caso de avería en el controlador se abre el contacto del relé, borne nº 8

Pilotos

FDF11
Opción **H7**

FDF21...FDF33
Opción **H2**, **H3**, **H8**



Atención!

Con control de rotación, conectar siempre el controlador de nivel de tal forma, que en caso de un fallo de alimentación no se produzca una conexión no deseada.

Conexión Eléctrica

La conexión eléctrica se efectuará según el esquema de conexión.

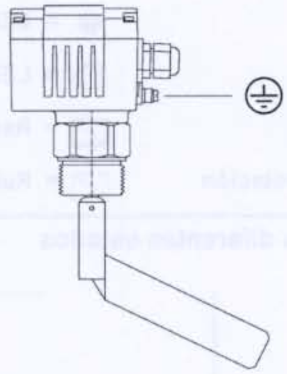
Atención!

Deberá asegurarse la estanqueidad de la entrada de cables.

Significado del símbolo

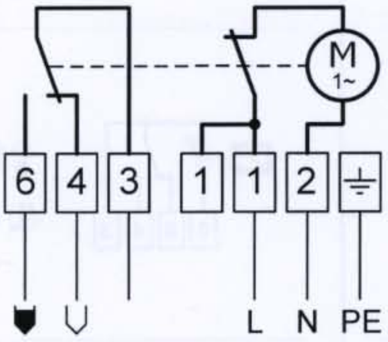
▼ = **lleno**
∪ = **vacío**
⚠ = **avería**

Puesta a tierra

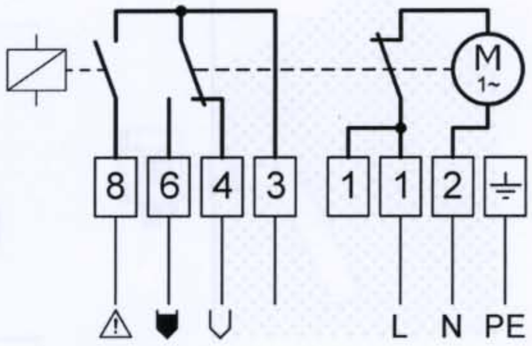


Conectar el borne de tierra con la tierra de la instalación.

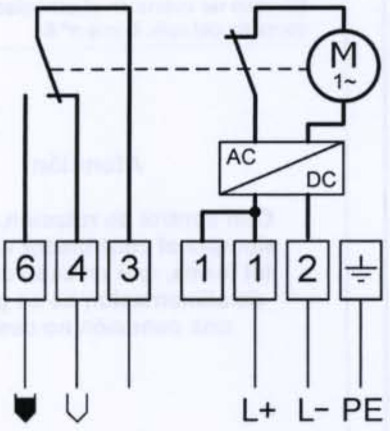
Esquema de conexión **AC**



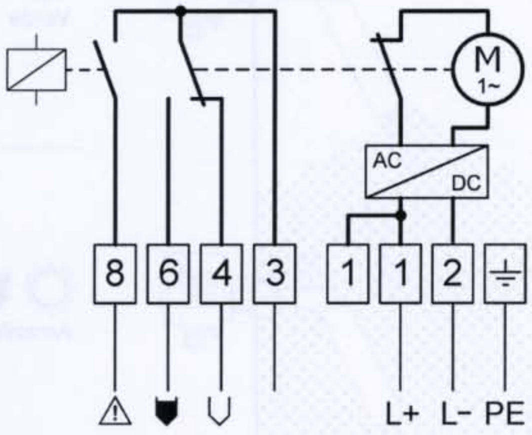
Esquema de conexión **AC** con control D1, D2



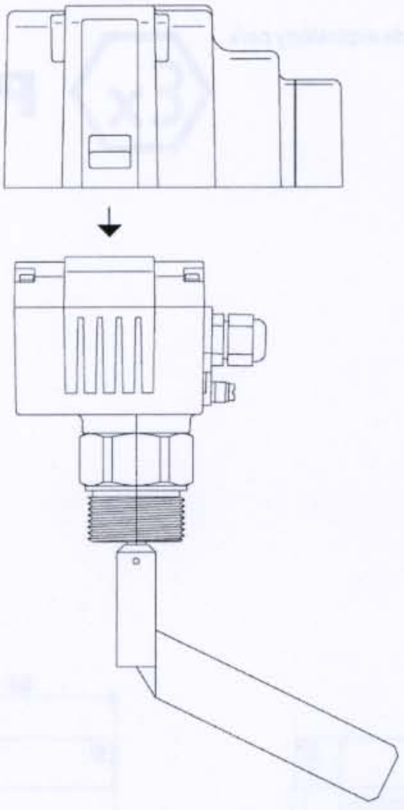
Esquema de conexión **DC**



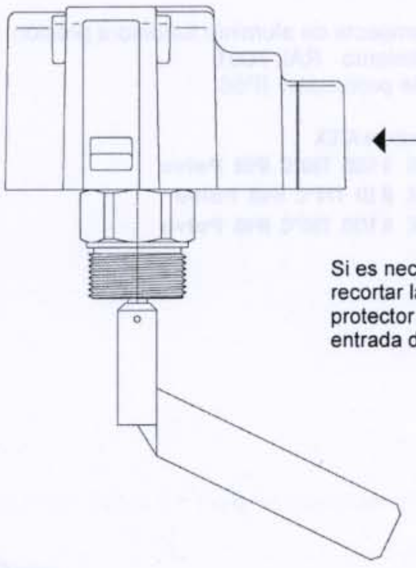
Esquema de conexión **DC** con control D1, D2



Protector de intemperie y condensaciones DF-SH

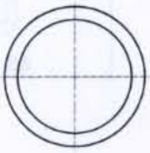


Recomendable en instalaciones en el exterior



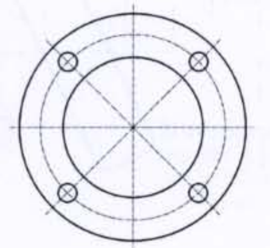
Si es necesario, se puede recortar la parte inferior del protector para facilitar la entrada del cable.

Juntas de estanqueidad DFDR

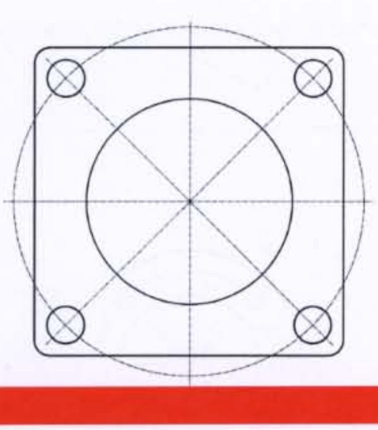


	Rosca
DFDR-G1	G1"
DFDR-G2	G1¼"
DFDR-G3	G1½"
DFDR-G4	G2"
DFDR-G5	M30
DFDR-G6	M32
DFDR-G7	G½"
DFDR-G8	G¾"

DFDR-F1
DFDR-F5
DFDR-F6
DFDR-F7



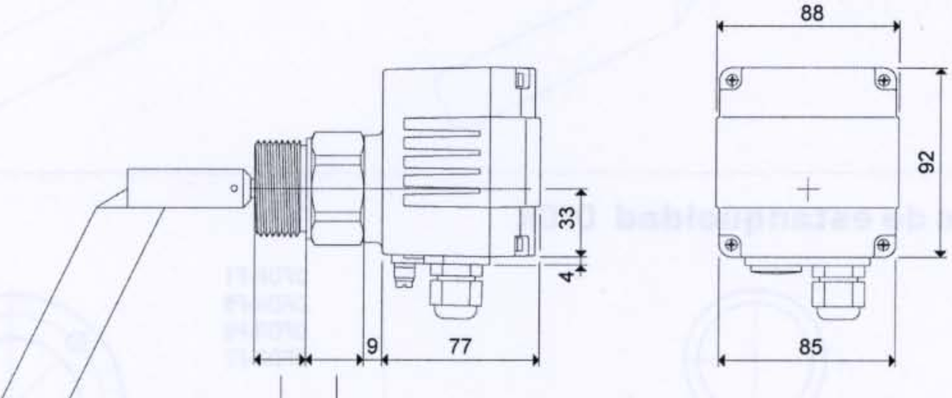
DFDR-F2



Caja A1, para todos los productos que no tienen peligro de explosión y para **Polvo**

Caja compacta de aluminio fundido a presión
Revestimiento RAL 7001
Clase de protección IP66

Especificaciones ATEX
- **B1** ATEX **II 1/2D T80°C IP66 Polvo**
- **B2** ATEX **II 1D T70°C IP66 Polvo**
- **B3** ATEX **II 1/3D T80°C IP66 Polvo**



Medidas según tipo de conexión.

Identificación según ATEX

Identificación de los controladores de nivel a palas rotativas FDF para su empleo en zonas con riesgo de explosión de polvo.

⟨Ex⟩ II 1 D T80°C IP66

Parte Eléctrica

Corresponde a **Directiva 94/9/CE**

Grupo de aparatos **II** = Todos excepto minería

Categoría de aparatos
Categoría **1** para Zona 20, 21 y 22
Categoría **2** para Zona 21 y 22
Categoría **3** para Zona 22

Clase de atmósfera explosiva **D** = Polvo

Temperatura **T..°C** temperatura superficial máxima

Grado de protección Clase de protección **IP66** (a prueba de polvo)

⟨Ex⟩ II 1 / 2 D T80°C IP66

Controlador de nivel **1/2** que se instala en el límite entre dos zonas diferentes. Aquí, por ejemplo se cumplen en parte las indicaciones de la categoría de aparatos 1 y 2.

⟨Ex⟩ II 1 D / 2 GD c IIB T X

Partes no Eléctricas

No es importante para la protección contra la explosión de polvo

Clase de protección contra incendio **c** seguridad constructiva

No es importante para la protección contra la explosión de polvo

Temperatura **T** temperatura superficial máxima

Símbolo **X** advertencia sobre condiciones especiales

Datos en la placa de características

talleres filsa, s. a. CE 0032
Bernat Metge, 33 - E-08100 Mollet del Vallès - Tel. +34 93 570 46 01

Tipo FDF21A1B1C1G2AM1V

⟨Ex⟩ II 1/2D T 80°C IP66 — IBExU 04 ATEX 1010 X
II 1D/2GD c IIB T X — IBExU 04 ATEX 1001 X

-25°C≥Ta≥+80°C / -20°C≥Ta≥+70°C
Δp -0,08bar...+0,08bar
p (Aplicación) -0,5bar...+5,0bar ⚠
Voltaje 220...240V~ AC
50...60Hz 3,5VA
Contacto 1mA 4V...2A 240V~
Unidad Nº ATEX123456 01/04
Nº Ped. 12345678/90 ☐

Observación: La **X** después del número del Certificado advierte sobre condiciones especiales para el empleo correcto del aparato en el Anexo del Certificado CE de la prueba de la muestra de construcción.

Montaje en el límite entre la Zona 20 y la Zona 21, lo mismo entre la **Zona 21 y la Zona 22, o no clasificadas.**

La ejecución **B1** es la más corriente y universal y puede ser empleada en casi todos los casos.

Código de pedido B1

Identificación:

II 1 / 2D Parte eléctrica
Categoría 1 / Categoría 2

II 1D / 2GD Parte no eléctrica
Categoría 1 / Categoría 2

Información Ex

Si existen polvos conductivos en la **Zona 22,** se deberá emplear la ejecución 1/2D.

B1

talleres filsa, s. a. CE 0032
Bernat Metge, 33 - E-08100 Mollet del Vallès - Tel. +34 93 570 46 01

Tipo FDF23A1**B1**C1G4AM1V

Ex **II 1/2D** T 80°C IP66 IBExU 04 ATEX 1010 X
II 1D/2GD c IIB T X IBExU 04 ATEX 1001 X

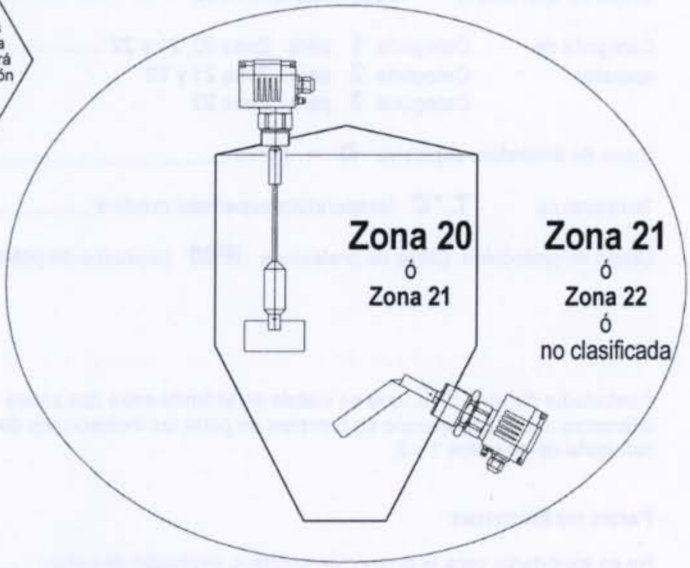
-25°C≥Ta≥+80°C / -20°C≥Ta≥+70°C
Δp -0,08bar...+0,08bar

Voltaje 220...240V~ AC
50...60Hz 3,5VA

p (Aplicación) -0,5bar...+5,0bar ⚠

Contacto 1mA 4V...2A 240V~

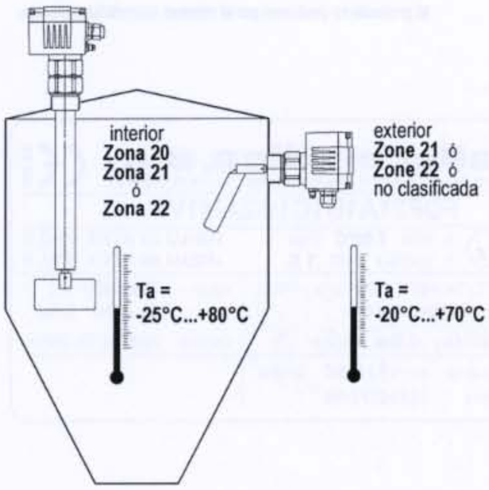
Unidad Nº ATEX123456 01/04
Nº Ped 12345678/90



Temperatura ambiente Ta

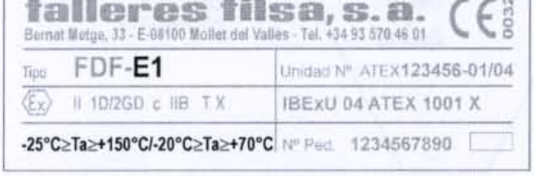
Rango de temperaturas máximas de aplicación de los aparatos.

talleres filsa, s. a. CE 0032
Bernat Metge, 33 - E-08100 Mollet del Valles - Tel. +34 93 570 46 01
Tipo FDF21A1B1C1G2AM1V
II 1/2D T 80°C IP66 — IBExU 04 ATEX 1010 X
II 1D/2GD c IIB T X — IBExU 04 ATEX 1001 X
-25°C≥Ta≥+80°C / -20°C≥Ta≥+70°C
Δp -0,08bar...+0,08bar
Voltaje 220...240V~ AC 50...60Hz 3,5VA
p (Aplicacion) -0,5bar...+5,0bar ⚠
Contacto 1mA 4V...2A 240V~
Unidad Nº ATEX123456 01/04
Nº Ped 12345678/90

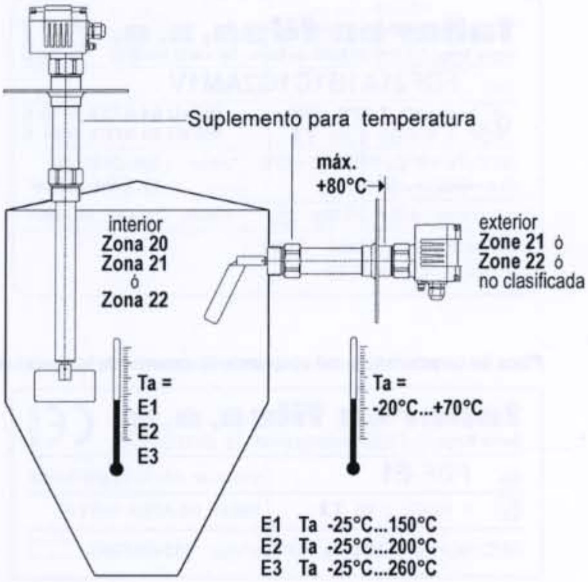


talleres filsa, s. a. CE 0032
Bernat Metge, 33 - E-08100 Mollet del Vallès - Tel. +34 93 570 46 01
Tipo FDF21A1B1C1G2AM1V
II 1/2D T 80°C IP66 — IBExU 04 ATEX 1010 X
II 1D/2GD c IIB T X — IBExU 04 ATEX 1001 X
-25°C≥Ta≥+80°C / -20°C≥Ta≥+70°C
Δp -0,08bar...+0,08bar
Voltaje 220...240V~ AC 50...60Hz 3,5VA
p (Aplicación) -0,5bar...+5,0bar ⚠
Contacto 1mA 4V...2A 240V~
Unidad Nº ATEX123456 01/04
Nº Ped. 12345678/90

Placa de características del suplemento para temperatura:



talleres filsa, s. a. CE 0032
Bernat Metge, 33 - E-08100 Mollet del Vallès - Tel. +34 93 570 46 01
Tipo FDF-**E1** — Unidad Nº ATEX123456-01/04
II 1D/2GD c IIB T X — IBExU 04 ATEX 1001 X
-25°C≥Ta≥+150°C/-20°C≥Ta≥+70°C — Nº Ped. 1234567890

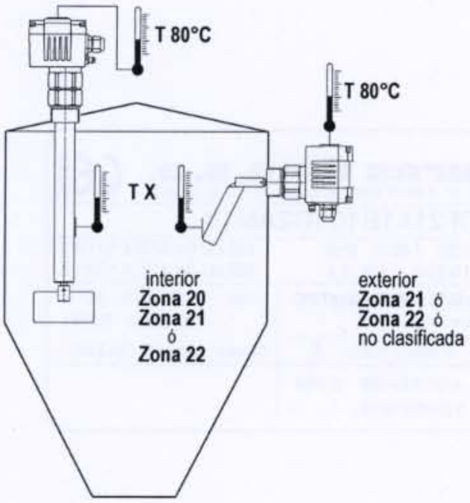


Temperatura superficial máxima T, TX

Temperatura superficial máxima del aparato en caso de avería.

Observación 1: La temperatura superficial T X de la parte no eléctrica del aparato (prolongaciones y pala) depende del producto en el interior del depósito y de la temperatura ambiente. Las partes (no eléctricas) en contacto con el producto no producen por sí mismas superficies calientes.

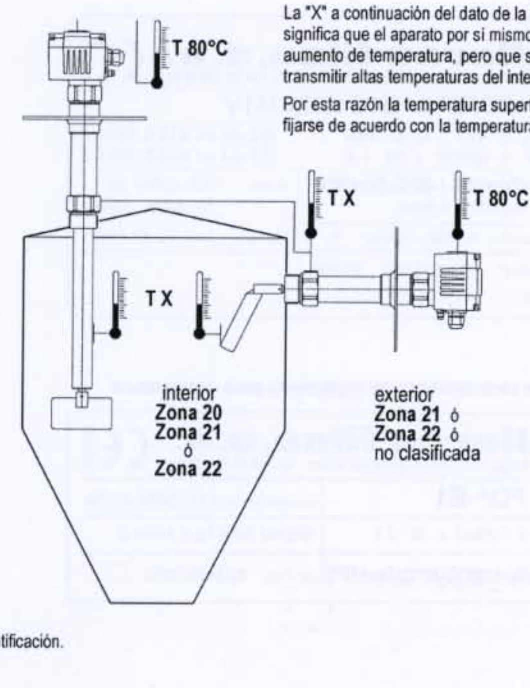
talleres filsa, s. a. CE 0032
Bernat Metge, 33 - E-08100 Mollet del Vallès - Tel. +34 93 570 46 01
Tipo FDF21A1B1C1G2AM1V
Ex II 1/2D **T 80°C** IP66 IBExU 04 ATEX 1010 X
II 1D/2GD c IIB **T X** IBExU 04 ATEX 1001 X
-25°C≥Ta≥+80°C / -20°C≥Ta≥+70°C
Δp -0,08bar...+0,08bar
Voltaje 220...240V~ AC
50...60Hz 3,5VA
p (Aplicacion) -0,5bar...+5.0bar ⚠
Contacto 1mA 4V...2A 240V~
Unidad Nº ATEX123456 01/04
Nº Ped 12345678/90



talleres filsa, s. a. CE 0032
Bernat Metge, 33 - E-08100 Mollet del Vallès - Tel. +34 93 570 46 01
Tipo FDF21A1B1C1G2AM1V
Ex II 1/2D **T 80°C** IP66 IBExU 04 ATEX 1010 X
II 1D/2GD c IIB **T X** IBExU 04 ATEX 1001 X
-25°C≥Ta≥+80°C / -20°C≥Ta≥+70°C
Δp -0,08bar...+0,08bar
Voltaje 220...240V~ AC
50...60Hz 3,5VA
p (Aplicador) -0,5bar...+5,0bar ⚠
Contacto 1mA 4V...2A 240V~
Unidad Nº ATEX123456 01/04
Nº Ped 12345678/90

La "X" a continuación del dato de la temperatura significa que el aparato por sí mismo no produce ningún aumento de temperatura, pero que sin embargo puede transmitir altas temperaturas del interior del depósito.

Por esta razón la temperatura superficial tiene que fijarse de acuerdo con la temperatura del producto.



Placa de características del acoplamiento especial de temperatura y presión:

talleres filsa, s. a. CE 0032
Bernat Metge, 33 - E-08100 Mollet del Vallès - Tel. +34 93 570 46 01
Tipo FDF-**E1** Unidad Nº ATEX123456-01/04
Ex II 1D/2GD c IIB **T X** IBExU 04 ATEX 1001 X
-25°C≥Ta≥+150°C/-20°C≥Ta≥+70°C Nº Ped 1234567890

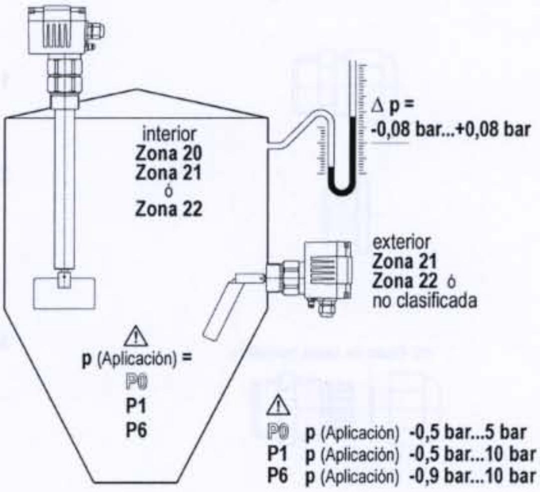
Observación 2: En la Norma EN 13463-1 no se indica la T delante de la X, no obstante facilita la identificación.

Presión, Depresión; (diferencial de presiones) Δ**p**, (presión de la aplicación) **p**

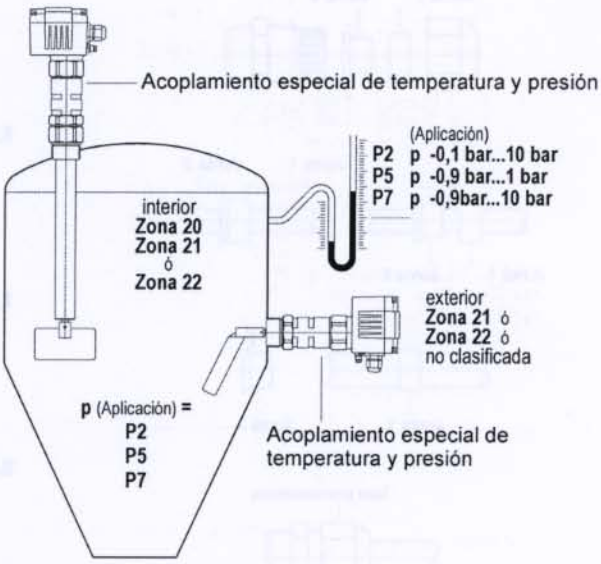
Sobrepresiones o depresiones fuera de las condiciones atmosféricas

La utilización de los controladores de nivel a palas rotativas en depósitos con sobrepresiones o depresiones requiere el exacto cumplimiento de las disposiciones legisladas.

talleres filsa, s. a.
Bernat Metge, 33 - E-08100 Mollet del Vallès - Tel. +34 93 570 46 01
CE 0032
Tipo FDF21A1B1C1G2AM1V
II 1/2D T 80°C IP66
II 1D/2GD c IIB T X
IBExU 04 ATEX 1010 X
IBExU 04 ATEX 1001 X
-25°C≥Ta≥+80°C / -20°C≥Ta≥+70°C
Δp -0,08bar...+0,08bar
p (Aplicación) -0,5bar...+5,0bar ⚠
Voltaje 220...240V~ AC
50...60Hz 3,5VA
Contacto 1mA 4V...2A 240V~
Unidad Nº ATEX123456 01/04
Nº Ped 12345678/90



talleres filsa, s. a.
Bernat Metge, 33 - E-08100 Mollet del Vallès - Tel. +34 93 570 46 01
CE 0032
Tipo FDF21A1B1C1G2AM1V
II 1/2D T 80°C IP66
II 1D/2GD c IIB T X
IBExU 04 ATEX 1010 X
IBExU 04 ATEX 1001 X
-25°C≥Ta≥+80°C / -20°C≥Ta≥+70°C
Δp -0,08bar...+0,08bar
p (Aplicación) -0,5bar...+5,0bar ⚠
Voltaje 220...240V~ AC
50...60Hz 3,5VA
Contacto 1mA 4V...2A 240V~
Unidad Nº ATEX123456 01/04
Nº Ped 12345678/90



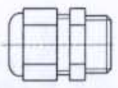
Placa de características del acoplamiento especial de temperatura y presión:

talleres filsa, s. a.
Bernat Metge, 33 - E-08100 Mollet del Vallès - Tel. +34 93 570 46 01
CE 0032
Tipo FDF-P2
Unidad Nº ATEX123456-01/04
II 1D/2GD c IIB T X
IBExU 04 ATEX 1001 X
Ta -25°C...+80°C / -20°C...70°C
p (Aplicación) -0,1bar...+10bar
Nº Ped 1234567890

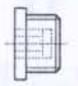
Instrucciones de funcionamiento

		Certificado CE de prueba de la muestra de construcción
Prensaestopas M20x1,5	50.620 PASW/EX	PTB 99 ATEX 3128 X
Tapón roscado M20x1,5	1920 PASW/EX	PTB 99 ATEX 3130
Obturador	WJ-D20-VPA/EX	PTB 99 ATEX 3128 X

Identificación del aparato según 94/9/CE ⟨Ex⟩ II 2 GD
Protección contra explosiones EEx e II

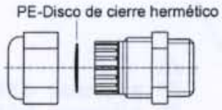


1. **El indicador de nivel se suministra con prensaestopas M20.**



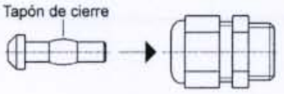
2. **El segundo orificio previsto para una introducción adicional del cable, está tapado con el tapón roscado.**

   Sobre demanda se suministra otro prensaestopas.

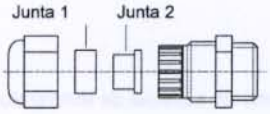


3. **El racor para cables se suministra con un disco de cierre hermético para evitar la entrada de polvo durante el transporte y almacenamiento.**

   Cuando se monte el indicador de nivel en el lugar previsto y después de efectuar la conexión eléctrica, apretar el prensaestopas con un par de giro según la posición 8

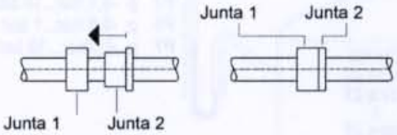


4. **Si no se puede introducir el cable inmediatamente, entonces se debe quitar el PE-Disco de cierre hermético y aplicar el tapón de cierre WJ-d20-WPA/EX rojo y apretarlo con un par de giro de 3Nm.**

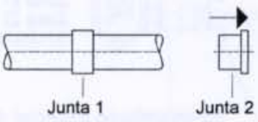


5. **El prensaestopas se suministra con dos juntas**

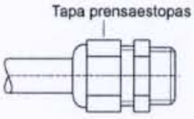
   Junta 1 = negro **Junta 2 = blanco**



6. **Cable de Ø 5,5 a 8 mm - utilizar las juntas 1 y 2**



7. **Con cable de Ø 8 a 13 mm - utilizar junta 1 y quitar la junta 2**



8. **Con cable Ø5.5 a 8 apretar con un par de 3.5Nm**
   Con cable Ø8 a 13 apretar con un par de 2.5Nm

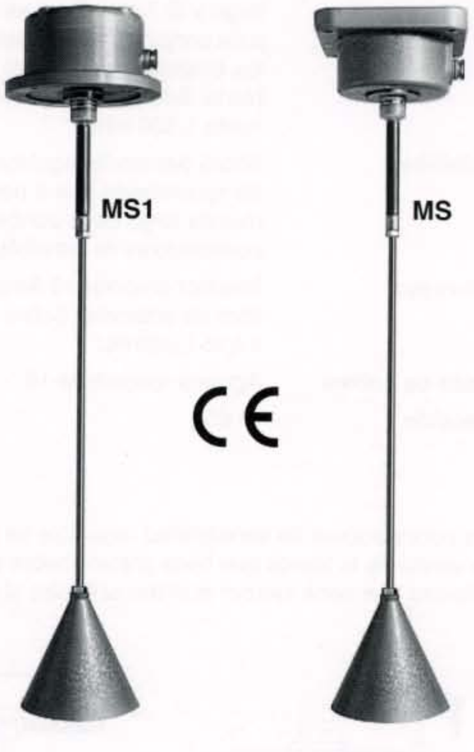
9. **El prensaestopas y el tapón roscado viene apretado de fábrica con un par de 3,75 Nm**
   Comprovar al realizar el montaje si el prensaestopas y el tapón roscado están apretados correctamente. En caso contrario deben apretarse con un par de 3.75Nm

Controladores de péndulo para el control de nivel de materiales a granel con formación de talud

Tipos MS 1 - MS

Esencialmente estos controladores se componen de un interruptor accionado por una varilla de longitud variable en cuyo final va atornillado un cono.

- ○ **Controlan el nivel máximo en silos, tolvas y recipientes de una gran variedad de materiales.**
- ○ **Evitan obstrucciones en los mecanismos de llenado.**
- ○ **Facilitan el control automático del material.**
- ○ **Señalizan cuando el material alcanza el nivel máximo evitando derramamientos.**
- ○ **No precisan adaptación.**
- ○ **Larga duración.**
- ○ **Económico.**



Funcionamiento

El cono del controlador debe estar expuesto al material a detectar.

Cuando el talud del material que va llenando el silo se pone en contacto con el cono ejerce contra éste una presión progresiva desplazando el conjunto cono varilla y actuando un interruptor. Este interruptor debe estar conectado a los sistemas de control para efectuar el paro o la puesta en marcha de los mecanismos de señalización y transporte.

Al vaciarse el silo el péndulo recupera la posición normal y deja de actuar el interruptor.

Emplazamiento y montaje

Estos aparatos solamente se emplean para montajes en el techo del silo y siempre para el control de nivel máximo.

Para su buen funcionamiento hay que tener en cuenta los siguientes puntos:

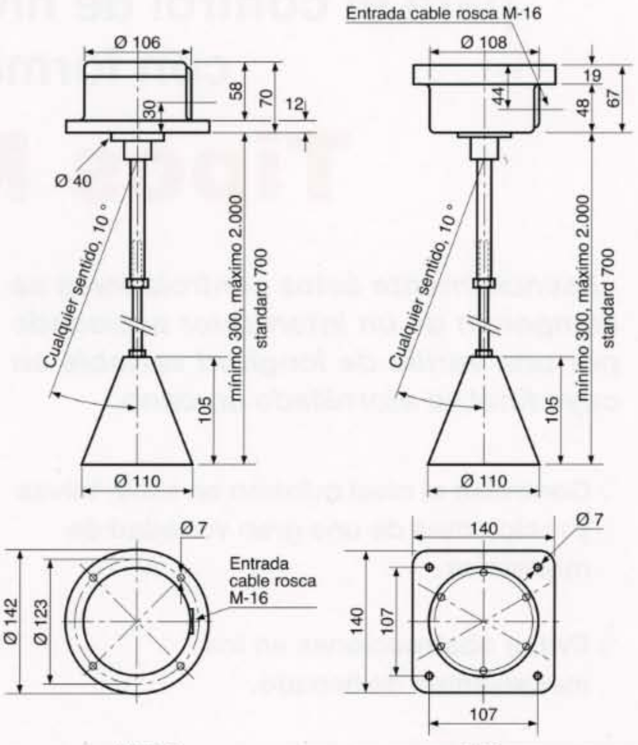
- ○ La caja del controlador tiene que quedar a nivel con la varilla en posición vertical.
- ○ El material que entra no debe golpear en ningún momento contra la varilla o el cono.
- ○ El controlador debe quedar con la distancia suficiente para que al desplazarse el cono no presione contra las paredes del silo antes de haber actuado el interruptor.
- ○ No es conveniente que el material a controlar forme un talud de menos de 20 ° de la horizontal.
- ○ El material en el silo no debe tener densidades aparentes de menos de 0,25.

Características técnicas:

MS1	**Para montajes sobre el techo del silo.**
MS	**Para montajes con la caja enrasada a nivel del suelo en pisos de hormigón.**
Cuerpo y tapa	Aluminio.
Temperatura	Material de -20 a +100 °C.
Cono	Aluminio inyectado.
Péndulo sonda	Varilla en duraluminio de 500 mm de largo y Ø 7 mm. Esta varilla va fijada a un conjunto flexible para evitar que los empujes del material puedan doblarla. Sobre demanda se suministra hasta 1.500 mm.
Sensibilidad	Sobre demanda regulable. Se recomienda que a partir de 1.000 mm de largo de la sonda se empleen controladores de sensibilidad regulable.
Micro-ruptor	Inversor unipolar 10 Amp. 250 V. c.a. libre de potencial.
Entrada de cables	Agujero roscado M-16.
Protección	IP 65.

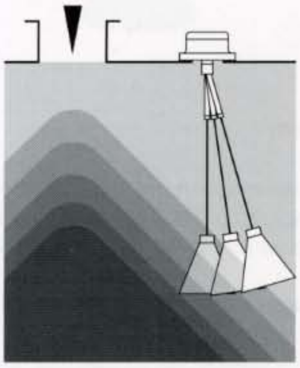
Dimensiones

Medidas aproximadas dadas en mm.

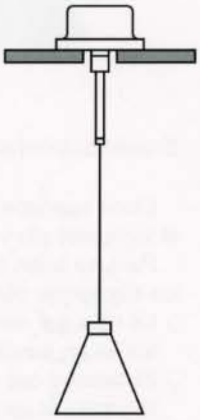


MS 1 **MS**

Los controladores de sensibilidad regulable se suministran ajustados a la sensibilidad máxima. Para disminuir la sensibilidad, debe apretarse la tuerca que hace presión sobre el mecanismo de regulación. A medida que se va apretando la tuerca, aumenta el esfuerzo que debe ejercer el material contra el cono para actuar el interruptor.

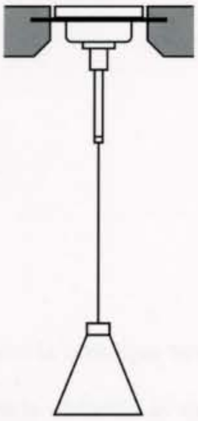


El empuje del material desplaza el conjunto cono varilla que al alcanzar una inclinación de 10 ° actúa un interruptor.



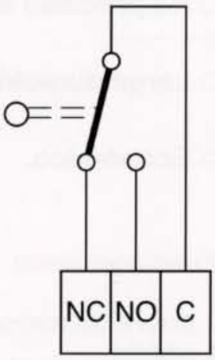
MS 1

Acoplamiento en silos de chapa



MS

Acoplamiento en silos de hormigón mediante una chapa empotrada.



MICRO-RUPTOR

NC Normal cerrado.
NO Normal abierto.
C Común.

Filsa se esmera en mejorar sus productos, reservándose el derecho de modificar diseños, materiales y datos sin indicación expresa. 12/05

filsa
controladores de nivel
para sólidos y líquidos

Controladores por desplazamiento de sonda para el control de materiales a granel

Tipos MP - MR - MBP - MBR

Esencialmente estos controladores se componen de un interruptor accionado por una sonda de longitud variable.

- **Controlan nivel, flujos y obstrucciones.**
- **Adaptables en tuberías, transportadores sin fin, transportadores a cadena, silos, etc.**
- **Evitan y señalizan obstrucciones.**
- **Facilitan el control automático del material.**
- **Larga duración.**
- **Económicos.**


MP


MR


MBP


MBR

Funcionamiento

La sonda del controlador debe estar expuesta al material a detectar.

El empuje que ejerce el material obliga a la sonda a retroceder actuando un interruptor. Este interruptor debe estar conectado a los sistemas de control para efectuar el paro o la puesta en marcha de los mecanismos de señalización y transporte.

Emplazamiento

Los controles del tipo M se pueden montar con facilidad en tuberías redondas y rectangulares, silos, roscas sin fin, transportadores a cadena, etc. La sonda se suministra rígida o flexible, del largo conveniente para ajustarse el máximo a las características del trabajo a efectuar.

Montaje

- Hacer un taladro en la parte central donde debe situarse el controlador, ø 30 en tipos MP - MR y 35mm en MBR -MBP.
- Introducir la sonda colocando la entrada de cables en la posición deseada.
- Señalar en el tubo o recipiente los taladros de la pletina de fijación.
- Hacer los taladros y fijar el controlador.

MP - MR Para controlar cargas en tuberías, la sonda debe dejarse como mínimo a 10 mm. del fondo del tubo. El largo standard de la sonda es de 150 mm. de convenir se puede cortar y dejarla al largo adecuado.

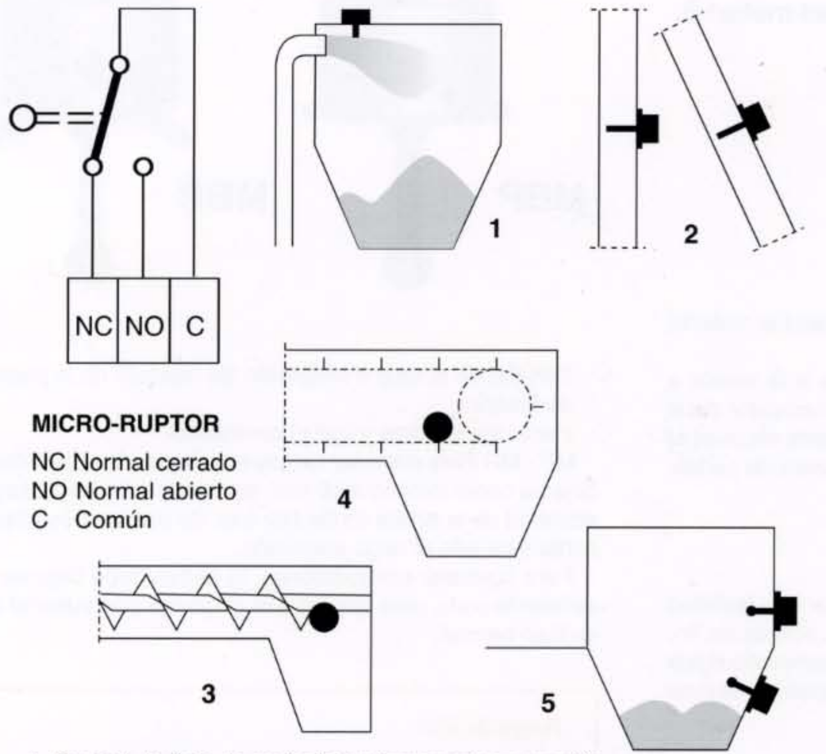
Para controlar obstrucciones, la sonda debe dejarse lo suficiente corta para que no sea golpeada por material en su flujo normal.

Regulación

El mecanismo de regulación está ajustado a la sensibilidad máxima. Mediante la tuerca de regulación debe darse la presión necesaria para asegurar el retorno de la sonda a la posición de vacío, cuando quede libre de material.

Características técnicas:

MP	**Para montajes en superficies planas.**
MR	**Para montajes en superficies redondas.**
MBP	**Para el control de nivel bajo o intermedio de productos harinosos en silos de superficies planas.**
MBR	**Para el control de nivel bajo o intermedio en silos de superficies redondas.**
Cuerpo y tapa	Aluminio.
Pletina soporte	Acero al carbono.
Temperatura	Material de -20 a +80 °C.
Sonda MP - MR	Standard. Tubo de aluminio rígido protegido con una funda de goma sintetica.
Sonda MBP - MBR	Standard. Flexible recubierto con goma sintetica y bola de baquelita.
Sensibilidad	Regulable.
Micro-ruptor	Inversor unipolar 10 Amp. 250 V. a.c. libre de potencial.
Entrada de cables	Agujero roscado M-16.
Protección	IP 65.



MICRO-RUPTOR

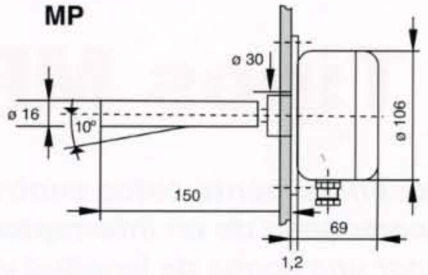
NC Normal cerrado
NO Normal abierto
C Común

1. Control de flujo de material en transportes a presión.
2. Control de flujo en tuberías.
3. Control de obstrucciones en roscas sin fin.
4. Control de obstrucciones en transportadores de cadena.
5. Control de niveles bajos o intermedios de materiales finos.

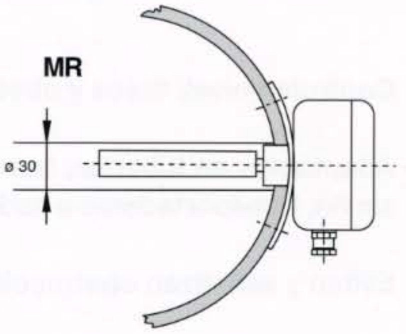
Dimensiones

Medidas aproximadas dadas en mm.

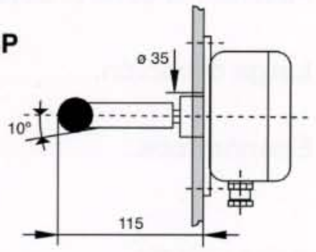
MP



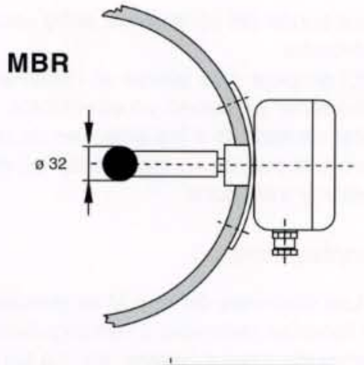
MR

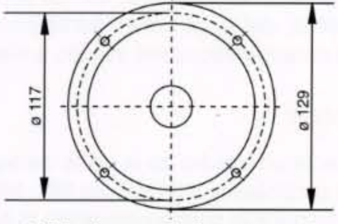


MBP



MBR





4 Taladros equidistantes ø5

Filsa se esmera en mejorar sus productos, reservándose el derecho de modificar diseños, materiales y datos sin indicación expresa. 12/05

Control de nivel a lengüeta para materiales a granel

Tipo MAV

Información general

Esencialmente, este controlador, es un interruptor accionado por una lengüeta desplazable y está destinado a controlar el nivel del material en **tolvas y recipientes pequeños**.

Funcionamiento

La lengüeta debe estar expuesta al material que se ha de controlar. A medida que el material va llenando la tolva, ejerce una presión progresiva contra la lengüeta y la obliga a retroceder actuando un interruptor. Este interruptor debe estar conectado a los sistemas de control para efectuar el paro o la puesta en marcha de los mecanismos de señalización o tranporte.

Suministro

Se suministran en tres versiones:

Emplazamiento

El controlador debe colocarse en posición vertical y en el punto adecuado para que el material entrante alcance la lengüeta al llenarse la tolva, dejándola libre al vaciarse.

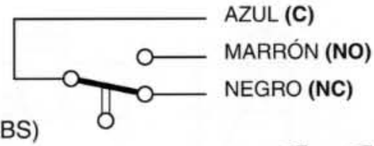
Debe evitarse la caida directa del material sobre la lengüeta.

Especificaciones

Cuerpo y lengüeta:
Poliamida 6

Caja protectora:
Butadieno Estireno (ABS)

Interruptor:
Micro inversor unipolar, 5 AMP. 220 Vac.
Libre de potencial.



Tipo MAV 2330

Con cable manguera tripolar de 45 cm. de largo

Tipo MAV 2330-1

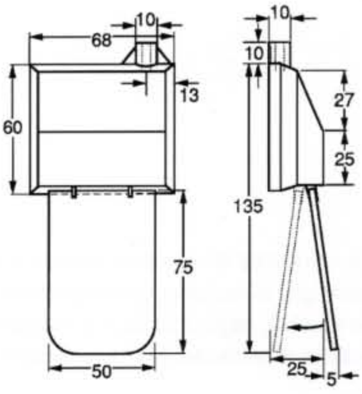
Alojado en caja de protección con prensa estopas. Cable manguera tripolar de 45 cm. de largo

Tipo MAV 2330-2

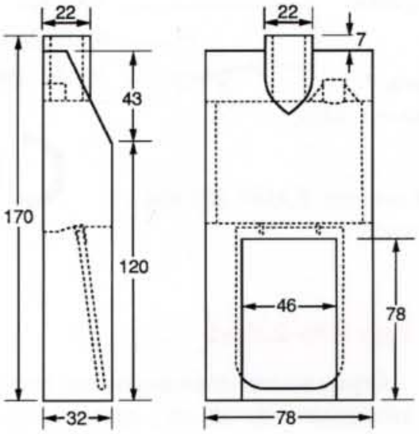
Alojado en caja de protección con tubo PG9 incorporado de 33 cm., cable manguera tripolar de 45 cm. de largo

Este tubo es para suspender el controlador, que, mediante una brida desplazable, se puede situar a la altura adecuada.

Dimensiones



Interruptor
Simple
Tipo 2330



Interruptor
Encapsulado
Tipos
2330-1
2330-2

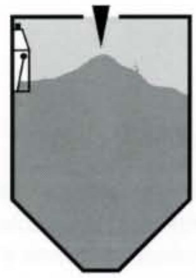
Si se emplea el tipo 2330 sin encapsular

Acoplar una protección para evitar que el material empuje la lengüeta por delante y evite que pueda bloquearla por detrás.

Sugerencias de montaje

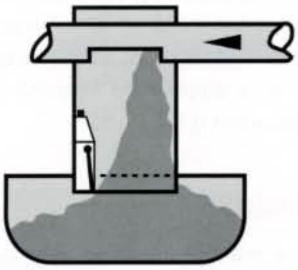
MAV 2330-1

Controlador encapsulado atornillado a un lateral en una tolva pequeña controlando el nivel alto.



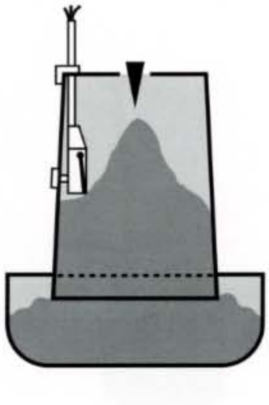
MAV 2330-1

Controlador encapsulado atornillado a un lateral en un comedero pequeño de aves. Para el sistema de transporte al llenarse la tolva y vuelve a ponerlo en marcha al vaciarse.



MAV 2330-2

Controlador encapsulado suspendido mediante tubo con brida desplazable. Controla el nivel alto de un comedero de aves, parando o poniendo en marcha el sistema de llenado.

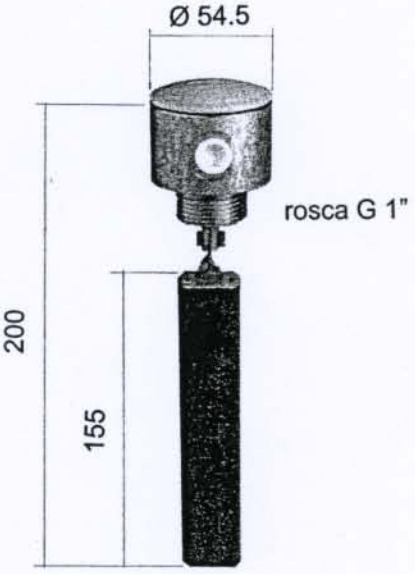


Controlador por desplazamiento a lámina tipo: TL

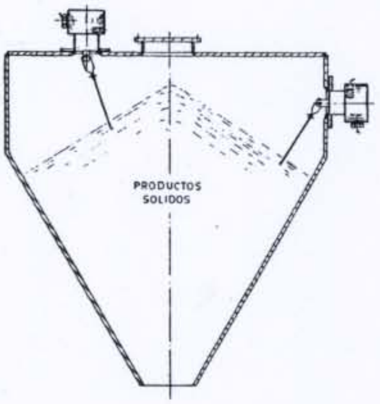
Información e Instrucciones de montaje

Funcionamiento

La lámina flexible del controlador debe estar expuesta al material a controlar. La presión que ejerce el material flexiona la lámina hacia la parte superior del tubo o los laterales en tolvas y recipientes accionando un micro-ruptor inversor unipolar libre de potencial de 5A.



medidas dadas en mm.



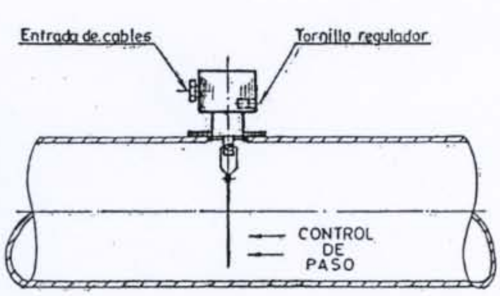
Montaje

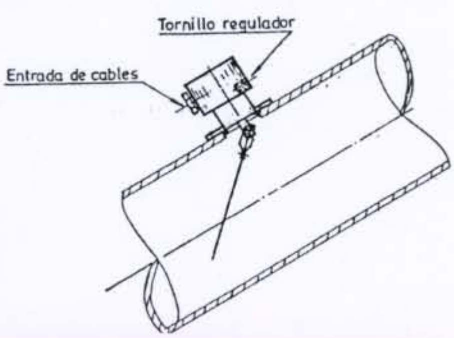
La entrada de cables debe estar situada en el lado hacia donde circula el material. (*si se monta en otra posición, no funciona el indicador*)

Regulación de la lámina

Si el aparato va montado en tuberías, la lámina debe montarse inclinada en la dirección que circula el material. Para dejar la lámina en la posición adecuada, debe aflojarse el tornillo de la articulación, se sitúa la lámina en la posición de trabajo, apretando a continuación el tornillo de fijación.

Es conveniente para el buen funcionamiento del controlador, que la lámina quede a unos 10mm. como mínimo del fondo del tubo. Si es necesario se puede cortar.





Regulación de la sensibilidad

Apretando o aflojando el tornillo de regulación (ver dibujo) aumenta o disminuye la sensibilidad del aparato. La sensibilidad ajustada, debe ser la necesaria para que controle con seguridad y, al mismo tiempo, tenga la fuerza suficiente para que la lámina, al desaparecer la presión del material, retroceda a su posición inicial.

NORTECH
INTERNATIONAL

TD136 Single Channel Detectors

The innovative TD136 series of single channel inductive loop vehicle detectors used to detect vehicles presence by means of an inductive loop buried under the road and have all the features and benefits found on much larger modules. No longer is it necessary to make compromises when selecting a detector for Traffic control, counting or traffic analysis − these "one−chip" microprocessor−based units are suitable for them all.
Available in standard & custom variations these detectors can cater to your every system requirement.

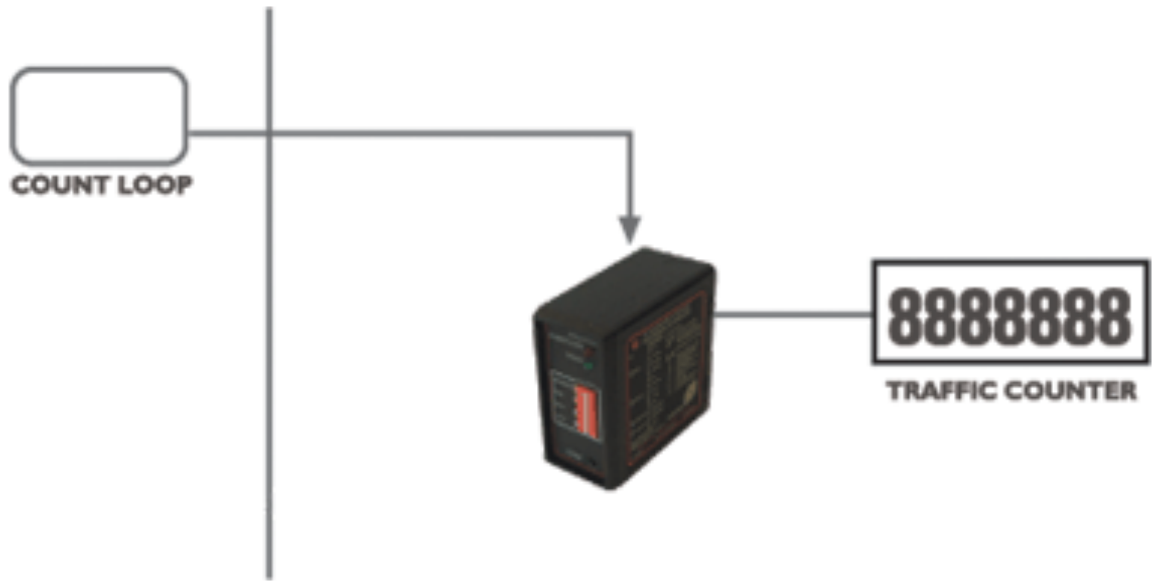
APPLICATIONS

- Traffic Control Applications
- Vehicle Counting
- Toll Systems
- Traffic Analysis

FEATURES

· Compact Size:	This compact and well engineered housing combines all of the industry requirements regarding features and functionality and allows this detector to be incorporated into any new or existing traffic detection system.
· Diagnostic Capabilities:	Comprehensive diagnostics capabilities allow for accurate diagnosis of loop and installation problems.
· Selectable Presence:	The output of the presence relay can be selected to maintain an output for an extension period, or defined presence output times.
· Loop Isolation Protection:	The loop is isolated and provides protection against lightning and transient damage and allows for operation with single point to ground sensor loops. Added filtering reduces interference from external noise.
· Loop Frequency Indication:	Interference between adjacent loop / detectors can be determined by an integral indication, and eliminated by changing the frequency settings.
· Environmental Analyser:	Continuous monitoring of external parameters ensure reliable product performance & operations under all environmental and power supply conditions.
· Delay on Detect:	Provides a turn−on delay, thus allowing selective detection which is often useful for screening out unwanted inputs.
· Visual Fault Monitor:	A fault indication is provided in the event of the loop input becoming faulty, or alternatively if the loop is out of the operational range. This feature will help in localising the fault in the event of a maintenance call−out.

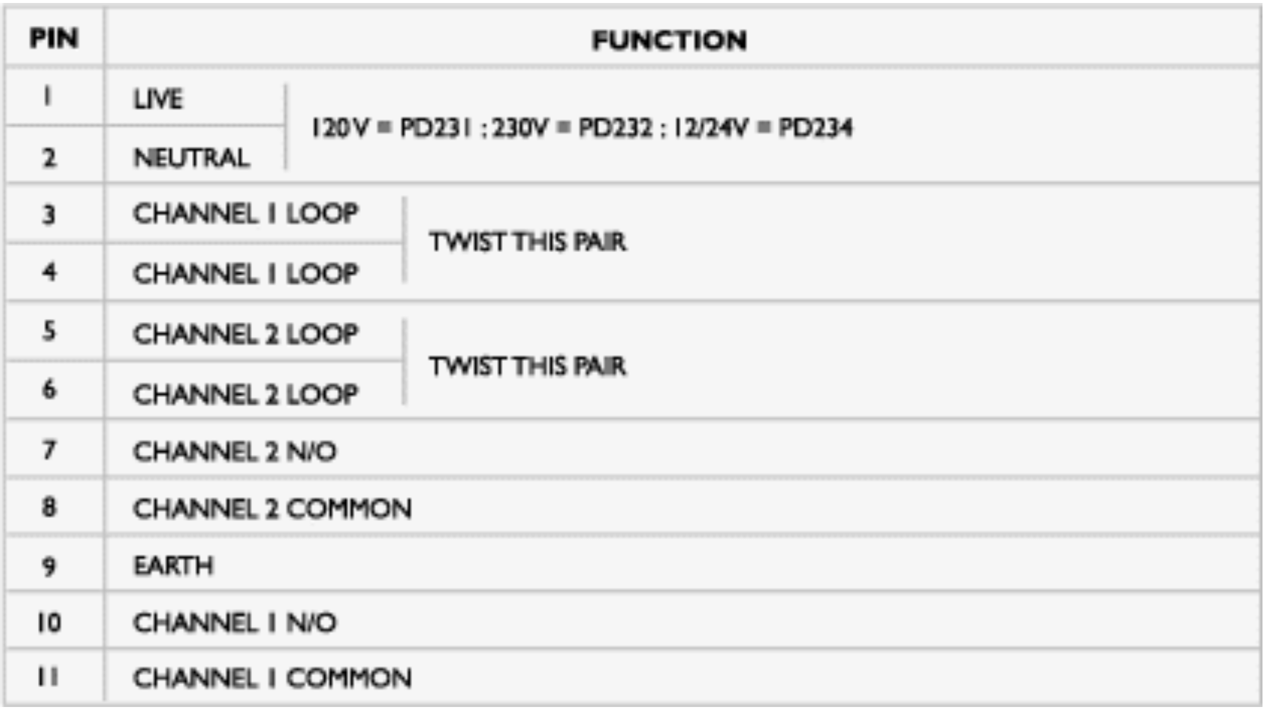
Using the TD136 Detector as a Traffic Counter



Technical Data TD 136

Self−tuning Range:	20 – 1500 µH
Sensitivity:	Four step adjustable on faceplate High 0.02% △ DL/L Med−High 0.05% △ DL/L Med−Low 0.1% △ DL/L Low 0.5% △ DL/L
Frequency:	Four step adjustable on faceplate 12−80kHz (Frequency determined by loop geometry)
Output Configuration:	2 output relays: Relay 1 = Presence output (fail safe) Relay 2 = Fault output (Fail−Safe)
Pulse Output Duration:	Approx. 150 ms (factory option – 250 ms).
Presence Time:	Limited presence − 1 hour for 3% △ DL/L or permanent presence option
Operating Modes:	Four−way mode selector on faceplate: Limited presence / 1 sec, 4mm, 40min Delay Output (0,10,20,30 seconds)
Indications:	The following faceplate indications are provided: Red LED − Diagnostic Green LED − Channel indicator Tuning − on steady followed by flashed frequency count (x10kHz) Undetected − off Detect − on steady Fault − on with short off periods
Protection:	Loop isolation transformer, zener diode clamping on loop inputs and gas discharge tube protection.
Power Requirements:	120 V AC 15% 48 − 60Hz 230V AC 15% 48 − 60Hz 12−24V AC/DC Requirements − 1.5VA max @ 230V
Output Relays: **(Rating and Type)**	Presence Relay − 5A @ 230V AC Change−over contact (Fail−Safe) Fault Relay − 5A @ 230V AC Change−over contact
Operating Temp Range:	−20°C to +70°C (Circuit sealed against condensation)
Material:	High heat ABS blend
Dimensions:	76mm (high) 40mm (wide) x 78mm (deep)
Mounting Position:	Shelf or DIN−rail socket
Connector:	Single rear mount 11−pin ubmangnal (86CP11) Option − 1 metre flying lead

TD 136 Typical Wiring Configuration for standard models.



PIN	FUNCTION	
1	LIVE	120V = PD231 : 230V = PD232 : 12/24V = PD234
2	NEUTRAL	
3	CHANNEL 1 LOOP	TWIST THIS PAIR
4	CHANNEL 1 LOOP	
5	CHANNEL 2 LOOP	TWIST THIS PAIR
6	CHANNEL 2 LOOP	
7	CHANNEL 2 N/O	
8	CHANNEL 2 COMMON	
9	EARTH	
10	CHANNEL 1 N/O	
11	CHANNEL 1 COMMON	

**** May vary according to special requirements***

Programmazione IEC 61131 su SlimLine

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Sistemi in elettronica

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FAX (39)-0142-451988

INDICE

1 SlimLine

Il modulo CPU ARM7 SlimLine è l'unità centrale base di questa famiglia di controllori programmabili (PLC). Il dispositivo consente la gestione dei moduli di espansione I/O SlimLine attraverso il bus di espansione I2C™ High-Speed, ed incorpora altresì un alimentatore ad alta efficienza, dimensionato per il collegamento di fino a 16 moduli di espansione.

Il modulo è ingegnerizzato in un compatto contenitore in PC/ABS autoestinguente UL94 V-0 e riciclabile; esso è direttamente innestabile su guide DIN secondo gli standard EN50022/IEC60715 ed accetta tensioni di alimentazione nel range 10-30Vdc. A livello hardware questa CPU è dotata di:

1 Porta Ethernet 10/100 BaseT RJ45 (Solo versioni Full)

2 Porte COM RS232

1 porta MiniUSB

1 Bus di campo RS485(ModBus) o CAN bus (Solo versioni Full)

2 Input digitali isolati

2 Output digitali isolati

1 slot micro-SD card (Solo versioni Full)

1 bus di espansione I2C High-speed

Grazie all'utilizzo di memorie non volatili in tecnologia FRAM (RAM ferroelettriche), è stato possibile una riduzione sensibile del size della batteria al litio, minimizzando l'impatto ambientale a fine vita del prodotto. La tecnologia FRAM garantisce inoltre un numero di cicli di scrittura praticamente illimitati, migliorando quindi l'affidabilità del sistema, ed un bassissimo consumo di energia anche nelle fasi di scrittura.

SlimLine è programmabile nei 5 linguaggi previsti dalla norma IEC61131-3, attraverso il tool di sviluppo LogicLab, scaricabile ed utilizzabile gratuitamente e senza limitazioni.

1.1 Risorse del sistema

Esistono modi diversi per accedere alle risorse del sistema.

Gli ***I/O logici*** presenti sul modulo CPU e sui moduli di estensione sono gestiti tramite le funzioni ***SysGetPhrDI*** e ***SysGetPhrDO***.

Gli I/O logici dei moduli di estensione sono automaticamente gestiti in immagine di processo dal sistema operativo che provvede a trasferire lo stato di tutti gli ingressi logici nella immagine degli ingressi in memoria di sistema ed a trasferire il valore presente nella immagine delle uscite dalla memoria di sistema alle uscite logiche.

Quindi testando lo stato della immagine di memoria degli ingressi logici si testa lo stato del relativo punto di ingresso (Esempio ***IX0.0*** corrisponde all'ingresso 0 del modulo 0, ***IX1.5*** corrisponde all'ingresso 5 del modulo 1).

Scrivendo lo stato nella immagine di memoria delle uscite logiche si setta lo stato del relativo punto di uscita (Esempio ***QX0.0*** corrisponde all'uscita 0 del modulo 0, ***QX1.5*** corrisponde all'uscita 5 del modulo 1).

Gli ***I/O analogici*** presenti sui moduli di estensione sono gestiti tramite le funzioni ***SysGetAnInp*** e ***SysSetAnOut***

I ***contatori*** sul modulo CPU e sui moduli di estensione sono acquisiti dal blocco funzione ***SysGetCounter***.

Gli ingressi ***encoder*** presenti sui moduli di estensione sono acquisiti dal blocco funzione ***SysGetEncoder***.

Per accedere alle ***porte seriali*** presenti sul modulo CPU occorre utilizzare la funzione ***Sysfopen*** definendo il nome della porta da utilizzare. Esistono moduli di estensione che sono provvisti di porte seriali. L'accesso a queste porte è esattamente uguale a quello delle porte presenti sul modulo CPU: occorre utilizzare la funzione ***Sysfopen*** definendo il nome della porta da utilizzare. Si utilizza la definizione ***PCOMx.y*** dove con ***x*** si indica l'indirizzo del modulo e con ***y*** il numero di porta presente sul modulo. (Esempio ***PCOM0.0*** definisce la porta 0 presente sul modulo 0, ***PCOM1.2*** definisce la porta 2 presente sul modulo 1.

COM0	Porta seriale RS232 (Su modulo CPU)
COM1	Porta seriale RS232 (Su modulo CPU)
COM2	Porta seriale RS485 (Su modulo CPU)
PCOMx.y	Porta seriale ***y*** sul modulo di estensione ***x***. (***PCOM0.2*** definisce porta 2 sul modulo 0).

Il ***CAN bus*** viene gestito dalle funzioni ***SysCANRxMsg*** e ***SysCANTxMsg***.

2 Architettura memoria

La memoria del sistema è così suddivisa:

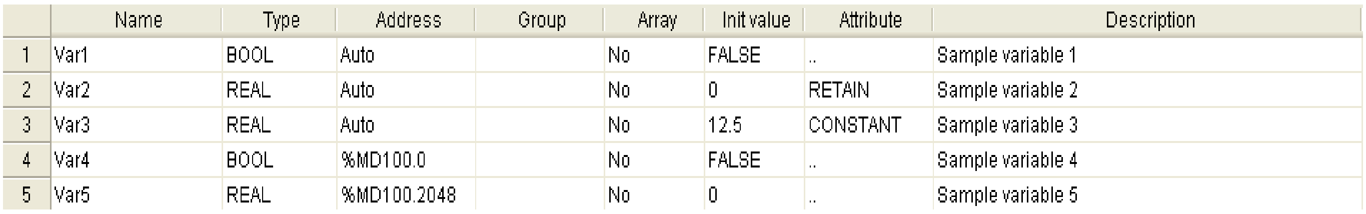
DB	Dimensione	Descrizione
IX0	32 Bytes	Ingressi logici modulo 00 (R)
IX1	32 Bytes	Ingressi logici modulo 01 (R)
IX2	32 Bytes	Ingressi logici modulo 02 (R)
IX3	32 Bytes	Ingressi logici modulo 03 (R)
IX4	32 Bytes	Ingressi logici modulo 04 (R)
IX5	32 Bytes	Ingressi logici modulo 05 (R)
IX6	32 Bytes	Ingressi logici modulo 06 (R)
IX7	32 Bytes	Ingressi logici modulo 07 (R)
IX8	32 Bytes	Ingressi logici modulo 08 (R)
IX9	32 Bytes	Ingressi logici modulo 09 (R)
IX10	32 Bytes	Ingressi logici modulo 10 (R)
IX11	32 Bytes	Ingressi logici modulo 11 (R)
IX12	32 Bytes	Ingressi logici modulo 12 (R)
IX13	32 Bytes	Ingressi logici modulo 13 (R)
IX14	32 Bytes	Ingressi logici modulo 14 (R)
IX15	32 Bytes	Ingressi logici modulo 15 (R)
QX0	32 Bytes	Uscite logiche modulo 00 (R/W)
QX1	32 Bytes	Uscite logiche modulo 01 (R/W)
QX2	32 Bytes	Uscite logiche modulo 02 (R/W)
QX3	32 Bytes	Uscite logiche modulo 03 (R/W)
QX4	32 Bytes	Uscite logiche modulo 04 (R/W)
QX5	32 Bytes	Uscite logiche modulo 05 (R/W)
QX6	32 Bytes	Uscite logiche modulo 06 (R/W)
QX7	32 Bytes	Uscite logiche modulo 07 (R/W)
QX8	32 Bytes	Uscite logiche modulo 08 (R/W)
QX9	32 Bytes	Uscite logiche modulo 09 (R/W)
QX10	32 Bytes	Uscite logiche modulo 10 (R/W)
QX11	32 Bytes	Uscite logiche modulo 11 (R/W)
QX12	32 Bytes	Uscite logiche modulo 12 (R/W)
QX13	32 Bytes	Uscite logiche modulo 13 (R/W)
QX14	32 Bytes	Uscite logiche modulo 14 (R/W)
QX15	32 Bytes	Uscite logiche modulo 15 (R/W)
MX0	512 Bytes	Variabili di sistema sola lettura (R)
MX1	512 Bytes	Variabili di sistema lettura/scrittura (R/W)
MX100	4096 Bytes	Memoria utente (R/W). Da indirizzo 2048 a 4095 i dati sono ritentivi.

2.1 Memoria di backup (Retain)

SlimLine dispone di 2048 bytes di memoria ritentiva nell'area memoria utente ***MX100*** ed ulteriori 2000 bytes di memoria ritentiva a disposizione utente per allocare variabili mnemoniche.

Le variabili allocate nella memoria utente ***MX100*** da indirizzo 2048 ad indirizzo 4095 sono ritentive, mantengono il loro valore anche allo spegnimento del sistema.

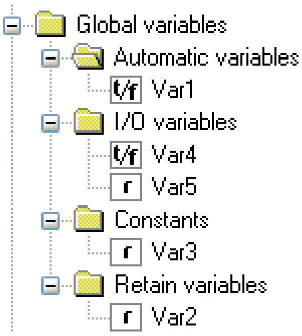
Qualsiasi variabile mnemonica a cui viene attribuito l'attributo ***RETAIN***, manterrà il suo valore anche allo spegnimento del sistema. Da quanto detto precedentemente l'area totale allocabile per le variabili ***RETAIN*** è di 2000 bytes.



	Name	Type	Address	Group	Array	Init value	Attribute	Description
1	Var1	BOOL	Auto		No	FALSE	..	Sample variable 1
2	Var2	REAL	Auto		No	0	RETAIN	Sample variable 2
3	Var3	REAL	Auto		No	12.5	CONSTANT	Sample variable 3
4	Var4	BOOL	%MD100.0		No	FALSE	..	Sample variable 4
5	Var5	REAL	%MD100.2048		No	0	..	Sample variable 5

Come si vede dalla foto la variabile ***Var2*** è dichiarata con l'attributo ***RETAIN*** e manterrà il suo valore anche allo spegnimento del sistema. La variabile ***Var5*** allocata nella memoria utente ***MD100.2048*** pur essendo ritentiva non necessita dell'attributo ***RETAIN*** in quanto è implicito dalla sua allocazione.

Nella finestra di navigazione progetto, tutte le variabili globali sono suddivise in base alla loro definizione, e come si nota nella cartella delle variabili ritentive figureranno solo le variabili mnemoniche ***Var2*** e non le variabili allocate nella memoria utente ***Var5*** pur essendo anch'essa di tipo ritentivo.



2.2 Accesso alla memoria

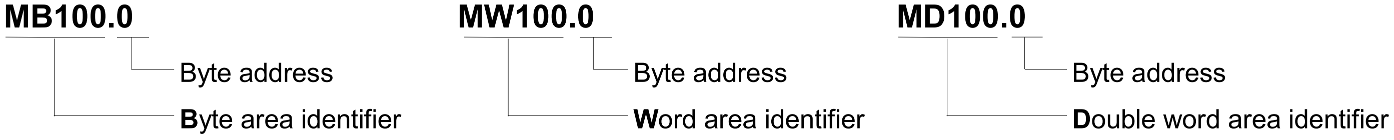
IX: Immagine di processo ingressi logici
SlimLine esegue la lettura degli ingressi logici all'inizio di ogni loop di esecuzione programma. E' possibile accedere a quest'area utilizzando variabili di tipo ***BOOL***, ogni indirizzo rappresenta lo stato booleano del relativo ingresso logico. L'indirizzo ***IX0.0***, rappresenta lo stato dell'ingresso 0 del modulo 0, l'indirizzo ***IX5.12***, rappresenta lo stato dell'ingresso 12 del modulo 5.

QX: Immagine di processo uscite logiche
SlimLine esegue la scrittura delle uscite logiche alla fine di ogni loop di esecuzione programma. E' possibile accedere a quest'area utilizzando variabili di tipo ***BOOL***, ogni indirizzo rappresenta lo stato booleano della relativa uscita logica. L'indirizzo ***QX0.0***, rappresenta lo stato dell'uscita 0 del modulo 0,l'indirizzo ***QX5.12***, rappresenta lo stato dell'uscita 12 del modulo 5.

MX: Area di memoria
A queste aree è possibile accedere utilizzando tutti i tipi di variabili definiti. Siccome tutte le variabili utilizzano la stessa area di memoria, occorre prestare attenzione alla dimensione in bytes del tipo definito per evitare sovrapposizioni di indirizzo.

Ad esempio una variabile ***DWORD*** allocata ad indirizzo ***MX100.10*** utilizzerà anche lo spazio di memoria ***MX100.11***, ***MX100.12*** ed ***MX100.13***. Quindi allocando una variabile ***BYTE*** all'indirizzo ***MX100.11*** si andrebbe ad occupare uno spazio di memoria già utilizzato dalla variabile precedente.

E' comunque possibile allocare variabili sovrapponendone l'indirizzo, esempio allocare due variabili ***BYTE*** sugli stessi indirizzi di una variabile ***WORD*** per andarne a considerare la parte MSB od LSB. Oppure allocare due variabili ***WORD*** sugli stessi indirizzi di una variabile ***DWORD*** per andarne a considerare la parte MSW od LSW. Riporto una semplice tabella esplicativa.



MB100.0	MB100.0			
	LSB	MSB		
MW100.0	MB100.0	MB100.1		
	LSB			MSB
MD100.0	MB100.0	MB100.1	MB100.2	MB100.3

Attenzione! SlimLine è basato su architettura ARM e questo tipo di architettura assume che:

Le variabili a 16 bits, ***WORD***, ***INT***, ***UINT*** siano allocate in memoria ad indirizzi ***divisibili per 2***. Quindi una variabile a 16 bits potrà assere allocata ad esempio ad indirizzo MW100.32 ma non ad indirizzo MW100.33.

Le variabili a 32 bits ***DWORD***, ***DINT***, ***UDINT***, ***REAL*** siano allocate ad indirizzi ***divisibili per 4***. Quindi una variabile a 32 bits potrà assere allocata ad esempio ad indirizzo MD100.32 ma non ad indirizzo MD100.33, MD100.34, MD100.35.

3 Definizione tipo dati

Oltre ai dati standard definiti dalla normativa IEC61131 sono stati definiti altri tipi di dato che possono essere utilizzati nel programma PLC.

3.1 FILEP, file pointer

Questo tipo di dati è utilizzato dalle funzioni che eseguono accesso alle risorse di I/O del sistema, una variabile di tipo ***FILEP*** punta ad una risorsa utilizzata per effettuare la lettura e/o scrittura di dati. Un esempio di file pointer è il puntatore ad una porta seriale od un file su disco.

3.2 SYSSERIALMODE, modo comunicazione porta seriale

Questo tipo di dati è utilizzato dalle funzioni che eseguono lettura ed impostazione modo di comunicazione su porta seriale. Il tipo dati contiene tutte le informazioni per caratterizzare la comunicazione sulla porta seriale.

Name	Type	Description
Baudrate	UDINT	Valore di baud rate porta seriale (da 300 a 115200 baud)
Parity	STRING[1]	Tipo di parità, valori possibili “E” pari, “O” dispari, “N” nessuna.
DataBits	USINT	Numero di bit frame dato, valori possibili 7, 8.
StopBits	USINT	Numero di bit di stop, valori possibili 1, 2.
DTRManagement	USINT	Modo di gestione del segnale DTR sulla porta seriale, vedi Serial mode definition.
DTRComplement	BOOL	FALSE: DTR normale, TRUE: DTR complementato.
EchoFlush	BOOL	FALSE: I dati trasmessi sono ritornati in ricezione. TRUE:I dati trasmessi sono ignorati, su comunicazioni in RS485.
DTROnTime	UINT	Tempo di attesa trasmissione caratteri su porta seriale dopo attivazione segnale DTR (mS). Questo parametro assume significato solo se ***DTRManagement*** è impostato nel modo ***DTR_AUTO_W_TIMES***, vedi Serial mode definition.
DTROffTime	UINT	Tempo di attesa dopo trasmissione ultimo dato e disattivazione segnale DTR (mS). Questo parametro assume significato solo se ***DTRManagement*** è impostato nel modo ***DTR_AUTO_W_TIMES***, vedi Serial mode definition.

3.3 SYSCANMESSAGE, messaggio CAN

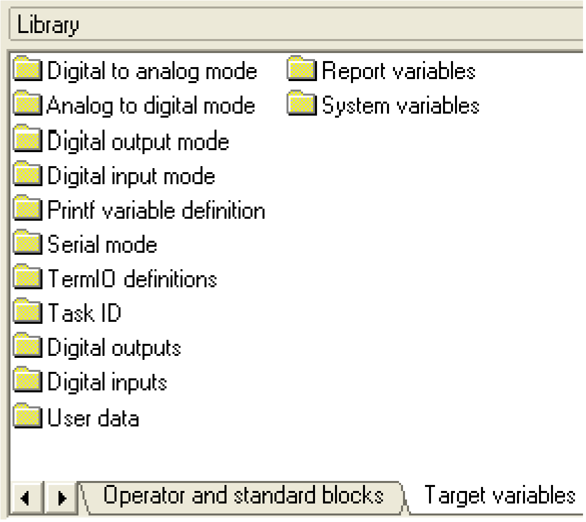
Questo tipo di dati è utilizzato dalle funzioni che gestiscono il controller CAN. La struttura definisce il formato di un messaggio CAN.

Name	Type	Description
RmReq	BOOL	FALSE:Data frame, TRUE:Remote request.
Length	USINT	Lunghezza record dati da 0 a 8 bytes.
MsgID	UDINT	Message ID, 11 o 29 bit di identificativo messaggio. Il bit 31 è il bit di FF.
Data	ARRAY[0..7] OF USINT	Array dati messaggio

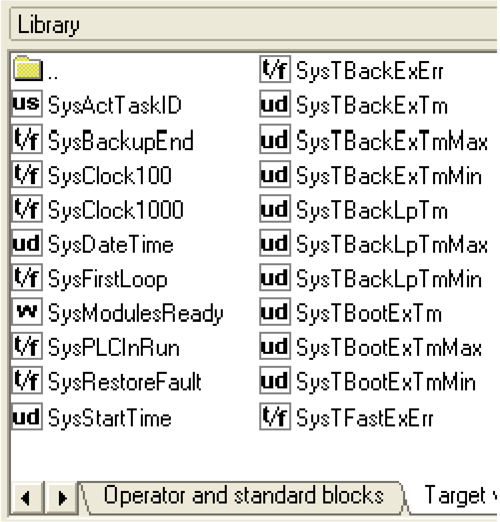
4 Variabili di sistema

Con l'ambiente di sviluppo LogicLab vengono pubblicate variabili di sistema che possono essere referenziate nel programma per accedere ad informazioni sul sistema. Le variabili sono visualizzate da LogicLab nella finestra delle librerie.

Se la finestra non è visualizzata, occorre abilitarne la visualizzazione dalla voce di menù ***Wiew*** → ***Tool windows*** → ***Library***. Attivando il Tab ***Target variables*** verrà visualizzato un elenco con tutte le variabili pubblicate suddivise in cartelle. Un doppio click del mouse sulla cartella ***System variables*** si aprirà la cartella visualizzando tutte le variabili pubblicate (Vedi foto a destra).

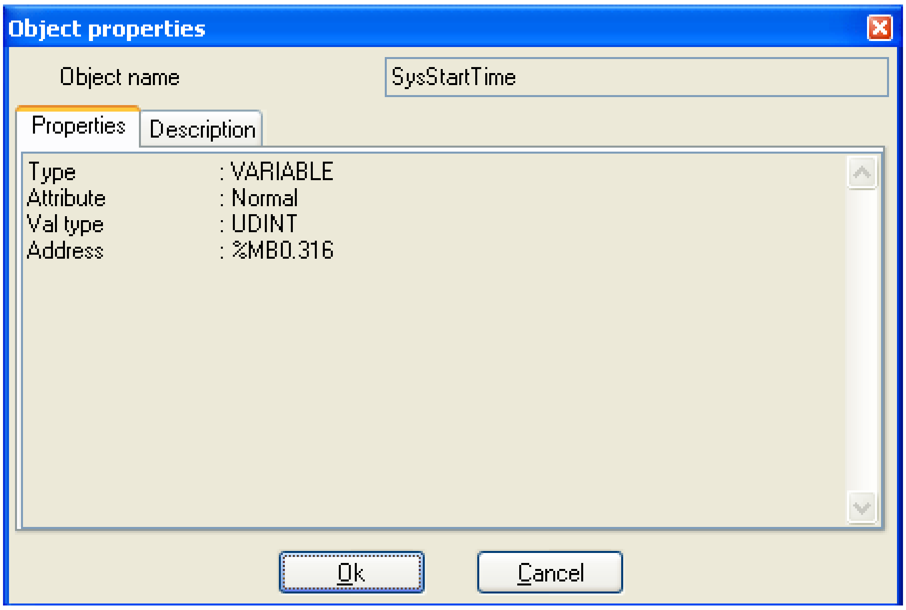


Digital to analog mode
Analog to digital mode
Digital output mode
Digital input mode
Printf variable definition
Serial mode
TermIO definitions
Task ID
Digital outputs
Digital inputs
User data
Report variables
System variables



..
us SysActTaskID
t/f SysBackupEnd
t/f SysClock100
t/f SysClock1000
ud SysDateTime
t/f SysFirstLoop
w SysModulesReady
t/f SysPLCInRun
t/f SysRestoreFault
ud SysStartTime
t/f SysTBackExErr
ud SysTBackExTm
ud SysTBackExTmMax
ud SysTBackExTmMin
ud SysTBackLpTm
ud SysTBackLpTmMax
ud SysTBackLpTmMin
ud SysTBootExTm
ud SysTBootExTmMax
ud SysTBootExTmMin
t/f SysTFastExErr

Agendo con il tasto destro del mouse su ogni singola variabile è possibile visualizzarne la finestra delle proprietà in cui è indicato il tipo e l'indirizzo di allocazione, cosi come nella figura a lato.



Object name: SysStartTime

Type : VARIABLE
Attribute : Normal
Val type : UDINT
Address : %MB0.316

4.1 Variabili sola lettura (System variables)

Queste variabili di sola lettura presenti nella cartella ***System variables***, ritornano informazioni sul sistema. Il programma utente può utilizzare le variabili a piacere ma non può modificarne il valore.

Name	Type	Description
SysClock100	BOOL	Clock lampeggiante con duty cycle di 100 mS.
SysClock1000	BOOL	Clock lampeggiante con duty cycle di 1 S.
SysBackupEnd	BOOL	Attiva per un loop di programma al termine di un ciclo di backup dati.
SysRestoreFault	BOOL	Si attiva alla accensione se i dati di backup sono in errore. Tutti i dati sono azzerati.
SysPLCInRun	BOOL	Sempre attiva.
SysFirstLoop	BOOL	Attiva per un loop alla prima esecuzione di ogni task PLC.
SysLLabCn	BOOL	Attiva se l'ambiente di sviluppo LogicLab è connesso al sistema.
SysActTaskID	USINT	Numero di identificazione della task in corso, vedi tipi definiti.
SysModulesReady	UINT	Ogni bit della variabile se attivo indica la presenza del modulo connesso al bus SlimLine.
SysTBackLpTm	UDINT	Tempo di loop attuale della task di background PLC (uS).
SysTBackLpTmMin	UDINT	Tempo di loop minimo della task di background PLC (uS). E' possibile inizializzarne il valore settando il bit SysTimeInit.
SysTBackLpTmMax	UDINT	Tempo di loop massimo della task di background PLC (uS). E' possibile inizializzarne il valore settando il bit SysTimeInit.
SysTBootExTm	UDINT	Tempo di esecuzione attuale della task di boot PLC (uS).
SysTBootExTmMin	UDINT	Tempo di esecuzione minimo della task di boot PLC (uS). E' possibile inizializzarne il valore settando il bit SysTimeInit.
SysTBootExTm	UDINT	Tempo di esecuzione massimo della task di boot PLC (uS). E' possibile inizializzarne il valore settando il bit SysTimeInit.
SysTFastExTm	UDINT	Tempo di esecuzione attuale della task fast PLC (uS).
SysTFastExTmMin	UDINT	Tempo di esecuzione minimo della task fast PLC (uS). E' possibile inizializzarne il valore settando il bit SysTimeInit.
SysTFastExTmMax	UDINT	Tempo di esecuzione massimo della task fast PLC (uS). E' possibile inizializzarne il valore settando il bit SysTimeInit.
SysTSlowExTm	UDINT	Tempo di esecuzione attuale della task slow (uS).
SysTSlowExTmMin	UDINT	Tempo di esecuzione minimo della task slow (uS). E' possibile inizializzarne il valore settando il bit SysTimeInit.
SysTSlowExTmMax	UDINT	Tempo di esecuzione massimo della task slow (uS). E' possibile inizializzarne il valore settando il bit SysTimeInit.
SysTBackExTm	UDINT	Tempo di esecuzione attuale della task background (uS).
SysTBackExTmMin	UDINT	Tempo di esecuzione minimo della task background (uS). E' possibile inizializzarne il valore settando il bit SysTimeInit.
SysTBackExTmMax	UDINT	Tempo di esecuzione massimo della task background (uS). E' possibile inizializzarne il valore settando il bit SysTimeInit.
SysStartTime	UDINT	Data ed ora di start esecuzione programma PLC (Epoch time).
SysTime	UDINT	Tempo di sistema si incrementa ad ogni 1 mS raggiunto il valore massimo si reinizializza.
SysTFastLpTm	UDINT	Tempo di loop della task fast PLC. Il tempo è impostabile tramite la funzione SysSetTaskLpTime.
SysTSlowLpTm	UDINT	Tempo di loop della task slow PLC. Il tempo è impostabile tramite la funzione SysSetTaskLpTime.
SysApplID	UDINT	ID applicazione, è un numero univoco che identifica il programma utente attualmente in esecuzione sul sistema.
SysMfcCode	UDINT	Codice manufacturer, questo codice và richiesto con il prodotto. Se non definito è ritornato il codice ***0***.
SysCustomerCode	UDINT	Codice customer, questo codice può essere impostato dall'utente che ha accesso come amministratore al sistema. Se non definito è ritornato il codice ***0***.

4.2 Variabili sola lettura (Report variables)

Queste variabili di sola lettura presenti nella cartella ***Report variables***, ritornano informazioni di report sul funzionamento del sistema. Il programma utente può utilizzare le variabili a piacere ma non può modificarne il valore.

Name	Type	Description
ErCode	UDINT	Numero dell'errore di esecuzione programma.
SysErTime	UDINT	Data ed ora in cui l'errore è avvenuto (Epoch time).
ErActTaskID	USINT	Numero di identificazione della task in cui l'errore si è verificato.
ErInfos	STRING[32]	Stringa ascii con informazioni aggiuntive sull'errore.

4.3 Variabili lettura e scrittura (System variables)

Queste variabili lettura e scrittura presenti nella cartella ***System variables***, permettono di leggere e scrivere da programma utente informazioni sul funzionamento del sistema. Il programma utente può utilizzare le variabili a piacere ed anche modificarne il valore.

Name	Type	Description
SysTimeInit	BOOL	Attivata da programma utente o da debug permette di inizializzare il calcolo dei tempi di loop e di esecuzione delle task PLC. La variabile viene automaticamente resettata dal sistema.
SysDateTime	UDINT	Data ed ora di sistema (Epoch time). Modificando il valore verrà automaticamente aggiornato anche il real time clock.
SysLastError	UDINT	Last error, ritorna il valore dell'ultimo errore verificatosi nella esecuzione di una funzione o di un blocco funzione, elenco errori.

5 Definizioni dati

Oltre alle cartelle delle variabili di sistema sono presenti anche cartelle con identificatori di tipo dati che permettono di identificare in modo unifico un dato di sistema.

5.1 Variable types, definizione tipo variabili

La definizione del tipo di variabili è utilizzata nella funzione di stampa formattata ***SysVarfprintf***. Per ogni tipo di variabile è definito un valore USINT che lo identifica, il valore è indicato anche con definizioni che si possono trovare nella cartella ***Variable types definition***.

Value	Define	Type	Description
10	BOOL_TYPE	USINT	Variabile booleana (BOOL), 1 bit può assumere solo significato FALSE o TRUE.
20	BYTE_TYPE	USINT	Variabile byte (BYTE) 8 bits senza segno, range da 0 a 255.
21	SINT_TYPE	USINT	Variabile byte (SINT) 8 bits con segno, range da -128 a +127.
22	USINT_TYPE	USINT	Variabile byte (USINT) 8 bits senza segno, range da 0 a 255.
30	WORD_TYPE	USINT	Variabile word (WORD) 16 bits senza segno, range da 0 a 65535.
31	INT_TYPE	USINT	Variabile word (INT) 16 bits con segno, range da -32768 a 32767.
32	UINT_TYPE	USINT	Variabile word (UINT) 16 bits senza segno, range da 0 a 65535.
40	DWORD_TYPE	USINT	Variabile double word (DWORD) 32 bits senza segno, range da 0 a 4294967295.
41	DINT_TYPE	USINT	Variabile double word (DINT) 32 bits con segno, range da -2147483648 a 2147483647.
42	UDINT_TYPE	USINT	Variabile double word (UDINT) 32 bits senza segno, range da 0 a 4294967295.
43	REAL_TYPE	USINT	Variabile floating (REAL) 32 bits con segno, range da -3.40E+38 a +3.40E+38.
50	STRING_TYPE	USINT	Variabile stringa (STRING).

5.2 Task ID definition, identificatore di task PLC

Le task PLC sono identificate da un identificativo di tipo ***USINT***, il valore della task corrente in esecuzione può essere letto dal programma utente dalla variabile ***SysActTaskID***. L'ID di task è indicato anche con definizioni che si possono trovare nella cartella ***Task ID***.

Value	Define	Type	Description
0	ID_TASK_BOOT	USINT	Identifica la task di boot PLC. Questa task viene eseguita solo al primo loop di esecuzione programma utente.
1	ID_TASK_BACK	USINT	Identifica la task di background. Questa task è eseguita in background alle task slow e fast. Il tempo di loop di questa task non è fisso ma dipende dal carico di lavoro della CPU nella esecuzione delle altre tasks.
2	ID_TASK_SLOW	USINT	Identifica la task slow. Questa task è eseguita con un tempo di loop fisso definito con la funzione SysSetTaskLpTime. Di default il tempo è fissato a 10 mS.
3	ID_TASK_FAST	USINT	Identifica la task fast. Questa task è eseguita con un tempo di loop fisso definito con la funzione SysSetTaskLpTime. Di default il tempo è fissato a 1 mS.

5.3 TermIO, definizioni per terminale di I/O

Nella gestione dei terminali di I/O sono utilizzate delle definizioni che si possono trovare nella cartella ***TermIO definition***.

Value	Define	Type	Description
0	NULL	FILEP	Identifica un puntatore vuoto. Utilizzato come ritorno da alcune funzioni in caso di errore.
-1	EOF	INT	Identifica il fine file. Utilizzato come valore di ritorno da alcune funzioni in caso di fine file raggiunto.

5.4 Serial mode definition, definizioni modo seriale

Nella gestione dei terminali di I/O sono utilizate delle definizioni che si possono trovare nella cartella ***Serial mode definition***.

Value	Define	Type	Description
0	DTR_OFF	USINT	Valore membro DTRManagement del dato SYSSERIALMODE, indica segnale DTR sempre in condizione di off.
1	DTR_ON	USINT	Valore membro DTRManagement del dato SYSSERIALMODE, indica segnale DTR sempre in condizione di on.
2	DTR_AUTO_WO_TIMES	USINT	Valore membro DTRManagement del dato SYSSERIALMODE, indica segnale DTR in funzionamento automatico senza interposizione di tempi.
3	DTR_AUTO_W_TIMES	USINT	Valore membro DTRManagement del dato SYSSERIALMODE, indica segnale DTR in funzionamento automatico con interposizione di tempi.

6 Protocollo modbus

Il modbus è un protocollo di comunicazione seriale diventato uno standard de facto nella comunicazione di tipo industriale, ed è ora il protocollo di connessione più diffuso fra i dispositivi elettronici industriali. E' un protocollo di tipo richiesta/risposta ed offre dei servizi specificati da function codes.

SlimLine supporta il protocollo modbus Rtu sulle porte seriali, e modbus Over IP su connessione ethernet su porta ***502***. Il protocollo modbus Rtu sulla porta seriale ha come parametri di comunicazione di default ***115200, e, 8, 1***, e l'indirizzo di nodo sia su porta seriale che su TCP/IP è ***1***.

6.1 Accesso variabili da modbus

Le funzioni del protocollo accedono tutte alla memoria utente ***MX100***, le funzioni supportate sono:

Code	Function	Tipo oggetto	Tipo accesso	Range indirizzo
01h	Read coil status	Bit singolo	Read	40000-44095 ***(Note 1)***
02h	Read input status	Bit singolo	Read	40000-44095 ***(Note 1)***
03h	Read holding registers	Word (16 Bit)	Read	40000-42047 ***(Note 2)***
04h	Read input registers	Word (16 Bit)	Read	40000-42047 ***(Note 2)***
05h	Force single coil	Bit singolo	Write	40000-44095 ***(Note 1)***
06h	Preset single register	Word (16 Bit)	Write	40000-42047 ***(Note 2)***
10h	Preset multiple registers	Word (16 Bit)	Write	40000-42047 ***(Note 2)***

Note 1) Nelle funzioni che accedono al bit singolo (In realtà ogni bit equivale ad un byte di memoria) si utilizza nel comando l'indirizzo della variabile, quindi dovendo accedere alla locazione ***MX100.50*** utilizzeremo come indirizzo il valore ***40050***.
Note 2) Nelle funzioni che accedono ai registri (16 Bits) occorre considerare l'indirizzo della variabile diviso per 2, quindi dovendo raggiungere da modbus la locazione ***MX100.50*** utilizzeremo come indirizzo il valore ***40025***.

6.1.1 Lettura variabili da modbus

Per la lettura delle variabili si utilizza il comando ***Read holding registers*** (Codice ***0x03***). Ipotizzando di dover accedere in lettura ad una variabile ***DWORD*** allocata in memoria all'indirizzo ***MX100.64*** calcoleremo l'indirizzo di lettura nel modo:

((Indirizzo variabile/2)+Offset)-1 → ((64/2)+40000)-1=40031 → 0x9C5F

Essendo una variabile ***DWORD*** dovremo leggere 2 registri consecutivi a partire dal suo indirizzo di allocazione, ipotizzando che il valore della variabile sia ***0x12345678*** avremo.

Frames modbus RTU

Stringa di comando: ***01 03 9C 5F 00 02 DA 49***
Stringa di risposta: ***01 03 04 56 78 12 34 66 D5***

Frames modbus TCP/IP

Stringa di comando: ***00 00 00 00 00 06 01 03 9C 5F 00 02***
Stringa di risposta: ***00 00 00 00 00 07 01 03 04 56 78 12 34***

La rappresentazione dei dati in SlimLine è nel formato ***Little-Endian***, la numerazione inizia dal byte meno significativo per finire col più significativo, quindi come si nota dalla stringa di risposta il valore della variabile a 32 bits ***0x12345678*** viene ritornato suddiviso in due registri a 16 bits con i valori ***0x5678***, ***0x1234***.

6.1.2 Scrittura variabili da modbus

Per la scrittura delle variabili si utilizza il comando ***Preset multiple registers*** (Codice ***0x10***). Ipotizzando di dover accedere in scrittura ad una variabile ***DWORD*** allocata in memoria all'indirizzo ***MX100.64*** calcoleremo l'indirizzo di scrittura nel modo:

((Indirizzo variabile/2)+Offset)-1 → ((64/2)+40000)-1=40031 → 0x9C5F

Essendo una variabile ***DWORD*** dovremo scrivere 2 registri consecutivi a partire dal suo indirizzo di allocazione, ipotizzando di dover scrivere nella variabile il valore ***0x12345678*** avremo.

Frames modbus RTU

Stringa di comando: ***01 10 9C 5F 00 02 04 56 78 12 34 D3 33***
Stringa di risposta: ***01 10 9C 5F 00 02 5F 8A***

Frames modbus TCP/IP

Stringa di comando: ***00 00 00 00 00 0B 01 10 9C 5F 00 02 04 56 78 12 34***
Stringa di risposta: ***00 00 00 00 00 06 01 10 9C 5F 00 02***

La rappresentazione dei dati in SlimLine è nel formato ***Little-Endian***, la numerazione inizia dal byte meno significativo per finire col più significativo, quindi come si nota dalla stringa di comando il valore da scrivere a 32 bits ***0x12345678*** viene definito suddiviso in due registri a 16 bits con i valori ***0x5678***, ***0x1234***.

6.2 Accesso Real time clock da modbus

E' possibile accedere al real time clock utilizzando i comandi modbus di accesso ai registri le funzioni supportate sono:

Code	Function	Tipo oggetto	Tipo accesso	Range indirizzo
03h	Read holding registers	Word (16 Bit)	Read	100-105 (150 per l'Epoch time)
04h	Read input registers	Word (16 Bit)	Read	100-105 (150 per l'Epoch time)
06h	Preset single register	Word (16 Bit)	Write	100-105 (150 per l'Epoch time)
10h	Preset multiple registers	Word (16 Bit)	Write	100-105 (150 per l'Epoch time)

I registri (16 Bits) del real time clock sono allocati in locazioni consecutive a partire dall'indirizzo modbus 100. I registri contengono il valore attuale del real time clock e scrivendo un nuovo valore il real time clock verrà automaticamente aggiornato.

Address	Register	Note
100	Second	Valore secondi (Range da 0 a 59)
101	Minute	Valore minuti (Range da 0 a 59)
102	Hour	Valore ora (Range da 0 a 23)
103	Day	Valore giorno (Range da 1 a 31)
104	Month	Valore mese (Range da 1 a 12)
105	Year	Valore anno (Range da 1900 a 2037)

6.2.1 Lettura RTC da modbus

Per la lettura dei registri del real time clock si utilizza il comando ***Read holding registers*** (Codice ***0x03***). Dovremo leggere 6 registri consecutivi a partire dall'indirizzo di allocazione, l'indirizzamento di modbus prevede un offset di 1, quindi ***99*** (***0x0063***).

Frames modbus RTU

Stringa di comando: ***01 03 00 63 00 06 35 D6***
Stringa di risposta: ***01 03 0C 00 1E 00 30 00 0B 00 1D 00 09 07 DA A2 32***

Frames modbus TCP/IP

Stringa di comando: ***00 00 00 00 00 06 01 03 00 63 00 06***
Stringa di risposta: ***00 00 00 00 00 0F 01 03 0C 00 1E 00 30 00 0B 00 1D 00 09 07 DA***

Come si vede dalla risposta il valore è:

Secondi: 30 (***0x001E***)
Minuti: 48 (***0x0030***)
Ora: 11 (***0x000B***)
Giorno: 29 (***0x001D***)
Mese: 9 (***0x0009***)
Anno: 2010 (**0x07DA**)

6.2.2 Scrittura RTC da modbus

Per la scrittura dei registri del real time clock si utilizza il comando ***Preset multiple registers*** (Codice ***0x10***). Dovremo scrivere 6 registri consecutivi a partire dall'indirizzo di allocazione, l'indirizzamento di modbus prevede un offset di 1, quindi ***99*** (***0x0063***). Ipotizziamo di dover impostare nel real time clock i valori:

Secondi: 30 (***0x001E***)
Minuti: 48 (***0x0030***)
Ora: 11 (***0x000B***)
Giorno: 29 (***0x001D***)
Mese: 9 (***0x0009***)
Anno: 2010 (**0x07DA**)

Frames modbus RTU

Stringa di comando: ***01 10 00 63 00 06 08 00 1E 00 30 00 0B 00 1D 00 09 07 DA 5D C8***
Stringa di risposta: ***01 10 00 63 00 06 B0 15***

Frames modbus TCP/IP

Stringa di comando: ***00 00 00 00 00 13 01 10 00 63 00 06 08 00 1E 00 30 00 0B 00 1D 00 09 07 DA***
Stringa di risposta: ***00 00 00 00 00 06 01 10 00 63 00 06***

6.3 Accesso Epoch time da modbus

E' allocato anche un registro a 32 bits per il valore di data/ora in Epoch time, l'acceso a questo registro in lettura e/o scrittura và sempre effettuato usando due registri a 16 bits.

Address	Register	Note
150	Epoch time	Epoch time

6.3.1 Lettura Epoch time da modbus

Per la lettura dell'epoch time si utilizza il comando ***Read holding registers*** (Codice ***0x03***). Dovremo leggere 2 registri consecutivi a partire dall'indirizzo di allocazione, l'indirizzamento di modbus prevede un offset di 1, quindi ***149*** (***0x0095***).

Frames modbus RTU

Stringa di comando: ***01 03 00 95 00 02 D4 27***
Stringa di risposta: ***01 03 04 30 B5 4C A3 90 6C***

Frames modbus TCP/IP

Stringa di comando: ***00 00 00 00 00 06 01 03 00 95 00 02***
Stringa di risposta: ***00 00 00 00 00 07 01 03 04 30 B5 4C A3***

Come si vede dalla risposta il valore è: ***0x4CA330B5 → 1285763253 → GMT: Wed, 29 Sep 2010 12:27:33 UTC***.

6.3.2 Scrittura Epoch time da modbus

Per la scrittura dell'epoch time si utilizza il comando ***Preset multiple registers*** (Codice ***0x10***). Dovremo scrivere 2 registri consecutivi a partire dall'indirizzo di allocazione, l'indirizzamento di modbus prevede un offset di 1, quindi ***149*** (***0x0095***). Ipotizziamo di dover impostare il valore:

GMT: Wed, 29 Sep 2010 12:27:33 UTC → 1285763253 → 0x4CA330B5

Frames modbus RTU

Stringa di comando: ***01 10 00 95 00 02 04 30 B5 4C A3 50 A3***
Stringa di risposta: ***01 10 00 95 00 02 51 E4***

Frames modbus TCP/IP

Stringa di comando: ***00 00 00 00 00 0B 01 10 00 95 00 02 04 30 B5 4C A3***
Stringa di risposta: ***00 00 00 00 00 06 01 10 00 95 00 02***

7 Funzioni ed FB

Funzioni

Le funzioni hanno numero di variabili in ingresso variabile e sempre una sola variabile in uscita. Per utilizzarle basta inserirle nei programmi LD ed FBD e connetterle alle variabili. Nei programmi IL devono essere chiamate con l'istruzione CAL, nei programmi ST basta indicarne il nome per essere eseguite.

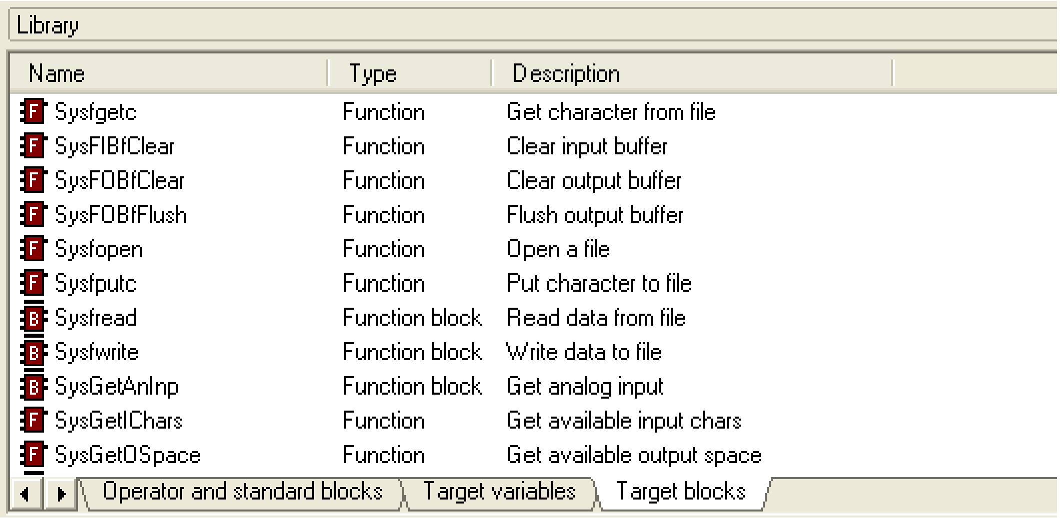
Function Blocks

Le FB a differenza delle funzioni allocano nel programma una variabile che contiene tutte le variabili di input e di output gestite dal blocco funzione. Per utilizzarle basta inserirle nei programmi LD ed FBD e connetterle alle variabili. Nei programmi IL devono essere chiamate con l'istruzione CAL, nei programmi ST basta indicarne il nome per essere eseguite.

7.0.1 Funzioni ed FB embedded

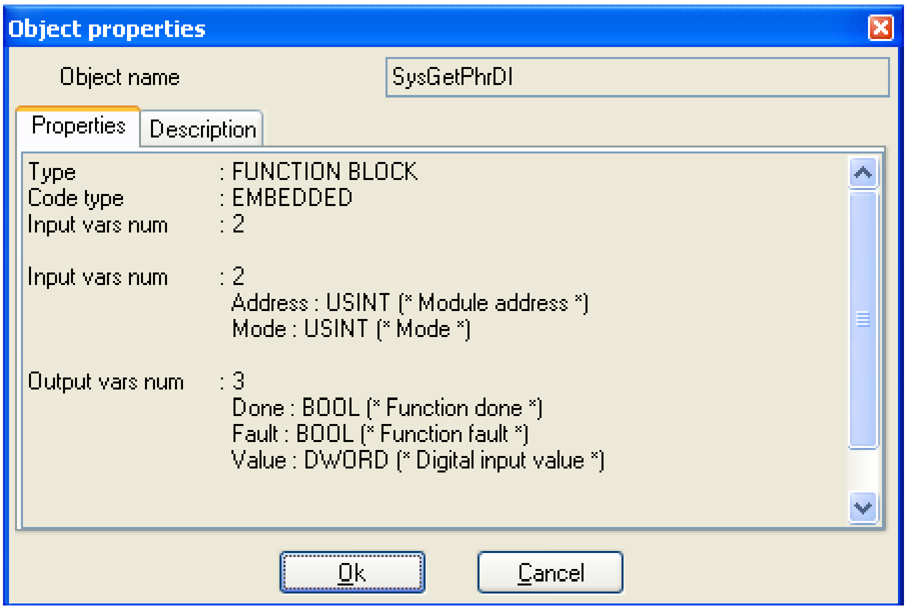
Con l'ambiente di sviluppo LogicLab vengono fornite funzioni e blocchi funzione (FB) embedded che permettono di accedere alle risorse hardware e software del sistema ***Slim line***. Le funzioni e le FB embedded sono visualizzate da LogicLab nella finestra delle librerie.

Se la finestra non è visualizzata, occorre abilitarne la visualizzazione dalla voce di menù ***View*** → ***Tool windows*** → ***Library***. Attivando il Tab ***Target blocks*** verrà visualizzato un elenco con tutte le funzioni (Indicate con ***F***) ed i blocchi funzione (Indicati con ***B***) embedded.



Name	Type	Description
F Sysfgetc	Function	Get character from file
F SysFIBfClear	Function	Clear input buffer
F SysFOBfClear	Function	Clear output buffer
F SysFOBfFlush	Function	Flush output buffer
F Sysfopen	Function	Open a file
F Sysfputc	Function	Put character to file
B Sysfread	Function block	Read data from file
B Sysfwrite	Function block	Write data to file
B SysGetAnInp	Function block	Get analog input
F SysGetIChars	Function	Get available input chars
F SysGetOSpace	Function	Get available output space

Agendo con il tasto destro del mouse su ogni singola funzione o blocco funzione è possibile visualizzarne la finestra delle proprietà in cui sono indicate le variabili in ingresso ed il ritorno delle funzioni, mentre per i blocchi funzioni sono indicate le variabili in ingresso ed in uscita, cosi come nella figura a lato.



Object name: SysGetPhrDI

```
Type              : FUNCTION BLOCK
Code type         : EMBEDDED
Input vars num    : 2

Input vars num    : 2
                    Address : USINT (* Module address *)
                    Mode : USINT (* Mode *)

Output vars num   : 3
                    Done : BOOL (* Function done *)
                    Fault : BOOL (* Function fault *)
                    Value : DWORD (* Digital input value *)
```

7.0.2 Librerie

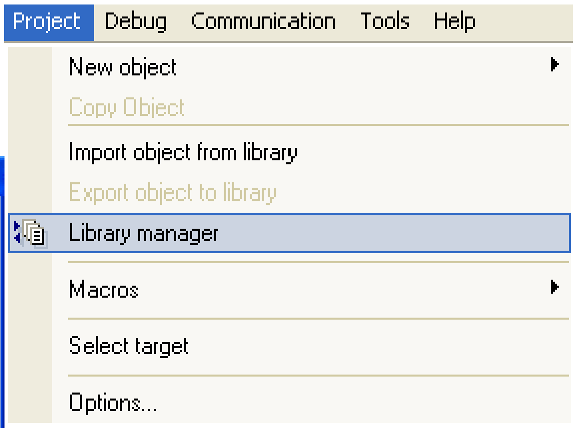
In aggiunta alle funzioni ed FB embedded sono fornite delle librerie che contengono una serie di funzioni e blocchi funzioni che possono essere utilizzati nel proprio programma. Le librerie fornite con LogicLab si trovano nella directory di installazione programma ***Programmi\Elsist\IEC61131Suite\LogicLab2p0\Libraries***, ma è possibile anche utilizzare librerie fornite successivamente o di cui si è eseguito il download dal sito. Esistono due possibilità per utilizzare le librerie:

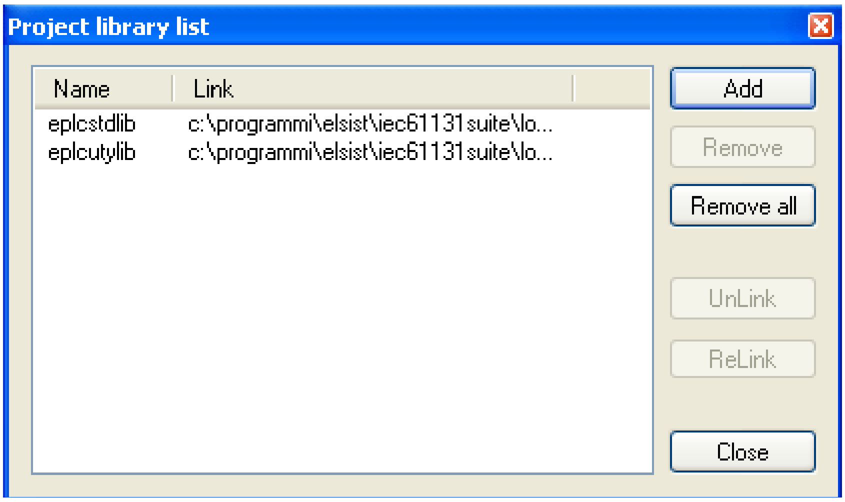
Import libreria: In questo modo vengono importati nel proprio programma tutti gli oggetti presenti nella libreria, gli oggetti possono così essere utilizzati nel programma. Questa è una buona soluzione. La controindicazione è quella di aumentare la dimensione del file di progetto LogicLab (*.ppjs), in quanto deve contenere oltre al proprio programma anche tutti gli oggetti della libreria importata. ***Il programma eseguibile generato conterrà comunque solo gli oggetti utilizzati***.

Import oggetti: In questo modo è possibile importare da una libreria solo gli oggetti (Funzioni, FB, ecc) che interessano, i quali diverranno parte integrante del proprio progetto.

7.0.3 Import libreria

Con questa modalità vengono importati tutti gli oggetti presenti nella libreria. Per importare nel proprio programma l'intera libreria dal menù selezionare la voce ***Project → Library manager*** si aprirà una finestra come quella sotto riportata.



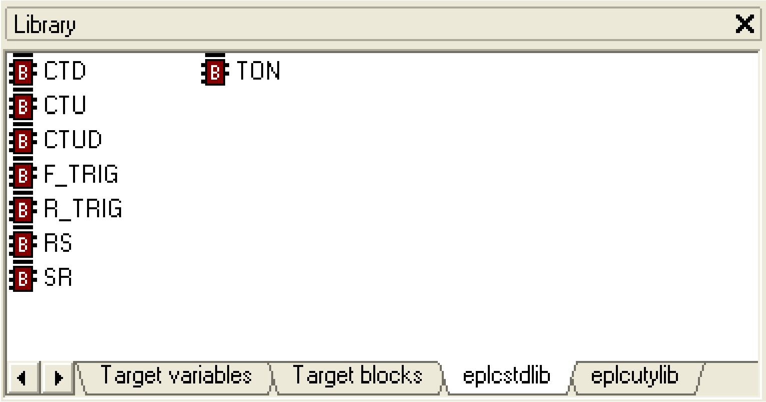


Name	Link
eplcstdlib	c:\programmi\elsist\iec61131suite\lo...
eplcutylib	c:\programmi\elsist\iec61131suite\lo...

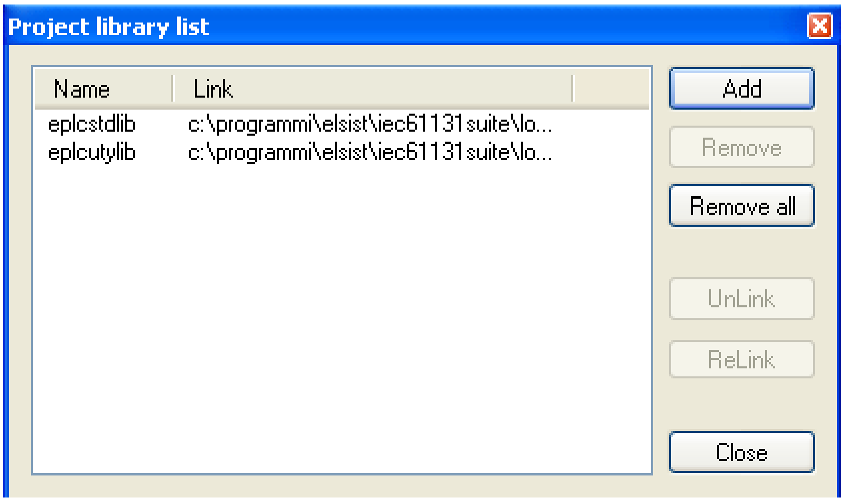
Agendo sul tasto ***Add*** si aprirà una finestra di browser del disco. Scegliere la directory dove si trova la libreria, e selezionare i files di libreria da importare.

Agendo sul tasto ***Close***, nella finestra ***Library*** di LogicLab (***Ctrl-L***) verranno visualizzati dei tabs aggiuntivi, uno per ogni libreria importata.

Basta trascinare l'oggetto desiderato nel proprio progetto per poterlo utilizzare.



7.0.4 Link a libreria



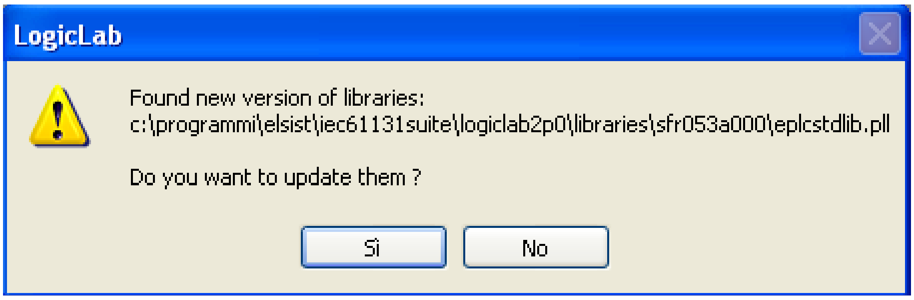
Name	Link
eplcstdlib	c:\programmi\elsist\iec61131suite\lo...
eplcutylib	c:\programmi\elsist\iec61131suite\lo...

Eseguendo l'import delle librerie nel proprio progetto come indicato al capitolo precedente tutti gli oggetti della libreria importata vengono trasferiti nel proprio file di progetto (*.ppjs), ma viene comunque mantenuto un link alla libreria di origine come si vede dalla finestra a lato.

Questo permette nel caso la libreria sorgente venga modificata con una versione più recente di effettuare l'aggiornamento automatico della nuova libreria nel proprio progetto.

Se la libreria sorgente non è più presente oppure è stata spostata dalla posizione da dove è stata importata, LogicLab non eseguirà più il controllo senza segnalare errori.

Tramite il menù ***Project*** → ***Library manager*** che apre la finestra a lato, come si vede, è possibile selezionare le varie librerie e con il tasto ***UnLink*** rimuovere il link oppure con il tasto ***ReLink*** eseguire un link alla nuova posizione dove si trova la libreria.



Found new version of libraries:
c:\programmi\elsist\iec61131suite\logiclab2p0\libraries\sfr053a000\eplcstdlib.pll

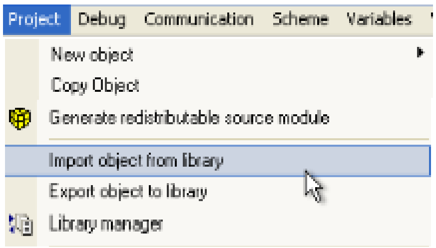
Do you want to update them ?

Aprendo il progetto, LogicLab controlla tutte le librerie importate e nel caso una o più librerie sorgenti siano più recenti delle versioni importate viene visualizzato un messaggio di avvertimento che chiede conferma se eseguire oppure no l'aggiornamento delle librerie.

Eseguendo l'aggiornamento tutti gli oggetti della libreria importata presenti nel proprio progetto vengono sovrascritti con gli oggetti presenti nella libreria sorgente ed eventuali nuovi oggetti sono automaticamente importati.

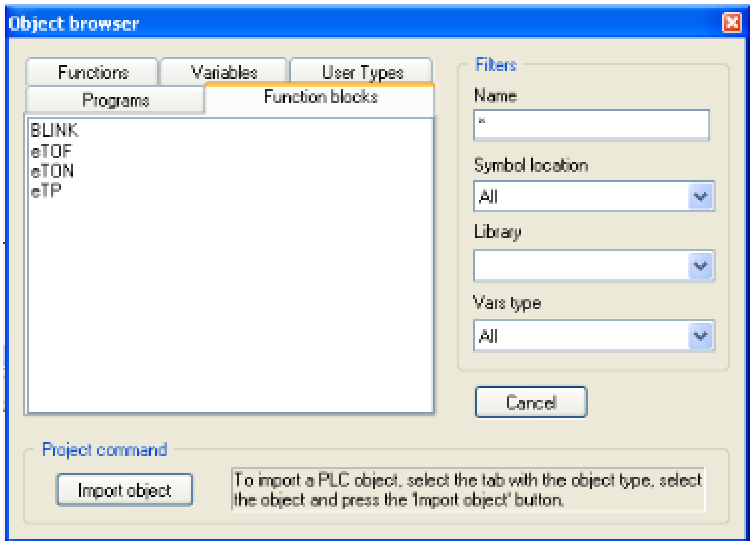
7.0.5 Importazione oggetti

Per importare nel proprio programma oggetti dalle librerie occorre nel menù selezionare la voce ***Project → Import object from library***. Si aprirà una finestra di browser del disco. Scegliere la directory dove si trova la libreria, e selezionare il file di libreria da cui si desidera importare gli oggetti.

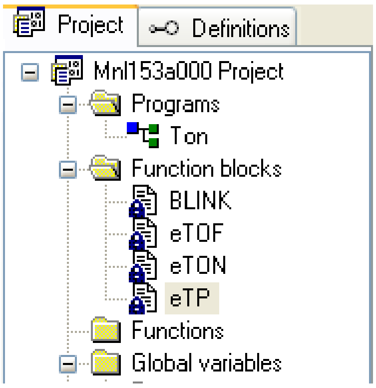


Si aprirà la finestra di ***Object browser*** che permetterà di visualizzare tutti gli oggetti presenti nella libreria. Selezionando i vari tabulatori presenti è possibile visualizzare tutti gli oggetti della libreria ordinati per nome.

Con un click del mouse si evidenzia l'oggetto o gli oggetti desiderati. Con il tasto ***Import object*** gli oggetti selezionati verranno inclusi nel programma.



To import a PLC object, select the tab with the object type, select the object and press the 'Import object' button.



Come si nota dalla foto a destra alcuni oggetti appaiono visualizzati con un simbolo di lucchetto, questo sta ad indicare che sono oggetti protetti, cioè non possono essere modificati. Una volta importati nel proprio programma gli oggetti resteranno inclusi nel programma stesso e sarà possibile utilizzarli su qualsiasi PC anche se non si dispone della libreria originale.

7.0.6 Considerazioni su link a libreria e su import oggetti

Come visto nei paragrafi precedenti per utilizzare funzioni e/o blocchi funzione di libreria è possibile usare due diversi metodi, importare solo l'oggetto desiderato oppure tutta la libreria nel proprio progetto.

In entrambi i casi l'oggetto verrà incluso nel proprio progetto, in questo modo si è sicuri che anche nel futuro con versioni successive di libreria sarà sempre possibile ricompilare il progetto utilizzando l'oggetto con il quale si era sviluppato e testato.

Nel caso si desideri sostituire l'oggetto con una versione più recente dello stesso si userà un diverso approccio in funzione del fatto che l'oggetto sia presente in una libreria collegata oppure sia stato importato.

Libreria collegata

Come visto precedentemente, le librerie collegate mantengono un riferimento alla libreria di origine, nel percorso di memorizzazione nella distribuzione di LogicLab le librerie sono incluse in directories il cui nome rappresenta la versione. In questo modo potranno essere distribuite versioni successive di libreria, ma il progetto alla sua riapertura farà sempre il controllo con la versione originale senza eseguire l'aggiornamento automatico.

Per effettuare l'aggiornamento di un oggetto di una libreria collegata occorre eseguire un ***ReLink*** alla nuova versione della libreria. ***Attenzione!*** Questa operazione aggiornerà tutti gli oggetti presenti nella libreria.

Oggetto importato

Nel caso di oggetto importato, per effettuare l'aggiornamento, basterà rimuovere l'oggetto attuale dal progetto ed eseguire un import dello stesso oggetto dalla nuova versione della libreria.

Conclusioni

In generale si consiglia di non eseguire il collegamento della libreria ma di includere i singoli oggetti nel proprio progetto, questo permette una più semplice gestione degli aggiornamenti.

Alcune librerie contengono una serie di oggetti (Funzioni e blocchi funzione) che sono di vasto impiego, in questo caso è consigliabile sempre collegare queste librerie. Ecco l'elenco delle librerie che si consiglia di collegare al progetto:

Libreria	**Codice**	**Descrizione**
ePLCStdLib	SFR053*000	Libreria standard IEC61131, contiene funzioni e blocchi funzione definiti dalla normativa IEC61131 e non presenti nella libreria embedded del prodotto.
ePLCAuxLib	SFR058*000	Libreria ausiliaria, contiene funzioni e blocchi funzione di varia utilità.

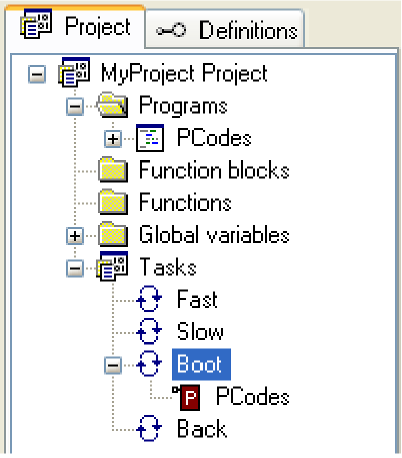
7.0.7 Protezione funzioni e blocchi funzione

Alcune funzioni e/o blocchi funzione di libreria possono essere protetti da un codice che deve essere ordinato separatamente. Per abilitarne l'esecuzione occorre sbloccarle definendone il codice (Stringa alfabetica di 18 caratteri) con la funzione ***SysPCodeAccept***.

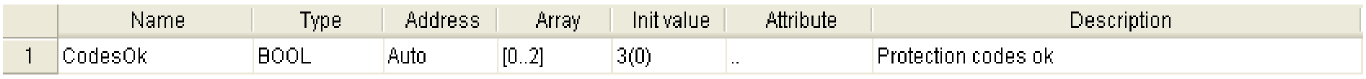
La funzione deve essere eseguita una sola volta passando il codice di protezione, se il codice è corretto la funzione ritorna ***TRUE*** e la relativa funzione sarà sprotetta fino al prossimo riavvio del programma. E' possibile eseguire più chiamate alla funzione una per ogni codice di protezione da definire.

Il consiglio è di inserire le varie chiamate alla funzione in un programma che verrà eseguito nella task di boot quindi prima di ogni chiamata ad altri programmi, garantendo lo sblocco delle funzioni desiderate.

A lato si può vedere come in un progetto il programma di definizione codici di protezione ***PCodes*** sia definito nella esecuzione della task di boot. Di seguito riportiamo il codice sorgente del programma ***PCodes*** realizzato in linguaggio ST. Naturalmente i codici riportati sono di fantasia pertanto se eseguito la funzione ***SysPCodeAccept*** ritornerà sempre ***FALSE***.



Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	CodesOk	BOOL	Auto	[0..2]	3(0)	..	Protection codes ok

Programma ST

```
(* Check the protection codes. *)

    CodesOk[0]:=SysPCodeAccept('abcdefghijklmnopqr'); (* Protection code ok (Function 1) *)
    CodesOk[1]:=SysPCodeAccept('rqponmlkjihgfedcba'); (* Protection code ok (Function 2) *)
    CodesOk[2]:=SysPCodeAccept('abcdefghiihgfedcba'); (* Protection code ok (Function 3) *)

(* [End of file] *)
```

Normalmente le funzioni ed i blocchi funzioni protetti possono funzionare in modo demo per un certo periodo di tempo dalla loro prima esecuzione dopo l'accensione del sistema. Terminato il tempo di prova termina il funzionamento e viene generato un errore che è rilevabile con la funzione ***SysGetLastError***.

7.1 Funzioni ed FB per gestione Flip/Flop

7.1.1 F_TRIG, Falling edge trigger

Type	Library	Version
FB	ePLCStdLib	SFR053A000

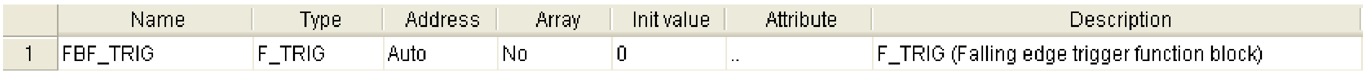
Questo blocco funzione attiva l'uscita ***Q*** per un loop di programma sul fronte di disattivazione dell'ingresso di clock ***CLK***.

CLK (BOOL)	Clock, sul fronte di disattivazione del segnale, viene attivata l'uscita Q per un loop di programma.
Q (BOOL)	Uscita, attiva per un loop di programma sul fronte di disattivazione dell'ingresso di clock CLK.

Esempi

Sul fronte di disattivazione dell'ingresso digitale ***Di00M00*** viene attivata per un loop di programma l'uscita digitale ***Do00M00***.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	FBF_TRIG	F_TRIG	Auto	No	0	..	F_TRIG (Falling edge trigger function block)

Esempio LD *(Ptp115a100)*

Esempio IL

```
CAL FBF_TRIG (* Call the F_TRIG function block *)

LD Di00M00
ST FBF_TRIG.CLK (* Transfer the digital input to the function block clock *)

LD FBF_TRIG.Q
ST Do00M00  (* On the falling edge of digital input the output is set *)
```

Esempio ST

```
FBF_TRIG(); (* Call the F_TRIG function block *)

FBF_TRIG.CLK:=Di00M00; (* Transfer the digital input to the function block clock *)
Do00M00:=FBF_TRIG.Q; (* On the falling edge of digital input the output is set *)
```

7.1.2 R_TRIG, Raising edge trigger

Type	Library	Version
FB	ePLCStdLib	SFR053A000

Questo blocco funzione attiva l'uscita ***Q*** per un loop di programma sul fronte di attivazione dell'ingresso di clock ***CLK***.

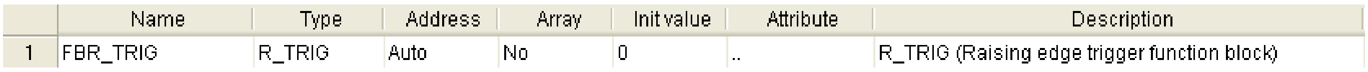
CLK (BOOL) Clock, sul fronte di attivazione del segnale, viene attivata l'uscita Q per un loop di programma.

Q (BOOL) Uscita, attiva per un loop di programma sul fronte di attivazione dell'ingresso di clock CLK.

Esempi

Sul fronte di attivazione dell'ingresso digitale ***Di00M00*** viene attivata per un loop di programma l'uscita digitale ***Do00M00***.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	FBR_TRIG	R_TRIG	Auto	No	0	..	R_TRIG (Raising edge trigger function block)

Esempio LD *(Ptp115a100)*

Esempio IL

```
CAL FBR_TRIG (* Call the R_TRIG function block *)

LD Di00M00
ST FBR_TRIG.CLK (* Transfer the digital input to the function block clock *)

LD FBR_TRIG.Q
ST Do00M00 (* On the raising edge of digital input the output is set *)
```

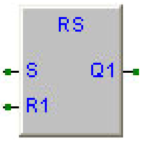
Esempio ST

```
FBR_TRIG(); (* Call the R_TRIG function block *)

FBR_TRIG.CLK:=Di00M00; (* On the raising edge of digital input the counter count up *)
Do00M00:=FBR_TRIG.Q; (* On the raising edge of digital input the output is set *)
```

7.1.3 RS, Reset/Set flip flop

Type	Library	Version
FB	ePLCStdLib	SFR053A000

Questo blocco funzione su attivazione del comando di set ***S*** attiva l'uscita ***Q1*** che rimane attiva anche quando il comando viene disattivato. Per disattivare l'uscita occorre attivare il comando di reset ***R1***.



Il comando di reset R1 è prioritario sul comando di set S.

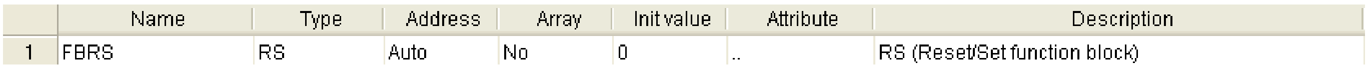
S (BOOL)	Set, su attivazione del segnale, viene attivata l'uscita Q1 che rimane attiva anche quando il comando viene disattivato.
R1 (BOOL)	Reset, su attivazione del segnale, viene disattivata l'uscita Q1 è prioritario sul comando di set S.
Q1 (BOOL)	Uscita, si attiva e disattiva in funzione dei comandi di S set e R1 reset.

Esempi

Sulla attivazione dell'ingresso digitale ***Di00M00*** viene attivata l'uscita digitale ***Do00M00*** che rimane attiva anche quando l'ingresso digitale ***Di00M00*** viene disattivato. Per disattivare l'uscita digitale ***Do00M00*** occorre attivare l'ingresso digitale ***Di01M00***.

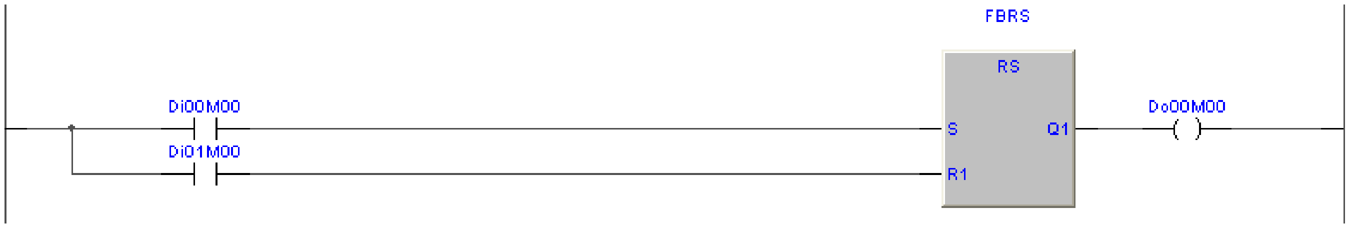
Nota! L'ingresso digitale ***Di01M00*** ha la priorità sull'ingresso digitale ***Di00M00***.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	FBRS	RS	Auto	No	0	..	RS (Reset/Set function block)

Esempio LD (Ptp115a100)



Esempio IL

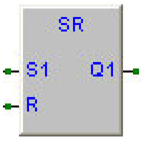
```
CAL FBRS (* Call the RSG function block *)

LD Di00M00
ST FBRS.S (* Transfer the digital input to the set command *)

LD Di01M00
ST FBRS.R1 (* Transfer the digital input to the reset command *)

LD FBRS.Q1
ST Do00M00 (* The function block output is copied to digital output *)
```

Esempio ST

```
FBRS(); (* Call the RS function block *)

FBRS.S:=Di00M00; (* Transfer the digital input to the set command *)
FBRS.R1:=Di01M00; (* Transfer the digital input to the reset command *)
Do00M00:=FBRS.Q1; (* The function block output is copied to digital output *)
```

7.1.4 SR, Set/Reset flip flop

Type	Library	Version
FB	ePLCStdLib	SFR053A000



Questo blocco funzione su attivazione del comando di set ***S1*** attiva l'uscita ***Q1*** che rimane attiva anche quando il comando di set viene disattivato. Per disattivare l'uscita occorre attivare il comando di reset ***R***.

Il comando di set S1 è prioritario sul comando di reset R.

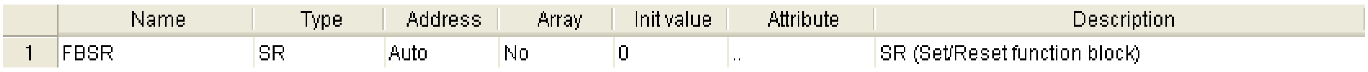
S1 (BOOL)	Set, su attivazione del segnale, viene attivata l'uscita Q1 che rimane attiva anche quando il comando viene disattivato. Il comando è prioritario sul comando di reset R.
R (BOOL)	Reset, su attivazione del segnale, viene disattivata l'uscita Q1.
Q1 (BOOL)	Uscita, si attiva e disattiva in funzione dei comandi di S set e R reset.

Esempi

Sulla attivazione dell'ingresso digitale ***Di00M00*** viene attivata l'uscita digitale ***Do00M00*** che rimane attiva anche quando l'ingresso digitale ***Di00M00*** viene disattivato. Per disattivare l'uscita digitale ***Do00M00*** occorre attivare l'ingresso digitale ***Di01M00***.

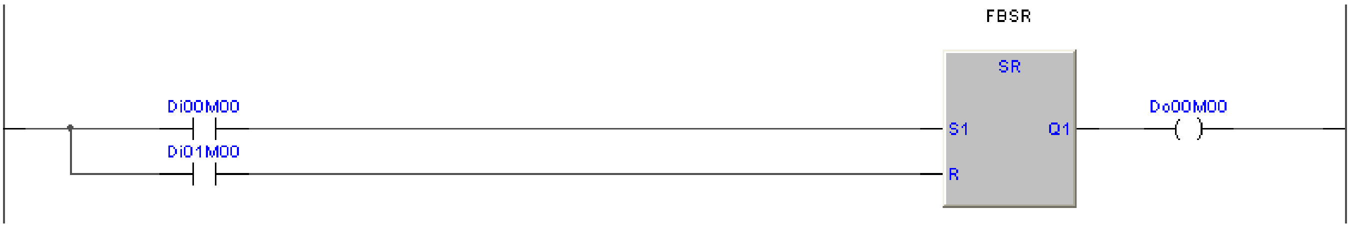
Nota! L'ingresso digitale ***Di00M00*** ha la priorità sull'ingresso digitale ***Di01M00***.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	FBSR	SR	Auto	No	0	..	SR (Set/Reset function block)

Esempio LD *(Ptp115a100)*



Esempio IL

```
CAL FBSR (* Call the SR function block *)

LD Di00M00
ST FBRS.S1 (* Transfer the digital input to the set command *)

LD Di01M00
ST FBRS.R (* Transfer the digital input to the reset command *)

LD FBRS.Q1
ST Do00M00 (* The function block output is copied to digital output *)
```

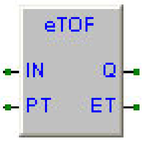
Esempio ST

```
FBSR(); (* Call the SR function block *)

FBSR.S1:=Di00M00; (* Transfer the digital input to the set command *)
FBSR.R:=Di01M00; (* Transfer the digital input to the reset command *)
Do00M00:=FBSR.Q1; (* The function block output is copied to digital output *)
```

7.2 Funzioni ed FB per gestione timers

7.2.1 eTOF, Timer Off

Type	Library	Version
FB	ePLCStdLib	SFR053A000



Questo blocco funzione esegue la temporizzazione sulla disattivazione, attivando l'ingresso ***IN*** l'uscita ***Q*** si attiva immediatamente ed il tempo in uscita ***ET*** si azzera. Disattivando l'ingresso IN inizia il conteggio e dopo il tempo definito ***PT*** espresso in mS, si disattiva l'uscita ***Q***. Sulla uscita ***ET*** viene ritornato il tempo trascorso dalla disattivazione dell'ingresso espresso in mS.

IN (BOOL) Ingresso timer, attivandolo l'uscita Q si attiva immediatamente ed il tempo in uscita ET si azzera. Disattivandolo inizia il conteggio e dopo il tempo definito in PT, si disattiva l'uscita Q.

PT (UDINT) Preset tempo, definisce il tempo di ritardo dalla disattivazione dell'ingresso IN alla disattivazione dell'uscita Q, espresso in mS.

Q (BOOL) Uscita timer, si attiva su attivazione ingresso IN, e si disattiva dopo il tempo definito in PT dalla disattivazione dell'ingresso IN.

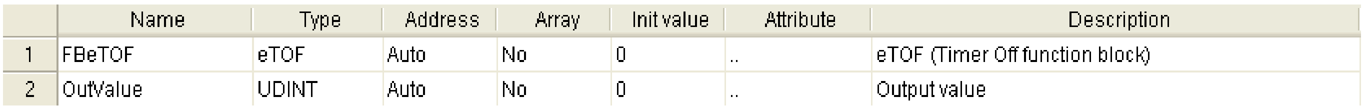
ET (UDINT) Tempo timer, si azzera su attivazione ingresso IN ed inizia conteggio da disattivazione ingresso IN. Raggiunto tempo impostato in PT si arresta conteggio, espresso in mS.

Esempi

Il timer è presettato a 1 secondo (1000 mS). Attivando l'ingresso digitale ***Di00M00*** si attiva immediatamente l'uscita digitale ***Do00M00*** ed il valore di tempo nella variabile ***VarOut*** è azzerato.

Disattivando l''ingresso digitale ***Di00M00*** il timer inizia il conteggio del tempo, il valore di tempo trascorso dalla disattivazione è trasferito nella variabile ***VarOut***. Trascorso il tempo l'uscita digitale ***Do00M00*** si disattiva.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	FBeTOF	eTOF	Auto	No	0	..	eTOF (Timer Off function block)
2	OutValue	UDINT	Auto	No	0	..	Output value

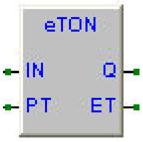
Esempio LD *(Ptp115a100)*

Esempio IL

```
CAL FBeTOF (* Call the eTOF function block *)

LD  Di00M00
ST  FBeTOF.IN (* Transfer the digital input to timer input *)

LD  1000
ST  FBeTOF.PT (* Set the delay time *)

LD  FBeTOF.Q
ST  Do00M00 (* When time is passed the digital output is set *)

LD  FBeTOF.ET
ST  OutValue (* The counting time is copied to variable *)
```

7.2.2 eTON, Timer On

Type	Library	Version
FB	ePLCStdLib	SFR053A000



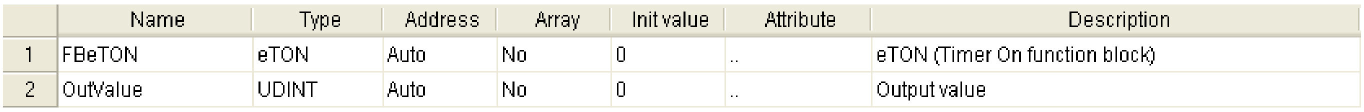
Questo blocco funzione esegue la temporizzazione sulla attivazione, attivando l'ingresso ***IN*** inizia il conteggio e dopo il tempo definito ***PT*** espresso in mS, si attiva l'uscita ***Q***. Sulla uscita ***ET*** viene ritornato il tempo trascorso dalla attivazione dell'ingresso espresso in mS. Disattivando l'ingresso ***IN*** l'uscita ***Q*** si disattiva istantaneamente ed il valore di tempo su uscita ***ET*** si azzera.

IN (BOOL)	Ingresso timer, attivandolo inizia il conteggio e dopo il tempo definito in PT, si attiva l'uscita Q. Disattivandolo l'uscita Q si disattiva immediatamente ed il tempo in uscita ET si azzera.
PT (UDINT)	Preset tempo, definisce il tempo di ritardo dalla attivazione dell'ingresso IN alla attivazione dell'uscita Q, espresso in mS.
Q (BOOL)	Uscita timer, si attiva dopo il tempo definito in PT dalla attivazione dell'ingresso IN e si disattiva su disattivazione ingresso IN.
ET (UDINT)	Tempo timer, inizia conteggio da attivazione ingresso IN, raggiunto tempo impostato in PT si arresta conteggio. Si azzera su disattivazione ingresso IN, espresso in mS.

Esempi

Su attivazione dell'ingresso digitale ***Di00M00*** dopo 1 S (1000 mS) viene attivata l'uscita digitale ***Do00M00***. Disattivando l'ingresso digitale ***Di00M00*** l'uscita digitale ***Do00M00*** si disattiva immediatamente.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	FBeTON	eTON	Auto	No	0	..	eTON (Timer On function block)
2	OutValue	UDINT	Auto	No	0	..	Output value

Esempio LD *(Ptp115a100)*

Esempio IL

```
CAL FBeTON (* Call the eTON function block *)
LD  Di00M00
ST  FBeTON.IN (* Transfer the digital input to timer input *)

LD  1000
ST  FBeTON.PT (* Set the delay time *)

LD  FBeTON.Q
ST  Do00M00 (* When time is passed the digital output is set *)

LD  FBeTON.ET
ST  OutValue (* The counting time is copied to variable *)
```

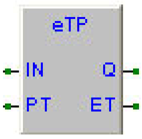
Esempio ST

```
FBeTON(PT:=1000); (* Call the eTON function block *)

FBeTON.IN:=Di00M00; (* Transfer the digital input to timer input *)
OutValue:=FBeTON.ET; (* The counting time is copied to variable *)
Do00M00:=F_eTON.Q; (* When time is passed the digital output is set *)
```

7.2.3 eTP, Timer pulse

Type	Library	Version
FB	ePLCStdLib	SFR053A000

Questo blocco funzione esegue la temporizzazione su impulso di attivazione, attivando l'ingresso ***IN*** l'uscita ***Q*** si attiva, in uscita ***ET*** è ritornato il tempo trascorso (in mS) dall'impulso di attivazione. Raggiunto il tempo impostato ***PT*** (in mS), indipendentemente dallo stato dell'ingresso ***IN***, l'uscita ***Q*** si azzera, mentre il tempo in uscita su ***ET*** si azzera solo se ingresso ***IN*** non è più attivo.



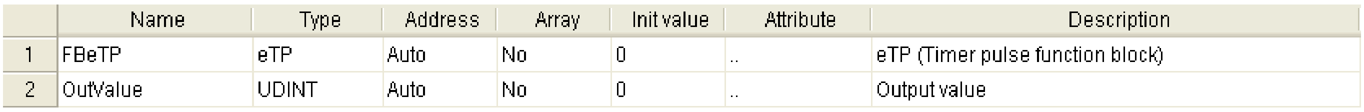
IN (BOOL)	Ingresso timer, attivandolo si attiva l'uscita Q ed inizia il conteggio, dopo il tempo definito in PT indipendentemente dallo stato dell'ingresso IN, l'uscita Q si azzera.
PT (UDINT)	Preset tempo, definisce il tempo di attivazione dell'uscita Q, espresso in mS.
Q (BOOL)	Uscita timer, si attiva all'attivazione dell'ingresso IN per il tempo definito in PT.
ET (UDINT)	Tempo timer, inizia conteggio da attivazione ingresso IN, raggiunto tempo impostato in PT si arresta conteggio, espresso in mS.

Esempi

Il timer è presettato a 5 secondi (5000 mS). Attivando l'ingresso digitale ***Di00M00*** si attiva immediatamente l'uscita digitale ***Do00M00*** ed il valore di tempo nella variabile ***VarOut*** inizia il conteggio. Raggiunto il tempo definito 5 secondi, l'uscita ***Do00M00*** si azzera mentre il valore di tempo nella variabile ***VarOut*** rimane bloccato sul valore di preset (5000 mS) sino alla disattivazione dell'ingresso ***Di00M00***.

Disattivando l'ingresso digitale ***Di00M00*** durante la temporizzazione non si hanno ripercussioni nè sullo stato dell'uscita ***Do00M00***, nè sul valore della variabile ***VarOut***.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	FBeTP	eTP	Auto	No	0	..	eTP (Timer pulse function block)
2	OutValue	UDINT	Auto	No	0	..	Output value

Esempio LD *(Ptp115a100)*

Esempio IL

```
CAL FBeTP (* Call the eTP function block *)

LD  Di00M00
ST  FBeTP.IN (* Transfer the digital input to timer input *)

LD  5000
ST  FBeTP.PT (* Set the delay time *)

LD  FBeTP.Q
ST  Do00M00 (* When time is passed the digital output is set *)

LD  FBeTP.ET
ST  OutValue (* The counting time is copied to variable *)
```

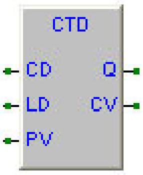
Esempio ST

```
FBeTP(PT:=5000); (* Call the eTP function block *)

FBeTP.IN:=Di00M00; (* Transfer the digital input to timer input *)
OutValue:=FBeTP.ET; (* The counting time is copied to variable *)
Do00M00:=FBeTP.Q; (* When time is passed the digital output is set *)
```

7.3 Funzioni ed FB per gestione counters

7.3.1 CTD, Counter Down

Type	Library	Version
FB	ePLCStdLib	SFR053A000



Questo blocco funzione esegue la gestione di un counter in decremento. Agendo sull'ingresso di load ***LD*** è possibile in qualsiasi momento trasferire il valore di preset definito su ***PV*** nel counter ***CV***. Ad ogni fronte di attivazione dell'ingresso ***CD***, il valore del counter ***CV*** viene decrementato, quando il valore raggiunge 0, l'uscita ***Q*** viene settata ed il conteggio si arresta. Solo agendo sull'ingresso di load ***LD*** è possibile presettare il counter e fare ripartire un nuovo conteggio.

L'ingresso di load LD è prioritario sull'ingresso di decremento CD.

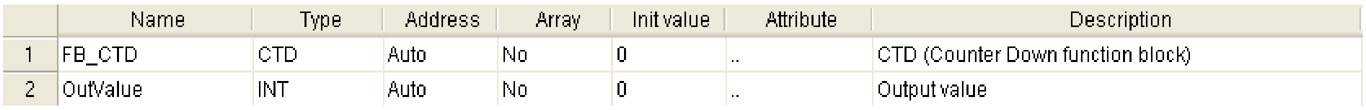
CD (BOOL)	Comando decremento counter, ad ogni fronte attivazione il valore del counter CV si decrementa.
LD (BOOL)	Comando di load, attivando l'ingresso il valore di preset PV, viene trasferito nel valore del counter CV.
PV (INT)	Valore di preset, attivando l'ingresso di load LD, viene trasferito nel valore del counter CV.
Q (BOOL)	Uscita counter, attiva se il valore del counter CV raggiunge il valore 0.
CV (INT)	Valore counter, valore di conteggio counter, quando raggiunge il valore 0, l'uscita Q si attiva ed il counter non si decrementa più.

Esempi

Il counter è presettato a 10 ed il suo valore in uscita CV è copiato nella variabile ***OutValue***. Attivando l'ingresso digitale ***Di01M00*** il counter viene presettato ed il suo valore in uscita CV è posto a 10, resettando anche l'uscita Q.

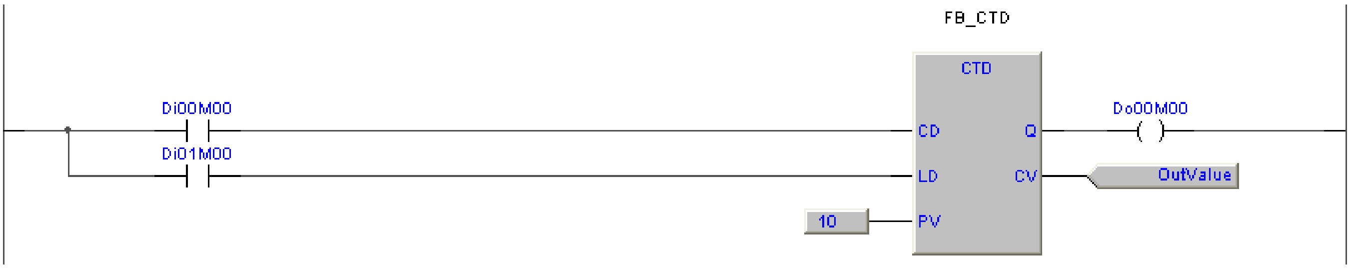
Sul fronte di attivazione dell'ingresso digitale ***Di00M00*** il counter è decrementato di 1, quando il valore di conteggio si azzera, il conteggio si arresta e viene attivata l'uscita del counter Q che attiva l'uscita digitale ***Do00M00***. Per fare ripartire il conteggio occorre attivare l'ingresso digitale ***Di01M00*** che presetta il counter.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	FB_CTD	CTD	Auto	No	0	..	CTD (Counter Down function block)
2	OutValue	INT	Auto	No	0	..	Output value

Esempio LD *(Ptp115a100)*



Esempio IL

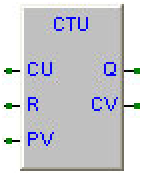
```
CAL FB_CTD (* Call the CTD function block *)
LD 10
ST FB_CTD.PV (* Preset value *)

LD Di00M01
ST FB_CTD.CD (* On the raising edge of digital input the counter count down *)

LD Di01M00
ST FB_CTD.LD (* If the digital input is set the PV value is loaded *)

LD FB_CTD.Q
ST Do00M00 (* If the counter value is 0 the digital output is set *)

LD FB_CTD.CV
ST OutValue (* The counter value is copied to the variable *)
```

Esempio ST

```
FB_CTD(PV:=10); (* Call the CTD function block and preset counter *)

FB_CTD.CD:=Di00M00; (* On the raising edge of digital input the counter count down *)
FB_CTD.LD:=Di01M00; (* If the digital input is set the PV value is loaded *)
Do00M00:=FB_CTD.Q; (* If the counter value is 0 the digital output is set *)
OutValue:=FB_CTD.CV; (* The counter value is copied to the variable *)
```

7.3.2 CTU, Counter Up

Type	Library	Version
FB	ePLCStdLib	SFR053A000



Questo blocco funzione esegue la gestione di un counter in incremento. Agendo sull'ingresso di reset ***R*** è possibile in qualsiasi momento azzerare il valore del counter ***CV***. Ad ogni fronte di attivazione dell'ingresso ***CU***, il valore del counter ***CV*** viene incrementato. Quando il valore del counter ***CV*** raggiunge il valore di preset, definito su ***PV***, l'uscita ***Q*** viene settata ed il conteggio si arresta. Solo agendo sull'ingresso di reset ***R*** si potrà resettare il counter e fare ripartire un nuovo conteggio.

L'ingresso di reset R è prioritario sull'ingresso di incremento CU.

CU (BOOL) Comando incremento counter, ad ogni fronte attivazione il valore del counter CV si incrementa.

R (BOOL) Comando di reset, attivando l'ingresso il valore del counter CV si resetta.

PV (INT) Valore di preset, quando il valore del counter CV raggiunge questo valore l'uscita Q si attiva ed il counter non si incrementa più.

Q (BOOL) Uscita counter, attiva se il valore del counter CV raggiunge il valore definito in preset PV.

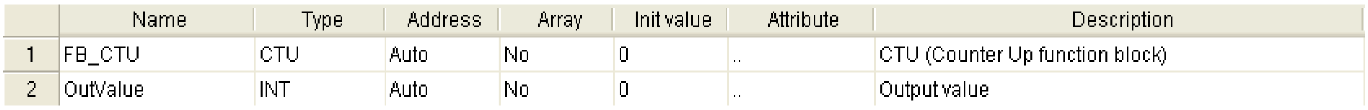
CV (INT) Valore counter, valore di conteggio counter, quando raggiunge il valore di preset PV, l'uscita Q si attiva ed il counter non si incrementa più.

Esempi

Il counter è presettato a 10 ed il suo valore in uscita CV è copiato nella variabile ***OutValue***. Attivando l'ingresso digitale ***Di01M00*** il counter viene resettato ed il suo valore in uscita CV è posto a 0, resettando anche l'uscita Q.

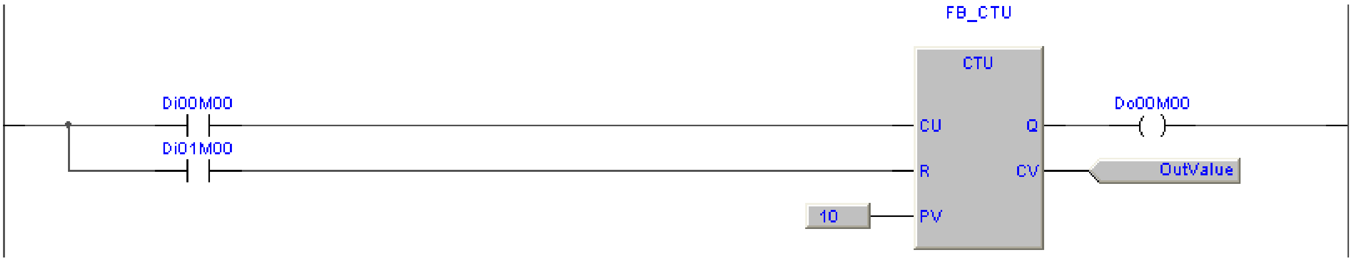
Sul fronte di attivazione dell'ingresso digitale ***Di00M00*** il counter è incrementato di 1, quando il valore di conteggio raggiunge il valore di preset, il conteggio si arresta e viene attivata l'uscita del counter Q che attiva l'uscita digitale ***Do00M00***. Per fare ripartire il conteggio occorre attivare l'ingresso digitale ***Di01M00*** che resetta il counter.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	FB_CTU	CTU	Auto	No	0	..	CTU (Counter Up function block)
2	OutValue	INT	Auto	No	0	..	Output value

Esempio LD *(Ptp115a100)*

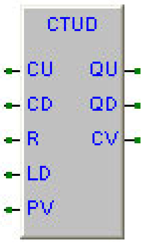


Esempio IL

```
CAL FBCTU (* Call the CTU function block *)
LD  10
ST  FBCTU.PV (* Preset counter *)

LD Di00M00
ST FB_CTU.CU (* On the raising edge of digital input the counter count up *)

LD Di01M00
ST FB_CTU.R (* If the digital input is set the counter is reset *)

LD FBCTU.Q
ST Do00M00 (* If the counter value has reached the preset the digital output is set *)

LD FB_CTU.CV
ST OutValue (* The counter value is copied to the variable *)
```

7.3.3 CTUD, Counter Up/Down

Type	Library	Version
FB	ePLCStdLib	SFR053A000



Questo blocco funzione esegue la gestione di un counter in incremento e decremento. Agendo sull'ingresso di reset R è possibile in qualsiasi momento azzerare il valore del counter ***CV***. Agendo sull'ingresso di load ***LD*** è possibile in qualsiasi momento trasferire il valore di preset definito su ***PV*** nel counter ***CV***.

Ad ogni fronte di attivazione dell'ingresso ***CU***, il valore del counter ***CV*** viene incrementato. Quando il valore del counter ***CV*** raggiunge il valore di preset, definito su ***PV***, l'uscita ***Q*** viene settata ed il conteggio si arresta. Solo agendo sull'ingresso di reset ***R*** si potrà resettare il counter e fare ripartire un nuovo conteggio.

Ad ogni fronte di attivazione dell'ingresso ***CD***, il valore del counter ***CV*** viene decrementato, quando il valore raggiunge 0, l'uscita ***Q*** viene settata ed il conteggio si arresta. Solo agendo sull'ingresso di load ***LD*** è possibile presettare il counter e fare ripartire un nuovo conteggio.

CU (BOOL)	Comando incremento counter, ad ogni fronte attivazione il valore del counter CV si incrementa
CD (BOOL)	Comando decremento counter, ad ogni fronte attivazione il valore del counter CV si decrementa.
R (BOOL)	Comando di reset, attivando l'ingresso il valore del counter CV si resetta.
LD (BOOL)	Comando di load, attivando l'ingresso il valore di preset PV, viene trasferito nel valore del counter CV.
PV (INT)	Valore di preset, quando il valore del counter CV raggiunge questo valore l'uscita Q si attiva ed il counter non si incrementa più.
QU (BOOL)	Uscita counter up, attiva se il valore del counter CV raggiunge il valore definito in preset PV.
QD (BOOL)	Uscita counter down, attiva se il valore del counter CV raggiunge il valore 0.
CV (INT)	Valore counter, valore di conteggio counter, quando raggiunge il valore di preset PV, l'uscita Q si attiva ed il counter non si incrementa più.

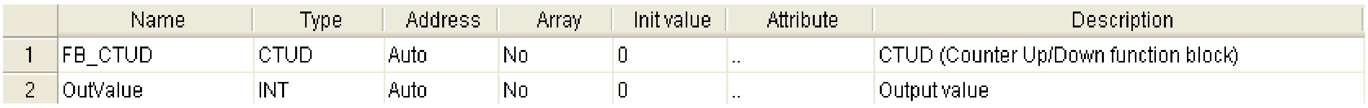
Esempi

Il counter è presettato a 10 ed il suo valore in uscita CV è copiato nella variabile ***VarOut***. Attivando l'ingresso digitale ***Di02M00*** il counter viene resettato ed il suo valore in uscita CV è posto a 0, resettando anche l'uscita QU. Attivando l'ingresso digitale ***Di03M00*** il counter viene presettato ed il suo valore in uscita CV è posto a 10, resettando anche l'uscita QD.

Sul fronte di attivazione dell'ingresso digitale ***Di00M00*** il counter è incrementato di 1, quando il valore di conteggio raggiunge il valore di preset, il conteggio si arresta e viene attivata l'uscita del counter QU che attiva l'uscita digitale ***Do00M00***. Per fare ripartire il conteggio occorre attivare l'ingresso digitale ***Di02M00*** che resetta il counter.

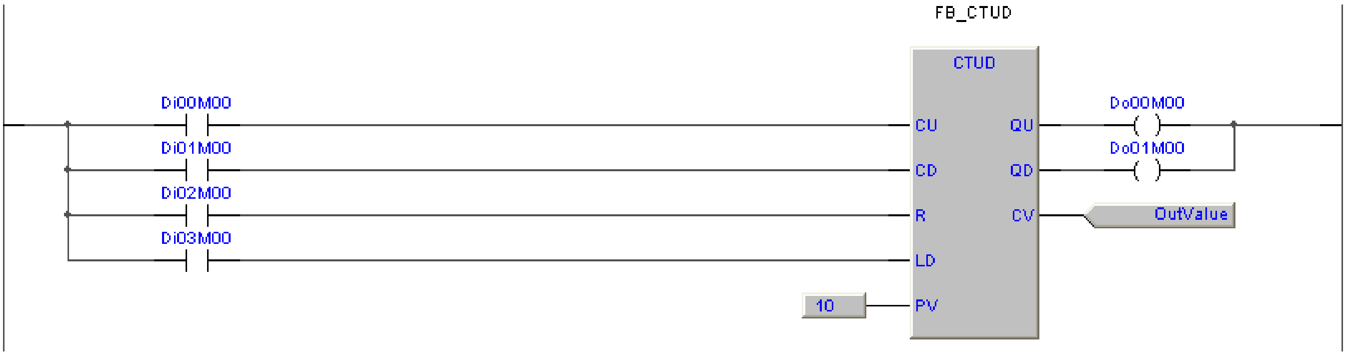
Sul fronte di attivazione dell'ingresso digitale ***Di01M00*** il counter è decrementato di 1, quando il valore di conteggio si azzera, il conteggio si arresta e viene attivata l'uscita del counter QD che attiva l'uscita digitale ***Do01M00***. Per fare ripartire il conteggio occorre attivare l'ingresso digitale ***Di03M00*** che presetta il counter.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	FB_CTUD	CTUD	Auto	No	0	..	CTUD (Counter Up/Down function block)
2	OutValue	INT	Auto	No	0	..	Output value

Esempio LD *(Ptp115a100)*



Esempio IL

```
CAL FB_CTUD (* Call the CTUD function block *)
LD 10
ST FB_CTUD.PV (* Preset value *)

LD Di00M00
ST FB_CTUD.CU (* On the raising edge of digital input the counter count up *)

LD Di01M00
ST FB_CTUD.CD (* On the raising edge of digital input the counter count down *)

LD Di02M00
ST FB_CTUD.R (* If the digital input is set the counter is reset *)

LD Di03M00
ST FB_CTUD.LD (* If the digital input is set the PV value is loaded *)

LD FB_CTUD.QU
ST Do00M00 (* If the counter value has reached the preset the digital output is set *)

LD FB_CTUD.QD
ST Do01M00 (* If the counter value is 0 the digital output is set *)

LD FB_CTUD.CV
ST OutValue (* The counter value is copied to the variable *)
```

Esempio ST

```
FB_CTUD(PV:=10); (* Call the CTD function block and preset counter *)

FB_CTUD.CU:=Di00M00; (* On the raising edge of digital input the counter count up *)
FB_CTUD.CD:=Di01M00; (* On the raising edge of digital input the counter count down *)
FB_CTUD.R:=Di02M00; (* If the digital input is set the counter is reset *)
FB_CTUD.LD:=Di03M00; (* If the digital input is set the PV value is loaded *)
Do00M00:=FB_CTUD.QU; (* If the counter value has reached the preset the digital output is set *)
Do01M00:=FB_CTUD.QD; (* If the counter value is 0 the digital output is set *)
OutValue:=FBCTUD.CV; (* The counter value is copied to the variable *)
```

7.4 Funzioni ed FB per conversione dati

7.4.1 VBitTest, Variable bit test

Type	Library	Version
Function	ePLCAuxLib	SFR058A000

Questa funzione esegue il test di un bit in una variabile.

Parametri funzione:

Variable (UDINT) Variabile in cui testare il bit.

Bit (USINT) Numero del bit da testare (Range da 0 a 31).

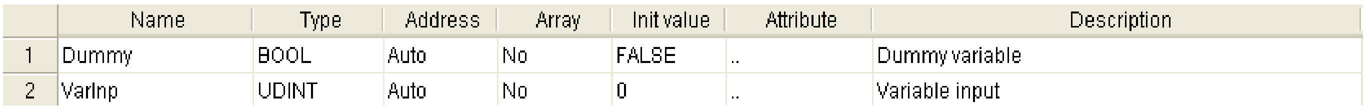
La funzione ritorna:

(BOOL) Stato bit indicato.

Esempi

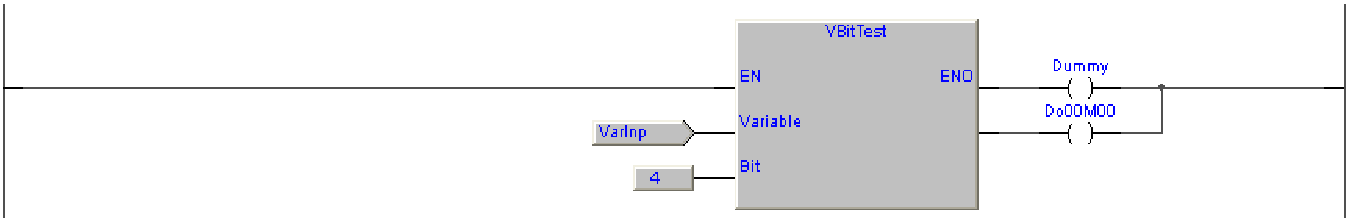
Lo stato del bit 4 della variabile ***VarInp*** viene trasferito sull'uscita digitale ***Do00M00***.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	Dummy	BOOL	Auto	No	FALSE	..	Dummy variable
2	VarInp	UDINT	Auto	No	0	..	Variable input

Esempio LD



Esempio IL

```
LD VarInp (* Variable input *)
VBitTest 4 (* Variable bit test *)
ST Do00M00 (* Transfer bit status to digital output *)
```

Esempio ST

```
Do00M00:=VBitTest(VarInp, 4); (* Variable bit test *)
```

7.4.2 VBitSet, Variable bit set

Type	Library	Version
Function	ePLCAuxLib	SFR058A000

Questa funzione esegue il set di un bit in una variabile.

Parametri funzione:

Value (BOOL) Valore bit da settare.

Variable (UDINT) Variabile in cui settare il bit.

Bit (USINT) Numero del bit da settare (Range da 0 a 31).

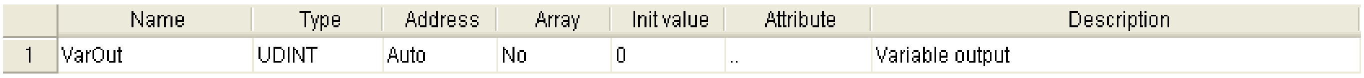
La funzione ritorna:

(UDINT) Valore variabile dopo il set del bit.

Esempi

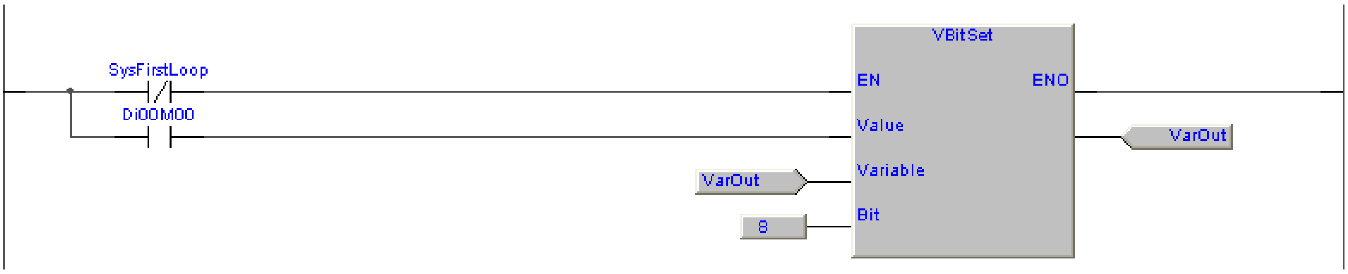
Lo stato dell'ingresso digitale ***Di00M00*** è trasferito nel bit 8 della variabile ***VarOut***.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	VarOut	UDINT	Auto	No	0	..	Variable output

Esempio LD



Esempio IL

```
LD Di00M00 (* Variable input *)
VBitSet VarOut, 8 (* Variable bit set *)
ST VarOut (* Transfer result to variable *)
```

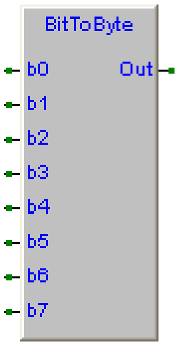
Esempio ST

```
VarOut:=VBitSet(Di00M00, VarOut, 8); (* Variable bit set *)
```

7.4.3 BitToByte, Bit to byte conversion

Type	Library	Version
FB	ePLCUtyLib	SFR054A000

Questo blocco funzione permette di convertire 8 variabili ***BOOL*** in una variabile ***BYTE***.



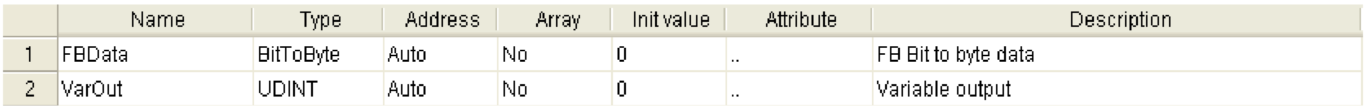
b0 (BOOL)	Bit 0 del byte di ***Out***.
...	...
b7 (BOOL)	Bit 7 del byte di ***Out***.
Out (BYTE)	Risultato conversione ingressi a bit.

Esempi

Gli 8 ingressi digitali del modulo 0 sono trasferiti nella variabile ***VarOut***. Attivando il solo ingresso digitale ***Di00M00*** la variabile ***VarOut*** assumerà valore 1, attivando il solo ingresso digitale ***Di01M00*** la variabile ***VarOut*** assumerà valore 2, e così via fino all'ingresso ***Di07M00*** attivando il quale la variabile ***VarOut*** assumerà valore 128. Attivando più ingressi contemporaneamente la variabile ***VarOut*** assumerà valore pari alla somma degli ingressi attivati.

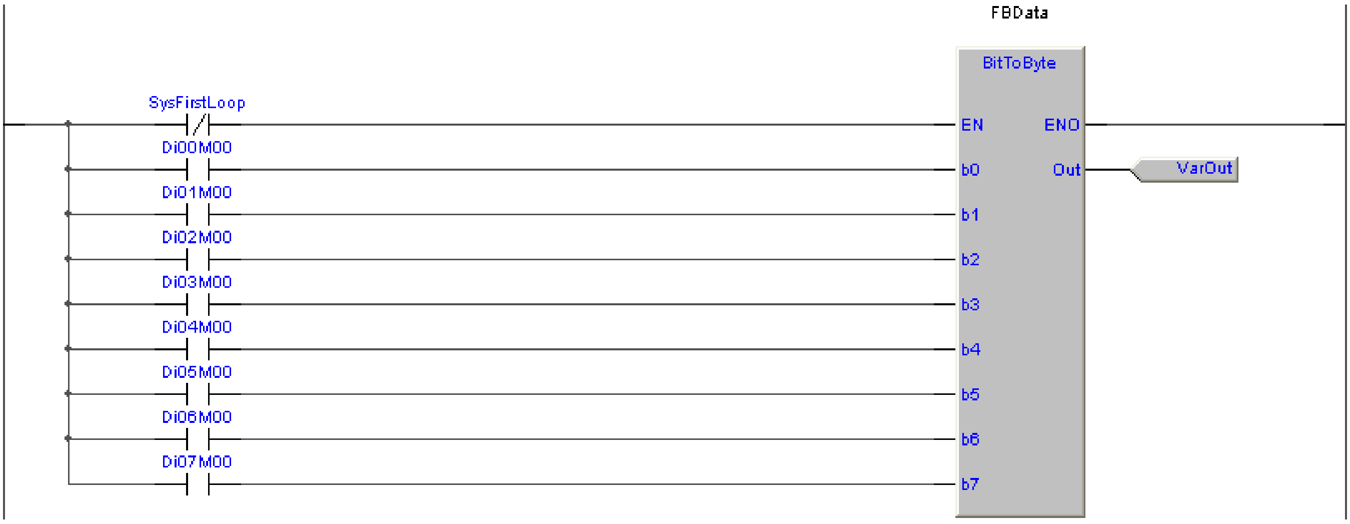
Per semplicità negli esempi IL e ST non vengono riportati tutti i bit.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	FBData	BitToByte	Auto	No	0	..	FB Bit to byte data
2	VarOut	UDINT	Auto	No	0	..	Variable output

Esempio LD *(Ptp114a100)*



Esempio IL *(Ptp114a100)*

```
LD  Di00M00
ST  FBData.b0 (* Transfer digital input to input bit *)

LD  Di07M00
ST  FBData.b7 (* Transfer digital input to input bit *)

CAL FBData (* Call the BitToByte function block *)

LD  FBData.Out
ST  VarOut (* Transfer the result to variable *)
```

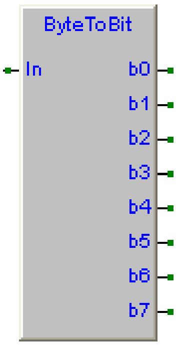
Esempio ST

```
FBData.b0:=Di00M00; (* Transfer digital input to input bit *)
FBData.b7:=Di07M00; (* Transfer digital input to input bit *)

FBData(); (* Call the BitToByte function block *)

VarOut:=FBData.Out; (* Transfer the result to variable *)
```

7.4.4 ByteToBit, Byte to bit conversion

Type	Library	Version
FB	ePLCUtyLib	SFR054A000

Questo blocco funzione permette di convertire una variabile ***BYTE*** in 8 variabili ***BOOL***.

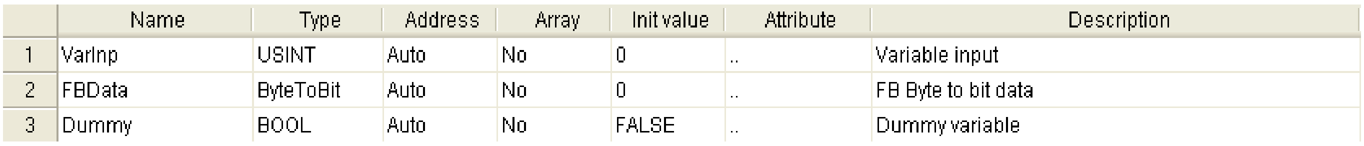


In (BYTE)	Valore byte da convertire
b0 (BOOL)	Bit 0 di ***In***.
...	...
b7 (BOOL)	Bit 7 di ***In***.

Esempi

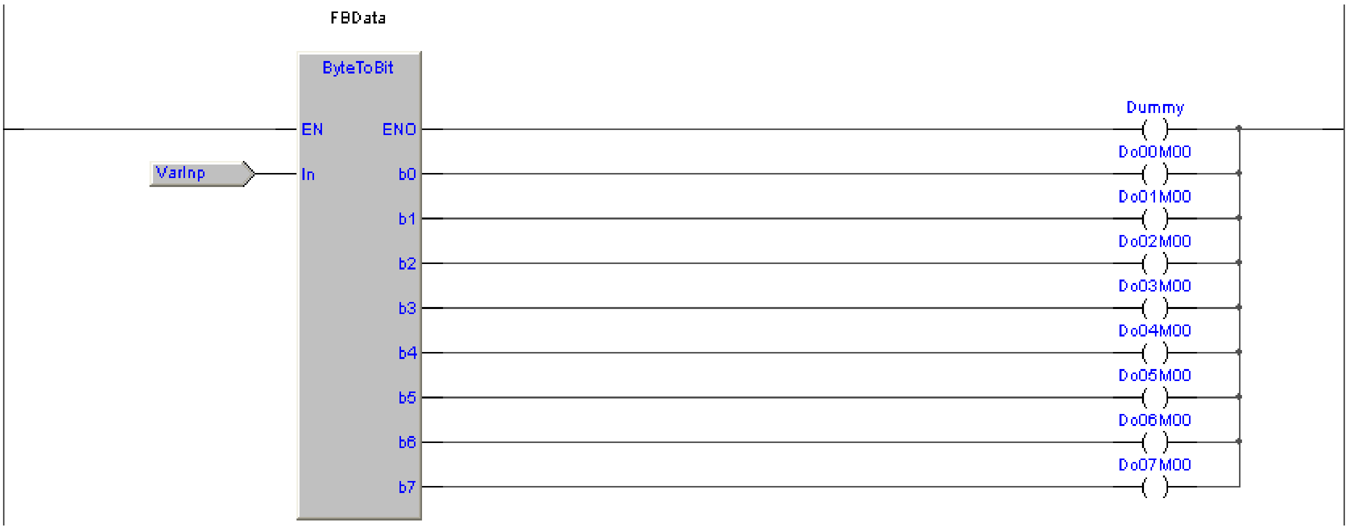
Lo stato del bit 0 della variabile ***VarInp*** viene trasferito sull'uscita digitale ***Do00M00*** lo stato del bit 1 della variabile ***VarInp*** viene trasferito sull'uscita digitale ***Do01M00*** e così via fino allo stato del bit 7 della variabile ***VarInp*** viene trasferito sull'uscita digitale ***Do07M00***. Per semplicità negli esempi IL e ST non vengono riportati tutti i bit.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	VarInp	USINT	Auto	No	0	..	Variable input
2	FBData	ByteToBit	Auto	No	0	..	FB Byte to bit data
3	Dummy	BOOL	Auto	No	FALSE	..	Dummy variable

Esempio LD *(Ptp114a100)*



Esempio IL *(Ptp114a100)*

```
LD  VarInp
ST  FBData.In (* Transfer the variable to input *)

CAL FBData  (* Call the ByteToBit function block *)

LD  FBData.b0
ST  Di00M00  (* Transfer output bit to digital output *)
```

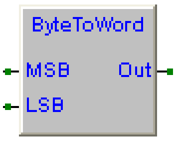
Esempio ST *(Ptp114a100)*

```
FBData(In:=VarInp); (* Call the ByteToBit function block *)

Do00M00:=FBData.b0; (* Transfer output bit to digital output *)
Do01M00:=FBData.b1; (* Transfer output bit to digital output *)
```

7.4.5 ByteToWord, Byte to word conversion

Type	Library	Version
FB	ePLCUtyLib	SFR054A000

Questo blocco funzione permette di convertire due variabili ***BYTE*** in una variabile ***WORD***.

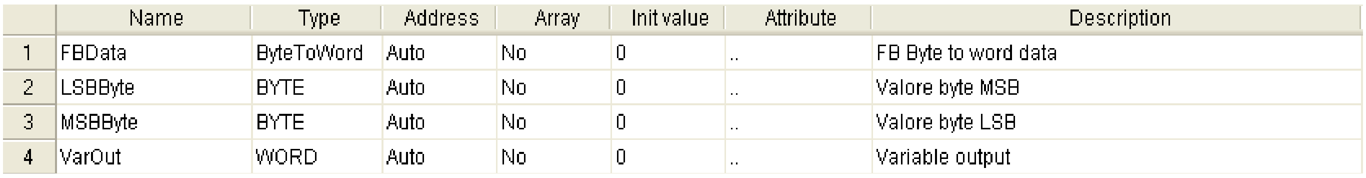


MSB (BYTE)	MSB del valore in uscita ***Out***
LSB (BYTE)	LSB del valore in uscita ***Out***
Out (WORD)	Valore in uscita

Esempi

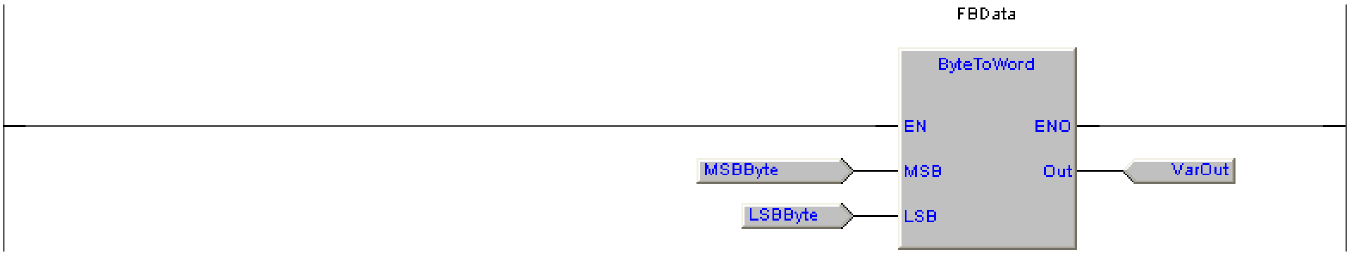
Le due variabili ***MSBByte*** e ***LSBByte*** sono uniti nella variabile ***VarOut*** in uscita.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	FBData	ByteToWord	Auto	No	0	..	FB Byte to word data
2	LSBByte	BYTE	Auto	No	0	..	Valore byte MSB
3	MSBByte	BYTE	Auto	No	0	..	Valore byte LSB
4	VarOut	WORD	Auto	No	0	..	Variable output

Esempio LD *(Ptp114a100)*



Esempio IL *(Ptp114a100)*

```
LD  MSBByte
ST  FBData.MSB (* Transfer the MSB variable to input *)

LD  LSBByte
ST  FBData.LSB (* Transfer the LSB variable to input *)

CAL FBData  (* Call the ByteToWord function block *)

LD  FBData.Out
ST  VarOut  (* Transfer output to variable *)
```

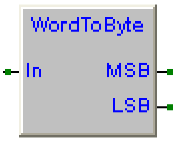
Esempio ST *(Ptp114a100)*

```
FBData.MSB:=MSBByte; (* Transfer the MSB variable to input *)
FBData.LSB:=LSBByte; (* Transfer the LSB variable to input *)

FBData(); (* Call the ByteToWord function block *)

VarOut:=FBData.Out; (* Transfer output to variable *)
```

7.4.6 WordToByte, Word to byte conversion

Type	Library	Version
FB	ePLCUtyLib	SFR054A000

Questo blocco funzione permette di convertire una variabile ***WORD*** in due variabili ***BYTE***.



IN (WORD) Variabile da convertire.

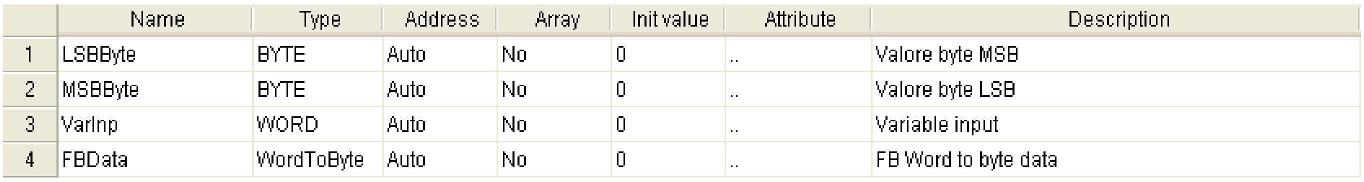
MSB (BYTE) MSB del valore in ingresso.

LSB (BYTE) LSB del valore in ingresso.

Esempi

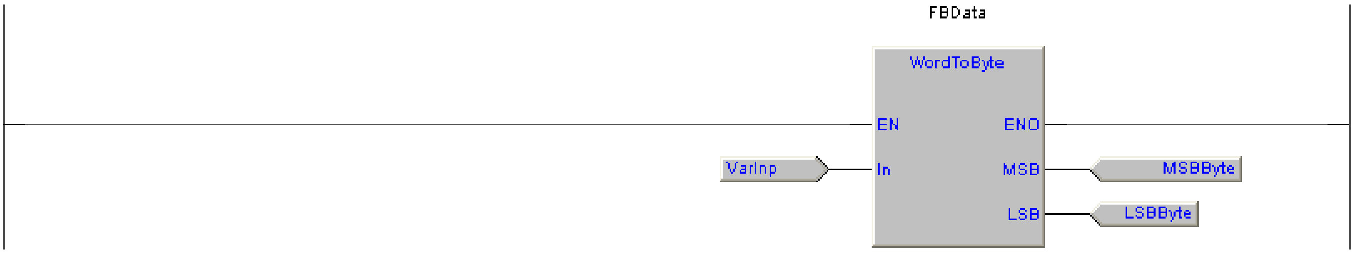
Le variabile ***VarInp*** è divisa nelle due variabili ***MSBByte*** e ***LSBByte***.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	LSBByte	BYTE	Auto	No	0	..	Valore byte MSB
2	MSBByte	BYTE	Auto	No	0	..	Valore byte LSB
3	VarInp	WORD	Auto	No	0	..	Variable input
4	FBData	WordToByte	Auto	No	0	..	FB Word to byte data

Esempio LD *(Ptp114a100)*



Esempio IL *(Ptp114a100)*

```
LD  VarInp
ST  FBData.In (* Transfer the variable to input *)

CAL FBData (* Call the WordToByte function block *)

LD  FBData.MSB
ST  MSBByte (* Transfer the MSB output to variable *)

LD  FBData.LSB
ST  LSBByte (* Transfer the LSB output to variable *)
```

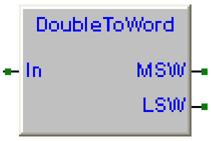
Esempio ST *(Ptp114a100)*

```
FBData.In:=VarInp; (* Transfer the variable to input *)

FBData(); (* Call the WordToByte function block *)

MSBByte:=FBData.MSB; (* Transfer the MSB output to variable *)
LSBByte:=FBData.LSB; (* Transfer the LSB output to variable *)
```

7.4.7 DoubleToWord, Double to word conversion

Type	Library	Version
FB	ePLCUtyLib	SFR054A000

Questo blocco funzione permette di convertire una variabile DWORD in due variabili WORD.

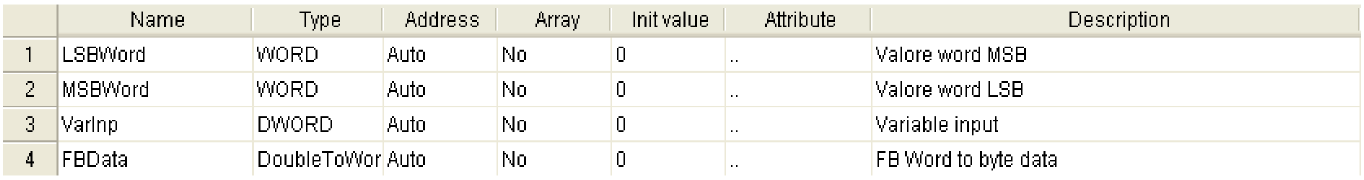


IN (DWORD)	Variabile da convertire.
MSW (WORD)	MSW del valore in ingresso.
LSW (WORD)	LSW del valore in ingresso.

Esempi

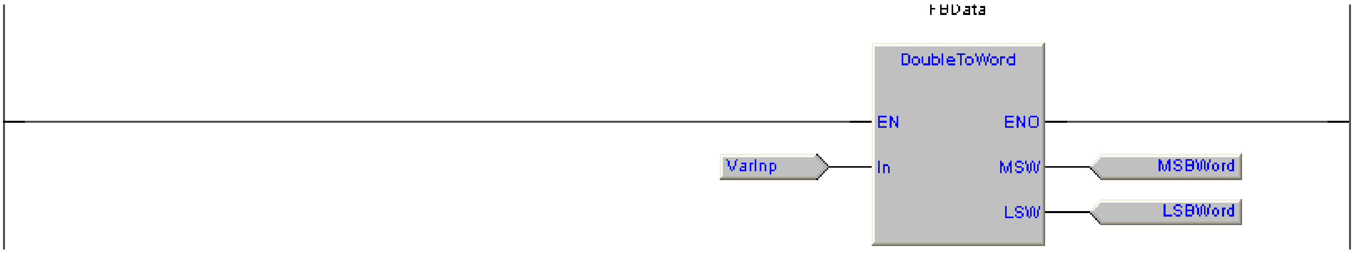
Le variabile ***VarInp*** è divisa nelle due variabili ***MSBWord*** e ***LSBWord***.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	LSBWord	WORD	Auto	No	0	..	Valore word MSB
2	MSBWord	WORD	Auto	No	0	..	Valore word LSB
3	VarInp	DWORD	Auto	No	0	..	Variable input
4	FBData	DoubleToWor	Auto	No	0	..	FB Word to byte data

Esempio LD *(Ptp114a100)*



Esempio IL *(Ptp114a100)*

```
LD   VarInp
ST   FBData.In (* Transfer the variable to input *)

CAL FBData (* Call the DoubleToWord function block *)

LD   FBData.MSW
ST   MSBWord (* Transfer the MSW output to variable *)

LD   FBData.LSW
ST   LSBWord (* Transfer the LSW output to variable *)
```

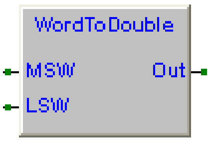
Esempio ST *(Ptp114a100)*

```
FBData.In:=VarInp; (* Transfer the variable to input *)

FBData(); (* Call the DoubleToWord function block *)

MSBWord:=FBData.MSW; (* Transfer the MSW output to variable *)
MSBWord:=FBData.LSW; (* Transfer the LSW output to variable *)
```

7.4.8 WordToDouble, Word to double conversion

Type	Library	Version
FB	ePLCUtyLib	SFR054A000

Questo blocco funzione permette di convertire due variabili ***WORD*** in una variabile ***DWORD***.



MSW (WORD) MSB del valore in uscita ***Out***

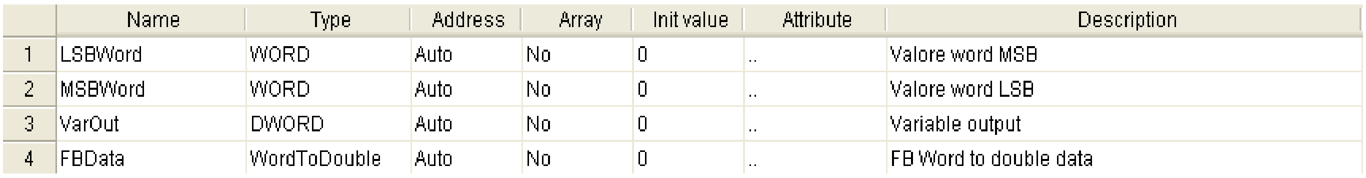
LSW (WORD) LSB del valore in uscita ***Out***

Out (DWORD) Valore in uscita

Esempi

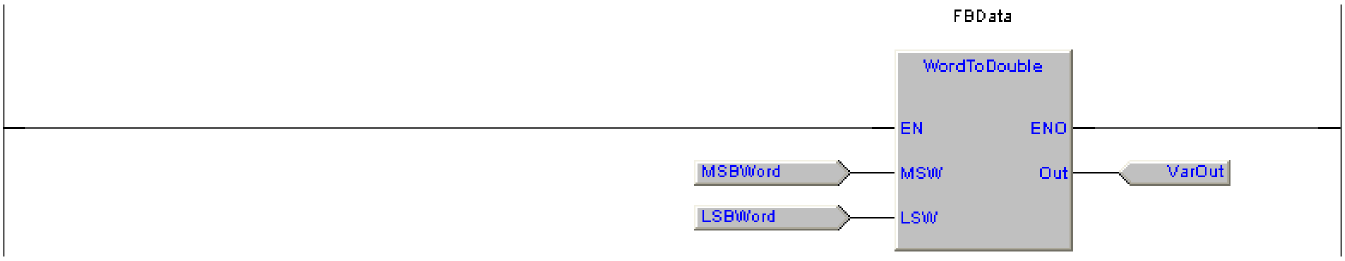
Le due variabili ***MSBWord*** e ***LSBWord*** sono uniti nella variabile ***VarOut*** in uscita.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	LSBWord	WORD	Auto	No	0	..	Valore word MSB
2	MSBWord	WORD	Auto	No	0	..	Valore word LSB
3	VarOut	DWORD	Auto	No	0	..	Variable output
4	FBData	WordToDouble	Auto	No	0	..	FB Word to double data

Esempio LD *(Ptp114a100)*



Esempio IL *(Ptp114a100)*

```
LD   MSBWord
ST   FBData.MSW (* Transfer the MSW variable to input *)

LD   LSBWord
ST   FBData.LSW (* Transfer the LSW variable to input *)

CAL FBData  (* Call the WordToDouble function block *)

LD   FBData.Out
ST   VarOut  (* Transfer output to variable *)
```

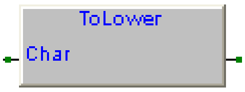
Esempio ST *(Ptp114a100)*

```
FBData.MSW:=MSBWord; (* Transfer the MSW variable to input *)
FBData.LSW:=LSBWord; (* Transfer the LSW variable to input *)

FBData(); (* Call the WordToDouble function block *)

VarOut:=FBData.Out; (* Transfer output to variable *)
```

7.4.9 ToLower, Uppercase to lowercase letter conversion

Type	Library	Version
Function	ePLCAuxLib	SFR058A000

Questa funzione converte un carattere dal formato maiuscolo nel corrispondente carattere in formato minuscolo.



Parametri funzione:

Char (USINT) Carattere da convertire.

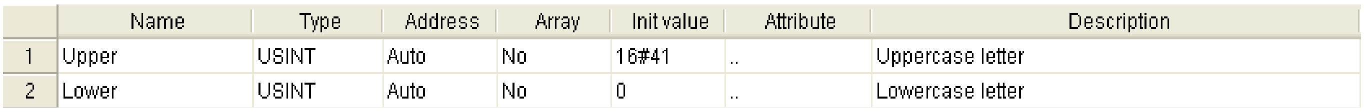
La funzione ritorna:

(USINT) Carattere nel formato minuscolo.

Esempi

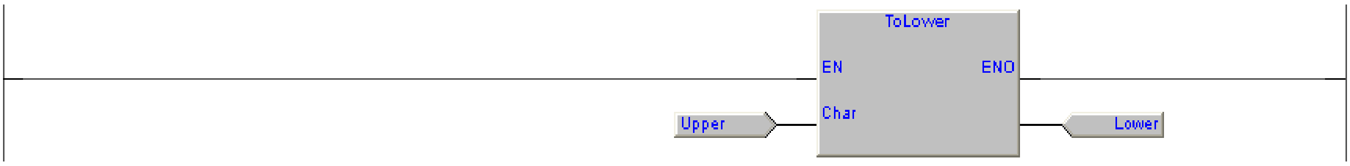
La variabile ***Upper*** viene convertita nel corrispondente valore minuscolo e trasferita in ***Lower***. Il valore di inizializzazione 16#41 che corrisponde alla lettera ***A***, viene convertito nel valore 16#61 che corrisponde alla lettera ***a***.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	Upper	USINT	Auto	No	16#41	..	Uppercase letter
2	Lower	USINT	Auto	No	0	..	Lowercase letter

Esempio LD



Esempio IL

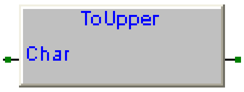
```
LD  Upper (* Uppercase letter *)
ToLower (* Uppercase to lowercase letter conversion *)
ST  Lower (* Lowercase letter *)
```

Esempio ST

```
Lower:=ToLower(Upper); (* Uppercase to lowercase letter conversion *)
```

7.4.10 ToUpper, Lowercase to uppercase letter conversion

Type	Library	Version
Function	ePLCAuxLib	SFR058A000



Questa funzione converte un carattere dal formato minuscolo nel corrispondente carattere in formato maiuscolo.

Parametri funzione:

Char (USINT) Carattere da convertire.

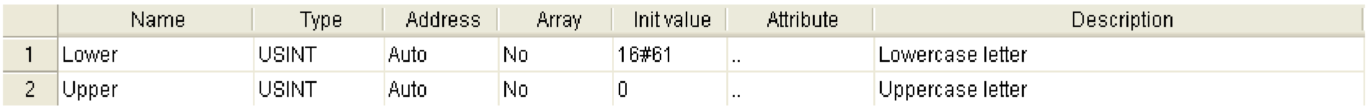
La funzione ritorna:

(USINT) Carattere nel formato maiuscolo.

Esempi

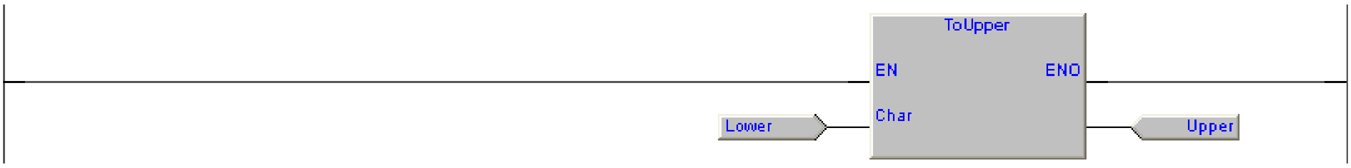
La variabile ***Lower*** viene convertita nel corrispondente valore maiuscolo e trasferita in ***Upper***. Il valore di inizializzazione 16#61 che corrisponde alla lettera ***a***, viene convertito nel valore 16#41 che corrisponde alla lettera ***A***.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	Lower	USINT	Auto	No	16#61	..	Lowercase letter
2	Upper	USINT	Auto	No	0	..	Uppercase letter

Esempio LD



Esempio IL

```
LD  Lower (* Lowercase letter *)
ToUpper (* Lowercase to uppercase letter conversion *)
ST  Upper (* Lowercase letter *)
```

Esempio ST

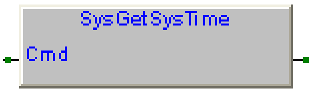
```
Upper:=ToUpper(Lower); (* Lowercase to uppercase letter conversion *)
```

7.5 Funzioni ed FB di utilità sistema

7.5.1 SysGetSysTime, get system time

Type	Library	Version
Function	Embedded	3.0

Questa funzione ritorna il tempo di sistema espresso in µS. E' possibile definire con il valore di ***Cmd*** se si vuole avere il tempo di sistema attuale (***Cmd:=TRUE***) oppure quello memorizzato con la precedente esecuzione della funzione (***Cmd:=FALSE***).



Parametri funzione:

Cmd (BOOL) Indica il valore di tempo che deve essere ritornato.
TRUE: Viene salvato e ritornato il valore attuale di tempo.
FALSE: Viene ritornato il tempo salvato dalla precedente chiamata con ***Cmd:=TRUE***.

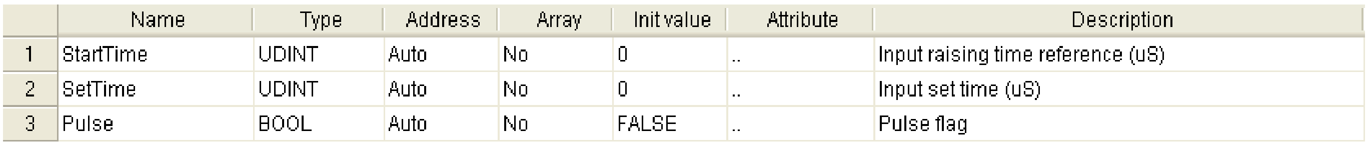
La funzione ritorna:

(UDINT) Tempo di sistema espresso in µS.

Esempi

Viene calcolato il tempo in cui l'ingresso digitale ***Di00M00*** rimane nella condizione di attivo.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	StartTime	UDINT	Auto	No	0	..	Input raising time reference (uS)
2	SetTime	UDINT	Auto	No	0	..	Input set time (uS)
3	Pulse	BOOL	Auto	No	FALSE	..	Pulse flag

Esempio ST *(Ptp116a100)*

```
(* Check if input is activated. *)

IF (Di00M00 <> Pulse) THEN
    Pulse:=Di00M00; (* Pulse flag *)

    (* On input raising edge relate time is saved. *)

    IF (Di00M00) THEN StartTime:=SysGetSysTime(TRUE); END_IF;

    (* On input falling edge the set time is calculated. *)

    IF (NOT(Di00M00)) THEN SetTime:=SysGetSysTime(TRUE)-StartTime; END_IF;

END_IF;
```

7.5.1.1 Calcolo timeout

Essendo il valore di tempo di sistema ritornato dalla funzione un numero ***UDINT*** che si incrementa ogni µS, ed al valore massimo esegue overflow a zero, non è possibile effettuare comparazioni dirette con il tempo di riferimento ma occorre sempre eseguire la differenza.

Nel seguente esempio viene attivato ***Timeout*** se l'ingresso ***Di00M00*** rimane attivo per più di un secondo.

```
IF NOT(Di00M00) THEN TimeBf:=SysGetSysTime(TRUE);
ELSE IF ((SysGetSysTime(TRUE)-TimeBf) >= 1000000) THEN Timeout:=TRUE; END_IF;
END_IF;
```

Lo stesso esempio scritto in questo modo non funziona correttamente.

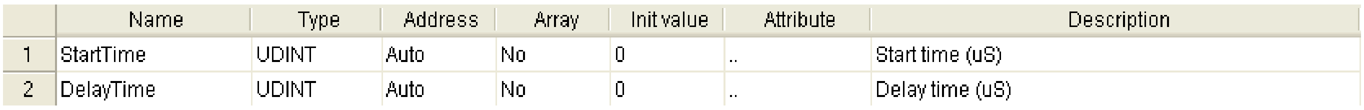
```
IF NOT(Di00M00) THEN TimeBf:=SysGetSysTime(TRUE);
ELSE IF (SysGetSysTime(TRUE) >= (TimeBf+1000000)) THEN Timeout:=TRUE; END_IF;
END_IF;
```

7.5.1.2 Semplice cronometro

Questo esempio realizza un semplice cronometro per misurare il tempo che intercorre tra un comando di start ed il comando di stop. Utilizzando ad esempio due fotocellule una sulla linea di start ed una sulla linea di stop di un percorso è possibile calcolare il tempo di percorrenza espresso in µS.

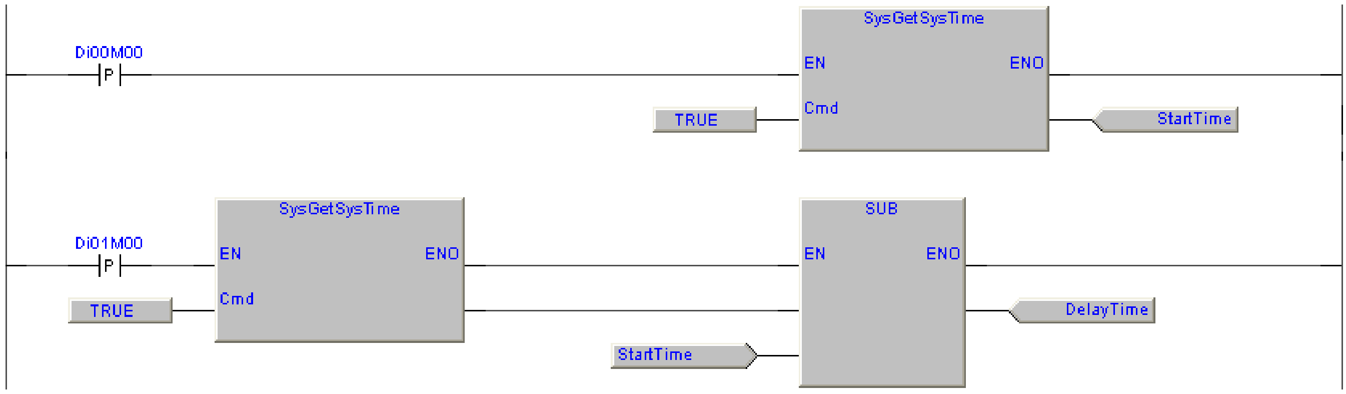
Attivando l'ingresso di start ***Di00M00*** viene salvato il tempo di sistema allo start nella variabile ***StartTime***, attivando l'ingresso di stop ***Di01M00*** viene calcolato il tempo trascorso tra il tempo salvato allo start ed il tempo nel momento di stop. Il tempo calcolato è salvato nella variabile ***DelayTime***.

Definizione variabili



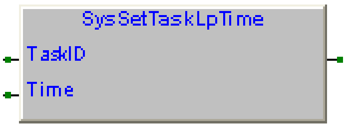
	Name	Type	Address	Array	Init value	Attribute	Description
1	StartTime	UDINT	Auto	No	0	..	Start time (uS)
2	DelayTime	UDINT	Auto	No	0	..	Delay time (uS)

Esempio LD *(Ptp119a000)*



7.5.2 SysSetTaskLpTime, set task loop time

Type	Library	Version
Function	Embedded	3.0



Questa funzione permette di impostare il tempo di esecuzione delle tasks PLC. Esistono due tasks eseguite a tempo la task slow ***ID_TASK_SLOW*** e la task fast ***ID_TASK_FAST***, ad ognuna di queste task può essere assegnato un tempo di esecuzione.

Se il tempo impostato non è compreso nel range definito o se il rapporto tra i tempi di esecuzione della task fast rispetto alla slow non sono coerenti la funzione non modifica i tempi di esecuzione e ritorna ***FALSE***. Di seguito sono riportati i range di tempo definibili per le varie tasks.

ID_TASK_FAST	Range da 100 µS a 10 mS
ID_TASK_SLOW	Range da 1 a 100 mS

Parametri funzione:

TaskID (USINT)	Identifica la task a cui si vuole definire il tempo di esecuzione secondo le definizioni in Task ID.
Time (UDINT)	Indica il valore di tempo di esecuzione task espresso in µS.

La funzione ritorna:

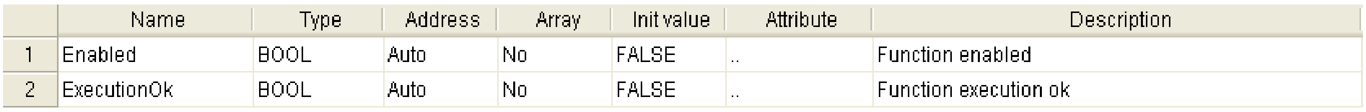
(BOOL)	***TRUE:*** Se funzione eseguita correttamente ***FALSE:*** In caso di errore esecuzione, esempio parametri errati.

Esempi

Attivando l'ingresso ***Di00M00*** viene impostato un tempo di esecuzione di 5 ms per la task PlcFast.

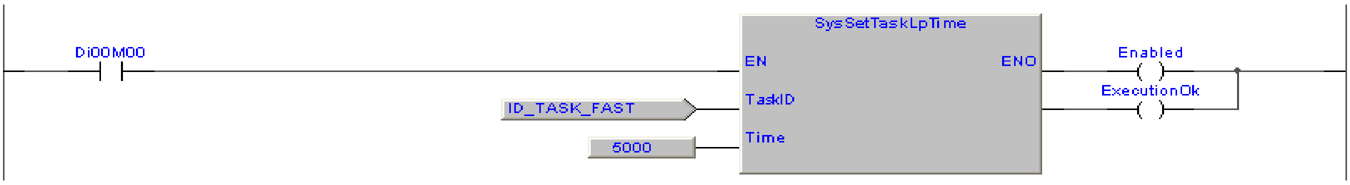
Attenzione! Per aumentare i tempi di esecuzione delle tasks dal valore di default occorre eseguire la funzione nella task di boot.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	Enabled	BOOL	Auto	No	FALSE	..	Function enabled
2	ExecutionOk	BOOL	Auto	No	FALSE	..	Function execution ok

Esempio LD *(Ptp116a100)*



Esempio ST

```
Enabled:=Di00M00; (* Function enabled *)

IF Di00M00 THEN
    ExecutionOk:=SysSetTaskLpTime(TaskID:=ID_TASK_FAST, Time:=5000); (* Function execution ok *)
END_IF;
```

7.5.3 SysGetRandom, get random number

Type	Library	Version
Function	Embedded	3.0

Questa funzione ritorna un numero random compreso tra 0.0 e 1.0. E' possibile definire con il valore di ***Cmd*** se si vuole avere un nuovo numero random (***Cmd:=TRUE***) oppure quello memorizzato con la precedente esecuzione della funzione (***Cmd:=FALSE***).

Parametri funzione:

Cmd (BOOL) Indica il numero random ritornato.
TRUE: Viene salvato e ritornato un nuovo numero random.
FALSE: Viene ritornato il numero salvato dalla precedente chiamata con ***Cmd:=TRUE***.

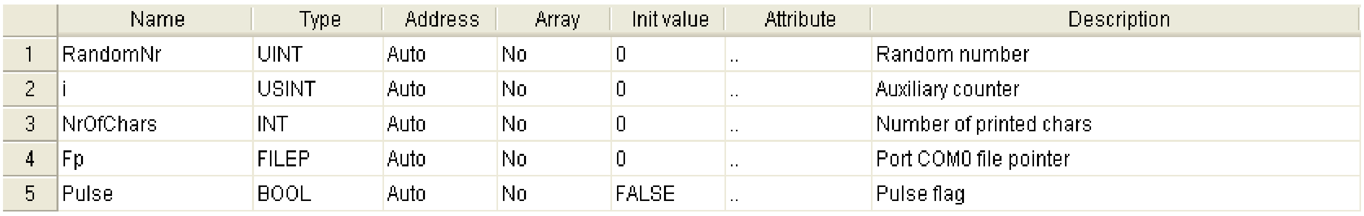
La funzione ritorna:

(REAL) Un numero random compreso nel range da 0.0 a 1.0.

Esempi

Attivando l'ingresso digitale ***Di00M00*** viene inviato sulla porta seriale ***COM0*** una sequenza di 10 numeri random.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	RandomNr	UINT	Auto	No	0	..	Random number
2	i	USINT	Auto	No	0	..	Auxiliary counter
3	NrOfChars	INT	Auto	No	0	..	Number of printed chars
4	Fp	FILEP	Auto	No	0	..	Port COM0 file pointer
5	Pulse	BOOL	Auto	No	FALSE	..	Pulse flag

Esempio ST *(Ptp116a100)*

```
(* Here the COM0 port is opened in read/write. *)

    IF (Fp = NULL) THEN
        Fp:=Sysfopen('COM0', 'rw'); (* Port COM0 file pointer *)
    END_IF;

    (* Check if input is activated. *)

    F (Di00M00 <> Pulse) THEN
        Pulse:=Di00M00; (* Pulse flag *)

    (* On input raising edge print out 10 random numbers. *)

        IF (Di00M00) THEN

            FOR i:=0 TO (9) BY 1 DO
                RandomNr:=TO_UINT(SysGetRandom(TRUE)*1000.0); (* Random number *)
                NrOfChars:=SysVarfprintf(Fp, 'Rn:%03d$r$n', UINT_TYPE, ADR(RandomNr));
            END_FOR;
        END_IF;
    END_IF;
```

Collegando un terminale seriale alla porta ***COM0*** impostato a ***115200,e,8,1*** vedremo un elenco del tipo:

```
Rn:437
Rn:488
Rn:898
...
Rn:261
Rn:944
```

7.5.4 SysGetLastError, get last error

Type	Library	Version
Function	Embedded	5.0

Questa funzione ritorna il numero dell'ultimo errore rilevato da una funzione e/o da un blocco funzione (Elenco errori). Occorre eseguire la funzione su abilitazione del bit di fault in uscita dalla funzione e/o blocco funzione da controllare. E' possibile definire con il valore di ***Cmd*** se si vuole avere il valore attuale dell'ultimo errore (***Cmd:=TRUE***) oppure quello memorizzato con la precedente esecuzione della funzione (***Cmd:=FALSE***).

Parametri funzione:

Cmd (BOOL)	Indica il numero di errore ritornato. ***TRUE:*** Viene ritornato l'ultimo valore di errore. ***FALSE:*** Viene ritornato il numero salvato dalla precedente chiamata con ***Cmd:=TRUE***.

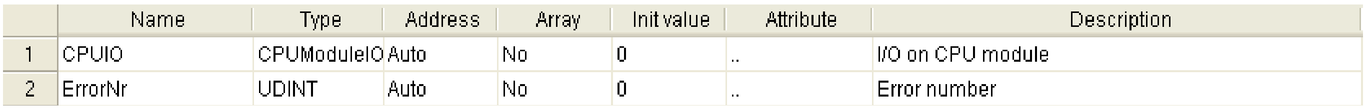
La funzione ritorna:

(UDINT)	Il numero dell'ultimo errore rilevato

Esempi

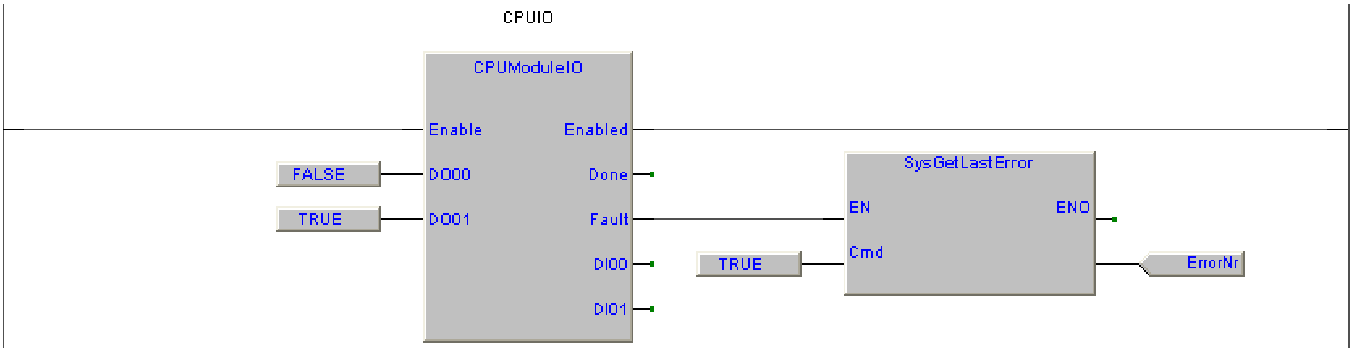
Viene salvato l'eventuale errore durante l'esecuzione del blocco funzione ***CPUModuleIO***. In caso di errore il numero di errore è trasferito nella variabile ***ErrorNr***.

Definizione variabili



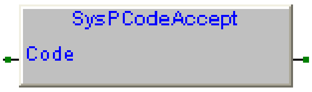
	Name	Type	Address	Array	Init value	Attribute	Description
1	CPUIO	CPUModuleIO	Auto	No	0	..	I/O on CPU module
2	ErrorNr	UDINT	Auto	No	0	..	Error number

Esempio LD



7.5.5 SysPCodeAccept, accepts the protection code

Type	Library	Version
Function	Embedded	4.0



Alcune funzioni di programma e/o blocchi funzione possono essere protetti da un codice che deve essere ordinato separatamente. Per abilitare l'esecuzione della funzione e/o del blocco funzione occorre sbloccarlo definendone il codice con questa funzione.

La funzione controlla il codice fornito e ritorna ***TRUE*** se codice accettato. Vedere capitolo ***Protezione funzioni e blocchi funzione*** per ulteriori informazioni.

Parametri funzione:

Code (STRING[20]) Codice di protezione.

La funzione ritorna:

(BOOL) ***TRUE:*** Codice verificato ID relativo sbloccato. ***FALSE:*** Codice non verificato.

Codici di errore

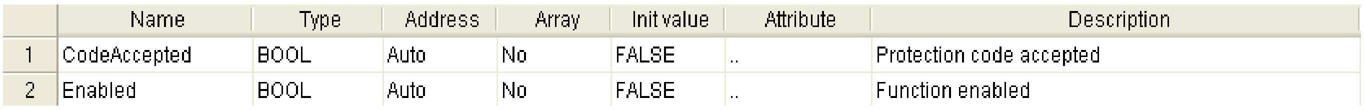
In caso di errore la funzione torna ***FALSE*** e con ***SysGetLastError*** è possibile rilevare il codice di errore.

9991100	Lunghezza ***Code*** non corretta.
9991110 ÷ 5	Codice definito in ***Code*** non corretto.
9991200	Non vi è più spazio per eseguire ulteriori funzioni protette.

Esempi

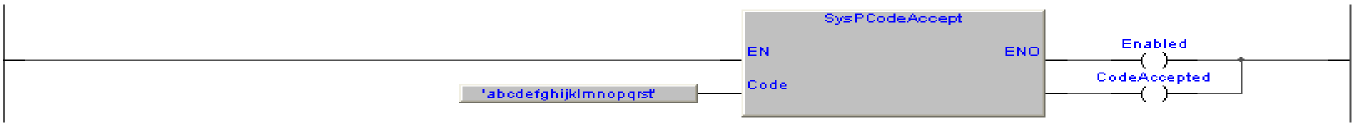
E' riportato un semplice programma che esegue il controllo sul codice di sblocco "***abcdefghijklmnopqrst***". Se il codice è corretto viene attivata la variabile ***CodeAccepted***.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	CodeAccepted	BOOL	Auto	No	FALSE	..	Protection code accepted
2	Enabled	BOOL	Auto	No	FALSE	..	Function enabled

Esempio LD *(Ptp116a100)*

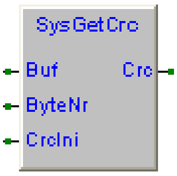


Esempio ST

```
(* Check the protection code. *)

    CodeAccepted:=SysPCodeAccept('abcdefghijklmnopqrst'); (* Protection code accepted *)
```

7.5.6 SysGetCrc, get CRC value

Type	Library	Version
FB	Embedded	3.0



Questa funzione esegue il calcolo del CRC ***Cyclic Redundancy Check***, (Controllo Ciclico di Ridondanza) su di un'area dati. Il calcolo è effettuato secondo le specifiche richieste dal protocollo ***modbus Rtu***

Occorre passare alla funzione l'indirizzo del buffer di memoria ***Buf*** ed il numero di bytes ***ByteNr*** su cui eseguire il calcolo del CRC.

Buf (@USINT)	Indirizzo dell'area di memoria su cui eseguire il calcolo del CRC.
ByteNr (UINT)	Numero di bytes su cui eseguire il calcolo del CRC a partire dall'indirizzo definito in ***Buf***.
CRCIni (UINT)	Valore di inizializzazione del CRC da calcolare.
CRC (UINT)	Valore CRC calcolato.

Codici di errore

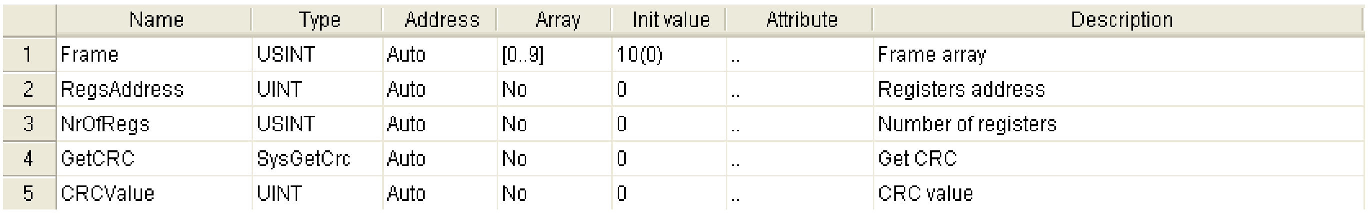
In caso di errore con ***SysGetLastError*** è possibile rilevare il codice di errore.

9978050	Errore allocazione blocco funzione.
9978070	Errore versione blocco funzione.

Esempi

Viene calcolato il CRC di un frame modbus Rtu per il comando di lettura registri ***Read holding registers***.

Definizione variabili

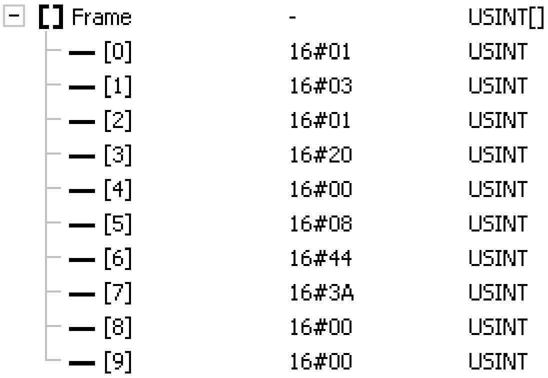


	Name	Type	Address	Array	Init value	Attribute	Description
1	Frame	USINT	Auto	[0..9]	10(0)	..	Frame array
2	RegsAddress	UINT	Auto	No	0	..	Registers address
3	NrOfRegs	USINT	Auto	No	0	..	Number of registers
4	GetCRC	SysGetCrc	Auto	No	0	..	Get CRC
5	CRCValue	UINT	Auto	No	0	..	CRC value

Esempio ST *(Ptp116a100)*

```
(* -------------------------------------------------------------------------- *)
(* Calculate CRC of a modbus Rtu frame for command "Read holding registers".  *)
(* +--+--+--+--+--+--+-+-+ *)
(* |Nd|03|Addr |NumR |CRC| *)
(* +--+--+--+--+--+--+-+-+ *)
(* -------------------------------------------------------------------------- *)
    (* Define the registers address and the number of registers to read. *)

    RegsAddress:=16#0120; (* Registers address *)
    NrOfRegs:=8; (* Number of registers *)

    (* Prepare the command frame. *)

    Frame[0]:=1; (* Node address *)
    Frame[1]:=3; (* Function code (16#03) *)
    Frame[2]:=TO_USINT(RegsAddress/256); (* MSB registers address *)
    Frame[3]:=TO_USINT(RegsAddress&255); (* LSB registers address *)
    Frame[4]:=0; (* MSB number of registers to read *)
    Frame[5]:=NrOfRegs; (* LSB number of registers to read *)

    (* Calculate the frame CRC. *)

    GetCRC.Buf:=ADR(Frame[0]); (* Buffer address *)
    GetCRC.ByteNr:=6; (* Byte number *)
    GetCRC.CrcIni:=16#FFFF; (* CRC ini value *)
    GetCRC(); (* Calculate CRC *)
    CRCValue:=GetCRC.Crc; (* CRC value *)
    Frame[6]:=TO_USINT(CRCValue/256); (* MSB of CRC value *)
    Frame[7]:=TO_USINT(CRCValue&255); (* LSB of CRC value *)
```

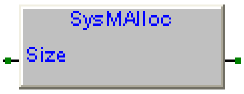
Il valore del CRC del frame modbus Rtu è 16#443A, l'intero frame è visibile ponendo nella finestra di watch la variabile ***Frame*** così come riportato nella figura.



Frame	-	USINT[]
[0]	16#01	USINT
[1]	16#03	USINT
[2]	16#01	USINT
[3]	16#20	USINT
[4]	16#00	USINT
[5]	16#08	USINT
[6]	16#44	USINT
[7]	16#3A	USINT
[8]	16#00	USINT
[9]	16#00	USINT

7.5.7 SysMAlloc, Memory allocation

Type	Library	Version
Function	Embedded	6.0



Questa funzione esegue l'allocazione di uno spazio di memoria della dimensione in byte definita da parametro ***Size***. La funzione ritorna il puntatore allo spazio di memoria allocato.

La memoria è allocata nella memoria di sistema e quindi non utilizza la memoria a disposizione del programma utente. Nel caso in cui non vi sia spazio in memoria per l'allocazione del buffer definito, la funzione ritorna ***0***.

Parametri funzione:

Size (UDINT) Dimensione in bytes dell'area da allocare.

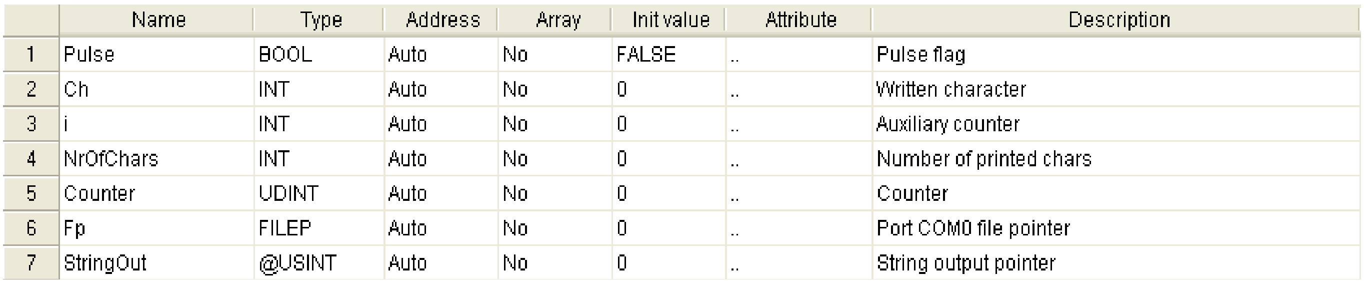
La funzione ritorna:

(@USINT) Indirizzo allocazione buffer. ***NULL*** se non vi è spazio per allocare il buffer.

Esempi

Su fronte attivazione ingresso ***Di00M00*** viene incrementata la variabile ***Counter*** e la stampa del suo valore trasferita nell'array ***StringOut***. Il valore presente in ***StringOut*** viene poi inviato sulla porta seriale ***COM0***.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	Pulse	BOOL	Auto	No	FALSE	..	Pulse flag
2	Ch	INT	Auto	No	0	..	Written character
3	i	INT	Auto	No	0	..	Auxiliary counter
4	NrOfChars	INT	Auto	No	0	..	Number of printed chars
5	Counter	UDINT	Auto	No	0	..	Counter
6	Fp	FILEP	Auto	No	0	..	Port COM0 file pointer
7	StringOut	@USINT	Auto	No	0	..	String output pointer

Esempio ST *(Ptp116a300)*

```
(* -------------------------------------------------------------------------- *)
(* "SysMAlloc" example                                                        *)
(* -------------------------------------------------------------------------- *)
    (* Here at first program execution loop allocate memory and open COM. *)

    IF (SysFirstLoop) THEN
        StringOut:=SysMAlloc(16); (* String output pointer *)
        Fp:=Sysfopen('COM0', 'rw'); (* Port COM0 file pointer *)
    END_IF;

    IF ((StringOut = 0) OR (Fp = 0)) THEN RETURN; END_IF;

    (* On input raising edge the counter value is printed. *)

    IF (Di00M00 <> Pulse) THEN
        Pulse:=Di00M00; (* Pulse flag *)

        IF (Di00M00) THEN
            Counter:=Counter+1; (* Counter *)
            NrOfChars:=SysVarsnprintf(StringOut, 32, 'Counter:%04d$r$n', UDINT_TYPE, ADR(Counter));

            FOR i:=0 TO NrOfChars DO
                Ch:=Sysfputc(TO_INT(@StringOut), Fp); (* Written character *)
                StringOut:=StringOut+1; (* String output pointer *)
            END_FOR;
        END_IF;
    END_IF;

(* [End of file] *)
```

7.6 Funzioni ed FB per gestione Data/Ora

7.6.1 SysETimeToDate, epoch time to date conversion

Type	Library	Version
FB	Embedded	3.0

Questo blocco funzione esegue la conversione della data espressa in epoch time. Occorre fornire al blocco funzione la data espressa nel formato epoch ime come presente nella variabile di sistema ***SysDateTime***, in uscita dal blocco funzione avremo i valori di data espressi nel formato Giorno/Mese/Anno ed Ora:Minuti:Secondi.

EpochTime (UDINT)	Occorre specificare la data espressa in epoch time.
Done (BOOL)	Attivato al termine della conversione.
Fault (BOOL)	Errore di conversione, viene attivato in caso di errore nella conversione.
Year (UINT)	Ritorna il valore di anno (Range da 1970 a 2099)
Month (USINT)	Ritorna il valore di mese dell'anno (Range da 1 a 12)
Day (USINT)	Ritorna il valore di giorno del mese (Range da 1 a 31)
WeekDay (USINT)	Ritorna il valore di giorno della settimana (Range da 0 a 6) 0: Domenica, 1:Lunedì, 2:Martedì, 3:Mercoledì, 4:Giovedì, 5:Venerdì, 6:Sabato
Hour (USINT)	Ritorna il valore di ora (Range da 0 a 23)
Minute (USINT)	Ritorna il valore di minuti (Range da 0 a 59)
Second (USINT)	Ritorna il valore di secondi (Range da 0 a 59)

Codici di errore

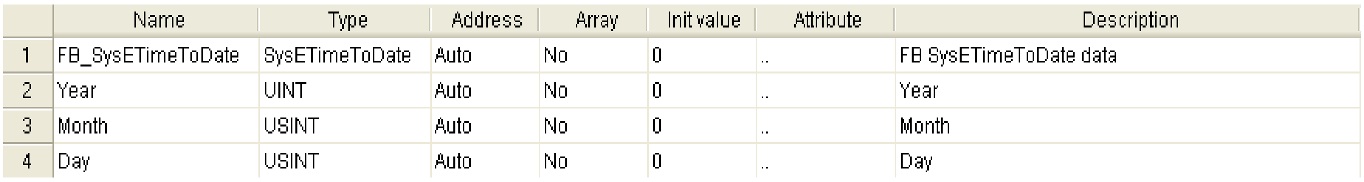
In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

9986050	Errore allocazione blocco funzione.
9986060	Errore versione blocco funzione.

Esempi

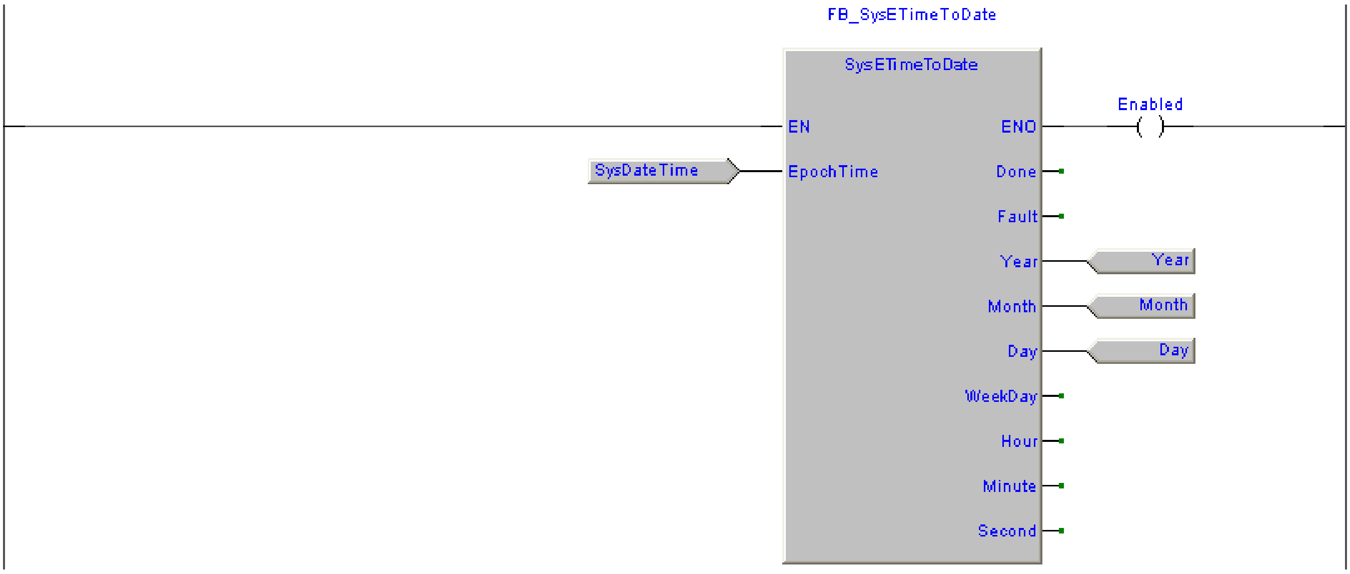
Viene convertito il valore di data ed ora espresso in epoch time dalla variabile ***SysDateTime*** e viene ritornato il valore di anno, mese e giorno nelle tre variabili definite.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	FB_SysETimeToDate	SysETimeToDate	Auto	No	0	..	FB SysETimeToDate data
2	Year	UINT	Auto	No	0	..	Year
3	Month	USINT	Auto	No	0	..	Month
4	Day	USINT	Auto	No	0	..	Day

Esempio LD *(Ptp116a100)*



Esempio IL *(Ptp116a100)*

```
(* Transfer system date e time to FB input variable. *)

    LD SysDateTime
    ST FB_SysETimeToDate.EpochTime

    CAL FB_SysETimeToDate (* Call the SysETimeToDate function block *)

(* Transfer the FB output variables to program variables. *)

    LD FB_SysETimeToDate.Year
    ST Year

    LD FB_SysETimeToDate.Month
    ST Month

    LD FB_SysETimeToDate.Day
    ST Day
```

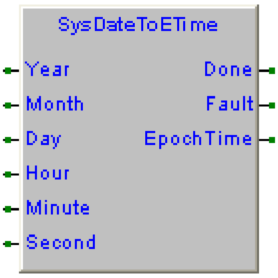
Esempio ST *(Ptp116a100)*

```
(* Here FB SysETimeToDate is executed and variables copied. *)

    FB_SysETimeToDate.EpochTime:=SysDateTime;
    FB_SysETimeToDate();
    Year:=FB_SysETimeToDate.Year; (* Year *)
    Month:=FB_SysETimeToDate.Month; (* Month *)
    Day:=FB_SysETimeToDate.Day; (* Day *)
```

7.6.2 SysDateToETime, date to epoch time conversion

Type	Library	Version
FB	Embedded	3.0

Questo blocco funzione esegue la conversione della data-ora in epoch time. Occorre fornire al blocco funzione la data e l'ora ed in uscita dal blocco funzione avremo un valore in epoch time.



Year (UINT)	Definisce il valore di anno (Range da 1970 a 2099)
Month (USINT)	Definisce il valore di mese dell'anno (Range da 1 a 12)
Day (USINT)	Definisce il valore di giorno del mese (Range da 1 a 31)
Hour (USINT)	Definisce il valore di ora (Range da 0 a 23)
Minute (USINT)	Definisce il valore di minuti (Range da 0 a 59)
Second (USINT)	Definisce il valore di secondi (Range da 0 a 59)
Done (BOOL)	Attivato al termine della conversione.
Fault (BOOL)	Errore di conversione, viene attivato in caso di errore nella conversione.
EpochTime (UDINT)	Ritorna data espressa in epoch time.

Codici di errore

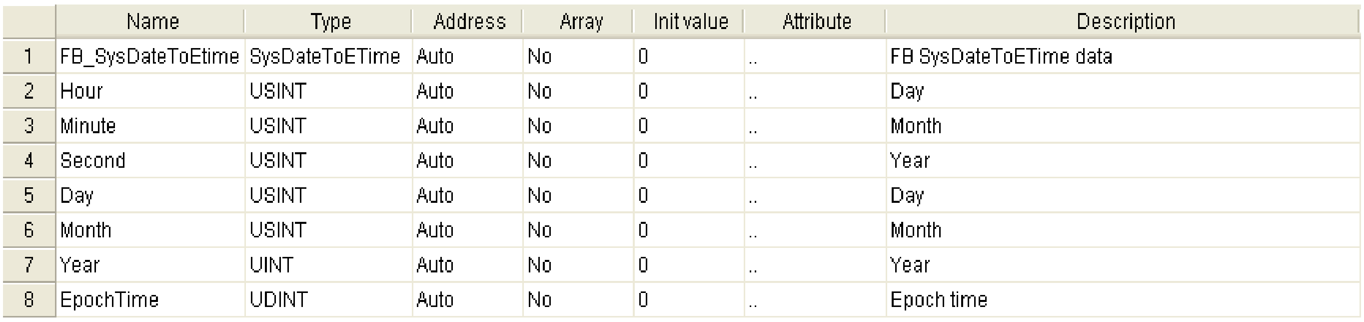
In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

9987050	Errore allocazione blocco funzione.
9987060	Errore versione blocco funzione.
9987200	Errore durante l'esecuzione del blocco funzione.

Esempi

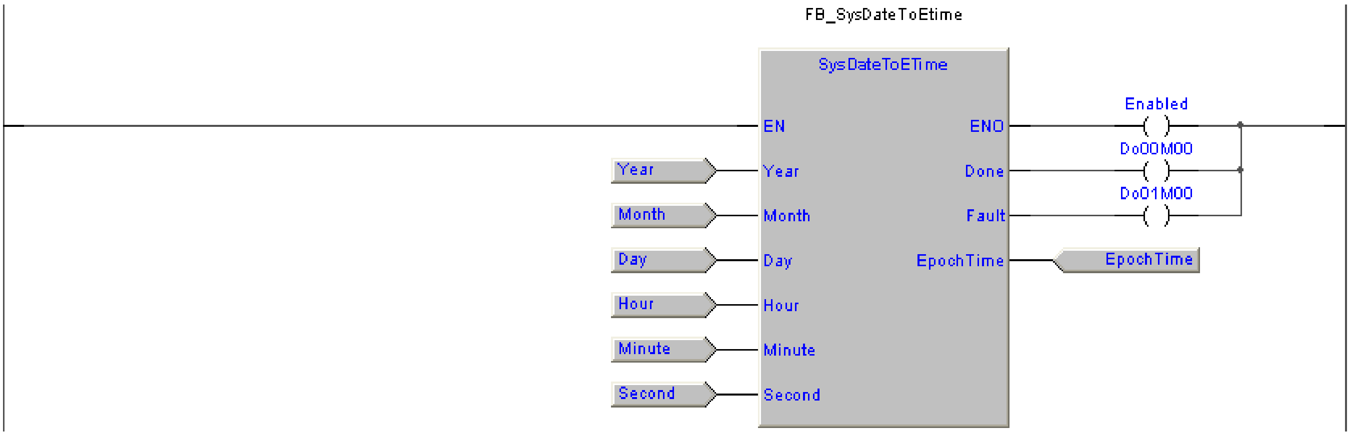
Viene convertito il valore di data ed ora in epoch time. Esempio definendo il valore di data 9/4/2010 e ora 14:20:15 avremo in uscita il valore 1270822815.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	FB_SysDateToEtime	SysDateToETime	Auto	No	0	..	FB SysDateToETime data
2	Hour	USINT	Auto	No	0	..	Day
3	Minute	USINT	Auto	No	0	..	Month
4	Second	USINT	Auto	No	0	..	Year
5	Day	USINT	Auto	No	0	..	Day
6	Month	USINT	Auto	No	0	..	Month
7	Year	UINT	Auto	No	0	..	Year
8	EpochTime	UDINT	Auto	No	0	..	Epoch time

Esempio LD *(Ptp116a100)*



Esempio IL *(Ptp116a100)*

```
(* Transfer date e time to FB input variable. *)

    LD Year
    ST FB_SysDateToEtime.Year

    LD Month
    ST FB_SysDateToEtime.Month

    LD Day
    ST FB_SysDateToEtime.Day

    CAL FB_SysDateToEtime (* Call the SysDateToEtime function block *)

(* Transfer the FB output variables to program variables. *)

    LD FB_SysDateToEtime.EpochTime
    ST EpochTime
```

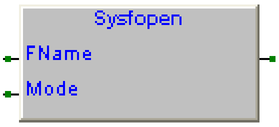
Esempio ST *(Ptp116a100)*

```
(* Here FB SysDateToETime is executed and variables copied. *)

    FB_SysDateToEtime.Year:=Year;
    FB_SysDateToEtime.Month:=Month;
    FB_SysDateToEtime.Day:=Day;
     FB_SysDateToEtime(); (* Call the SysDateToEtime function block *)
    EpochTime:=FB_SysDateToEtime.EpochTime; (* Epoch time *)
```

7.7 Funzioni ed FB per gestione terminale di I/O

7.7.1 Sysfopen, file open

Type	Library	Version
Function	Embedded	3.0



Questa funzione permette l'apertura del collegamento tra la risorsa indicata dal parametro ***FName***, ed un flusso di dati ***stream*** da impiegare nelle successive chiamate alle funzioni di I/O. La funzione ritorna il pointer alla risorsa.

Se la risorsa indicata è già aperta oppure il nome della risorsa è errato, la funzione ritorna ***NULL***. Se si sta aprendo un file su disco per crearlo, accertarsi che il disco sia formattato.

Parametri funzione:

FName (STRING[20]) E' il nome della risorsa da utilizzare.

Name	Resource
COM0	Serial port COM0
COM1	Serial port COM1
COM2	Serial port COM2
PCOMx.y	Porta seriale y su modulo periferico con indirizzo x
UDPSKT	UDP socket
TCPSKT	TCP socket
pathname	Percorso completo comprensivo del nome file (es.: 'Storage/myFile.txt')

Mode (STRING[4]) Indica il modo in cui la risorsa è aperta: r=read; w=write ; a=append. Per le porte seriali definire 'rw'.
Per creare un file su disco, occorre eseguire l'apertura in 'w' o 'a'.
L'apertura in 'w' su un file esistente, provoca la cancellazione del contenuto.
L'apertura in 'r' o 'w' posizionano l'indicatore di posizione dello stream all'inizio del file, l'apertura in 'a' lo posiziona alla fine.

La funzione ritorna:

(FILEP) Pointer alla risorsa.
NULL: In caso di errore.

Codici di errore

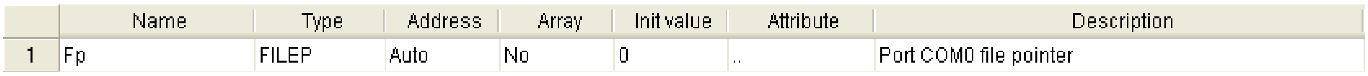
In caso di errore la funzione torna con ***NULL*** e con ***SysGetLastError*** è possibile rilevare il codice di errore.

9996100	Nome risorsa ***FName*** ha lunghezza errata.
9996110	Nome risorsa ***FName*** ha lunghezza errata.
9996200~2	Impossibile utilizzare porta da programma utente.

Esempi

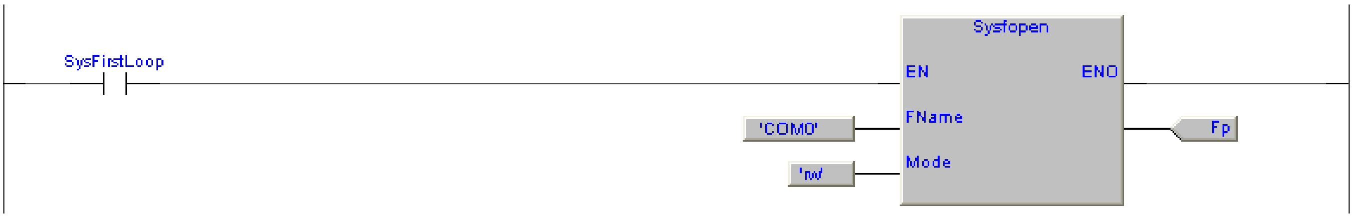
Viene aperta la porta seriale in read/write.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	Port COM0 file pointer

Esempio LD

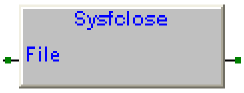


Esempio ST *(Ptp116a100)*

```
IF (Fp = NULL) THEN
    Fp:=Sysfopen('COM0', 'rw'); (* Port COM0 file pointer *)
END_IF;
```

7.7.2 Sysfclose, file close

Type	Library	Version
Function	Embedded	3.0



Questa funzione permette la chiusura del collegamento alla risorsa indicata dal parametro ***File***, precedentemente aperto dalla funzione Sysfopen.

In caso di errore chiusura, la funzione ritorna ***EOF***.

Parametri funzione:

File (FILEP)	Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.

La funzione ritorna:

(INT)	***0:*** Se esecuzione corretta. ***EOF:*** In caso di errore.

Codici di errore

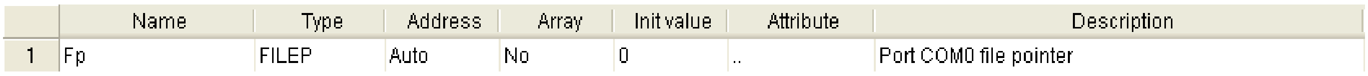
In caso di errore la funzione torna con ***EOF*** e con ***SysGetLastError*** è possibile rilevare il codice di errore.

9973100	Terminale di I/O usato in task fast o slow.
9973200	Errore nella chiusura della risorsa.

Esempi

Viene aperta e successivamente chiusa la porta seriale ***COM0***. Se la porta è correttamente aperta viene attivata l'uscita ***Do00M00***. Se la porta è correttamente chiusa viene attivata l'uscita ***Do01M00***.

Definizione variabili



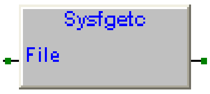
	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	Port COM0 file pointer

Esempio ST *(Ptp116a100)*

```
(* Here the COM0 port is opened in read/write. *)

    IF (Fp = NULL) THEN
        Fp:=Sysfopen('COM0', 'rw'); (* Port COM0 file pointer *)
        Do00M00:=(Fp <> NULL); (* Output is set if port is opened *)
    END_IF;

(* Here the COM0 port is closed. *)

    IF (Fp <> NULL) THEN
        Do01M00:=(Sysfclose(Fp) <> EOF); (* Output is set if port is closed *)
    END_IF;
```

7.7.3 Sysfgetc, get character from file

Type	Library	Version
Function	Embedded	3.0



Questa funzione ritorna un carattere dal flusso dati ***stream*** indicato dal parametro ***File***, precedentemente aperto dalla funzione Sysfopen.

La funzione ritorna il carattere letto dallo stream. In caso di errore o se nessun dato dallo stream, la funzione ritorna ***EOF***. Per essere certi che vi siano caratteri dallo stream è possibile utilizzare la funzione SysGetIChars che ne ritorna il numero.

Parametri funzione:

File (FILEP) Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.

La funzione ritorna:

(INT) Carattere letto dal flusso di dati.
EOF: In caso di errore o se nessun dato dallo stream.

Codici di errore

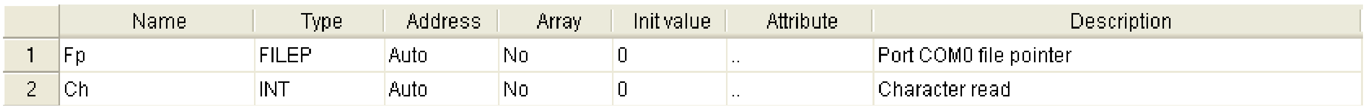
In caso di errore la funzione torna con ***EOF*** e con ***SysGetLastError*** è possibile rilevare il codice di errore.

9972100 Terminale di I/O usato in task fast o slow.

Esempi

Viene eseguita apertura porta seriale ***COM0*** e controllato se caratteri disponibili dalla porta. Se almeno un carattere è disponibile ne viene eseguita lettura ed il carattere letto è trasferito nella variabile ***Ch***.

Definizione variabili



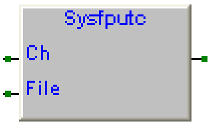
	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	Port COM0 file pointer
2	Ch	INT	Auto	No	0	..	Character read

Esempio ST *(Ptp116a100)*

```
(* Here the COM0 port is opened in read/write. *)

    IF (Fp = NULL) THEN
        Fp:=Sysfopen('COM0', 'rw'); (* Port COM0 file pointer *)
    END_IF;

(* Here check if a character is available from port and read it. *)

    IF (Fp <> NULL) THEN
        IF (TO_BOOL(SysGetIChars(Fp))) THEN
            Ch:=Sysfgetc(Fp); (* Get input character *)
        END_IF;
     END_IF;
```

7.7.4 Sysfputc, put character to file

Type	Library	Version
Function	Embedded	3.0



Questa funzione invia un carattere sul flusso dati ***stream*** indicato dal parametro ***File***, precedentemente aperto dalla funzione Sysfopen.

La funzione ritorna il carattere scritto sullo stream. In caso di errore o se lo stream non accetta il dato, la funzione ritorna EOF. Per essere certi che vi sia spazio sullo stream per accettare il carattere, è possibile utilizzare la funzione SysGetOSpace che ritorna lo spazio disponibile.

Parametri funzione:

Ch (INT)	Carattere da inviare sul flusso dati.
File (FILEP)	Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.

La funzione ritorna:

(INT)	Carattere scritto sul flusso di dati. ***EOF:*** In caso di errore o se lo stream non accetta il dato.

Codici di errore

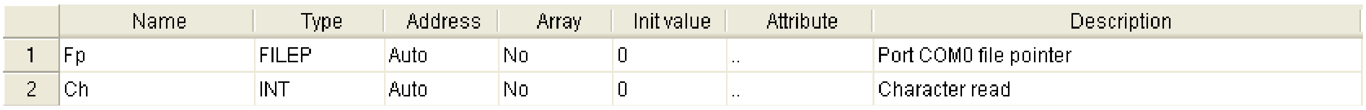
In caso di errore la funzione torna con ***EOF*** e con ***SysGetLastError*** è possibile rilevare il codice di errore.

9971100 Terminale di I/O usato in task fast o slow.

Esempi

E' riportato un semplice programma che esegue l'eco dei caratteri ricevuti dalla porta seriale ***COM0***. Viene eseguita apertura porta seriale ***COM0*** e controllato se caratteri disponibili dalla porta. Se almeno un carattere è disponibile ne viene eseguita lettura e successiva ritrasmissione.

Definizione variabili *(Ptp116a100)*



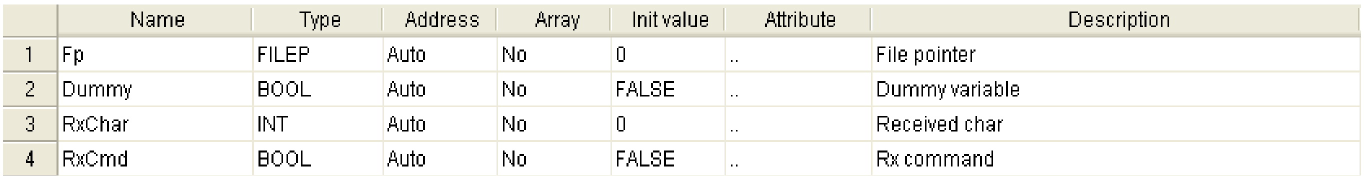
	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	Port COM0 file pointer
2	Ch	INT	Auto	No	0	..	Character read

Esempio ST

```
(* Here the COM0 port is opened in read/write. *)

    IF (Fp = NULL) THEN
        Fp:=Sysfopen('COM0', 'rw'); (* Port COM0 file pointer *)
    END_IF;

(* Here execute the received characters echo. *)

    IF (Fp <> NULL) THEN
        IF (TO_BOOL(SysGetIChars(Fp))) AND (TO_BOOL(SysGetOSpace(Fp))) THEN
            Ch:=Sysfgetc(Fp); (* Get input character *)
            Ch:=Sysfputc(Ch, Fp); (* Put input character *)
        END_IF;
    END_IF;
```

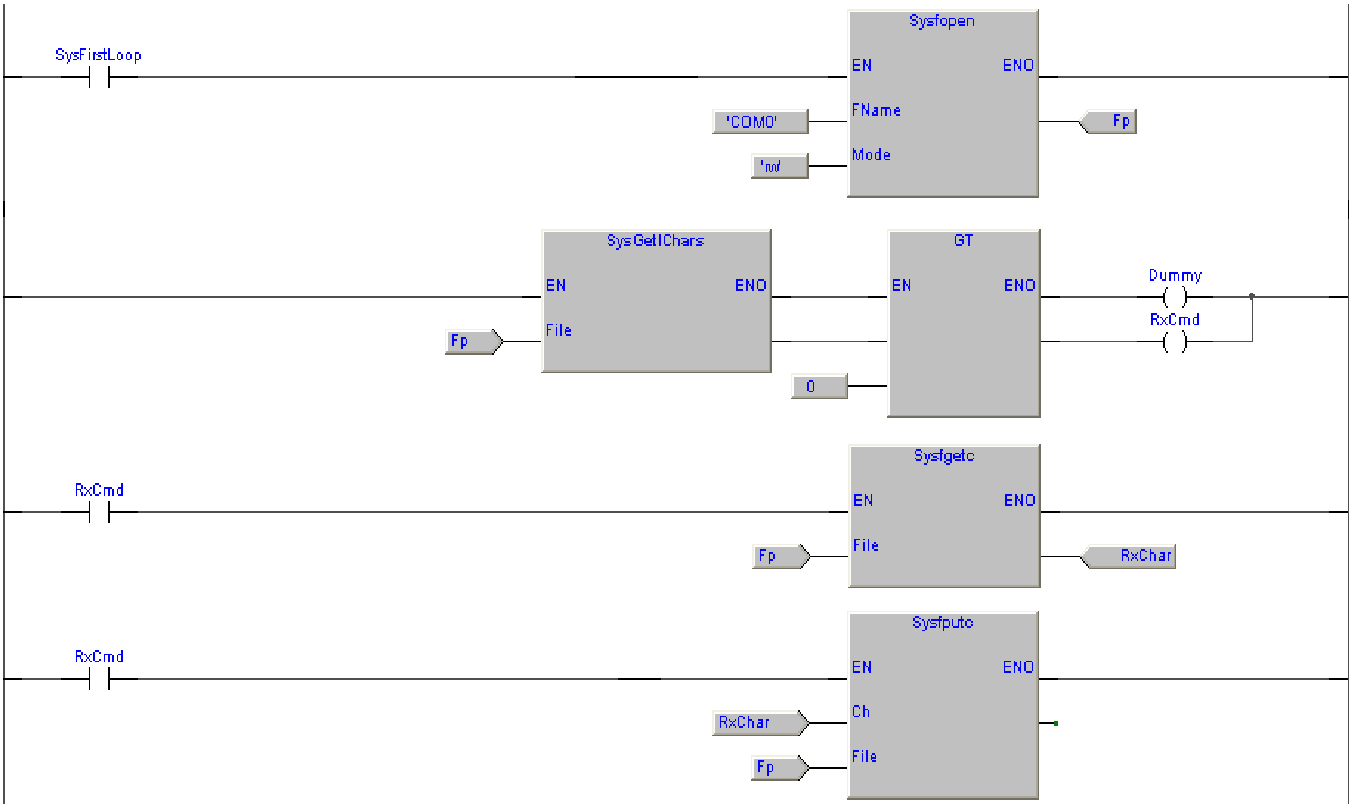
Utilizzando le funzioni di gestione terminale di I/O è possibile realizzare un semplice programma che esegue l'echo del carattere ricevuto dalla porta seriale ***COM0***. La porta viene aperta con il modo impostato di default (115200, e, 8, 1), se è ricevuto un carattere dalla porta si attiva ***RxCmd*** ed il carattere ricevuto è copiato in ***RxChar***. La ricezione di un carattere provoca la trasmissione del carattere ricevuto.

Definizione variabili



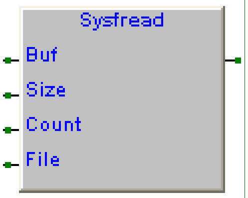
	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	File pointer
2	Dummy	BOOL	Auto	No	FALSE	..	Dummy variable
3	RxChar	INT	Auto	No	0	..	Received char
4	RxCmd	BOOL	Auto	No	FALSE	..	Rx command

Esempio LD *(Ptp119a000)*



7.7.5 Sysfread, read data from file

Type	Library	Version
Function	Embedded	3.0



Questa funzione esegue la lettura di un numero definito di stringhe di lunghezza definita dal flusso dati ***stream*** indicato dal parametro ***File***, precedentemente aperto dalla funzione Sysfopen.

La funzione ritorna il numero di stringhe dati lette. Se nello ***stream*** non ci sono abbastanza stringhe da soddisfare i parametri, viene ritornato un numero minore di stringhe lette rispetto al valore definito.

Parametri funzione:

Buf (@STRING)	Indirizzo della stringa dove trasferire le stringhe lette.
Size (INT)	Lunghezza in caratteri delle stringhe da leggere.
Count (INT)	Numero di stringhe da leggere.
File (FILEP)	Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.

La funzione ritorna:

(INT)	Numero di stringhe lette, se il valore ritornato è minore di ***Count***, significa che non vi erano abbastanza dati nello stream.

Codici di errore

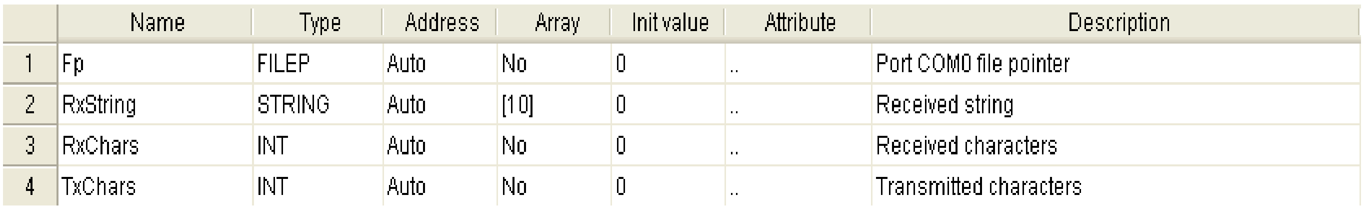
In caso di errore la funzione torna con ***0*** e con ***SysGetLastError*** è possibile rilevare il codice di errore.

9970100	Terminale di I/O usato in task fast o slow.

Esempi

Vengono attesi almeno 5 caratteri ricevuti dalla porta seriale e quando ricevuti viene letta una stringa di 5 caratteri (5 stringhe di 1 carattere), la stringa letta è trasferita nella variabile ***RxString***. La stringa letta viene poi ritrasmessa sulla porta seriale, notare come anche nella trasmissione è trasmessa una stringa di 5 caratteri (1 stringa di 5 caratteri) .

Definizione variabili



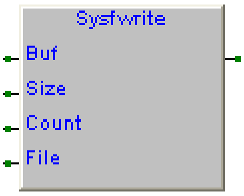
	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	Port COM0 file pointer
2	RxString	STRING	Auto	[10]	0	..	Received string
3	RxChars	INT	Auto	No	0	..	Received characters
4	TxChars	INT	Auto	No	0	..	Transmitted characters

Esempio ST

```
(* Here the COM0 port is opened in read/write. *)

    IF (Fp = NULL) THEN
        Fp:=Sysfopen('COM0', 'rw'); (* Port COM0 file pointer *)
    END_IF;

(* Here wait until at least 5 chars are received and echoes them. *)

    IF (Fp <> NULL) THEN
        IF (SysGetIChars(Fp) >= 5) THEN
            RxChars:=Sysfread(ADR(RxString), 1, 5, Fp); (* Received characters *)
            TxChars:=Sysfread(ADR(RxString), 5, 1, Fp); (* Received characters *)
        END_IF;
    END_IF;
```

7.7.6 Sysfwrite, write data to file

Type	Library	Version
Function	Embedded	3.0



Questa funzione esegue la scrittura di un numero definito di stringhe di lunghezza definita nel flusso dati ***stream*** indicato dal parametro ***File***, precedentemente aperto dalla funzione Sysfopen.

La funzione ritorna il numero di stringhe dati scritte. Se nello stream non c'è abbastanza spazio per contenere il numero di stringhe definito, viene ritornato un numero minore di stringhe scritte rispetto al valore definito.

Parametri funzione:

Buf (@STRING)	Indirizzo della stringa da scrivere.
Size (INT)	Lunghezza in caratteri delle stringhe da scrivere.
Count (INT)	Numero di stringhe da scrivere.
File (FILEP)	Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.

La funzione ritorna:

(INT)	Numero di stringhe scritte, se valore ritornato minore di ***Count***, non vi era abbastanza spazio nello stream.

Codici di errore

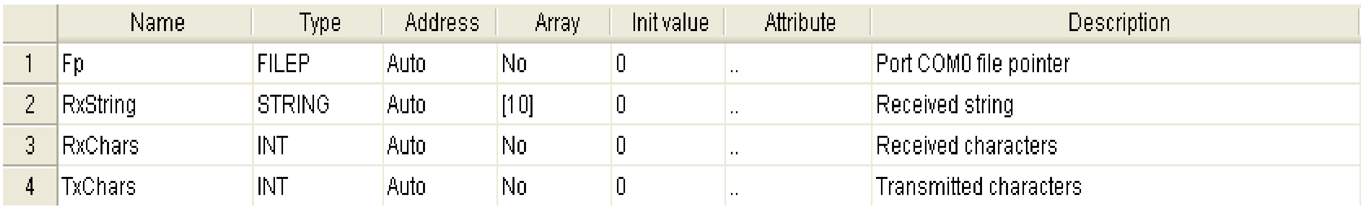
In caso di errore la funzione torna con ***0*** e con ***SysGetLastError*** è possibile rilevare il codice di errore.

9969100 Terminale di I/O usato in task fast o slow.

Esempi

Vengono attesi almeno 5 caratteri ricevuti dalla porta seriale e quando ricevuti viene letta una stringa di 5 caratteri (5 stringhe di 1 carattere), la stringa letta è trasferita nella variabile ***RxString***. La stringa letta viene poi ritrasmessa sulla porta seriale, notare come anche nella trasmissione è trasmessa una stringa di 5 caratteri (1 stringa di 5 caratteri) .

Definizione variabili



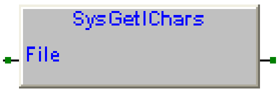
	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	Port COM0 file pointer
2	RxString	STRING	Auto	[10]	0	..	Received string
3	RxChars	INT	Auto	No	0	..	Received characters
4	TxChars	INT	Auto	No	0	..	Transmitted characters

Esempio ST

```
(* Here the COM0 port is opened in read/write. *)

    IF (Fp = NULL) THEN
        Fp:=Sysfopen('COM0', 'rw'); (* Port COM0 file pointer *)
    END_IF;

(* Here wait until at least 5 chars are received and echoes them. *)

    IF (Fp <> NULL) THEN
        IF (SysGetIChars(Fp) >= 5) THEN
            RxChars:=Sysfread(ADR(RxString), 1, 5, Fp); (* Received characters *)
            TxChars:=Sysfwrite(ADR(RxString), 5, 1, Fp); (* Transmitted characters *)
        END_IF;
    END_IF;
```

7.7.7 SysGetIChars, get input available characters from file

Type	Library	Version
Function	Embedded	3.0



Questa funzione ritorna il numero di caratteri disponibili per la lettura dal flusso dati ***stream*** indicato dal parametro ***File***, precedentemente aperto dalla funzione Sysfopen.

Se il valore ritornato è diverso da ***0*** i caratteri potranno essere letti con la funzione Sysfgetc.

Parametri funzione:

File (FILEP) Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.

La funzione ritorna:

(INT) Numero di caratteri disponibili dal flusso dati.

Codici di errore

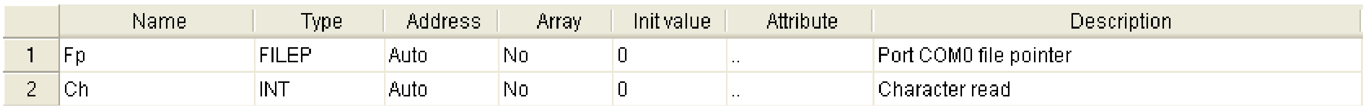
In caso di errore la funzione torna con ***0*** e con ***SysGetLastError*** è possibile rilevare il codice di errore.

9968100 Terminale di I/O usato in task fast o slow.

Esempi

E' riportato un semplice programma che esegue l'eco dei caratteri ricevuti dalla porta seriale ***COM0***. Viene eseguita apertura porta seriale ***COM0*** e controllato se caratteri disponibili dalla porta. Se almeno un carattere è disponibile ne viene eseguita lettura e successiva ritrasmissione.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	Port COM0 file pointer
2	Ch	INT	Auto	No	0	..	Character read

Esempio ST

```
(* Here the COM0 port is opened in read/write. *)

    IF (Fp = NULL) THEN
        Fp:=Sysfopen('COM0', 'rw'); (* Port COM0 file pointer *)
    END_IF;

(* Here execute the received characters echo. *)

    IF (Fp <> NULL) THEN
        IF (TO_BOOL(SysGetIChars(Fp))) AND (TO_BOOL(SysGetOSpace(Fp))) THEN
            Ch:=Sysfgetc(Fp); (* Get input character *)
            Ch:=Sysfputc(Ch, Fp); (* Put input character *)
        END_IF;
    END_IF;
```

7.7.8 SysGetOSpace, get output available space on file

Type	Library	Version
Function	Embedded	3.0

Questa funzione ritorna lo spazio disponibile per la scrittura dati sul flusso dati ***stream*** indicato dal parametro ***File***, precedentemente aperto dalla funzione ***Sysfopen***.

Se il valore ritornato è diverso da ***0*** i caratteri potranno essere scritti con la funzione ***Sysfputc***.

Parametri funzione:

File (FILEP) Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.

La funzione ritorna:

(INT) Spazio disponibile sul flusso dati per trasferire caratteri.
Se buffer vuoto viene ritornata la dimensione del buffer di trasmissione.

Codici di errore

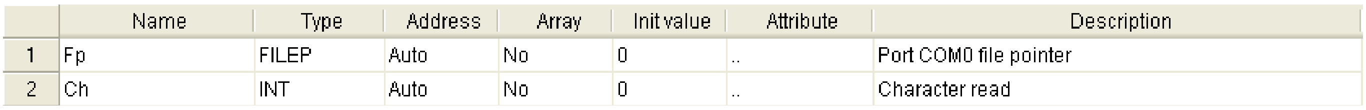
In caso di errore la funzione torna con ***0*** e con ***SysGetLastError*** è possibile rilevare il codice di errore.

9967100 Terminale di I/O usato in task fast o slow.

Esempi

E' riportato un semplice programma che esegue l'eco dei caratteri ricevuti dalla porta seriale ***COM0***. Viene eseguita apertura porta seriale ***COM0*** e controllato se caratteri disponibili dalla porta. Se almeno un carattere è disponibile ne viene eseguita lettura e successiva ritrasmissione.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	Port COM0 file pointer
2	Ch	INT	Auto	No	0	..	Character read

Esempio ST

```
(* Here the COM0 port is opened in read/write. *)

    IF (Fp = NULL) THEN
        Fp:=Sysfopen('COM0', 'rw'); (* Port COM0 file pointer *)
    END_IF;

(* Here execute the received characters echo. *)

    IF (Fp <> NULL) THEN
        IF (TO_BOOL(SysGetIChars(Fp))) AND (TO_BOOL(SysGetOSpace(Fp))) THEN
            Ch:=Sysfgetc(Fp); (* Get input character *)
            Ch:=Sysfputc(Ch, Fp); (* Put input character *)
        END_IF;
    END_IF;
```

7.7.9 SysGetRxBSize, get file Rx input buffer size

Type	Library	Version
Function	Embedded	5.0

Questa funzione ritorna la dimensione del buffer di input (Ricezione) sul flusso dati ***stream*** indicato dal parametro ***File***, precedentemente aperto dalla funzione ***Sysfopen***.

Parametri funzione:

File (FILEP) Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.

La funzione ritorna:

(UDINT) Dimensione buffer di input espressa in numero di caratteri (Bytes).

Codici di errore

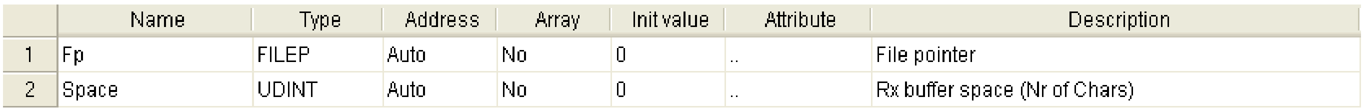
In caso di errore la funzione torna con ***0*** e con ***SysGetLastError*** è possibile rilevare il codice di errore.

9966100 Terminale di I/O usato in task fast o slow.

Esempi

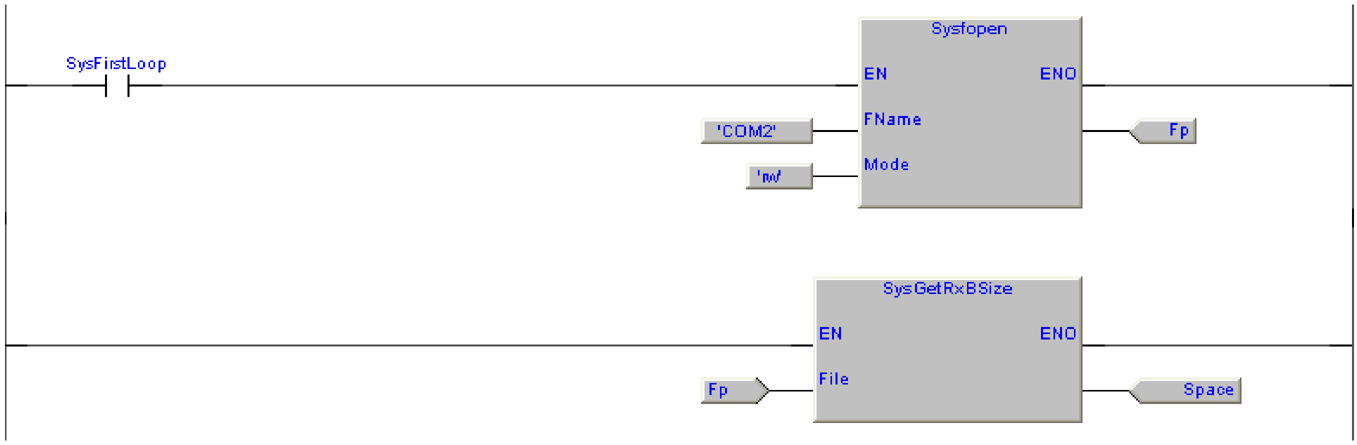
E' riportato un semplice programma che ritorna la dimensione del buffer di input (Ricezione) della porta seriale ***COM2***. Il valore ritornato espresso in numero di caratteri (Bytes), è trasferito nella variabile ***Space***.

Definizione variabili



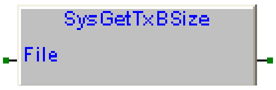
	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	File pointer
2	Space	UDINT	Auto	No	0	..	Rx buffer space (Nr of Chars)

Esempio LD



7.7.10 SysGetTxBSize, get file Tx output buffer size

Type	Library	Version
Function	Embedded	5.0



Questa funzione ritorna la dimensione del buffer di output (Trasmissione) sul flusso dati ***stream*** indicato dal parametro ***File***, precedentemente aperto dalla funzione ***Sysfopen***.

Parametri funzione:

File (FILEP) Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.

La funzione ritorna:

(UDINT) Dimensione buffer di output espressa in numero di caratteri (Bytes).

Codici di errore

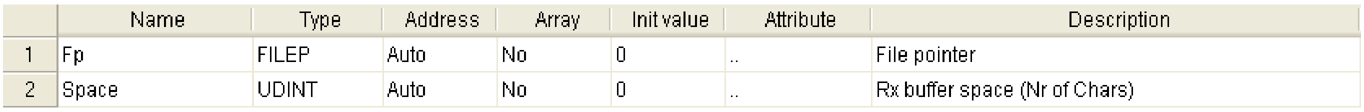
In caso di errore la funzione torna con ***0*** e con ***SysGetLastError*** è possibile rilevare il codice di errore.

9965100 Terminale di I/O usato in task fast o slow.

Esempi

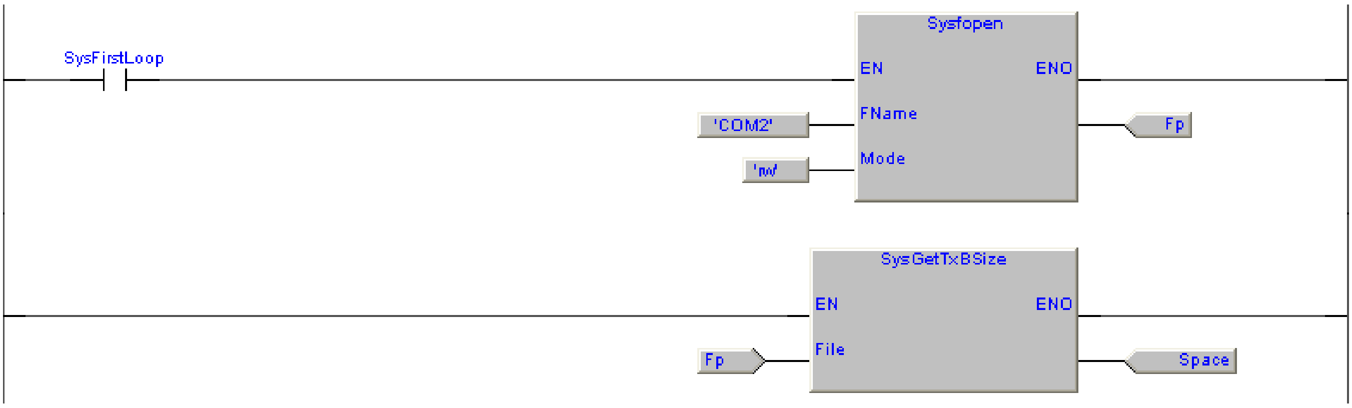
E' riportato un semplice programma che ritorna la dimensione del buffer di output (Trasmissione) della porta seriale ***COM2***. Il valore ritornato espresso in numero di caratteri (Bytes), è trasferito nella variabile ***Space***.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	File pointer
2	Space	UDINT	Auto	No	0	..	Rx buffer space (Nr of Chars)

Esempio LD



7.7.11 SysFIBfClear, file input buffer clear

Type	Library	Version
Function	Embedded	3.0

Questa funzione elimina tutti i caratteri in lettura presenti sul flusso dati ***stream*** indicato dal parametro ***File***, precedentemente aperto dalla funzione ***Sysfopen***.

La funzione ritorna ***FALSE*** in caso di errore.

Parametri funzione:

File (FILEP) Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.

La funzione ritorna:

(BOOL) ***FALSE:*** Errore esecuzione.
TRUE: Funzione eseguita correttamente.

Codici di errore

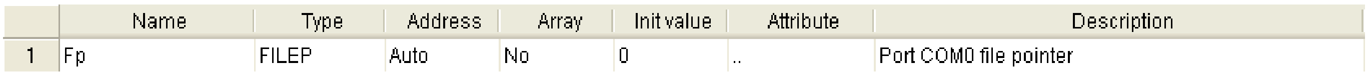
In caso di errore la funzione torna ***FALSE*** e con ***SysGetLastError*** è possibile rilevare il codice di errore.

9964100 Terminale di I/O usato in task fast o slow.

Esempi

Se è attivo l'ingresso ***Di00M00*** tutti i caratteri in ingresso dalla porta seriale saranno cancellati e l'uscita ***Do00M00*** attivata.

Definizione variabili



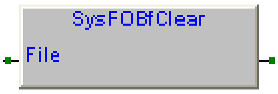
	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	Port COM0 file pointer

Esempio ST

```
(* Here the COM0 port is opened in read/write. *)

    IF (Fp = NULL) THEN
        Fp:=Sysfopen('COM0', 'rw'); (* Port COM0 file pointer *)
    END_IF;

(* If the input is active the input buffer is cleared. *)

    IF (Fp <> NULL) THEN
        IF (Di00M00) THEN Do00M00:=SysFIBfClear(Fp); END_IF;
    END_IF;
```

7.7.12 SysFOBfClear, file output buffer clear

Type	Library	Version
Function	Embedded	3.0



Questa funzione elimina tutti i caratteri in uscita presenti sul flusso dati ***stream*** indicato dal parametro ***File***, precedentemente aperto dalla funzione ***Sysfopen***.

La funzione ritorna ***FALSE*** in caso di errore.

Parametri funzione:

File (FILEP) Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.

La funzione ritorna:

(BOOL) ***FALSE:*** Errore esecuzione.
TRUE: Funzione eseguita correttamente.

Codici di errore

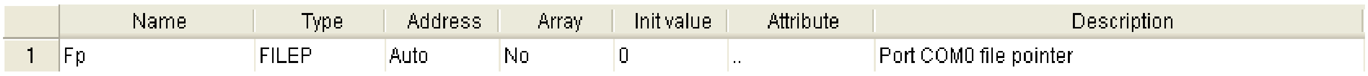
In caso di errore la funzione torna ***FALSE*** e con ***SysGetLastError*** è possibile rilevare il codice di errore.

9963100 Terminale di I/O usato in task fast o slow.

Esempi

Se è attivo l'ingresso ***Di00M00*** tutti i caratteri in uscita dalla porta seriale saranno cancellati e l'uscita ***Do00M00*** attivata.

Definizione variabili



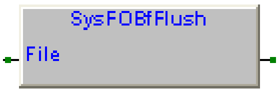
	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	Port COM0 file pointer

Esempio ST

```
(* Here the COM0 port is opened in read/write. *)

    IF (Fp = NULL) THEN
        Fp:=Sysfopen('COM0', 'rw'); (* Port COM0 file pointer *)
    END_IF;

(* If the input is active the ouput buffer is cleared. *)

    IF (Fp <> NULL) THEN
        IF (Di00M00) THEN Do00M00:=SysFOBfClear(Fp); END_IF;
    END_IF;
```

7.7.13 SysFOBfFlush, file output buffer flush

Type	Library	Version
Function	Embedded	3.0



Questa funzione forza l'uscita immediata dei caratteri presenti sul flusso dati ***stream*** indicato dal parametro ***File***, precedentemente aperto dalla funzione ***Sysfopen***, sulla risorsa connessa.

La funzione ritorna ***FALSE*** in caso di errore.

Parametri funzione:

File (FILEP) Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.

La funzione ritorna:

(BOOL) ***FALSE:*** Errore esecuzione.
TRUE: Funzione eseguita correttamente.

Codici di errore

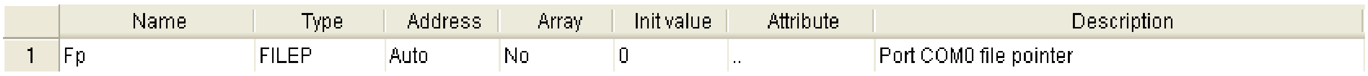
In caso di errore la funzione torna ***FALSE*** e con ***SysGetLastError*** è possibile rilevare il codice di errore.

9962100 Terminale di I/O usato in task fast o slow.

Esempi

Se è attivo l'ingresso ***Di00M00*** tutti i caratteri presenti nel buffer di uscita della porta seriale saranno trasmessi e l'uscita ***Do00M00*** attivata.

Definizione variabili



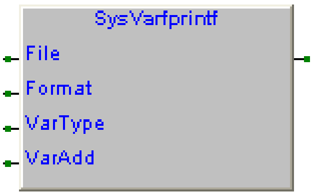
	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	Port COM0 file pointer

Esempio ST

```
(* Here the COM0 port is opened in read/write. *)

    IF (Fp = NULL) THEN
        Fp:=Sysfopen('COM0', 'rw'); (* Port COM0 file pointer *)
    END_IF;

(* If the input is active the ouput buffer is cleared. *)

    IF (Fp <> NULL) THEN
        IF (Di00M00) THEN Do00M00:=SysFOBfFlush(Fp); END_IF;
    END_IF;
```

7.7.14 SysVarfprintf, variable print to file

Type	Library	Version
Function	Embedded	3.0



Questa funzione esegue la stampa formattata di una variabile sullo stream collegato al parametro ***File***, precedentemente aperto dalla funzione ***Sysfopen***.

La stringa ***Format*** specifica il formato con il quale stampare la variabile. Mentre in ***VarType*** è indicato il tipo di variabile ed in ***VarAdd*** il suo indirizzo.

La funzione ritorna il numero di caratteri trasferiti nello stream, ***EOF*** in caso di errore.

Parametri funzione:

File (FILEP)	Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.
Format (STRING[80])	Ha due tipi di argomenti, i caratteri ordinari che vengono copiati nello stream di uscita, e le specifiche di conversione, contraddistinte dal simbolo percentuale (%) e da un carattere che specifica il formato con il quale stampare la variabile definita.
VarType (USINT)	Tipo variabile, come indicato nella tabella ***Variable types definition***.
VarAdd (UDINT)	Indirizzo variabile.

La funzione ritorna:

(INT)	Numero di caratteri trasferiti nello stream. ***EOF:*** Errore esecuzione.

Codici di errore

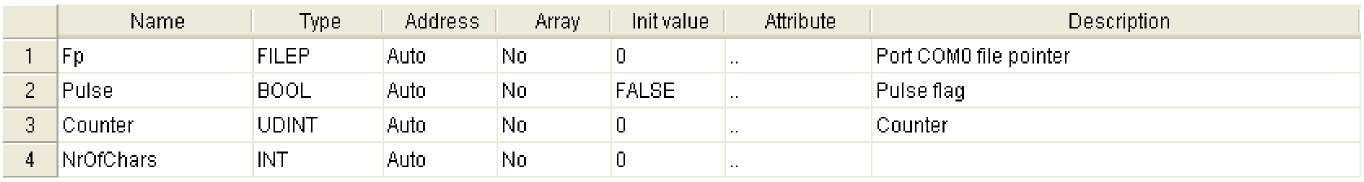
In caso di errore la funzione torna con ***EOF*** e con ***SysGetLastError*** è possibile rilevare il codice di errore.

9998010	Valore di ***File*** non definito.
9968100	Terminale di I/O usato in task fast o slow.
9998200	Tipo variabile non gestito, controllare ***VarType***.

Esempi

Su fronte attivazione ingresso ***Di00M00*** viene incrementata la variabile ***Counter*** ed il suo valore inviato sulla porta seriale ***COM0***. Nella variabile ***NrOfChars*** viene caricato il numero di caratteri inviati in uscita sulla porta seriale.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	Port COM0 file pointer
2	Pulse	BOOL	Auto	No	FALSE	..	Pulse flag
3	Counter	UDINT	Auto	No	0	..	Counter
4	NrOfChars	INT	Auto	No	0	..	

Esempio ST

```
(* Here the COM0 port is opened in read/write. *)

    IF (Fp = NULL) THEN Fp:=Sysfopen('COM0', 'rw'); END_IF;

    IF (Fp <> NULL) THEN

        IF (Di00M00 <> Pulse) THEN
            Pulse:=Di00M00; (* Pulse flag *)

            IF (Di00M00) THEN
                Counter:=Counter+1; (* Counter *)
                NrOfChars:=SysVarfprintf(Fp, 'Counter:%04d$r$n', UDINT_TYPE, ADR(Counter));
            END_IF;
        END_IF;
    END_IF;
```

7.8 File system

Le “CPU SlimLine ARM7” a partire dal firmware versione ***SFW167C100***, possono gestire il file system. In tali CPU esistono due directories predefinite:

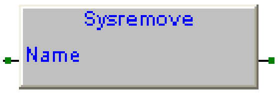
Storage: Directory allocata sulla memoria EEPROM presente su SlimLine (Tutte le versioni).

SDCard: Directory allocata sul chip SD Card che deve essere inserito nell'apposito connettore.

Per le operazioni di formattazione del file system si rimanda al manuale utente, il file system è raggiungibile da FTP, quindi utilizzando un client FTP è possibile creare nuovi files, cancellare files esistenti, rinominare files esistenti, leggere e scrivere dati nei files.

7.8.1 Sysremove, file remove

Type	Library	Version
Function	Embedded	7.0



Questa funzione esegue la rimozione (cancellazione) di un file. In ***Name*** occorre definire il nome del file da eliminare specificando l'intero percorso (Esempio Storage/File.txt).

Se l'operazione di rimozione va a buon fine la funzione ritorna ***TRUE***, in caso di errore viene ritornato ***FALSE***.

Parametri funzione:

Name (STRING[32])	Nome del file da cancellare.

La funzione ritorna:

(BOOL)	***FALSE:*** Errore esecuzione. ***TRUE:*** Ok esecuzione.

Codici di errore

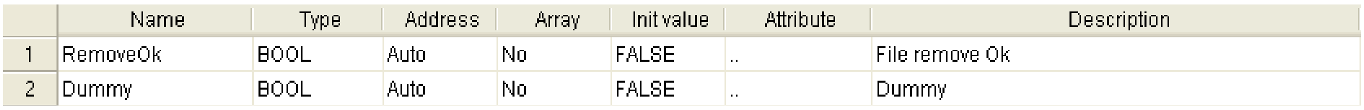
In caso di errore la funzione torna ***FALSE*** e con ***SysGetLastError*** è possibile rilevare il codice di errore.

9961100 Funzione richiamata in task fast o slow.

Esempi

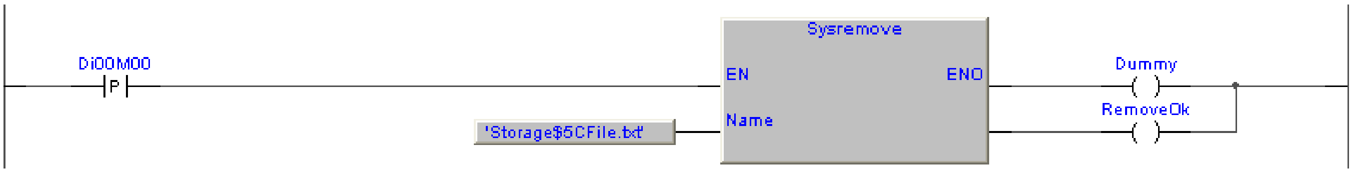
Sul fronte di attivazione dell'ingresso digitale ***Di00M00*** viene eliminato il file ***File.txt*** presente nella directory ***Storage***.

Definizione variabili



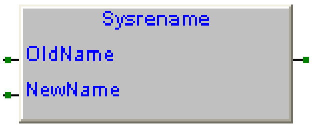
	Name	Type	Address	Array	Init value	Attribute	Description
1	RemoveOk	BOOL	Auto	No	FALSE	..	File remove Ok
2	Dummy	BOOL	Auto	No	FALSE	..	Dummy

Esempio LD



7.8.2 Sysrename, file rename

Type	Library	Version
Function	Embedded	7.0



Questa funzione esegue il cambiamento del nome di un file. In ***OldName*** occorre definire il nome del file da rinominare specificando l'intero percorso (Esempio Storage/OldFile.txt), in ***NewName*** occorre definire il nuovo nome del file specificando l'intero percorso (Esempio Storage/NewFile.txt).

Se l'operazione di rinomina va a buon fine la funzione ritorna ***TRUE***, in caso di errore viene ritornato ***FALSE***.

Parametri funzione:

OldName (STRING[32])	Nome del file da rinominare.
NewName (STRING[32])	Nuovo nome da dare al file.

La funzione ritorna:

(BOOL)	***FALSE:*** Errore esecuzione. ***TRUE:*** Ok esecuzione.

Codici di errore

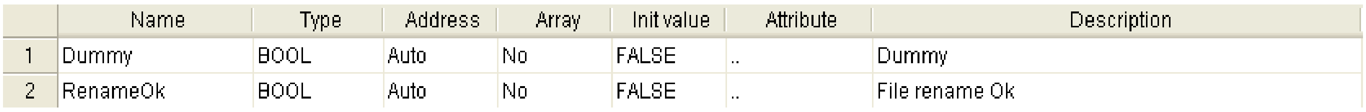
In caso di errore la funzione torna ***FALSE*** e con ***SysGetLastError*** è possibile rilevare il codice di errore.

9960100 Funzione richiamata in task fast o slow.

Esempi

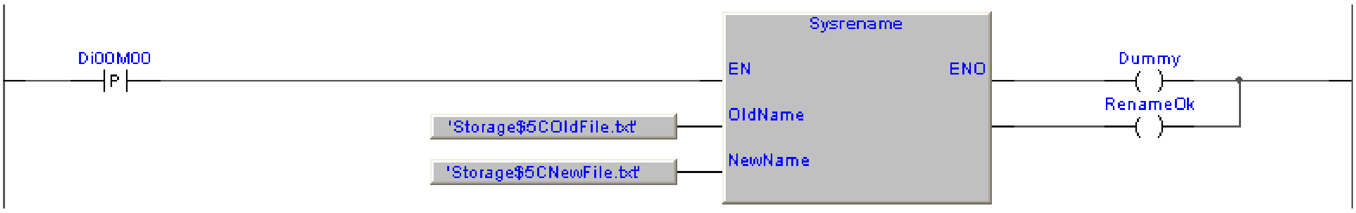
Sul fronte di attivazione dell'ingresso digitale ***Di00M00*** viene rinominato il file ***OldFile.txt*** presente nella directory ***Storage***. Il file assumerà il nuovo nome di ***NewFile.txt***.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	Dummy	BOOL	Auto	No	FALSE	..	Dummy
2	RenameOk	BOOL	Auto	No	FALSE	..	File rename Ok

Esempio LD



7.8.3 Sysfilelength, file lengh

Type	Library	Version
Function	Embedded	7.0

Questa funzione ritorna la lunghezza in bytes di un file. In ***Name*** occorre definire il nome del file di cui si vuole conoscere la lunghezza specificando l'intero percorso (Esempio Storage/File.txt).

Se il file indicato non è presente, la funzione ritorna ***-1***.

Parametri funzione:

Name (STRING[32]) Nome del file di cui si vuole conoscere la lunghezza.

La funzione ritorna:

(DINT) Lunghezza file (Bytes). ***EOF*** se file non presente.

Codici di errore

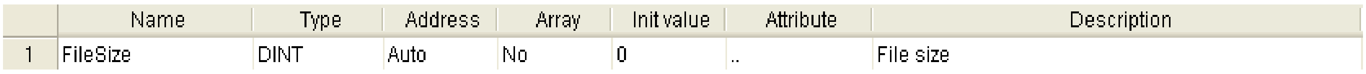
In caso di errore la funzione torna ***EOF*** e con ***SysGetLastError*** è possibile rilevare il codice di errore.

9959100 Funzione richiamata in task fast o slow.

Esempi

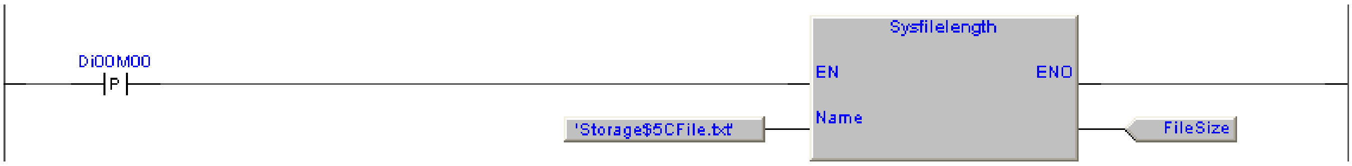
Sul fronte di attivazione dell'ingresso digitale ***Di00M00*** viene ritornata la lunghezza del file ***File.txt*** presente nella directory ***Storage***.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	FileSize	DINT	Auto	No	0	..	File size

Esempio LD



7.8.4 Sysfseek, file seek

Type	Library	Version
Function	Embedded	7.0

Questa funzione permette di cambiare l'indicatore di posizione dello stream collegato al parametro ***File***, precedentemente aperto dalla funzione ***Sysfopen***.

Offset specifica il numero di bytes dall'origine dove andrebbe posizionato l'indicatore di posizione. ***Origin*** specifica la posizione di origine rispetto alla quale spostare l'indicatore di posizione.

La funzione ritorna il valore attuale dell'indicatore di posizione. In caso di errore di posizionamento, l'indicatore di posizione rimane inalterato e la funzione ritorna ***EOF***.

Parametri funzione:

File (FILEP)	Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.
Offset (DINT)	Numero di bytes dall'origine dove posizionare l'indicatore di posizione
Origin (INT)	Occorre specificare la posizione di origine secondo la tabella sotto riportata.

Value	Mode	Description
0	ID_SEEK_SET	Inizio del file
1	ID_SEEK_CUR	Posizione corrente file
2	ID_SEEK_END	Fine del file

La funzione ritorna:

(DINT)	Valore attuale dell'indicatore di posizione. ***EOF*** se errore.

Codici di errore

In caso di errore la funzione torna ***EOF*** e con ***SysGetLastError*** è possibile rilevare il codice di errore.

9958100 Funzione richiamata in task fast o slow.

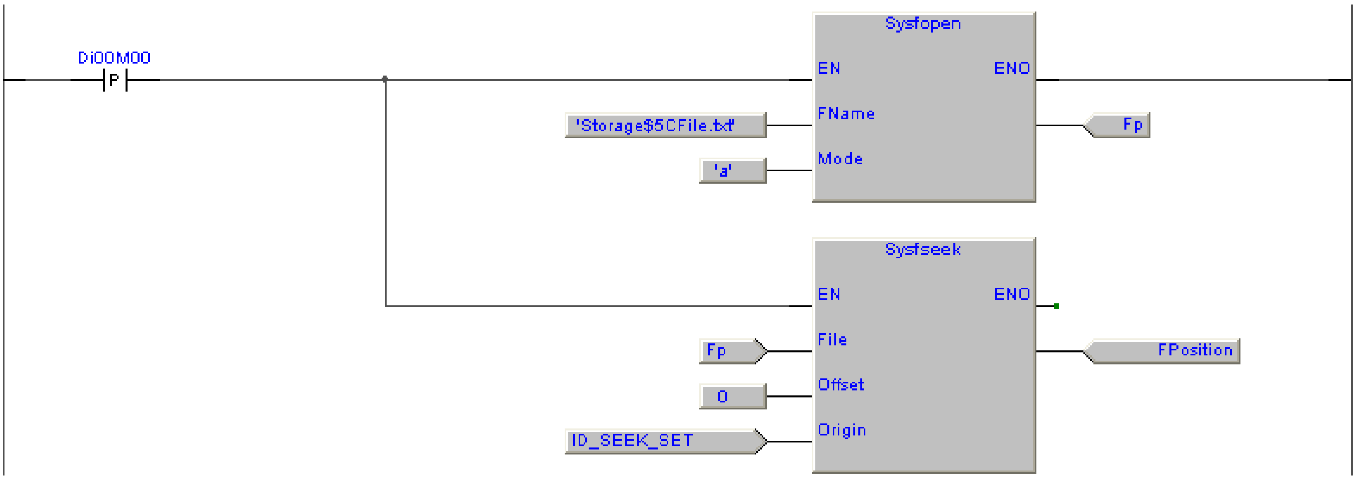
Esempi

Sul fronte di attivazione dell'ingresso ***Di00M00*** viene posizionato l'indicatore di posizione all'inizio del file ***File.txt*** presente nella directory ***Storage***.

Definizione variabili

	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	File pointer
2	FPosition	DINT	Auto	No	0	..	File position

Esempio LD

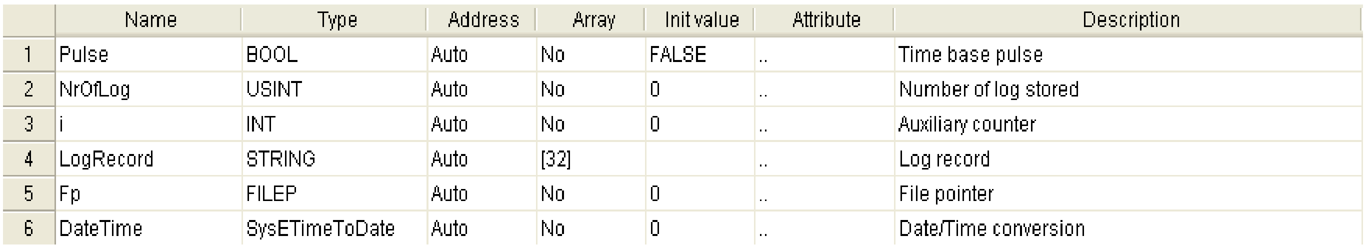


7.8.4.1 Scrittura file di log

Ecco un semplice programma che scrive nel file ***Log.txt*** presente nella directory ***Storage***, un record di log ad ogni secondo. Il record è scritto nel formato CSV e quindi facilmente importabile in Excel. Vengono scritti 50 records di log consecutivi, terminato il ciclo di scrittura si riprende dall'inizio del file sovrascrivendo i records già scritti. Il file di log creato sarà del tipo:

```
00;15;00;15;00000015;
01;15;00;16;00000005;
02;15;00;17;00000004;
03;15;00;18;00000004;
04;15;00;19;00000005;
```

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	Pulse	BOOL	Auto	No	FALSE	..	Time base pulse
2	NrOfLog	USINT	Auto	No	0	..	Number of log stored
3	i	INT	Auto	No	0	..	Auxiliary counter
4	LogRecord	STRING	Auto	[32]		..	Log record
5	Fp	FILEP	Auto	No	0	..	File pointer
6	DateTime	SysETimeToDate	Auto	No	0	..	Date/Time conversion

Esempio ST

```
(* Check if a second is passed. *)

    IF (SysClock1000 = Pulse) THEN RETURN; END_IF;
    Pulse:=SysClock1000; (* Time base pulse *)

    (* Open the file in "append" mode. *)

    Fp:=Sysfopen('Storage/Log.txt', 'a'); (* File pointer *)
    IF (Fp = NULL) THEN RETURN; END_IF;

    (* Create the log record. *)

    DateTime(EpochTime:=SysDateTime); (* Date time conversion *)
    i:=SysVarsnprintf(ADR(LogRecord), 4, '%02d;', USINT_TYPE, ADR(NrOfLog));
    i:=SysVarsnprintf(ADR(LogRecord[3]), 4, '%02d;', USINT_TYPE, ADR(DateTime.Hour));
    i:=SysVarsnprintf(ADR(LogRecord[6]), 4, '%02d;', USINT_TYPE, ADR(DateTime.Minute));
    i:=SysVarsnprintf(ADR(LogRecord[9]), 4, '%02d;', USINT_TYPE, ADR(DateTime.Second));
    i:=SysVarsnprintf(ADR(LogRecord[12]), 12, '%08ld;$r$n', UDINT_TYPE, ADR(SysTBackExTm));

    (* Set the file pointer on right position. *)

    i:=Sysfseek(Fp, TO_DINT(NrOfLog*23), ID_SEEK_SET);
    NrOfLog:=NrOfLog+1; (* Number of log stored *)
    IF (NrOfLog >= 50) THEN NrOfLog:=0; END_IF;

    i:=Sysfwrite(ADR(LogRecord), 23, 1, Fp); (* Write to file *)
    i:=Sysfclose(Fp); (* Close file *)
```

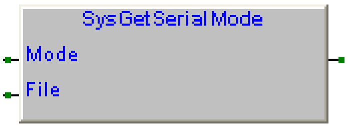
7.9 Funzioni ed FB per gestione porta seriale

I sistemi SlimLine dispongono di più porte seriali in base alla versione del prodotto. Le porte seriali vengono identificate con un nome del tipo ***COMx*** dove al posto della ***x*** vi è il numero di porta seriale.

Per la corrispondenza tra il numero di porta ed il connettore fisico ad essa connesso, si rimanda al manuale hardware del prodotto.

Type	Library	Version
Function	Embedded	3.0

7.9.1 SysGetSerialMode, get serial mode



Questa funzione ritorna il modo di comunicazione impostato sulla porta seriale connessa al parametro ***File***, precedentemente aperto dalla funzione ***Sysfopen***.

Nel parametro ***Mode*** occorre definire l'indirizzo della struttura ***SYSSERIALMODE*** in cui dovrà essere trasferito il modo seriale attualmente impostato sulla porta. La funzione ritorna ***FALSE*** in caso di errore.

Parametri funzione:

Mode (@SYSSERIALMODE)	Indirizzo struttura ***SYSSERIALMODE*** in cui trasferire il modo letto.
File (FILEP)	Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.

La funzione ritorna:

(BOOL)	***FALSE:*** Errore esecuzione. ***TRUE:*** Funzione eseguita correttamente.

Codici di errore

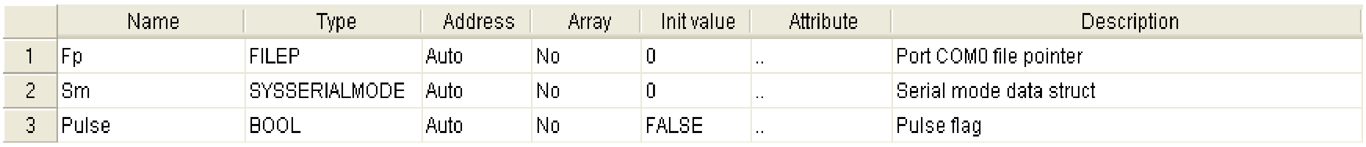
In caso di errore la funzione torna ***FALSE*** e con ***SysGetLastError*** è possibile rilevare il codice di errore.

9995010	Valore di ***File*** non definito.
9995020	Indirizzo struttura ***SYSSERIALMODE*** non corretto, verificare ***Mode***.
9995100 ÷ 1	Errore esecuzione funzione.

Esempi

Su fronte attivazione ingresso ***Di00M00*** viene salvato il modo impostato sulla porta seriale ***COM0*** nella variabile ***Sm*** e viene attivata l'uscita ***Do00M00***.

Definizione variabili

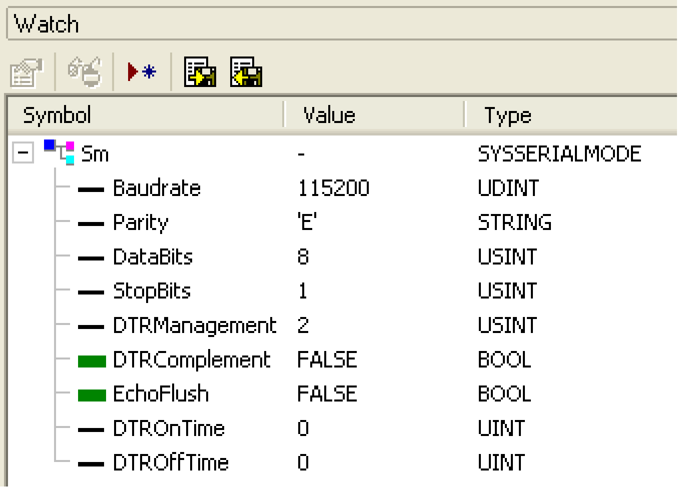


	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	Port COM0 file pointer
2	Sm	SYSSERIALMODE	Auto	No	0	..	Serial mode data struct
3	Pulse	BOOL	Auto	No	FALSE	..	Pulse flag

Esempio ST

```
(* Here the COM0 port is opened in read/write. *)

    IF (Fp = NULL) THEN
        Fp:=Sysfopen('COM0', 'rw'); (* Port COM0 file pointer *)
    END_IF;

(* Check if the COM0 port is open. *)

    IF (Fp <> NULL) THEN

        (* Check if input is activated. *)

        IF (Di00M00 <> Pulse) THEN
            Pulse:=Di00M00; (* Pulse flag *)

            (* On input raising edge the serial mode is read. *)

            IF (Di00M00) THEN
                Do00M00:=SysGetSerialMode(ADR(Sm), Fp);
            END_IF;
        END_IF;
    END_IF;
```

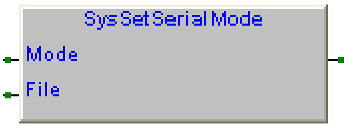
Mettendo in watch la variabile ***Sm*** di tipo ***SYSSERIALMODE*** possiamo vedere i valori di tutti i suoi membri come riportato nella figura a lato. In questo caso è visualizzata la configurazione di default ***115200, e, 8, 1***.



Symbol	Value	Type
Sm	-	SYSSERIALMODE
Baudrate	115200	UDINT
Parity	'E'	STRING
DataBits	8	USINT
StopBits	1	USINT
DTRManagement	2	USINT
DTRComplement	FALSE	BOOL
EchoFlush	FALSE	BOOL
DTROnTime	0	UINT
DTROffTime	0	UINT

7.9.2 SysSetSerialMode, set serial mode

Type	Library	Version
Function	Embedded	3.0



Questa funzione imposta il modo di comunicazione definito nella struttura ***SYSSERIALMODE*** sulla porta seriale connessa al parametro ***File***, precedentemente aperto dalla funzione ***Sysfopen***.

Nel parametro ***Mode*** occorre definire l'indirizzo della struttura ***SYSSERIALMODE*** in cui è definito il modo seriale da impostare sulla porta. La funzione ritorna ***FALSE*** in caso di errore.

Parametri funzione:

Mode (@SYSSERIALMODE)	Indirizzo struttura ***SYSSERIALMODE*** con il modo da impostare.
File (FILEP)	Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.

La funzione ritorna:

(BOOL)	***FALSE:*** Errore esecuzione. ***TRUE:*** Funzione eseguita correttamente.

Codici di errore

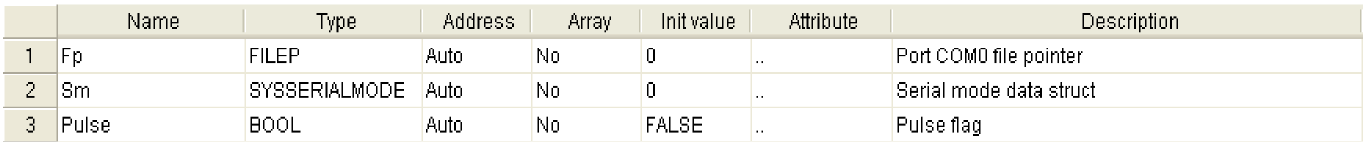
In caso di errore la funzione torna ***FALSE*** e con ***SysGetLastError*** è possibile rilevare il codice di errore.

9994010	Valore di ***File*** non definito.
9994020	Indirizzo struttura ***SYSSERIALMODE*** non corretto, verificare ***Mode***.
9994050	Errore valore di baud rate.
9994051	Errore valore di parità.
9994052	Errore valore bit di dato.
9994053	Errore valore bit di stop.
9995100	Errore esecuzione funzione.

Esempi

Su fronte attivazione ingresso ***Di00M00*** viene salvato il modo impostato sulla porta seriale ***COM0*** nella variabile ***Sm***. Poi vengono modificati alcuni dati e poi impostata la porta seriale. Viene attivata l'uscita ***Do00M00***.

Definizione variabili



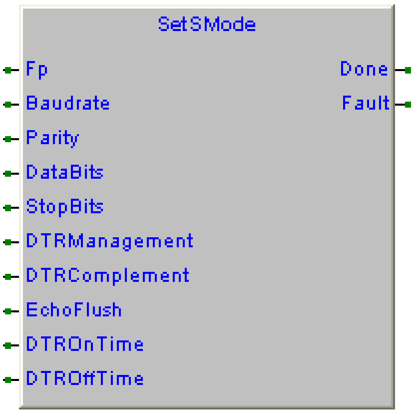
	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	Port COM0 file pointer
2	Sm	SYSSERIALMODE	Auto	No	0	..	Serial mode data struct
3	Pulse	BOOL	Auto	No	FALSE	..	Pulse flag

Esempio ST

```
(* On input raising edge the serial mode is changed. *)

IF (Di00M00 <> Pulse) THEN
    Pulse:=Di00M00; (* Pulse flag *)

    IF (Di00M00) THEN
        IF (Fp = NULL) THEN Fp:=Sysfopen('COM0', 'rw'); END_IF;
        Do00M00:=SysGetSerialMode(ADR(Sm), Fp);
        Sm.Baudrate:=19200;
        Sm.Parity:='N';
        Sm.DTRManagement:=DTR_AUTO_WO_TIMES;
        Do01M00:=SysSetSerialMode(ADR(Sm), Fp);
    END_IF;
END_IF;
```

7.9.3 SetSMode, Set serial mode

Type	Library	Version
FB	PLCUtyLib	SFR054A000



Questo blocco funzione esegue impostazione parametri di comunicazione porta seriale. Occorre passare al blocco funzione il puntatore al file di porta seriale su cui eseguire l'impostazione dei parametri di comunicazione così come viene ritornato dalla funzione di apertura file ***Sysfopen***. Per ulteriori chiarimenti sui vari parametri fare riferimento alla definizione modo comunicazione porta seriale ***SYSSERIALMODE***.

In caso di errore esecuzione (Esempio definizione di un parametro fuori range) il valore di impostazione della porta seriale non viene modificato e si attiverà l'uscita ***Fault***.

Attivando il modo di funzionamento ***DTR_AUTO_W_TIMES*** su ***DTRManagement*** è possibile con il parametro ***DTROnTime***, definire un tempo di attesa dopo attivazione segnale DTR prima della trasmissione dei dati su seriale. Con il parametro ***DTROffTime*** è possibile definire un tempo di attesa dopo la trasmissione dell'ultimo dato prima della disattivazione del segnale DTR.

Queste temporizzazioni sula gestione del segnale DTR permettono di gestire in modo automatico apparecchiature radiomodem, su cui deve essere attivato il comando di trasmissione prima di eseguire l'invio dei dati.

Fp (FILEP)	Puntatore al file di porta seriale come ritornato da funzione ***Sysfopen***.
Baudrate (UDINT)	Valore di baud rate porta seriale (da 300 a 115200 baud)
Parity (STRING[1])	Tipo di parità, valori possibili “E” pari, “O” dispari, “N” nessuna.
DataBits (USINT)	Numero di bit frame dato, valori possibili 7, 8.
StopBits (USINT)	Numero di bit di stop, valori possibili 1, 2.
DTRManagement (USINT)	Modo di gestione del segnale DTR sulla porta seriale, vedi definizione.
DTRComplement (BOOL)	***FALSE:*** DTR normale, ***TRUE:*** DTR complementato.
EchoFlush (BOOL)	***FALSE:*** I dati trasmessi sono ritornati in ricezione. ***TRUE:*** I dati trasmessi sono ignorati.
DTROnTime (UINT)	Tempo di attesa dopo attivazione segnale DTR prima di trasmissione caratteri (mS).
DTROffTime (UINT)	Tempo di attesa dopo trasmissione ultimo dato prima e disattivazione segnale DTR (mS).
Done (BOOL)	Impostazione modo eseguito correttamente.
Fault (BOOL)	Errore su esecuzione blocco funzione

Codici di errore

In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

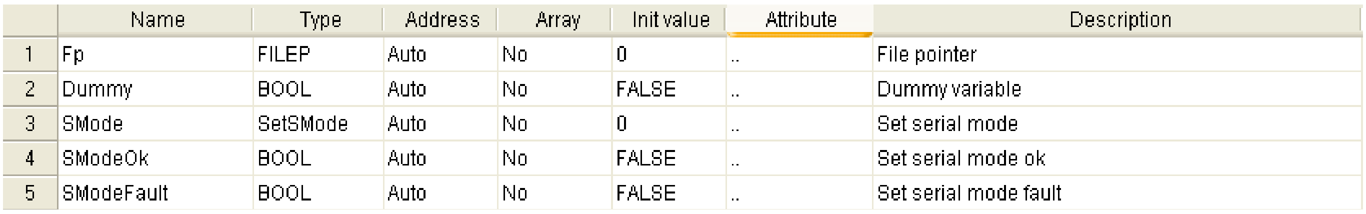
10006010 Lettura modo corrente in errore la funzione ***SysGetSerialMode*** è ritornata con errore probabilmente non è stato indicato correttamente il file pointer ***Fp***.

10006020 Impostazione modo in errore la funzione ***SysSetSerialMode*** è ritornata con errore probabilmente uno dei parametri definiti non è nel range corretto.

Esempi

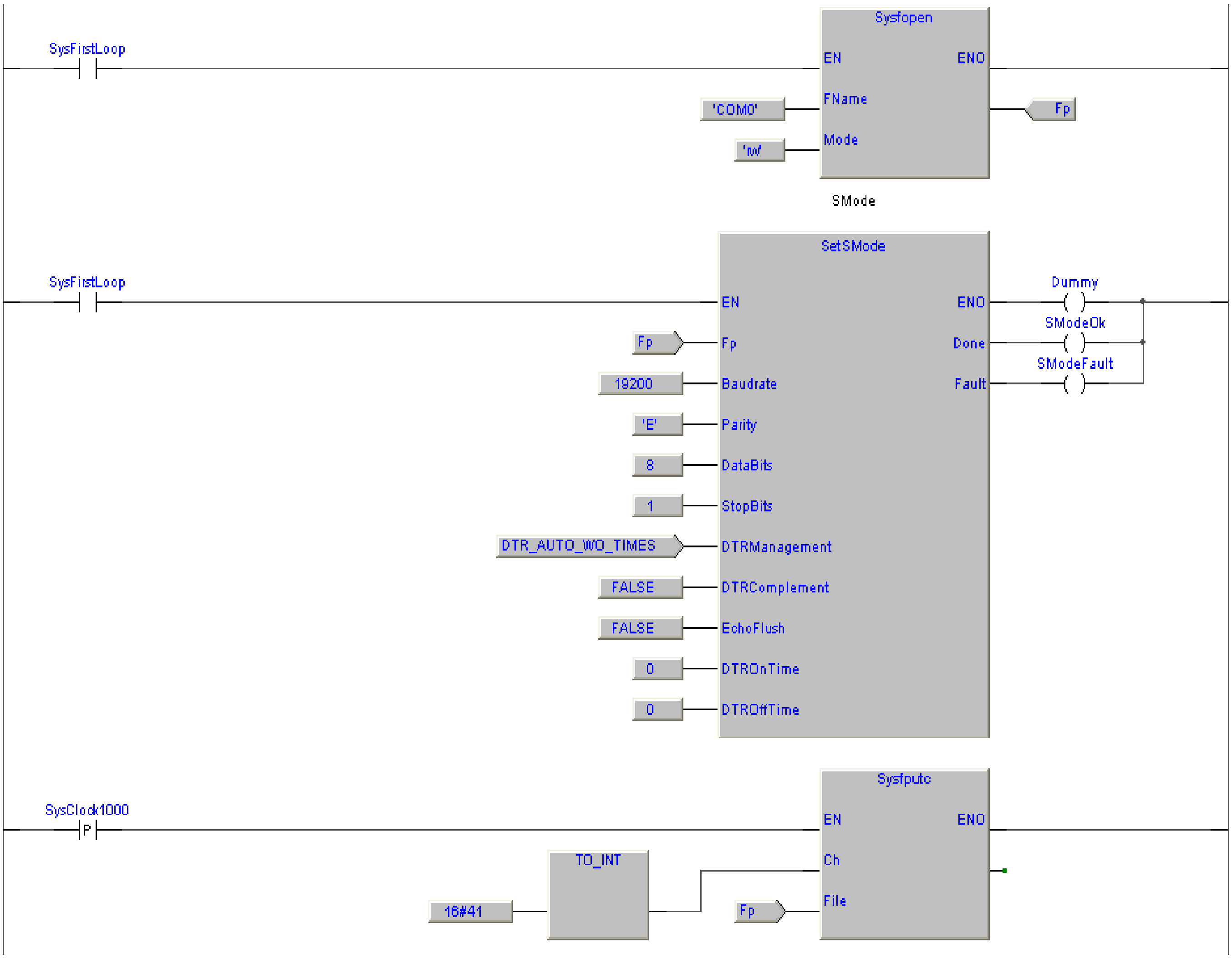
Al primo loop di esecuzione programma viene aperta la porta seriale ***COM0***, viene impostato il modo di comunicazione 19200, e, 8, 1. Ogni secondo viene inviato sulla porta seriale il carattere 'A' codice ascii 16#41.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	File pointer
2	Dummy	BOOL	Auto	No	FALSE	..	Dummy variable
3	SMode	SetSMode	Auto	No	0	..	Set serial mode
4	SModeOk	BOOL	Auto	No	FALSE	..	Set serial mode ok
5	SModeFault	BOOL	Auto	No	FALSE	..	Set serial mode fault

Esempio LD *(Ptp119a000)*



7.9.4 SysGetSerialCTS, get serial CTS signal status

Type	Library	Version
Function	Embedded	5.0

Questa funzione ritorna lo stato del segnale ***CTS*** della porta seriale connessa al parametro ***File***, precedentemente aperto dalla funzione ***Sysfopen***.

Parametri funzione:

File (FILEP)	Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.

La funzione ritorna:

(BOOL)	***FALSE:*** Segnale CTS non attivo. ***TRUE:*** Segnale CTS attivo.

Codici di errore

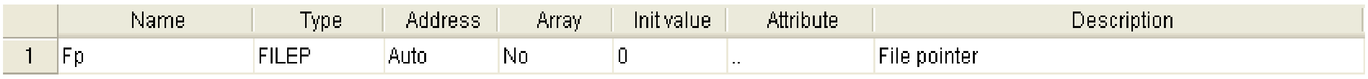
In caso di errore la funzione torna ***FALSE*** e con ***SysGetLastError*** è possibile rilevare il codice di errore.

9993010 Valore di ***File*** non definito.

Esempi

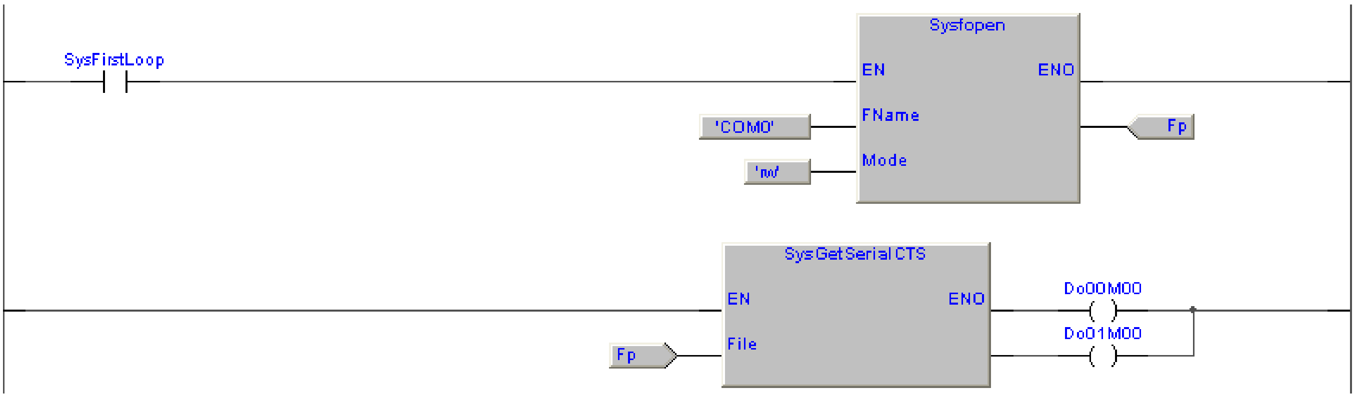
Lo stato del segnale ***CTS*** della porta seriale ***COM0*** è appoggiato sull'uscita ***Do01M00***.

Definizione variabili



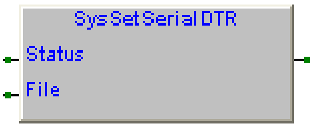
	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	File pointer

Esempio LD



7.9.5 SysSetSerialDTR, set DTR signal status

Type	Library	Version
Function	Embedded	5.0



Questa funzione imposta lo stato del segnale ***DTR*** della porta seriale connessa al parametro ***File***, precedentemente aperto dalla funzione ***Sysfopen***.

Per poter gestire il segnale DTR occorre avere definito sulla porta seriale il valore ***DTR_OFF*** nella variabile ***DTRManagement*** nella struttura ***SYSSERIALMODE***.

Parametri funzione:

Status (BOOL)	Stato segnale DTR su porta seriale
File (FILEP)	Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.

La funzione ritorna:

(BOOL)	***FALSE:*** Errore esecuzione. ***TRUE:*** Ok esecuzione.

Codici di errore

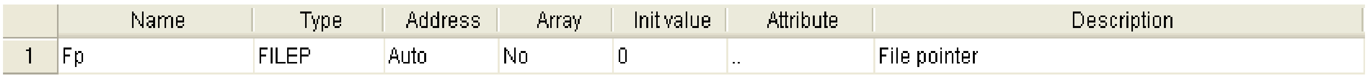
In caso di errore la funzione torna ***FALSE*** e con ***SysGetLastError*** è possibile rilevare il codice di errore.

9992010 Valore di ***File*** non definito.

Esempi

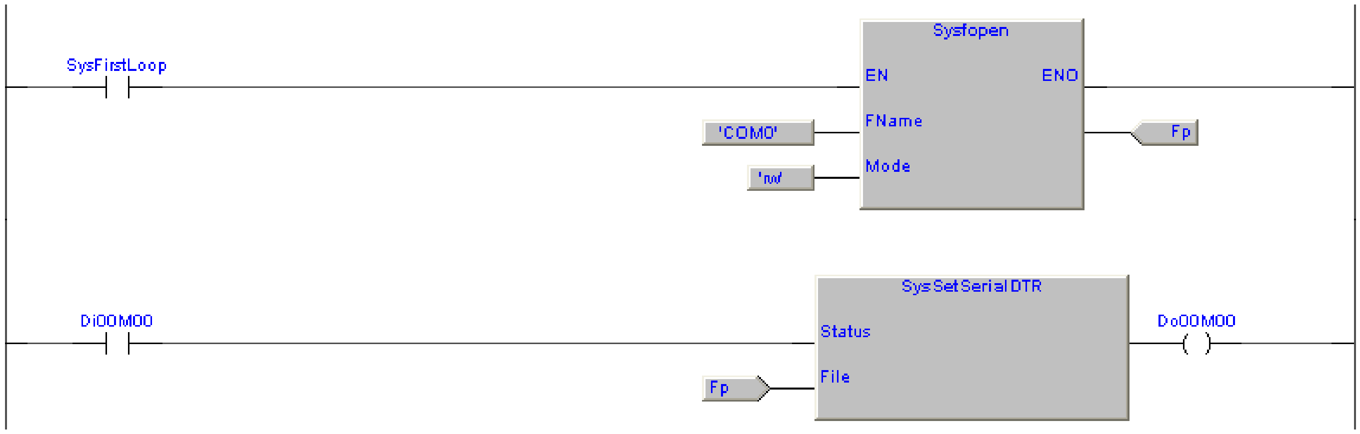
Lo stato dell'ingresso ***Di00M00*** viene trasferito sul segnale DTR della porta seriale ***COM0***.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	File pointer

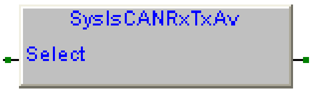
Esempio LD



7.10 Funzioni ed FB per gestione CAN bus

7.10.1 SysIsCANRxTxAv, checks if CAN Rx or Tx is available

Type	Library	Version
Function	Embedded	3.0



Questa funzione controlla:

Select:=FALSE: Se vi è almeno un messaggio nel buffer di ricezione CAN.
Select:=TRUE: Se vi è spazio per un messaggio nel buffer di trasmissione CAN.

La funzione ritorna TRUE se la condizione selezionata è vera.

Parametri funzione:

Select (BOOL) ***FALSE:*** Se vi è almeno un messaggio nel buffer di ricezione CAN.
TRUE: Se vi è spazio per un messaggio nel buffer di trasmissione CAN.

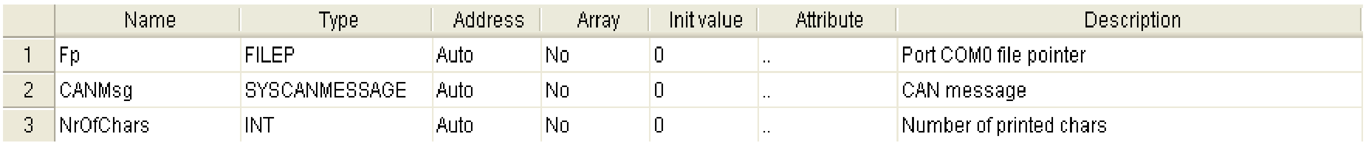
La funzione ritorna:

(BOOL) ***TRUE:*** Condizione selezionata è vera.

Esempi

E' riportato un semplice programma che esegue il controllo se un messaggio CAN è stato ricevuto, ne esegue la ricezione ed invia in uscita sulla porta seriale ***COM0*** la struttura del messaggio ricevuto.

Definizione variabili



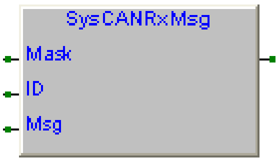
	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	Port COM0 file pointer
2	CANMsg	SYSCANMESSAGE	Auto	No	0	..	CAN message
3	NrOfChars	INT	Auto	No	0	..	Number of printed chars

Esempio ST

```
(* Here the COM0 port is opened in read/write. *)

    IF (Fp = NULL) THEN
        Fp:=Sysfopen('COM0', 'rw'); (* Port COM0 file pointer *)
    END_IF;

(* Here check if a CAN message is available and receive it. *)

    IF (SysIsCANRxTxAv(FALSE)) THEN
        IF (SysCANRxMsg(16#00000000, 16#00000000, ADR(CANMsg))) THEN

            NrOfChars:=SysVarfprintf(Fp, 'Length:%04d$r$n', USINT_TYPE, ADR(CANMsg.Length));
            NrOfChars:=SysVarfprintf(Fp, 'MsgID:%04d$r$n', UDINT_TYPE, ADR(CANMsg.MsgID));
            NrOfChars:=SysVarfprintf(Fp, 'Data[0]:%02X$r$n', UDINT_TYPE, ADR(CANMsg.Data[0]));

        END_IF;
    END_IF;
```

7.10.2 SysCANRxMsg, receives a CAN message

Type	Library	Version
Function	Embedded	3.0



Questa funzione riceve un messaggio CAN e lo trasferisce nella variabile il cui indirizzo è definito in ***Msg***. E' possibile definire un ***Mask*** ed un ***ID*** per ricevere i soli messaggi CAN desiderati.

La funzione ricerca nello stack dei messaggi un messaggio il cui ID posto in AND con ***Mask*** coincide con ***ID*** messo in AND con ***Mask***. La funzione ritorna TRUE se messaggio ricevuto.

Parametri funzione:

Mask (UDINT)	Codice maschera ID messaggio.
ID (UDINT)	ID check ID messaggio.
Msg (@SYSCANMESSAGE)	Indirizzo buffer messaggio ricevuto.

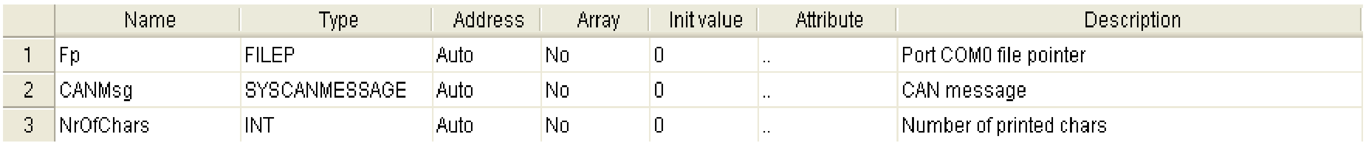
La funzione ritorna:

(BOOL)	***TRUE:*** Messaggio ricevuto.

Esempi

E' riportato un semplice programma che esegue la ricezione di qualsiasi messaggio CAN ed esegue l'invio in uscita sulla porta seriale ***COM0*** della struttura del messaggio ricevuto.

Definizione variabili



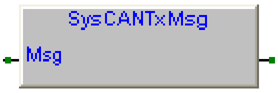
	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	Port COM0 file pointer
2	CANMsg	SYSCANMESSAGE	Auto	No	0	..	CAN message
3	NrOfChars	INT	Auto	No	0	..	Number of printed chars

Esempio ST

```
(* Here the COM0 port is opened in read/write. *)

    IF (Fp = NULL) THEN
        Fp:=Sysfopen('COM0', 'rw'); (* Port COM0 file pointer *)
    END_IF;

(* Here receive a CAN message. *) *)

    IF (SysCANRxMsg(16#3FFFFFFF, 16#00000000, ADR(CANMsg))) THEN

        NrOfChars:=SysVarfprintf(Fp, 'Length:%04d$r$n', USINT_TYPE, ADR(CANMsg.Length));
        NrOfChars:=SysVarfprintf(Fp, 'MsgID:%04d$r$n', UDINT_TYPE, ADR(CANMsg.MsgID));
        NrOfChars:=SysVarfprintf(Fp, 'Data[0]:%02X$r$n', UDINT_TYPE, ADR(CANMsg.Data[0]));

    END_IF;
```

7.10.3 SysCANTxMsg, transmit a CAN message

Type	Library	Version
Function	Embedded	3.0



Questa funzione trasmette un messaggio CAN, occorre creare il messaggio e poi passarne alla funzione l'indirizzo in ***Msg***.

La funzione ritorna TRUE se messaggio trasmesso.

Parametri funzione:

Msg (@SYSCANMESSAGE)	Indirizzo buffer messaggio da trasmettere.

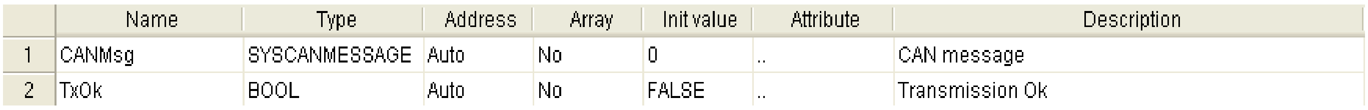
La funzione ritorna:

(BOOL)	***TRUE:*** Messaggio trasmesso.

Esempi

E' riportato un semplice programma che esegue la trasmissione di un messaggio CAN.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	CANMsg	SYSCANMESSAGE	Auto	No	0	..	CAN message
2	TxOk	BOOL	Auto	No	FALSE	..	Transmission Ok

Esempio ST

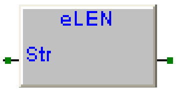
```
(* Here check if there is a space in Tx buffer and send a CAN message. *)

    IF (SysIsCANRxTxAv(TRUE)) THEN
        CANMsg.RmReq:=FALSE; (* eFALSE:Data frame, eTRUE:Remote request *)
        CANMsg.Length:=2; (* Data length *)
        CANMsg.MsgID:=16#00000000; (* Message ID (FF:Bit 31) (11 or 29 Bit) *)
        CANMsg.Data[0]:=16#01; (* Message data *)
        CANMsg.Data[1]:=16#00; (* Message data *)
        TxOk:=SysCANTxMsg(ADR(CANMsg)); (* Transmission Ok *)
    END_IF;
```

7.11 Funzioni ed FB per gestione stringhe

7.11.1 eLEN, string length

Type	Library	Version
Function	ePLCStdLib	SFR053A200

Questa funzione ritorna la lunghezza (Espressa in numero di caratteri) della stringa definita in ***Str***.



Parametri funzione:

Str (@USINT)	Pointer alla stringa di cui calcolare lunghezza.

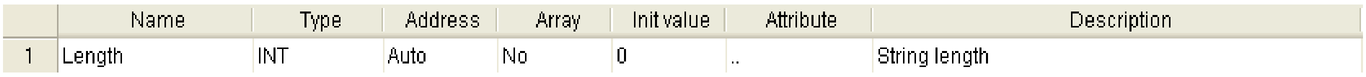
La funzione ritorna:

(INT)	Numero di caratteri della stringa.

Esempi

Viene calcolata la lunghezza della stringa ***'Hello!'*** ed il numero di caratteri che compongono la stringa viene trasferito nella variabile ***Length***. Il risultato del calcolo è ***6***.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	Length	INT	Auto	No	0	..	String length

Esempio LD

7.11.2 eFIND, string find

Type	Library	Version
Function	ePLCStdLib	SFR053A200

Questa funzione cerca la posizione del carattere di inizio della prima apparizione di ***In2*** in ***In1***. Se nessuna apparizione viene trovata, la funzione ritorna ***0***.

Se la stringa ***In2*** è trovata nella stringa ***In1***, viene ritornata la posizione dove si trova.

Esempio: ***eFIND(In1:='abcd', In2:='bc')***. Ha come risultato **2**.

Parametri funzione:

In1 (@USINT)	Pointer alla stringa dove effettuare la ricerca.
In1 (@USINT)	Pointer alla stringa da ricercare.

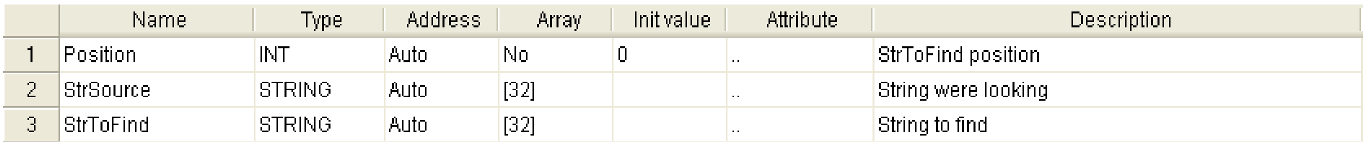
La funzione ritorna:

(INT)	Posizione dove la stringa ***In2*** è stata trovata. ***0*** se stringa non trovata.

Esempi

Viene eseguita la ricerca della stringa ***'lo'*** nella stringa ***'Hello world!'***. La posizione trovata è 4 e viene trasferita nella variabile ***Position***.

Definizione variabili



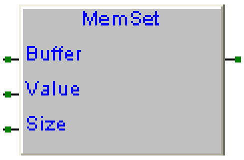
	Name	Type	Address	Array	Init value	Attribute	Description
1	Position	INT	Auto	No	0	..	StrToFind position
2	StrSource	STRING	Auto	[32]		..	String were looking
3	StrToFind	STRING	Auto	[32]		..	String to find

Esempio ST

```
(* Find the position where is StrToFind in StrSource. *)

    StrSource:='Hello world!';
    StrToFind:='lo';

    Position:=eFIND(ADR(StrSource), ADR(StrToFind));
```

7.11.3 MemSet, memory set

Type	Library	Version
Function	ePLCAuxLib	SFR058A000



Questa funzione trasferisce in ***Buffer*** il valore definito in ***Value*** per il numero di bytes definito in ***Size***.

La funzione ritorna il numero definito in ***Size***.

Parametri funzione:

Buffer (@USINT)	Pointer al buffer di memoria dove trasferire ***Value***.
Value (USINT)	Valore da trasferire nel buffer di memoria.
Size (UINT)	Numero di volte in cui ***Value*** è trasferito in ***Buffer***.

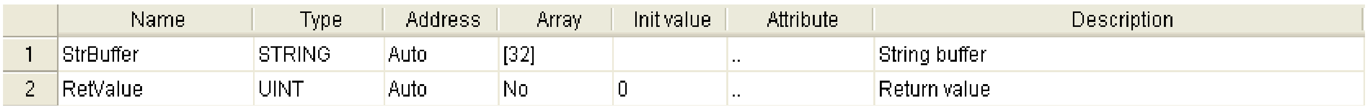
La funzione ritorna:

(UINT)	Valore definito in ***Size***.

Esempi

Viene eseguito l'azzeramento di tutti i bytes della stringa ***StrBuffer*** scrivendo il valore ***0*** in tutta la sua lunghezza.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	StrBuffer	STRING	Auto	[32]		..	String buffer
2	RetValue	UINT	Auto	No	0	..	Return value

Esempio ST *(Ptp116a100)*

```
(* The 'StrBuffer' variable is set to '0'. *)

    RetValue:=MemSet(ADR(StrBuffer), 0, 32); (* Return value *)
```

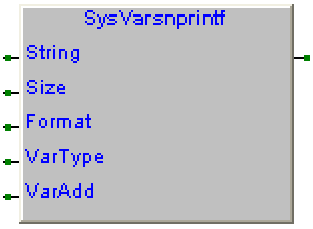
7.11.4 SysVarsnprintf, variable print to string

Type	Library	Version
Function	Embedded	4.0

Questa funzione trasferisce in ***String*** la stampa formattata di una variabile. Il valore stampato ritornato nella variabile stringa non può superare la lunghezza definita in ***Size***.

La stringa ***Format*** specifica il formato con il quale stampare la variabile. Mentre in ***VarType*** è indicato il tipo di variabile ed in ***VarAdd*** il suo indirizzo.

La funzione ritorna il numero di caratteri trasferiti nella variabile ***String***. EOF in caso di errore.



Parametri funzione:

String (@USINT)	Pointer all'array dove deve essere trasferito il risultato della stampa.
Size (UINT)	Numero di caratteri da trasferire nella variabile ***String***. Il numero definito è comprensivo del codice di fine stringa '\0'. Se la lunghezza della stringa di output supera il limite di ***Size*** byte, viene troncata al numero di byte indicato.
Format (STRING[80])	Ha due tipi di argomenti, i caratteri ordinari che vengono copiati nella variabile ***String*** di uscita, e le specifiche di conversione, contraddistinte dal simbolo percentuale (%) e da un carattere che specifica il formato con il quale stampare la variabile definita.
VarType (USINT)	Tipo variabile, come indicato nella tabella ***Variable types definition***.
VarAdd (UDINT)	Indirizzo variabile.

La funzione ritorna:

(INT)	Numero di caratteri comprensivo codice fine stringa '\0' trasferiti in variabile ***String***. ***EOF:*** Errore esecuzione.

Codici di errore

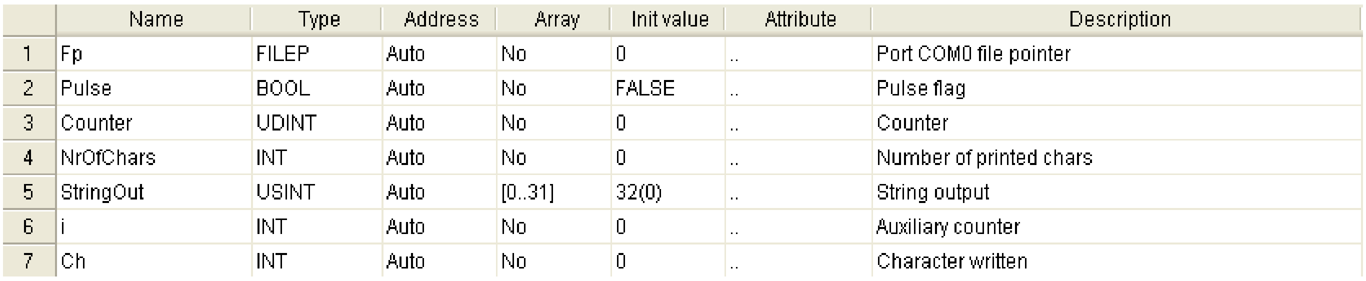
In caso di errore la funzione torna con ***EOF*** e con ***SysGetLastError*** è possibile rilevare il codice di errore.

9997100	Tipo variabile non gestito, controllare ***VarType***.
9997200	Il valore di ***Size*** limita la formattazione della stringa in uscita.

Esempi

Su fronte attivazione ingresso ***Di00M00*** viene incrementata la variabile ***Counter*** e la stampa del suo valore trasferita nell'array ***StringOut***. Il valore presente in ***StringOut*** viene poi inviato sulla porta seriale ***COM0***. Nella variabile ***NrOfChars*** viene caricato il numero di caratteri trasferiti in ***StringOut*** ed inviati in uscita sulla porta seriale.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	Port COM0 file pointer
2	Pulse	BOOL	Auto	No	FALSE	..	Pulse flag
3	Counter	UDINT	Auto	No	0	..	Counter
4	NrOfChars	INT	Auto	No	0	..	Number of printed chars
5	StringOut	USINT	Auto	[0..31]	32(0)	..	String output
6	i	INT	Auto	No	0	..	Auxiliary counter
7	Ch	INT	Auto	No	0	..	Character written

Esempio ST *(Ptp116a100)*

```
(* Here the COM0 port is opened in read/write. *)

    IF (Fp = NULL) THEN
        Fp:=Sysfopen('COM0', 'rw'); (* Port COM0 file pointer *)
    END_IF;

(* Check if the COM0 port is open. *)

    IF (Fp <> NULL) THEN
```

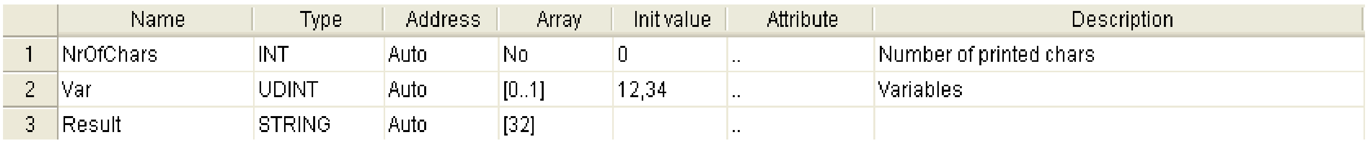
```
        (* Check if input is activated. *)

        IF (Di00M00 <> Pulse) THEN
            Pulse:=Di00M00; (* Pulse flag *)

            (* On input raising edge the counter value is printed. *)

            IF (Di00M00) THEN
                Counter:=Counter+1; (* Counter *)
                NrOfChars:=SysVarsnprintf(ADR(StringOut), 32, 'Counter:%04d$r$n', UDINT_TYPE, ADR(Counter));

                (* Copy the printed result to serial port. *)

                FOR i:=0 TO NrOfChars DO Ch:=Sysfputc(TO_INT(StringOut[i]), Fp); END_FOR;
            END_IF;
        END_IF;
    END_IF;
```

In questo esempio viene eseguito il merge tra le stampe del valore di due variabili. Eseguire il merge può essere molto utile per avere un unica stringa contenente la stampa del valore di piu variabili.

Mettendo in debug la variabile ***Result*** vedremo la stringa ***Var[0]:12 Var[1]:34***. Avendo bloccato la stampa a 12 caratteri il valore di ***Var[0]*** sarà stampato correttamente fino ad un massimo di 4 cifre (7 caratteri stringa, 4 caratteri valore più terminatore stringa '\0'). Per valori di ***Var[0]*** superiori a 9999 non saranno più stampate le cifre meno significative.

Il valore di ***Var[1]*** sarà stampato immediatamente dopo il valore di ***Var[0]***. Da notare l'offset decrementato di 1 per sovrascrivere il terminatore stringa '\0'. Per garantire la stampa di un massimo di 4 anche per ***Var[1]*** è stato definito un ***Size*** di 13, la stringa di testo inizia infatti con un carattere di space per separarla dalla stampa del valore della variabile precedente.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	NrOfChars	INT	Auto	No	0	..	Number of printed chars
2	Var	UDINT	Auto	[0..1]	12,34	..	Variables
3	Result	STRING	Auto	[32]		..	

Esempio ST

```
(* --------------------------------------------------------------------------- *)
(* EXECUTE A VARIABLES PRINT MERGE                                             *)
(* --------------------------------------------------------------------------- *)
(* Print the variable values, merging them into a single string. *)

    NrOfChars:=SysVarsnprintf(ADR(Result), 12, 'Var[0]:%d', UDINT_TYPE, ADR(Var[0]));
    NrOfChars:=SysVarsnprintf(ADR(Result[NrOfChars-1]), 13, '$20Var[1]:%d', UDINT_TYPE, ADR(Var[1]));

(* [End of file] *)
```

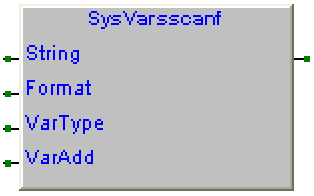
7.11.5 SysVarsscanf, extracts values from string

Type	Library	Version
Function	Embedded	4.0

Questa funzione legge la stringa ***String*** e ne interpreta il contenuto basandosi sul parametro ***Format***.

La stringa ***Format*** specifica il formato con il quale interpretare la variabile, in ***VarType*** è indicato il tipo di variabile ed in ***VarAdd*** il suo indirizzo.

La funzione ritorna TRUE se valore variabile trovato, in caso contrario FALSE.



Parametri funzione:

String (@USINT)	Pointer alla stringa da leggere.
Format (STRING[80])	Ha due tipi di argomenti, i caratteri ordinari che vengono copiati nella variabile ***String*** di uscita, e le specifiche di conversione, contraddistinte dal simbolo percentuale (%) e da un carattere che specifica il formato con il quale stampare la variabile definita.
VarType (USINT)	Tipo variabile, come indicato nella tabella ***Variable types definition***.
VarAdd (UDINT)	Indirizzo variabile.

La funzione ritorna:

(BOOL)	***TRUE:*** Valore variabile acquisito.

Codici di errore

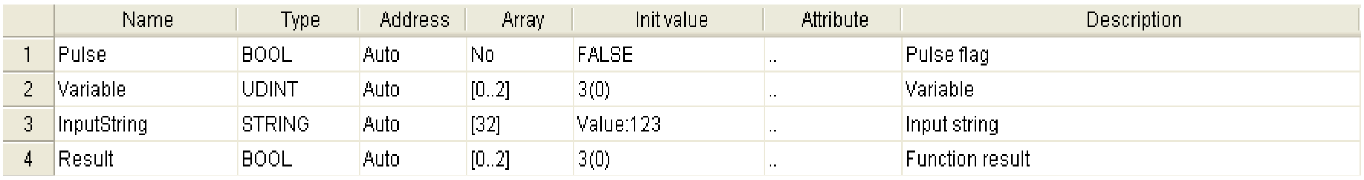
In caso di errore la funzione torna con ***FALSE*** e con ***SysGetLastError*** è possibile rilevare il codice di errore.

9999100 Tipo variabile non gestito, controllare ***VarType***.

Esempi

E' riportato un programma che esegue la lettura di una stringa ***InputString*** valorizzata con il testo ***Value:123***. Su fronte attivazione ingresso ***Di00M00*** sono eseguite tre diverse funzioni ***SysVarsscanf*** tutte sulla stringa ***InputString*** ma con diverse definizioni di ***Format***. Le prime due hanno esito positivo e le variabili ***Variable[0]*** e ***Variable[1]*** saranno valorizzate con il valore ***123***. La terza avrà esito negativo, la variabile ***Variable[2]*** sarà azzerata.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	Pulse	BOOL	Auto	No	FALSE	..	Pulse flag
2	Variable	UDINT	Auto	[0..2]	3(0)	..	Variable
3	InputString	STRING	Auto	[32]	Value:123	..	Input string
4	Result	BOOL	Auto	[0..2]	3(0)	..	Function result

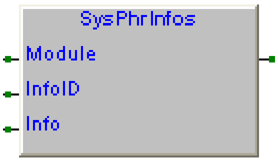
Esempio ST *(Ptp116a200)*

```
(* Check if input is activated. *)

    IF (Di00M00 <> Pulse) THEN
        Pulse:=Di00M00; (* Pulse flag *)

        IF (Di00M00) THEN
            Result[0]:=SysVarsscanf(ADR(InputString), 'Value:%d', UDINT_TYPE, ADR(Variable[0]));
            Result[1]:=SysVarsscanf(ADR(InputString)+6, '%d', UDINT_TYPE, ADR(Variable[1]));
            Result[2]:=SysVarsscanf(ADR(InputString), '%d', UDINT_TYPE, ADR(Variable[2]));
        END_IF;
    END_IF;
```

7.12 Funzioni ed FB per gestione moduli periferici

7.12.1 SysPhrInfos, get infos from peripheral modules

Type	Library	Version
Funzione	Embedded	5.0



Questa funzione esegue l'acquisizione di informazioni dai moduli periferici. Viene trasferita nella variabile stringa il cui indirizzo è passato in ***Info***, l'informazione indicata da ***InfoID*** relativa al modulo indicato in ***Module***.

La funzione ritorna ***TRUE*** se correttamente eseguita, in caso contrario ***FALSE***.

Parametri funzione:

Module (USINT) Occorre specificare l'indirizzo di modulo da cui eseguire l'acquisizione (Range da 0 a 15). Il valore 0 indica il primo modulo di estensione, 1 il secondo e così di seguito.

InfoID (USINT) Occorre specificare l'ID della informazione richiesta.

Value	Description
0	Ritorna codice prodotto
1	Ritorna codice programma

Info (STRING[10]) Indirizzo variabile dove trasferire l'informazione.

La funzione ritorna:

(BOOL) ***FALSE:*** Errore esecuzione. ***TRUE:*** Funzione eseguita correttamente.

Codici di errore

In caso di errore la funzione torna con ***FALSE*** e con ***SysGetLastError*** è possibile rilevare il codice di errore.

9990100 Il modulo indirizzato in ***Module*** non è presente.

9990110 Il valore di ***InfoID*** non è corretto.

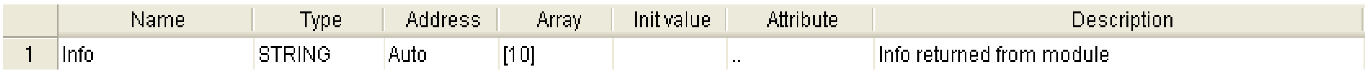
9990200 L'informazione richiesta non è supportata dal modulo.

9990210 Errore durante la richiesta della informazione dal modulo.

Esempi

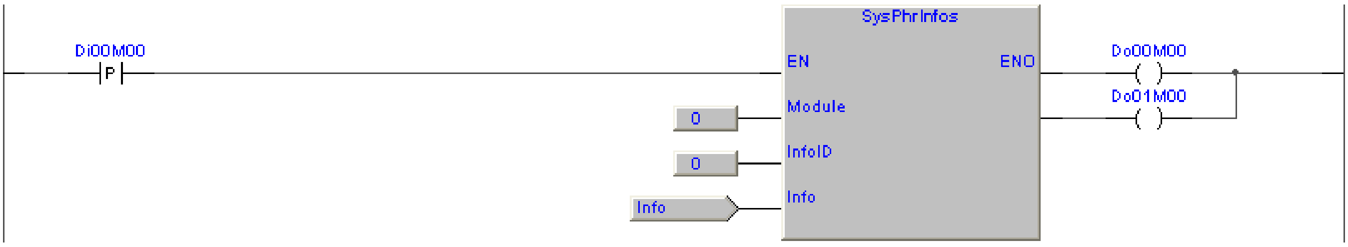
E' riportato un programma che esegue la lettura del codice prodotto dal modulo di estensione con indirizzo 0. Il codice ritornato è trasferito nella variabile ***Info***. Il ritorno della funzione è trasferito sull'uscita ***Do01M00***.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	Info	STRING	Auto	[10]		..	Info returned from module

Esempio LD

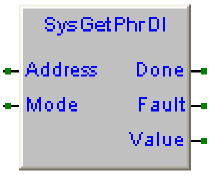


7.12.2 SysGetPhrDI, get peripheral digital input

Type	Library	Version
FB	Embedded	3.0

Questo blocco funzione esegue l'acquisizione degli ingressi digitali dai moduli periferici. Il blocco funzione ritorna lo stato degli ingressi digitali dal modulo indicato in ***Address*** in base al comando di ***Mode*** definito.

Per acquisire gli ingressi digitali presenti sul modulo CPU occorre definire ***Address*** 255 e ***Mode*** DI_8_LL. Si raccomanda di utilizzare in alternativa il blocco funzione ***CPUModuleIO***.



Address (USINT) Occorre specificare l'indirizzo di modulo da cui eseguire l'acquisizione degli ingressi digitali (Range da 0 a 255). Il valore 0 indica il primo modulo di estensione, 1 il secondo e così di seguito. L'indirizzo 255 indica il modulo CPU.

Mode (USINT) Occorre specificare il modo di acquisizione ingressi digitali secondo la tabella sotto riportata.

Mode	Define	Description
1	DI_8_LL	Read 0-7 input mode
2	DI_8_L	Read 8-15 input mode
3	DI_8_M	Read 16-23 input mode
4	DI_8_MM	Read 24-31 input mode
5	DI_16_L	Read 0-15 input mode
6	DI_16_M	Read 16-31 input mode
7	DI_32	Read 0-31 input mode

Done (BOOL) Dato acquisito, viene attivato se acquisizione ingressi digitali terminata.

Fault (BOOL) Errore di acquisizione, viene attivato in caso di errore nella sequenza di acquisizione.

Value (UDINT) Ritorna lo stato degli ingressi digitali acquisiti.

Codici di errore

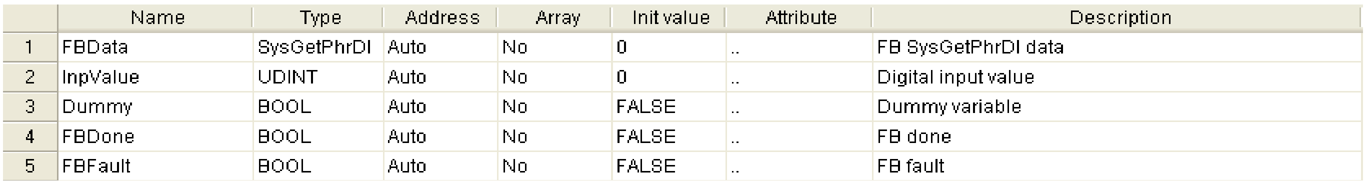
In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

9985050	Errore allocazione blocco funzione.
9985070	Errore versione blocco funzione.
9985100	Il modulo indirizzato in ***Address*** non è presente.
9985110~8	Il modo acquisizione definito in ***Mode*** non è corretto.
9985200~6	Errore durante l'esecuzione della lettura ingressi dal modulo periferico.

Esempi

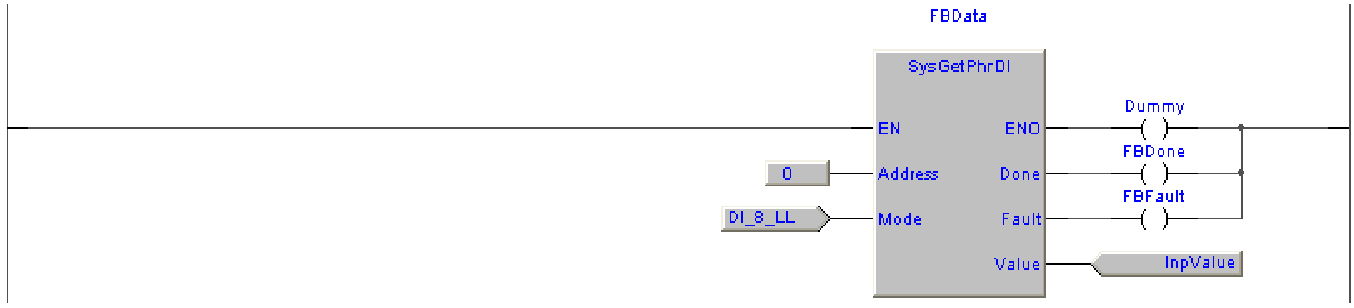
Viene acquisito lo stato degli 8 ingressi bassi (Da Inp 0 a Inp 7) del modulo di con indirizzo 0. Se dato valido viene attivata la variabile ***FBDone*** se errore di acquisizione viene attivata la variabile ***FBFault***. Il valore acquisito nel range da 0x00 a 0xFF è trasferito nella variabile ***InpValue***.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	FBData	SysGetPhrDI	Auto	No	0	..	FB SysGetPhrDI data
2	InpValue	UDINT	Auto	No	0	..	Digital input value
3	Dummy	BOOL	Auto	No	FALSE	..	Dummy variable
4	FBDone	BOOL	Auto	No	FALSE	..	FB done
5	FBFault	BOOL	Auto	No	FALSE	..	FB fault

Esempio LD *(Ptp116a100)*



Esempio IL *(Ptp116a100)*

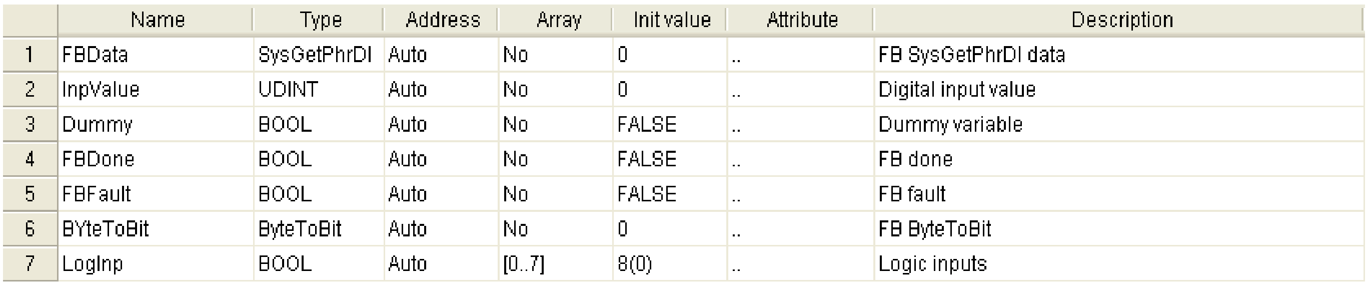
```
(* Read Inp 0 to 7 from module with address 0. *)

    LD 0
    ST FBData.Address

    LD DI_8_LL
    ST FBData.Mode

    CAL FBData

    LD FBData.Value
    ST InpValue
```

Esempio ST *(Ptp116a100)*

```
(* Read Inp 0 to 7 from module with address 0. *)

    FBData.Address:=0;
    FBData.Mode:=DI_8_LL;
    FBData(); (* Execute FB *)
    InpValue:=FBData.Value; (* Digital input value *)
```

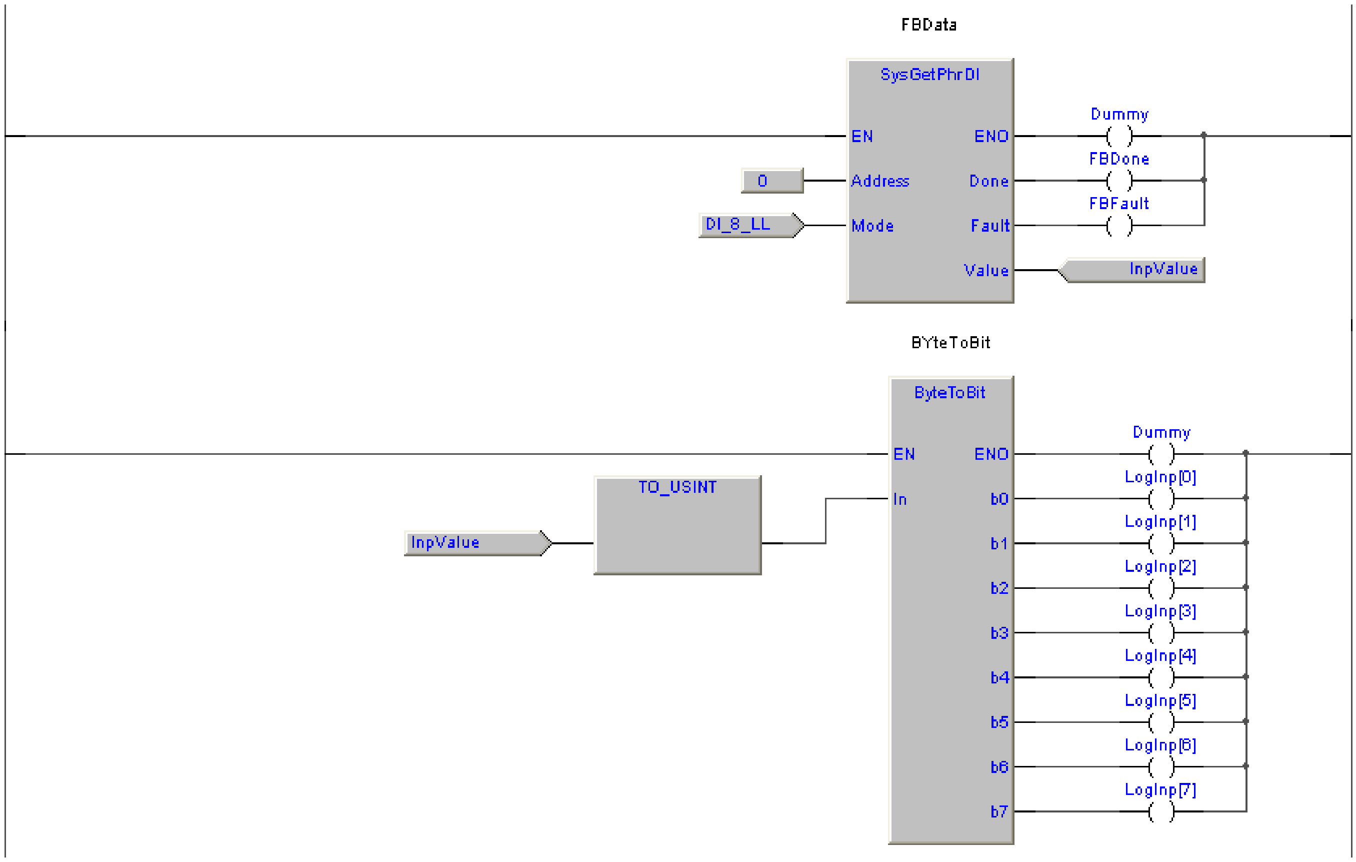
Questo esempio è una evoluzione dell'esempio precedente. Utilizzando il blocco funzione ***ByteToBit*** lo stato degli 8 ingressi bassi (Da Inp 0 a Inp 7) del modulo con indirizzo 0, è appoggiato su di un array di BOOL.

Definizione variabili



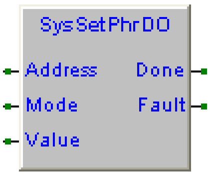
	Name	Type	Address	Array	Init value	Attribute	Description
1	FBData	SysGetPhrDI	Auto	No	0	..	FB SysGetPhrDI data
2	InpValue	UDINT	Auto	No	0	..	Digital input value
3	Dummy	BOOL	Auto	No	FALSE	..	Dummy variable
4	FBDone	BOOL	Auto	No	FALSE	..	FB done
5	FBFault	BOOL	Auto	No	FALSE	..	FB fault
6	BYteToBit	ByteToBit	Auto	No	0	..	FB ByteToBit
7	LogInp	BOOL	Auto	[0..7]	8(0)	..	Logic inputs

Esempio LD *(Ptp119a000)*



7.12.3 SysSetPhrDO, set peripheral digital output

Type	Library	Version
FB	Embedded	3.0



Questo blocco funzione esegue impostazione delle uscite digitali sui moduli periferici indirizzati con ***Address*** ed in base al comando di ***Mode*** definito.

Per gestire le uscite digitali presenti sul modulo CPU occorre definire ***Address*** 255 e ***Mode*** DO_8_LL. Si raccomanda di utilizzare in alternativa il blocco funzione ***CPUModuleIO***.

Address (USINT) Occorre specificare l'indirizzo del modulo su cui eseguire l'impostazione delle uscite digitali (Range da 0 a 255). Il valore 0 indica il primo modulo di estensione, 1 il secondo e così di seguito. L'indirizzo 255 indica il modulo CPU.

Mode (USINT) Occorre specificare il modo di gestione uscite digitali secondo la tabella sotto riportata.

Mode	Define	Description
1	DO_8_LL	Write 0-7 output mode
2	DO_8_L	Write 8-15 output mode
3	DO_8_M	Write 16-23 output mode
4	DO_8_MM	Write 24-31 output mode
5	DO_16_L	Write 0-15 output mode
6	DO_16_M	Write 16-31 output mode
7	DO_32	Write 0-31 output mode

Value (UDINT) Impostare il valore da trasferire sulle uscite digitali.

Done (BOOL) Dato settato. Viene attivato per un loop al termine del settaggio delle uscite digitali.

Fault **(BOOL)** Errore. Viene attivato in caso di errore nella sequenza di settaggio.

Codici di errore

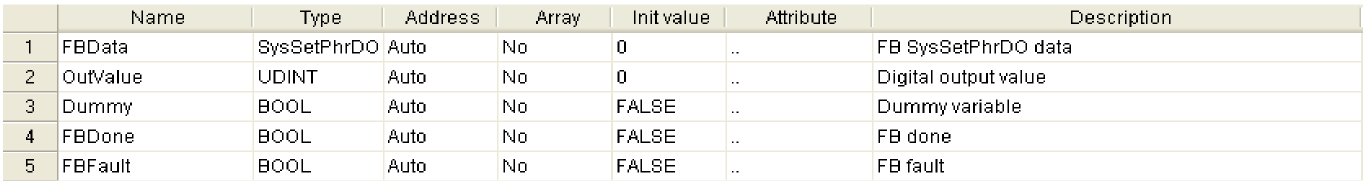
In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

9984050	Errore allocazione blocco funzione.
9984060	Terminato spazio memoria rilocabile, non è possibile eseguire l''FB.
9984070	Errore versione blocco funzione.
9984100	Il modulo indirizzato in ***Address*** non è presente.
9984110~8	Il modo gestione definito in ***Mode*** non è corretto.
9984200~6	Errore durante l'esecuzione gestione uscite digitali sul modulo periferico.

Esempi

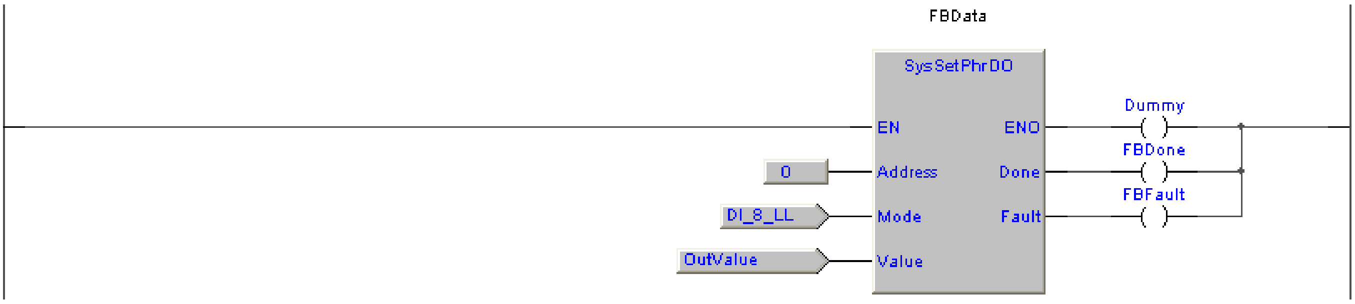
Viene trasferito il valore della variabile ***OutValue*** sulle 8 uscite basse (Da Out 0 a Out 7) del modulo con indirizzo 0.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	FBData	SysSetPhrDO	Auto	No	0	..	FB SysSetPhrDO data
2	OutValue	UDINT	Auto	No	0	..	Digital output value
3	Dummy	BOOL	Auto	No	FALSE	..	Dummy variable
4	FBDone	BOOL	Auto	No	FALSE	..	FB done
5	FBFault	BOOL	Auto	No	FALSE	..	FB fault

Esempio LD *(Ptp116a100)*



Esempio IL *(Ptp116a100)*

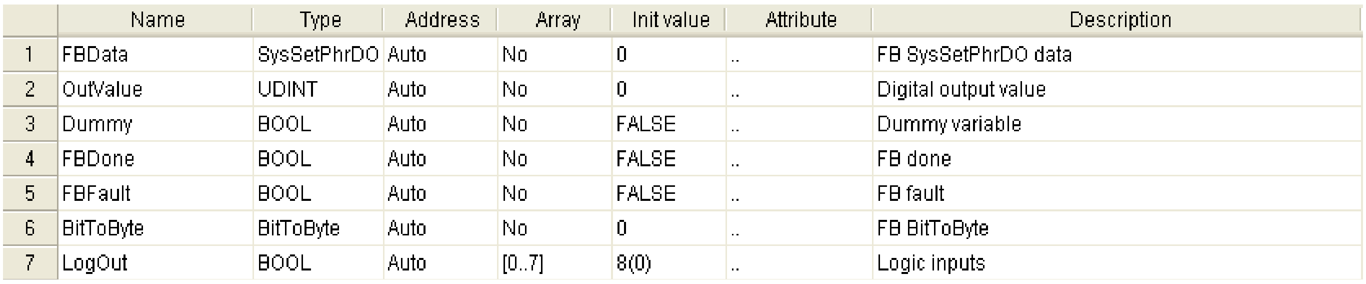
```
(* Manage digital outputs Out 0 to Out 7 on module with address 0. *)

    LD 0
    ST FBData.Address

    LD DO_8_LL
    ST FBData.Mode

    LD OutValue
    LD FBData.Value

    CAL FBData
```

Esempio ST *(Ptp116a100)*

```
(* Manage digital outputs Out 0 to Out 7 on module with address 0. *)

    FBData.Address:=0;
    FBData.Mode:=DO_8_LL;
    FBData.Value:=OutValue; (* Digital ouput value *)
    FBData(); (* Execute FB *)
```

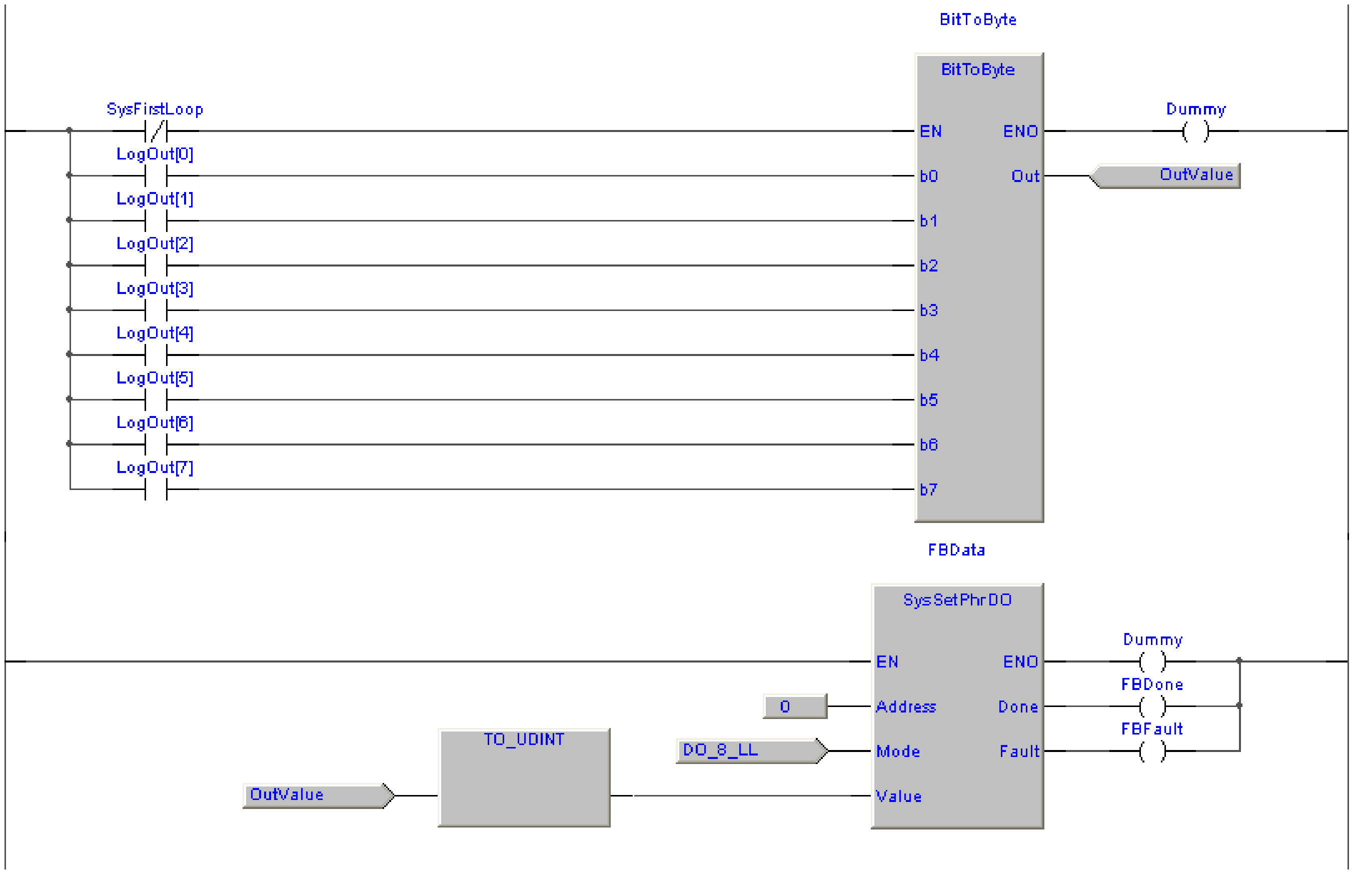
Questo esempio è una evoluzione dell'esempio precedente. Utilizzando il blocco funzione ***BitToByte*** un array di 8 BOOL è trasferito in uscita sulle 8 uscite basse (Da Out 0 a Out 7) del modulo con indirizzo 0.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	FBData	SysSetPhrDO	Auto	No	0	..	FB SysSetPhrDO data
2	OutValue	UDINT	Auto	No	0	..	Digital output value
3	Dummy	BOOL	Auto	No	FALSE	..	Dummy variable
4	FBDone	BOOL	Auto	No	FALSE	..	FB done
5	FBFault	BOOL	Auto	No	FALSE	..	FB fault
6	BitToByte	BitToByte	Auto	No	0	..	FB BitToByte
7	LogOut	BOOL	Auto	[0..7]	8(0)	..	Logic inputs

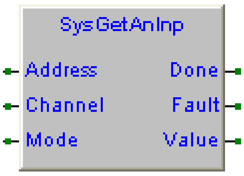
Esempio LD *(Ptp119a000)*



7.12.4 SysGetAnInp, get analog input

Type	Library	Version
FB	Embedded	3.0

Questo blocco funzione esegue l'acquisizione dell'ingresso analogico dal modulo di acquisizione. Il blocco funzione gestisce vari modi di acquisizione in funzione del modulo analogico a cui fa riferimento.



Address (USINT) Occorre specificare l'indirizzo del modulo da cui eseguire l'acquisizione analogica (Range da 0x00 a 0x0F). Il valore 0x00 indica il primo modulo di estensione, 0x01 il secondo e così di seguito.

Channel (USINT) Occorre specificare l'indirizzo del canale sul modulo (Range da 0x00 a 0x0F). Se viene settato un indirizzo di canale non presente, si interrompe l'esecuzione e viene settato il bit di ***Fault***.

Mode (USINT) Occorre specificare il modo di acquisizione analogica secondo la tabella sotto riportata.

Mode	Define	Description
0	AD_IDLE	Idle mode
1	AD_VOLT_0_125_COMMON	Voltage from 0 to 1.25 V (Common mode)
2	AD_VOLT_0_10_COMMON	Voltage from 0 to 10 V (Common mode)
3	AD_CURR_0_20_COMMON	Current from 0 to 20 mA (Common mode)
4	AD_CURR_4_20_COMMON	Current from 4 to 20 mA (Common mode)
5	AD_VOLT_0_1_COMMON	Voltage from 0 to 1 V (Common mode)
7	AD_VOLT_0_1_DIFFER	Voltage from 0 to 1 V (Differential mode)
8	AD_VOLT_0_125_DIFFER	Voltage from 0 to 1.25 V (Differential mode)
9	AD_VOLT_0_10_DIFFER	Voltage from 0 to 10 V (Differential mode)
10	AD_PT100_DIFFER	Pt100 sensor Celsius degree (Differential mode)
11	AD_PT1000_DIFFER	Pt1000 sensor Celsius degree (Differential mode)
12	AD_NI1000_DIFFER	Ni1000 sensor Celsius degree (Differential mode)
32	AD_PT100_DIN_43760	Pt100 DIN_43760 standard Celsius degree
33	AD_PT100_AMERICAN	Pt100 American standard Celsius degree
34	AD_PT100_ITS_90	Pt100 ITS-90 standard Celsius degree
35	AD_PT100_IEC_60751	Pt100 IEC-60751 standard Celsius degree
40	AD_PT1000_DIN_43760	Pt1000 DIN_43760 standard Celsius degree
41	AD_PT1000_AMERICAN	Pt1000 American standard Celsius degree
42	AD_PT1000_ITS_90	Pt1000 ITS-90 standard Celsius degree
43	AD_PT1000_IEC_60751	Pt1000 IEC-60751 standard Celsius degree
48	AD_NI1000_DIN_43760	Ni1000 DIN_43760 standard Celsius degree
64	AD_THERMOCOUPLE_B	Thermocouple B type Celsius degree
65	AD_THERMOCOUPLE_E	Thermocouple E type Celsius degree
66	AD_THERMOCOUPLE_J	Thermocouple J type Celsius degree
67	AD_THERMOCOUPLE_K	Thermocouple K type Celsius degree
68	AD_THERMOCOUPLE_N	Thermocouple N type Celsius degree
69	AD_THERMOCOUPLE_R	Thermocouple R type Celsius degree
70	AD_THERMOCOUPLE_S	Thermocouple S type Celsius degree
71	AD_THERMOCOUPLE_T	Thermocouple T type Celsius degree

Done (BOOL) Dato analogico acquisito, viene attivato al termine della acquisizione analogica.

Fault (BOOL) Errore di acquisizione, viene attivato in caso di errore nella sequenza di acquisizione.

Value (REAL) Ritorna il valore di acquisizione espresso nella unità definita dal modo di acquisizione. Potrebbe essere un valore NaN (Not A Number) ad indicare un problema nell'acquisizione, tipicamente sensore rotto.

Codici di errore

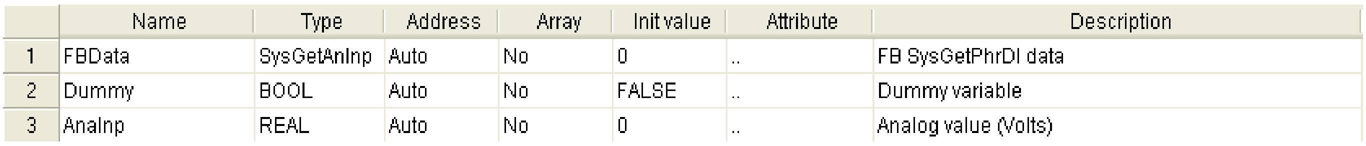
In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

9983050	Errore allocazione blocco funzione.
9983060	Terminato spazio memoria rilocabile, non è possibile eseguire l''FB.
9983070	Errore versione blocco funzione.
9983080	Impossibile inizializzare il modulo.
9983100	Il modulo indirizzato in ***Address*** non è presente.
9983110~1	Il modulo indirizzato non supporta i comandi acquisizione analogica.
9983150	Il valore ritornato dal modulo analogico non è corretto.
9983200	Il modo di acquisizione definito in ***Mode*** non è gestito dal modulo.
9983210	Errore nella acquisizione analogica dal modulo.

Esempi

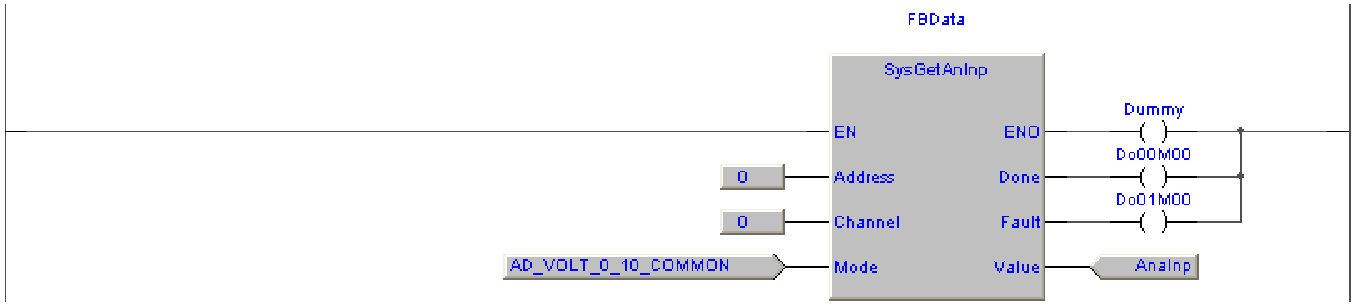
Viene eseguita l'acquisizione analogica dal canale 0 del modulo 0 in modo 0-10 Volt. Se dato valido viene attivata l'uscita digitale ***Do00M00*** se errore di conversione viene attivata l'uscita digitale ***Do01M00***. Il dato analogico acquisito nel range da 0.000 a 9.999 è trasferito nella variabile ***AnaInp***.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	FBData	SysGetAnInp	Auto	No	0	..	FB SysGetPhrDI data
2	Dummy	BOOL	Auto	No	FALSE	..	Dummy variable
3	AnaInp	REAL	Auto	No	0	..	Analog value (Volts)

Esempio LD *(Ptp116a100)*



Esempio IL

```
(* Acquires analog input 0 from module. *)

    LD   0
    ST   FB_SysGetAnInp.Address (* Set module address *)

    LD   0
    ST   FB_SysGetAnInp.Channel (* Set channel *)

    LD   AD_VOLT_0_10_COMMON
    ST   FB_SysGetAnInp.Mode (* Set acquisition mode *)

    CAL FBData (* Call the SysGetAnInp function block *)

    LD   FB_SysGetAnInp.Done
    ST   Do00M00 (* The output is active if data is acquired *)

    LD   FB_SysGetAnInp.Fault
    ST   Do01M00 (* The output is active if execution fault *)

    LD   FB_SysGetAnInp.Value
    ST   AnaInp (* Store the acquired value *)
```

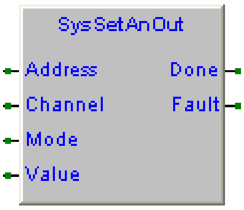
Esempio ST

```
(* Acquires analog input 0 from module. *)

    FB_SysGetAnInp(Address:=0, Channel:=0, Mode:=AD_VOLT_0_10_COMMON); (* Call the SysGetAnInp FB *)

    Do00M00:=FB_SysGetAnInp.Done; (* The output is active if data is acquired *)
    Do01M00:=FB_SysGetAnInp.Fault; (* The output is active if execution fault *)
    VarReal:=FB_SysGetAnInp.Value; (* Store the acquired value *)
```

7.12.5 SysSetAnOut, set analog output

Type	Library	Version
FB	Embedded	3.0

Questo blocco funzione esegue il set del valore sull'uscita analogica sul modulo di uscita. Il blocco funzione gestisce vari modi di uscita in funzione del modulo analogico a cui fa riferimento.



Address (USINT)	Occorre specificare l'indirizzo del modulo su cui settare il valore analogico (Range da 0x00 a 0x0F). Il valore 0x00 indica il primo modulo di estensione, 0x01 il secondo e così di seguito.
Channel (USINT)	Occorre specificare l'indirizzo del canale sul modulo (Range da 0x00 a 0x0F). Se viene settato un indirizzo di canale non presente, si interrompe l'esecuzione e viene settato il bit di ***Fault***.
Mode (USINT)	Occorre specificare il modo di gestione uscita analogica secondo la tabella sotto riportata.

Mode	Define	Description
1	DA_VOLT_0_10	Voltage from 0 to 10 V
2	DA_VOLT_0_5	Voltage from 0 to 5 V
3	DA_VOLT_M10_10	Voltage from -10 to +10 V
4	DA_VOLT_M5_5	Voltage from -5 to +5 V
5	DA_CURR_0_20	Current from 0 to 20 mA
6	DA_CURR_4_20	Current from 4 to 20 mA

Value (REAL)	Occorre specificare il valore di uscita espresso nella unità definita dal modo di gestione.
Done (BOOL)	Dato settato. Viene attivato per un loop al termine del settaggio dell'uscita analogica.
Fault (BOOL)	Errore. Viene attivato in caso di errore nella sequenza di settaggio.

Codici di errore

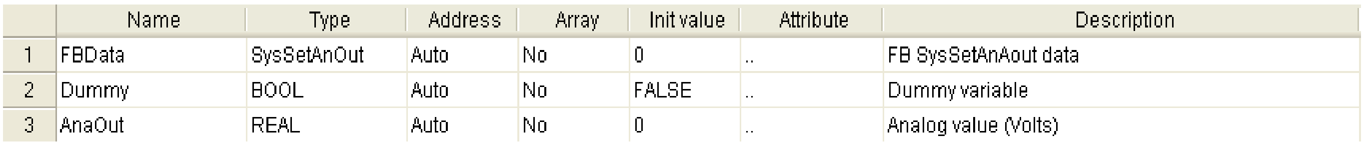
In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

9982050	Errore allocazione blocco funzione.
9982060	Terminato spazio memoria rilocabile, non è possibile eseguire l'"FB.
9982070	Errore versione blocco funzione.
9982080	Impossibile inizializzare il modulo.
9982100	Il modulo indirizzato in ***Address*** non è presente.
9982110~1	Il modulo indirizzato non supporta i comandi uscita analogica.
9982150	Il valore da impostare sul modulo analogico non è corretto.
9982200	Il modo di gestione definito in ***Mode*** non è gestito dal modulo.
9982210	Errore nella gestione uscita analogica sul modulo.

Esempi

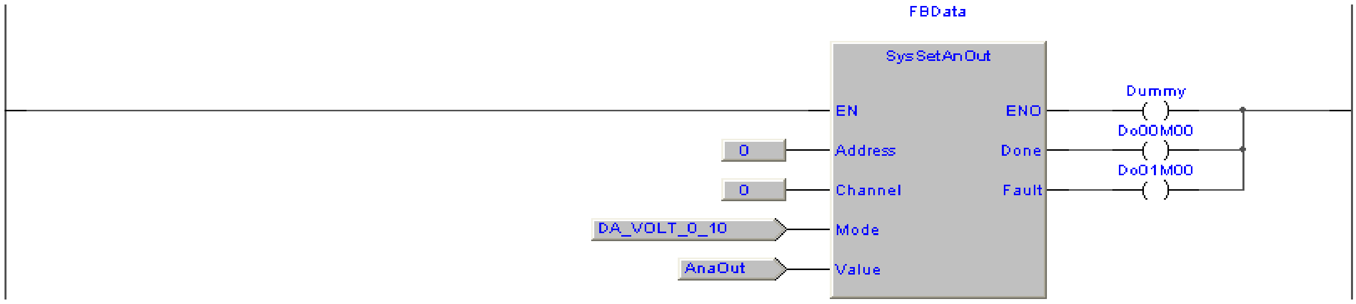
Viene eseguita l'uscita analogica dal canale 0 del modulo 0 in modo 0-10 Volt. Se dato valido viene attivata l'uscita digitale ***Do00M00*** se errore di conversione viene attivata l'uscita digitale ***Do01M00***. Il dato analogico da impostare in uscita nel range da 0.000 a 9.999 è presente nella variabile ***AnaOut***.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	FBData	SysSetAnOut	Auto	No	0	..	FB SysSetAnAout data
2	Dummy	BOOL	Auto	No	FALSE	..	Dummy variable
3	AnaOut	REAL	Auto	No	0	..	Analog value (Volts)

Esempio LD *(Ptp116a100)*



Esempio IL

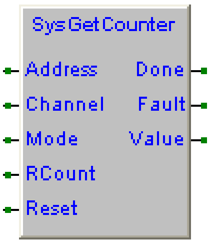
```
(* Manage analog output 0 on module 0. *)

    LD  0
    ST  FBData.Address (* Set module address *)

    LD  0
    ST  FBData.Channel (* Set channel *)

    LD  DA_VOLT_0_10
    ST  FBData.Mode (* Set management mode *)

    LD  AnaOut
    ST  FBData.Value (* Store the output value *)

    CAL FBData (* Call the SysSetAnOut function block *)

    LD  FBData.Done
    ST  Do00M00 (* The output is active  if data is set *)

    LD  FBData.Fault
    ST  Do01M00 (* The output is active if execution fault *)
```

Esempio ST

```
(* Manage analog output 0 on module 0. *)

    FBData.Value:=AnaOut; (* Store the ouput value *)
    FBData(Address:=0, Channel:=0, Mode:=DA_VOLT_0_10); (* Call the SysSetAnOut function block *)

    Do00M00:=FBData.Done; (* The output is active if data is set *)
    Do01M00:=FBData.Fault; (* The output is active if execution fault *)
```

7.12.6 SysGetCounter, get counter

Type	Library	Version
FB	Embedded	5.0



Questo blocco funzione esegue la lettura di un contatore. Il blocco funzione può essere utilizzato per acquisire il valore del contatore presente sul modulo CPU SlimLine e dai moduli che gestiscono la funzione contatore.

E' prevista la gestione del reset valore di conteggio e della inversione conteggio. In base alla definizione di ***Mode*** è possibile gestire conteggio su fronte positivo, negativo o su entrambi i fronti dell'ingresso clock del contatore. Se il modulo che gestisce il contatore lo prevede è possibile anche definire comandi hardware (Ingressi logici) di reset conteggio e di inversione conteggio.

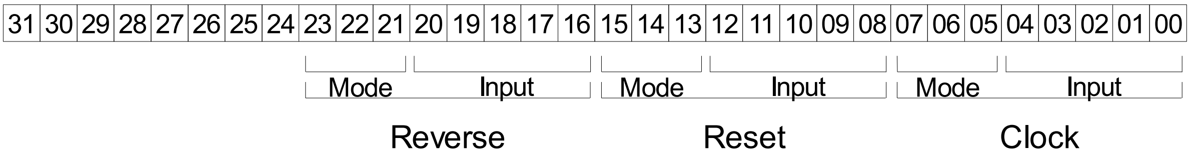
Address (USINT) Occorre specificare l'indirizzo di modulo da cui eseguire l'acquisizione counter (Range da 0 a 255). Il valore 0 indica il primo modulo di estensione, 1 il secondo e così di seguito.
L'indirizzo 255 indica il modulo CPU.

Se viene settato un indirizzo di modulo non presente, si interrompe l'esecuzione e viene settato il bit di ***Fault***.

Channel (USINT) Occorre specificare l'indirizzo del canale sul modulo (Range da 0 a 15).

Se viene settato un indirizzo di canale non presente, si interrompe l'esecuzione e viene settato il bit di ***Fault***.

Mode (UDINT) Modo acquisizione, espresso su 32 bit secondo lo schema riportato.



Clock	Input	Definisce ingresso logico da utilizzare come clock
	Mode	0: Conta su fronte salita 1: Conta su fronte discesa 2: Conta su entrambi i fronti

Reset	Input	Definisce ingresso logico da utilizzare come reset
	Mode	0: Non è utilizzato ingresso di reset 1: Reset counter se ingresso attivo 2: Reset conter se ingresso non attivo

Reverse	Input	Definisce ingresso logico da utilizzare come inversione conteggio
	Mode	0: Non è utilizzato ingresso di reverse 1: Inverte conteggio counter se ingresso attivo 2: Inverte conteggio conter se ingresso non attivo

Per calcolare il valore di mode si applica la formula:

((Reverse mode)*2097152)+((Reverse input)*65536)+((Reset mode)*8192)+((Reset input)*256)+((Clock mode)*32)+(Clock input)

Se viene settato un valore non corretto, si interrompe l'esecuzione e viene settato il bit di ***Fault***.

RCount (BOOL) Reverse counting, attivando questo ingresso ***Value*** viene decrementato ad ogni variazione di conteggio.

Reset (BOOL) Attivando questo ingresso si ha il reset del valore di conteggio ***Value***.

Done (BOOL) Dato counter acquisito, viene attivato per un loop al termine della acquisizione counter.

Fault (BOOL) Errore di acquisizione, viene attivato in caso di errore nella sequenza di acquisizione.

Value (UDINT) Valore contatore.

Codici di errore

In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

9981050	Errore allocazione blocco funzione.
9981060	Terminato spazio memoria rilocabile, non è possibile eseguire l''FB.
9981070	Errore versione blocco funzione.
9981080	Impossibile inizializzare il modulo.
9981100	Il modulo indirizzato in ***Address*** non è presente.
9981110	Il canale definito in ***Channel*** non è gestito.
9981200~1	Il modo di gestione definito in ***Mode*** non è gestito dal modulo.
9981210	Errore nella gestione lettura counter dal modulo.

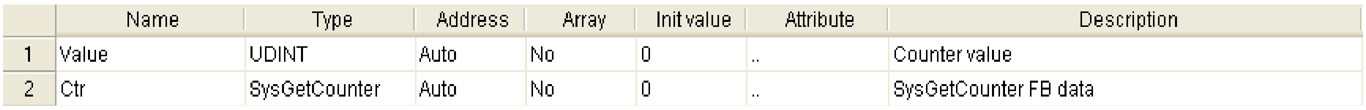
Esempi

Viene eseguita l'acquisizione del contatore dal modulo CPU di SlimLine, viene eseguito il conteggio su entrambi i fronti dell'ingresso di clock. Il valore di conteggio è trasferito nella variabile ***Value***. Su fine conversione viene attivata l'uscita digitale ***Do01M00*** se errore di conversione viene attivata l'uscita digitale ***Do02M00***.

Attivando l'ingresso ***Di00M00*** viene eseguita l'inversione del conteggio ad ogni variazione dell'ingresso di clock viene decrementato il valore di ***Value*** in uscita.

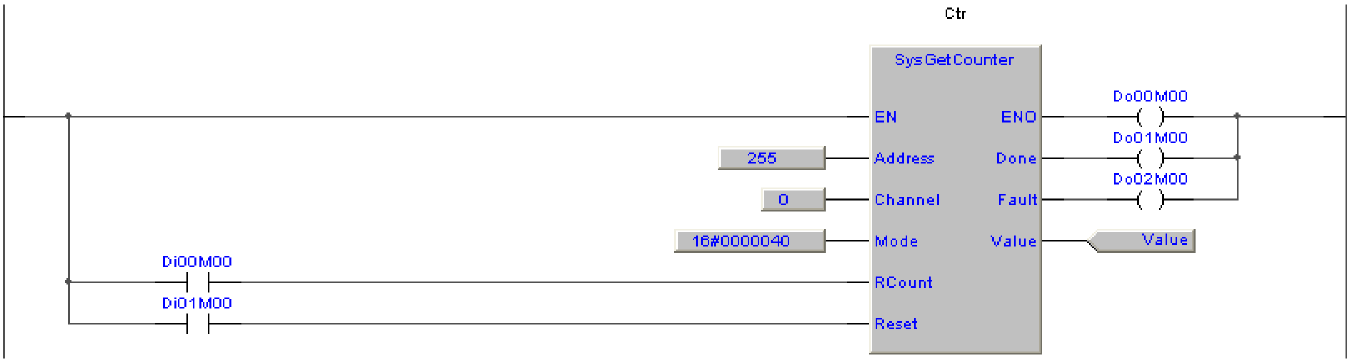
Attivando l'ingresso ***Di01M00*** viene eseguito il reset del conteggio il valore di ***Value*** in uscita è resettato.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	Value	UDINT	Auto	No	0	..	Counter value
2	Ctr	SysGetCounter	Auto	No	0	..	SysGetCounter FB data

Esempio LD

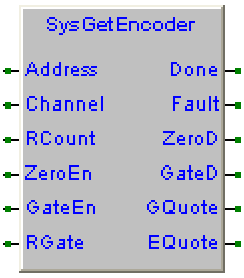


7.12.7 SysGetEncoder, get encoder input

Type	Library	Version
FB	Embedded	3.0

Questo blocco funzione esegue la lettura di un canale encoder. Il blocco funzione può essere utilizzato solo su sistemi che hanno moduli in grado di acquisire encoders incrementali.

E' prevista la gestione della tacca di zero e la possibilità di acquisire valori di quota all'interno di un segnale logico di gate.



Address (USINT)	Occorre specificare l'indirizzo di modulo da cui eseguire l'acquisizione encoder (Range da 0 a 15). Il valore 0 indica il primo modulo di estensione, 1 il secondo e così di seguito. Se viene settato un indirizzo di modulo non presente, si interrompe l'esecuzione e viene settato il bit di ***Fault***.
Channel (USINT)	Occorre specificare l'indirizzo del canale sul modulo (Range da 0 a 15). Se viene settato un indirizzo di canale non presente, si interrompe l'esecuzione e viene settato il bit di ***Fault***.
RCount (BOOL)	Reverse counting, attivando questo ingresso si inverte l'incremento di quota ***EQuote*** in funzione della direzione di rotazione encoder.
ZeroEn (BOOL)	Attivando questo ingresso si ha il reset della quota ***EQuote*** al passaggio della tacca di zero encoder.
GateEn (BOOL)	Attivando questo ingresso sul fronte di variazione dell'ingresso di Gate viene trasferito il valore di ***EQuote*** in ***GQuote***.
RGate (BOOL)	Attivando questo ingresso viene gestito il fronte di disattivazione dell'ingresso Gate.
Done (BOOL)	Dato encoder acquisito, viene attivato per un loop al termine della acquisizione encoder.
Fault (BOOL)	Errore di acquisizione, viene attivato in caso di errore nella sequenza di acquisizione.
ZeroD (BOOL)	Tacca di zero encoder acquisita, viene settata su acquisizione tacca di zero encoder, si resetta disattivando l'ingresso ***ZeroEn***.
GateD (BOOL)	Segnale di Gate acquisito, viene attivato per un loop alla acquisizione del segnale Gate.
GQuote (UINT)	Quota di gate, valore di quota encoder ***EQuote*** memorizzata sul fronte selezionato del segnale Gate.
EQuote (UINT)	Quota encoder, valore di quota encoder, al raggiungimento del valore minimo o massimo viene eseguito il roll over.

Codici di errore

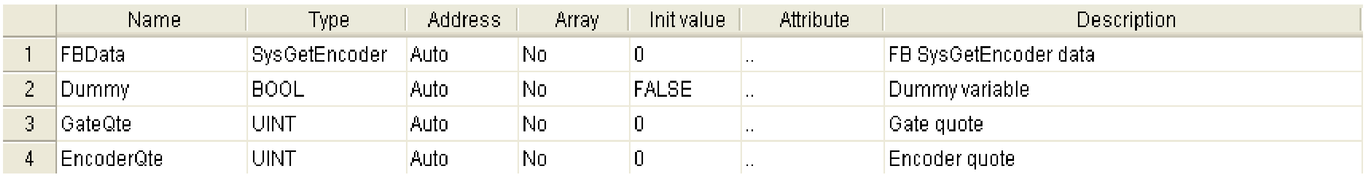
In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

9980050	Errore allocazione blocco funzione.
9980060	Terminato spazio memoria rilocabile, non è possibile eseguire l''FB.
9980070	Errore versione blocco funzione.
9980080	Impossibile inizializzare il modulo.
9980100	Il modulo indirizzato in ***Address*** non è presente.
9980110~2	Il modulo indirizzato non supporta i comandi acquisizione encoder.
9980200	Il modo di gestione definito in ***Mode*** non è gestito dal modulo.
9980210~2	Errore nella gestione lettura encoder dal modulo.

Esempi

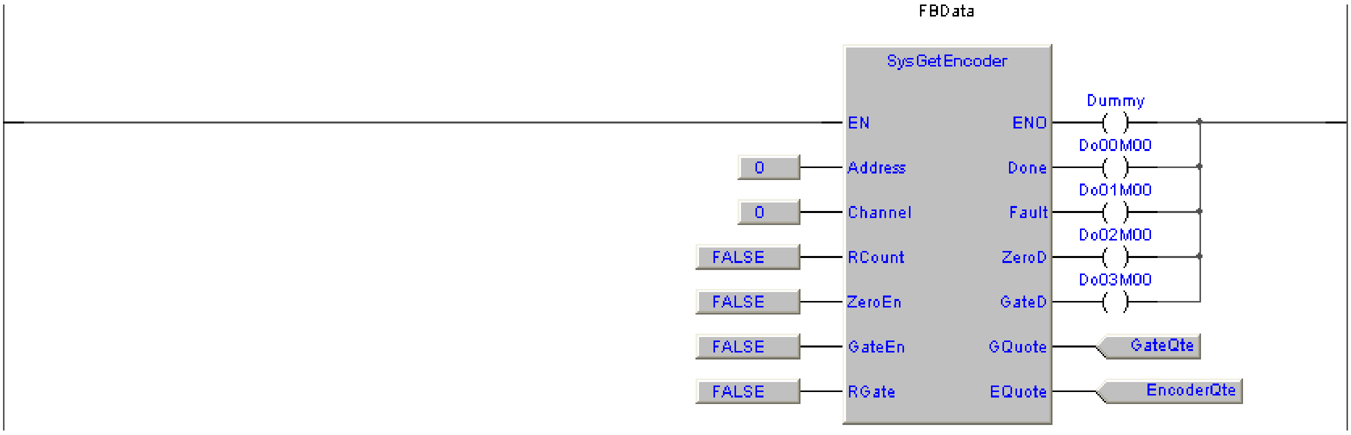
Viene eseguita l'acquisizione dell'ingresso encoder dal canale 0 del modulo 0, il valore di quota encoder è trasferito nella variabile ***EncoderQte***. Su fine conversione viene attivata l'uscita digitale ***Do00M00*** se errore di conversione viene attivata l'uscita digitale ***Do01M00***.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	FBData	SysGetEncoder	Auto	No	0	..	FB SysGetEncoder data
2	Dummy	BOOL	Auto	No	FALSE	..	Dummy variable
3	GateQte	UINT	Auto	No	0	..	Gate quote
4	EncoderQte	UINT	Auto	No	0	..	Encoder quote

Esempio LD *(Ptp116a100)*

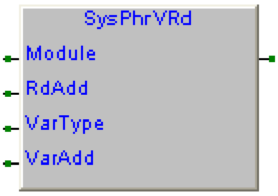


Esempio IL *(Ptp116a100)*

```
(* Acquires encoder 0 from module. *)

    LD  0
    ST  FBData.Address (* Set module address *)

    LD  0
    ST  FBData.Channel (* Set channel *)

    LD  FALSE
    ST  FBData.RCount (* Reverse counting *)
    ST  FBData.GateEn (* Gate enable *)
    ST  FBData.RGate (* Reverse gate *)

    CAL FBData (* Call the SysGetEncoder function block *)

    LD  FBData.Done
    ST  Do00M00 (* The output is active if data is acquired *)

    LD  FBData.Fault
    ST  Do01M00 (* The output is active if execution fault *)

    LD  FBData.GQuote
    ST  GateQte (* Gate quote *)

    LD  FBData.EQuote
    ST  EncoderQte (* Encoder quote *)
```

7.12.8 SysPhrVRd, read variable from peripheral module

Type	Library	Version
Function	Embedded	5.0



Questa funzione esegue la lettura di una variabile dal modulo periferico di estensione.

Occorre definire l'indirizzo di modulo ***Module***, l'indirizzo della variabile da leggere sul modulo periferico ***RdAdd***, il tipo di variabile ***VarType*** e l'indirizzo del buffer dove trasferire il valore letto ***VarAdd***.

Parametri funzione:

Module (USINT)	Occorre specificare l'indirizzo di modulo da cui eseguire la lettura (Range da 0 a 15). Il valore 0 indica il primo modulo di estensione, 1 il secondo e così di seguito.
RdAdd (UINT)	Indirizzo variabile da leggere come allocata sul modulo periferico.
VarType (USINT)	Tipo variabile, come indicato nella tabella ***Variable types definition***.
VarAdd (UDINT)	Indirizzo variabile.

La funzione ritorna:

(BOOL)	***FALSE:*** Errore esecuzione. ***TRUE:*** Funzione eseguita correttamente.

Codici di errore

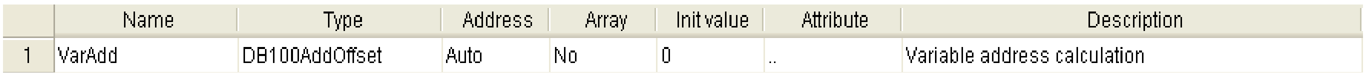
In caso di errore la funzione torna ***FALSE*** e con ***SysGetLastError*** è possibile rilevare il codice di errore.

9989100	Il modulo indirizzato in ***Module*** non è presente.
9989110	Il tipo variabile definito in ***VarType*** non è corretto.
9989200	Errore durante l'esecuzione della lettura della variabile dal modulo periferico.

Esempi

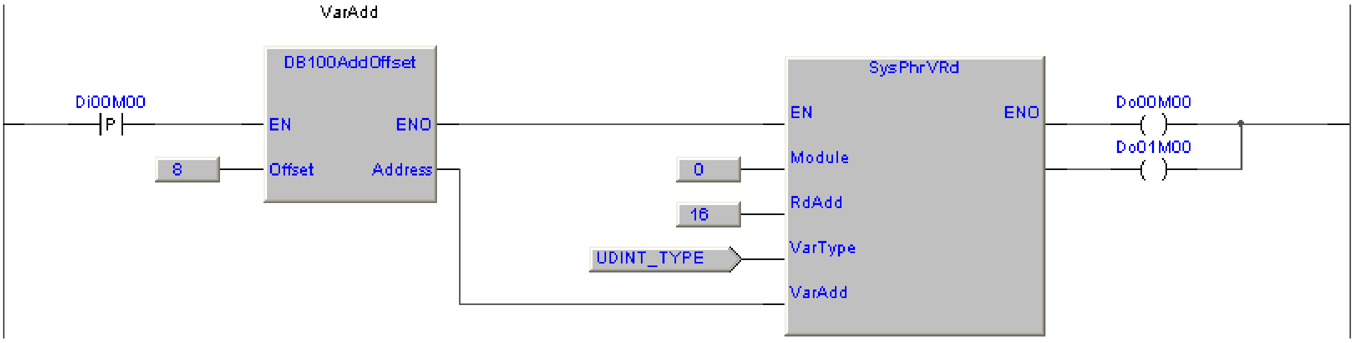
Attivando l'ingresso ***Di00M00*** viene eseguita la lettura della variabile ***UDINT*** da indirizzo ***16*** dal modulo periferico ***0***. Il valore della variabile è trasferito nella ***DB100*** ad offset ***8***.

Definizione variabili



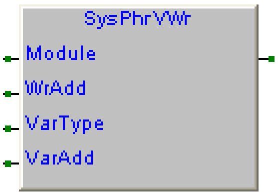
	Name	Type	Address	Array	Init value	Attribute	Description
1	VarAdd	DB100AddOffset	Auto	No	0	..	Variable address calculation

Esempio LD



7.12.9 SysPhrVWr, write variable to peripheral module

Type	Library	Version
Function	Embedded	5.0



Questa funzione esegue la scrittura di una variabile sul modulo periferico di estensione.

Occorre definire l'indirizzo di modulo ***Module***, l'indirizzo della variabile da scrivere sul modulo periferico ***WrAdd***, il tipo di variabile ***VarType*** e l'indirizzo del buffer dove si trova il valore da scrivere ***VarAdd***.

Parametri funzione:

Module (USINT)	Occorre specificare l'indirizzo di modulo su cui eseguire la scrittura (Range da 0 a 15). Il valore 0 indica il primo modulo di estensione, 1 il secondo e così di seguito.
WrAdd (UINT)	Indirizzo variabile da scrivere come allocata sul modulo periferico.
VarType (USINT)	Tipo variabile, come indicato nella tabella ***Variable types definition***.
VarAdd (UDINT)	Indirizzo variabile.

La funzione ritorna:

(BOOL)	***FALSE:*** Errore esecuzione. ***TRUE:*** Funzione eseguita correttamente.

Codici di errore

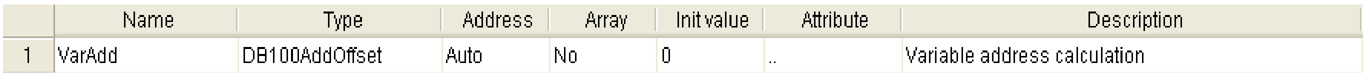
In caso di errore la funzione torna ***FALSE*** e con ***SysGetLastError*** è possibile rilevare il codice di errore.

9988100	Il modulo indirizzato in ***Module*** non è presente.
9988110	Il tipo variabile definito in ***VarType*** non è corretto.
9988200	Errore durante l'esecuzione della scrittura della variabile sul modulo periferico.

Esempi

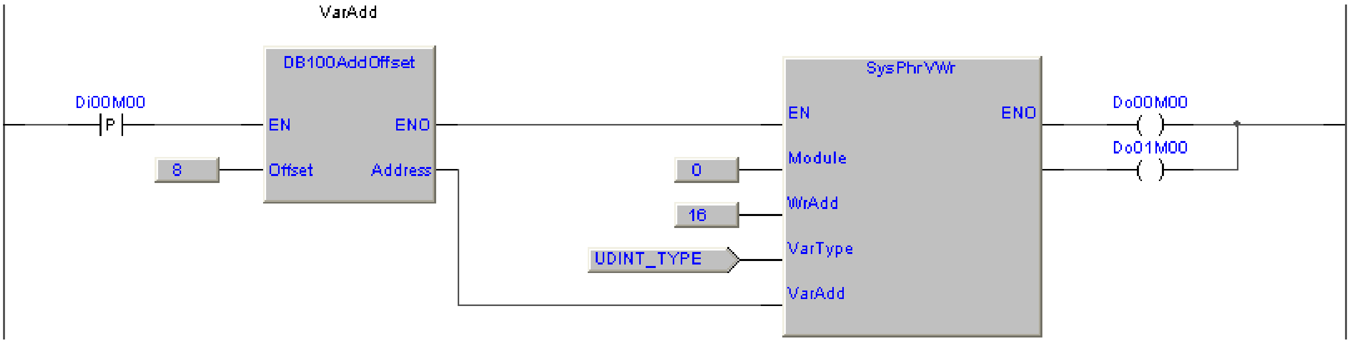
Attivando l'ingresso ***Di00M00*** viene eseguita la scrittura della variabile ***UDINT*** ad indirizzo ***16*** sul modulo periferico ***0***. Il valore da scrivere è presente nella ***DB100*** ad offset ***8***.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	VarAdd	DB100AddOffset	Auto	No	0	..	Variable address calculation

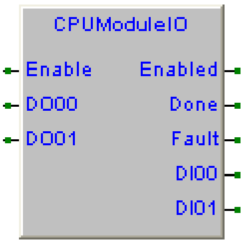
Esempio LD



7.12.10 CPUModuleIO, CPU module I/O management

Type	Library	Version
FB	PLCUtyLib	SFR054A400

Questo blocco funzione esegue la lettura dei due ingressi digitali e la gestione delle due uscite digitali presenti sul modulo CPU dello SlimLine.



Enable (BOOL)	Abilitazione gestione I/O, attivando l'ingresso vengono acquisiti gli ingressi logici e gestite le uscite logiche. Disattivando l'ingresso vengono disattivate anche le uscite logiche sul modulo CPU.
DO00 (BOOL)	Stato della uscita logica DO00 presente sul modulo CPU.
DO01 (BOOL)	Stato della uscita logica DO01 presente sul modulo CPU.
Enabled (BOOL)	Blocco funzione abilitato.
Done (BOOL)	Acquisizione input e gestione output eseguita.
Fault (BOOL)	Errore su acquisizione input e gestione output.
DI00 (BOOL)	Stato dell'ingresso logico DI00 presente sul modulo CPU.
DI01 (BOOL)	Stato dell'ingresso logico DI01 presente sul modulo CPU.

Codici di errore

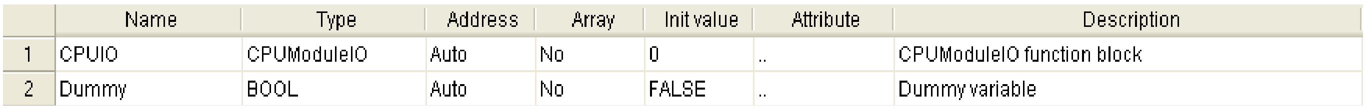
In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

10001100	Errore su esecuzione funzione lettura ingressi logici da modulo CPU
10001200	Errore su esecuzione funzione di set uscite logiche su modulo CPU

Esempi

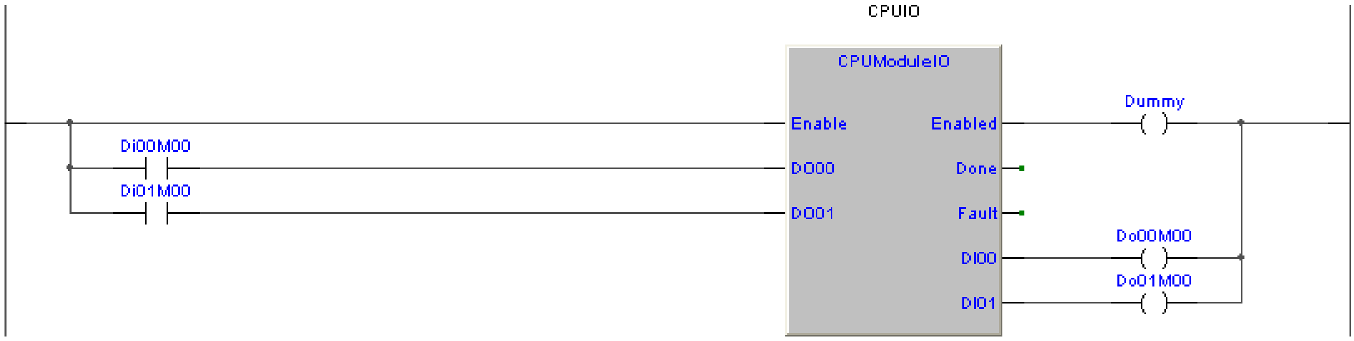
Viene eseguita la lettura dei due ingressi digitali e la gestione delle due uscite digitali presenti sul modulo CPU. Lo stato dei due ingressi logici è copiato nelle uscite ***Do00M00*** e ***Do01M00***. Lo delle variabili ***Di00M00*** e ***Di01M00*** è trasferito sulle due uscite logiche.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	CPUIO	CPUModuleIO	Auto	No	0	..	CPUModuleIO function block
2	Dummy	BOOL	Auto	No	FALSE	..	Dummy variable

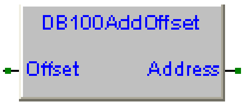
Esempio LD *(Ptp114a200)*



7.13 Funzioni ed FB di utilità generale

7.13.1 DB100AddOffset, returns DB100 address offset

Type	Library	Version
FB	ePLCUtyLib	SFR054A400



Questa funzione ritorna l'indirizzo della locazione di memoria all'interno della ***DB100***, il cui offset è fornito come parametro.

Parametri funzione:

Offset (UINT) Offset locazione memoria

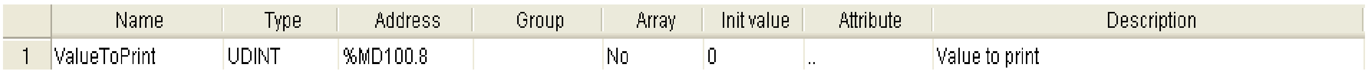
La funzione ritorna:

(UDINT) Indirizzo della locazione di memoria

Esempi

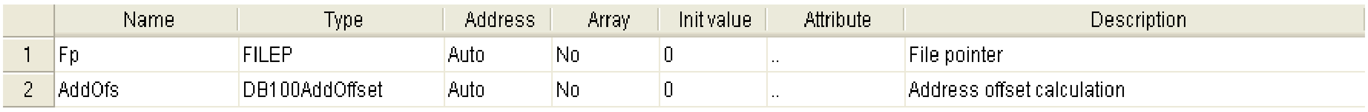
La variabile ***ValueToPrint*** è allocata nella ***DB100*** ad offset ***8***, ogni secondo ne viene incrementato il valore e su porta seriale ***COM0*** viene inviata la stringa ***Value is: xxxx***.

Definizione variabili globali



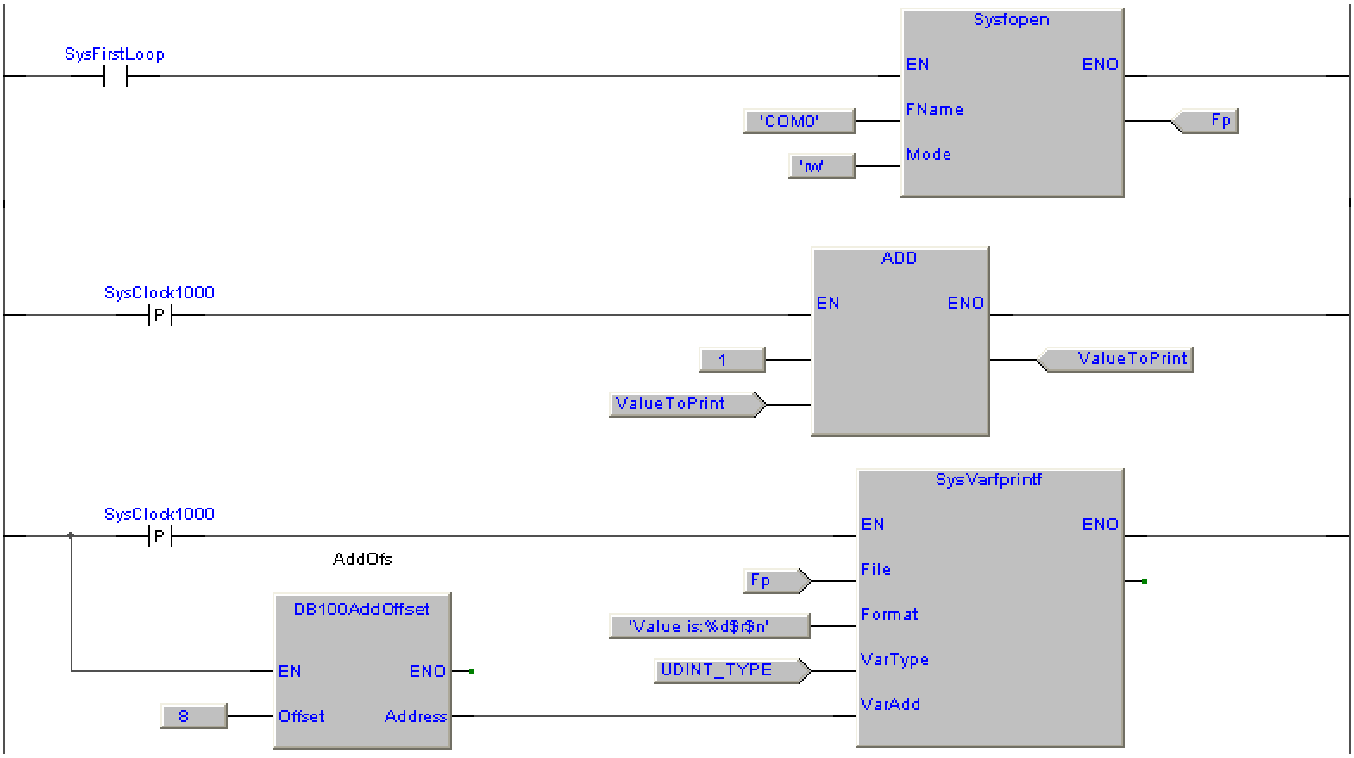
	Name	Type	Address	Group	Array	Init value	Attribute	Description
1	ValueToPrint	UDINT	%MD100.8		No	0	..	Value to print

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	File pointer
2	AddOfs	DB100AddOffset	Auto	No	0	..	Address offset calculation

Esempio LD



7.13.2 BLINK, blink command

Type	Library	Version
FB	PLCUtyLib	SFR054A000

Questo blocco funzione gestisce una uscita lampeggiante con tempo di ciclo definibile. Attivando l'ingresso ***ENABLE*** l'uscita ***OUT*** inizia a lampeggiare con tempi di ciclo alto e basso definiti.

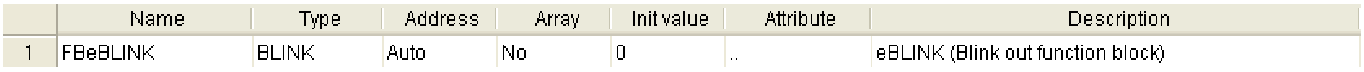
ENABLE (BOOL)	Abilitazione blocco funzione, attivandolo viene gestita l'uscita OUT lampeggiante. Disattivandolo l'uscita OUT viene resettata.
TIMELOW (UDINT)	Definisce il tempo in cui l'uscita OUT rimane nello stato logico low, espresso in mS.
TIMEHIGH (UDINT)	Definisce il tempo in cui l'uscita OUT rimane nello stato logico high espresso in mS.
OUT (BOOL)	Stato uscita lampeggiante.

Esempi

Viene impostato un lampeggio con 100 mS di tempo On e 1000 mS di tempo Off. Attivando l'ingresso digitale ***Di00M00*** l'uscita digitale ***Do00M00*** lampeggia con i tempi definiti.

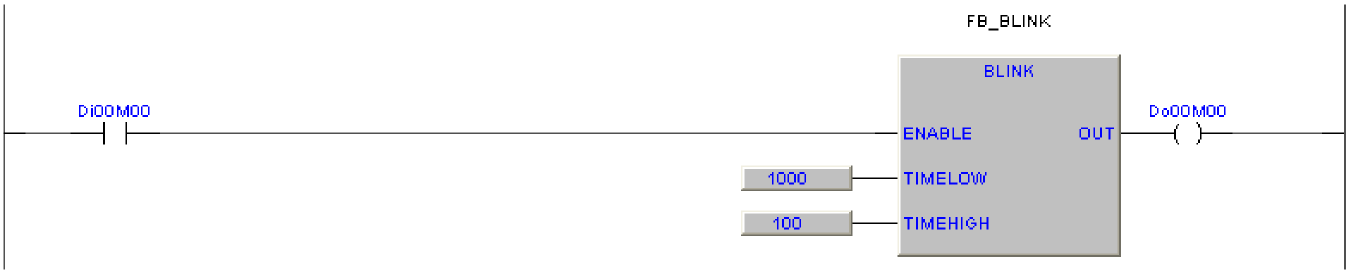
Disattivando l'ingresso digitale ***Di00M00*** l'uscita digitale ***Do00M00*** si azzera immediatamente.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	FBeBLINK	BLINK	Auto	No	0	..	eBLINK (Blink out function block)

Esempio LD *(Ptp114a100)*



Esempio IL *(Ptp114a100)*

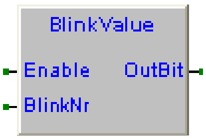
```
  CAL FB_BLINK (* Call the BLINK function block *)

   LD  Di00M00
   ST  FB_BLINK.ENABLE (* Transfer the digital input to enable input *)

   LD  1000
   ST  FB_BLINK.TIMELOW (* Set the time low *)

   LD  100
   ST  FB_BLINK.TIMEHIGH (* Set the time high *)

   LD  FB_BLINK.OUT
   ST  Do00M00 (* Copy FB output to logic output *)
```

Esempio ST *(Ptp114a100)*

```
   FB_BLINK(TIMELOW:=1000, TIMEHIGH:=100); (* Call the BLINK function block *)

   FB_BLINK.ENABLE:=Di00M00; (* Transfer the digital input to FB enable *)
   Do00M00:=FB_BLINK.OUT; (* Transfer the FB output to digital output *)
```

7.13.3 BlinkValue, blink out value

Type	Library	Version
FB	PLCUtyLib	SFR054A800



Questo blocco funzione gestisce una uscita lampeggiante con possibilità di definire il numero di lampeggi. Attivando l'ingresso ***Enable*** e definendo il numero di lampeggi in ***BlinkNr***, l'uscita ***OutBit*** inizia a lampeggiare con il numero di lampeggi definito.

Il numero di lampeggi è definito in decine ed unità, il valore delle decine è riportato con un lampeggio lento (1 Sec), mentre il numero delle unità è riportato con un lampeggio veloce (250 mS). Una pausa di 3 Sec separa le sequenze di lampeggio.

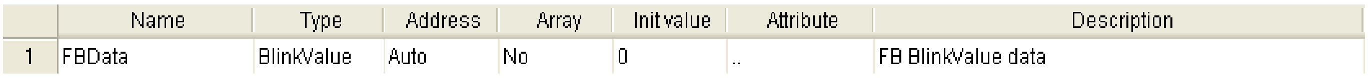
Enable (BOOL)	Abilitazione blocco funzione, attivandolo viene gestita l'uscita ***OutBit*** lampeggiante. Disattivandolo l'uscita viene resettata.
BlinkNr (USINT)	Definisce il numero di lampeggi dell'uscita ***OutBit***. Definendo tempo 0 l'uscita si disattiva.
OutBit (BOOL)	Stato uscita lampeggiante.

Esempi

Attivando l'ingresso digitale ***Di00M00*** l'uscita digitale ***Do00M00*** lampeggia con 2 lampeggi lenti (1 Sec), 3 lampeggi veloci (250 mS) ed una pausa di 3 Sec.

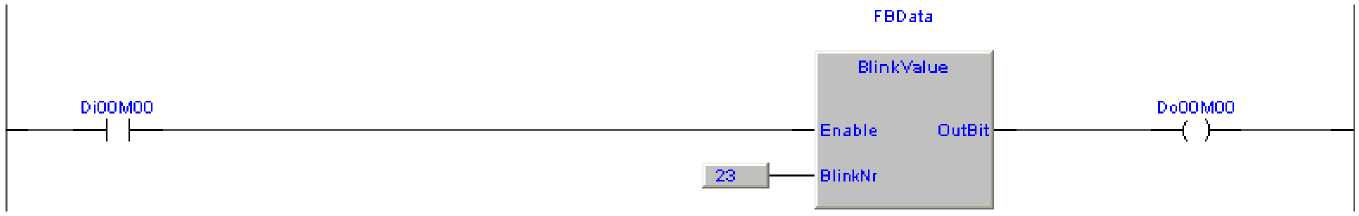
Disattivando l'ingresso digitale ***Di00M00*** l'uscita digitale ***Do00M00*** si azzera immediatamente.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	FBData	BlinkValue	Auto	No	0	..	FB BlinkValue data

Esempio LD *(Ptp114a500)*



Esempio IL *(Ptp114a500)*

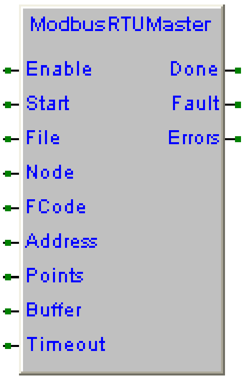
```
CAL FBData (* Call the "BlinkValue" function block *)

LD  Di00M00
ST  FBData.Enable (* Transfer the digital input to enable input *)

LD  23
ST  FBData.BlinkNr (* Set the number of blink *)

LD  FBData.OutBit
ST  Do00M00 (* Copy FB output to logic output *)
```

Esempio ST *(Ptp114a100)*

```
FBData(BlinkNr:=23); (* Call the BLINK function block *)

FBData.Enable:=Di00M00; (* Transfer the digital input to FB enable *)
Do00M00:=FBData.OutBit; (* Transfer the FB output to digital output *)
```

7.13.4 ModbusRTUMaster, modbus Rtu master

Type	Library	Version
FB	PLCUtyLib	SFR054A500



Questo blocco funzione esegue la gestione del protocollo modbus master, è possibile definire il terminale di I/O su cui effettuare la comunicazione ***File***. Attivando il comando di ***Start*** sul terminale di I/O viene inviato un frame per eseguire la funzione modbus definita in ***Function***.

Il comando ***Start*** se attivato in modo impulsivo permette l'esecuzione del comando definito una sola volta. Se è sempre attivo permette l'esecuzione ciclica del comando definito.

Se ***FCode*** è una funzione di lettura, il valore delle variabili a partire dall'indirizzo definito in ***Address*** per il numero di variabili definito da ***Points***, viene letto dal sistema slave e trasferito nelle variabili indirizzate da ***Buffer***.

Se ***Fcode*** è una funzione di scrittura, il valore delle variabili presenti nel buffer di memoria indirizzato da ***Buffer*** per il numero di variabili definito da ***Points***, è inviato al dispositivo slave che lo trasferirà nelle sue variabili a partire dall'indirizzo definito in ***Address***.

Terminato il comando viene attivata per un loop l'uscita ***Done***, in caso di errore esecuzione comando o tempo di esecuzione comando superiore al tempo definito in ***Timeout***, viene attivata per un loop l'uscita ***Fault*** ed incrementato il valore in ***Errors***.

Enable (BOOL) Comando di abilitazione blocco funzione.

Start (BOOL) Comando di esecuzione comando modbus.

File (FILEP) Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.

Node (USINT) Numero di nodo modbus su cui effettuare il comando (Range da 0 a 255).

FCode (USINT) Codice funzione modbus da eseguire nel comando (Range da 0 a 255).

Codice	Descrizione
01	Read coil status (Massimo 255 coils)
03	Read holding registers (Massimo 32 registri)
04	Read input registers (Massimo 32 registri)
0F	Force multiple coils (Massimo 255 coils)
10	Preset multiple registers (Massimo 32 registri)

Address (UINT) Indirizzo di allocazione variabili su sistema slave. In accordo alle specifiche modbus l'indirizzo inviato nel frame dati è (***Address-1***) (Range da 16#0001 a 16#FFFF).

Points (USINT) Numero di variabili consecutive su cui opera il comando (Range da 1 a 32).

Buffer (@USINT) Indirizzo buffer dati letti o da scrivere.

Timeout (UINT) Tempo massimo esecuzione comando espresso in mS. Se il comando non termina nel tempo definito viene abortito ed attivata l'uscita ***Fault***.

Done (BOOL) Attivo per un loop al termine della esecuzione del comando.

Fault (BOOL) Attivo per un loop su errore esecuzione del comando.

Errors (UDINT) Numero di errori, incrementato ad ogni nuovo errore, raggiunto valore massimo riparte da 0.

Codici di errore

In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

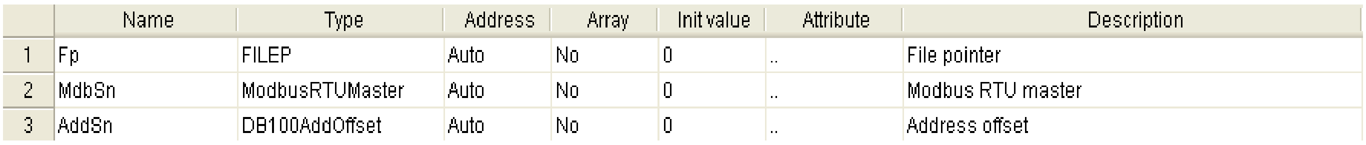
10007010	Valore di ***File*** non definito.
10007050	Timeout esecuzione.
10007060	Errore esecuzione.
10007100	Codice funzione definito in ***Function*** non gestito.
10007120	Valore di ***Points*** errato.
10007500	Errore in ricezione frame (Codice comando errato).
10007520	Errore in ricezione frame (CRC frame errato).
10007540	Errore in ricezione frame (Dati errati).

Esempi

Viene presentato un esempio di lettura da un sistema SlimLine slave. Attivando l'ingresso digitale ***Di00M00*** viene eseguita ogni secondo la lettura di 16 coils a partire da indirizzo 16#01 dal nodo modbus 1. Il valore dei coils letti è trasferito nella DB100 a partire da indirizzo 16. Terminata la lettura si attiverà per un loop l'uscita logica ***Do00M00***.

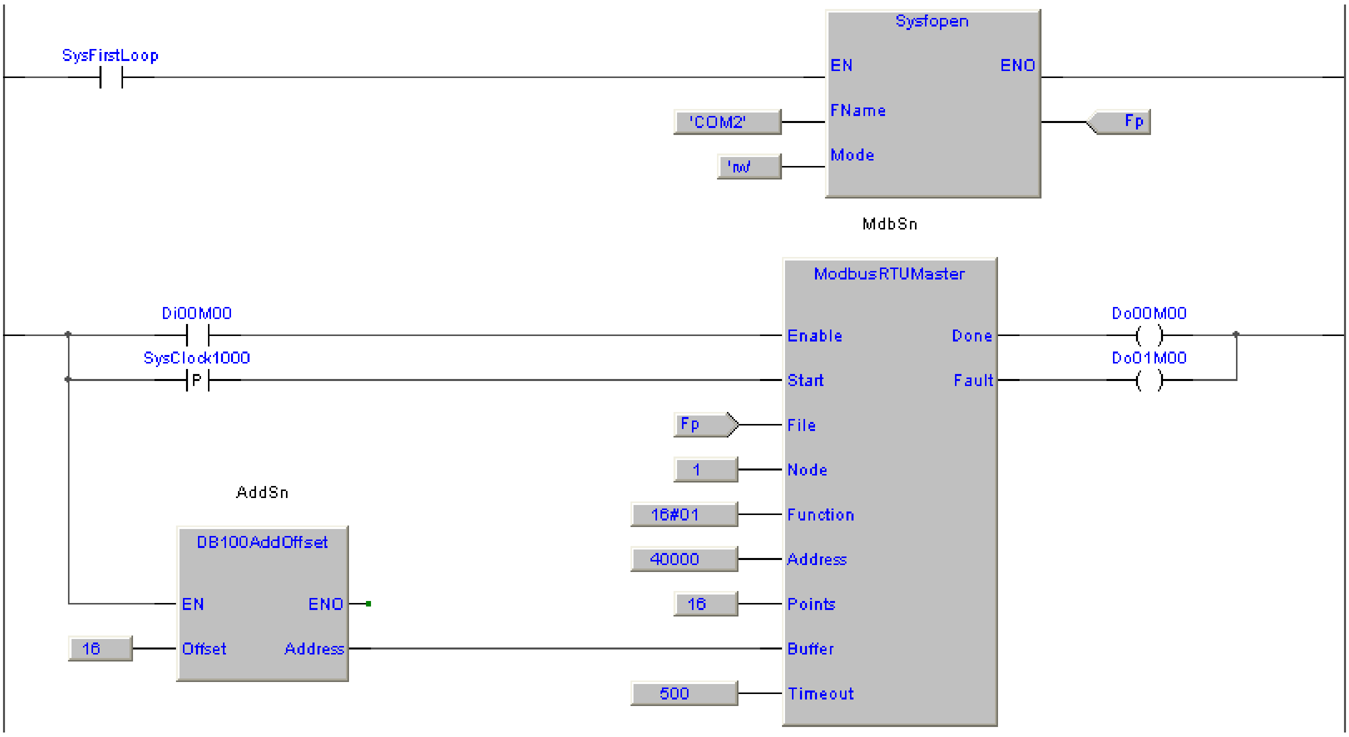
Nella variabile BOOL ad indirizzo MX100.16 verrà trasferita la variabile BOOL MX100.0 del sistema slave, ad indirizzo MX100.17 la variabile MX100.1, ad indirizzo MX100.18 la variabile MX100.2 e così via.

Definizione variabili



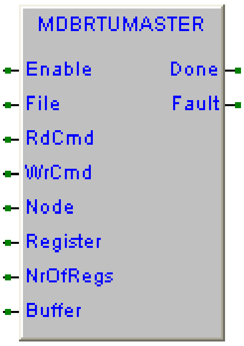
	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	File pointer
2	MdbSn	ModbusRTUMaster	Auto	No	0	..	Modbus RTU master
3	AddSn	DB100AddOffset	Auto	No	0	..	Address offset

Esempio LD *(Ptp114a300)*



7.13.5 MDBRTUMASTER, modbus Rtu master

Type	Library	Version
FB	PLCUtyLib	SFR054A000



Blocco funzione obsoleto, si consiglia di utilizzare ModbusRTUMaster.

Questo blocco funzione esegue la gestione del protocollo modbus master, è possibile definire il terminale di I/O su cui effettuare la comunicazione ***File***.

Attivando il comando di read ***RdCmd*** sul terminale di I/O viene inviato un frame modbus con il comando di ***Read Holding Registers*** (0x03) ed il valore ritornato dei registri viene trasferito nella variabile indirizzata da ***Buffer***.

Attivando il comando di write ***WrCmd*** sul terminale di I/O viene inviato un frame modbus con il comando di ***Preset Multiple Registers*** (0x10) con il valore dei registri acquisito dalla variabile indirizzata da ***Buffer***.

Terminato il comando viene attivato per un loop l'uscita ***Done***.

Enable (BOOL)	Comando di abilitazione blocco funzione.
File (FILEP)	Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.
RdCmd (BOOL)	Comando di esecuzione lettura registri.
WrCmd (BOOL)	Comando di esecuzione scrittura registri.
Node (USINT)	Numero di nodo modbus su cui effettuare il comando (Range da 0 a 255).
Register (UDINT)	Indirizzo di inizio lettura o scrittura registri su nodo modbus. In accordo alle specifiche modbus l'indirizzo inviato nel frame dati è (***Register-1***) (Range da 16#0001 a 16#FFFF).
NrOfRegs (USINT)	Numero di registri consecutivi da leggere o scrivere (Range da 1 a 32).
Buffer (@UINT)	Indirizzo buffer dati letti o da scrivere.
Done (BOOL)	Attivo per un loop al termine della esecuzione del comando.
Fault (BOOL)	Attivo per un loop su errore esecuzione del comando.

Codici di errore

In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

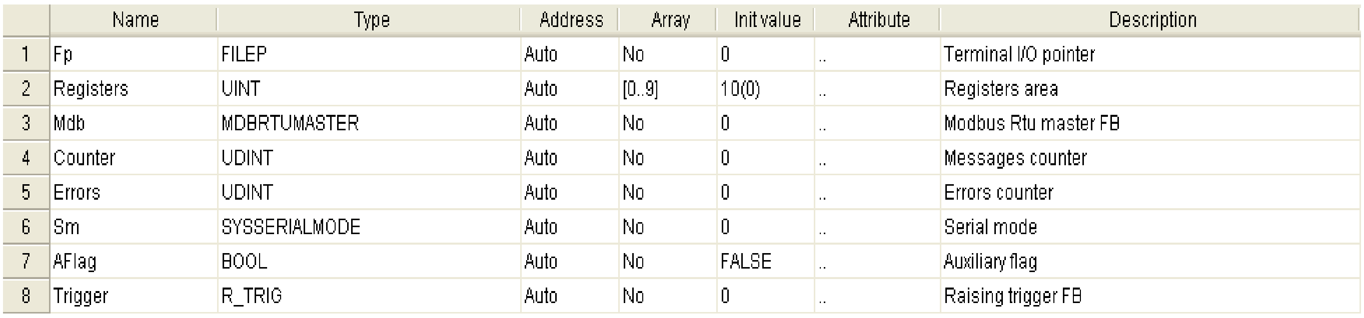
10000010	Valore di ***File*** non definito.
10000050	Timeout esecuzione
20000060	Errore sequenze gestione comando
10000100 10000102	Valore di ***Register*** errato
10000200	Frame risposta a comando read in errore
10000300	Frame risposta a comando write in errore
10000400	Errore in ricezione frame (Codice comando errato)
10000410	Errore in ricezione frame (CRC frame errato)

Esempi

Viene eseguita la lettura ogni 100 mS di 6 registri a partire da indirizzo 16#100 dal nodo modbus 1. Il valore dei registri letti è trasferito nell'array ***Registers***.

Spiando la porta seriale COM2 con un programma di emulazione terminale in grado di visualizzare i caratteri esadecimali vedremo ogni 100 mS la stringa con il comando modbus di ***Read Holding Register***: 01 03 01 00 00 06 C4 34.

Definizione variabili



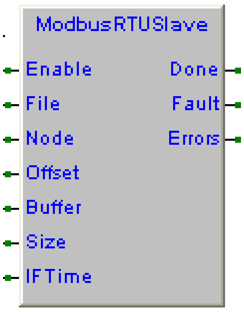
	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	Terminal I/O pointer
2	Registers	UINT	Auto	[0..9]	10(0)	..	Registers area
3	Mdb	MDBRTUMASTER	Auto	No	0	..	Modbus Rtu master FB
4	Counter	UDINT	Auto	No	0	..	Messages counter
5	Errors	UDINT	Auto	No	0	..	Errors counter
6	Sm	SYSSERIALMODE	Auto	No	0	..	Serial mode
7	AFlag	BOOL	Auto	No	FALSE	..	Auxiliary flag
8	Trigger	R_TRIG	Auto	No	0	..	Raising trigger FB

Esempio ST *(Ptp114a200)*

```
    (* ---------------------------------------------------------------------- *)
    (* OPEN THE COMMUNICATION PORT                                            *)
    (* ---------------------------------------------------------------------- *)
    (* Here open the COM2 port in read/write. *)

    IF (Fp = NULL) THEN
        Fp:=Sysfopen('COM2', 'rw'); (* Terminal I/O pointer *)
    END_IF;

    (* ---------------------------------------------------------------------- *)
    (* INITIALIZATION                                                         *)
    (* ---------------------------------------------------------------------- *)
    (* Set the serial mode. *)

    IF (SysFirstLoop) THEN
        AFlag:=SysGetSerialMode(ADR(Sm), Fp); (* Get serial mode *)
        Sm.Baudrate:=57600;
        Sm.Parity:='E';
        Sm.DTRManagement:=DTR_AUTO_WO_TIMES;
        AFlag:=SysSetSerialMode(ADR(Sm), Fp); (* Set serial mode *)
    END_IF;

    (* ---------------------------------------------------------------------- *)
    (* MODBUS MASTER                                                          *)
    (* ---------------------------------------------------------------------- *)
    (* Preset the modbus master FB parameters. *)

    Mdb.Enable:=TRUE; (* Function enable *)
    Mdb.File:=Fp; (* Terminal I/O pointer *)
    Mdb.Node:=1; (* Node number *)
    Mdb.Register:=257; (* Start register address *)
    Mdb.NrOfRegs:=6; (* Number of registers *)
    Mdb.Buffer:=ADR(Registers); (* Address of data buffer *)

    (* Call the modbus master FB an execute read command every 100 mS. *)

    Trigger(CLK:=SysClock100);
    Mdb(RdCmd:=Trigger.Q);

    (* Check if done or error and count them. *)

    IF (Mdb.Done) THEN Counter:=Counter+1; END_IF;
    IF (Mdb.Fault) THEN Errors:=Errors+1; END_IF;

(* [End of file] *)
```

7.13.6 ModbusRTUSlave, modbus Rtu slave

Type	Library	Version
FB	PLCUtyLib	SFR054A700



Sui sistemi SlimLine il protocollo modbus slave è già implementato dal sistema operativo, pertanto non occorre inserire blocchi funzione appositi nel programma utente. Questo blocco esegue l'override della gestione di sistema operativo e si utilizza in casi particolari, dove non è possibile utilizzare la gestione implementata nel sistema operativo. Per esempio quando si vuole consentire l'accesso ad un propria area di memoria diversa dalla DB100.

Questo blocco funzione esegue la gestione del protocollo modbus slave, è possibile definire il terminale di I/O su cui effettuare la comunicazione ***File***.

Occorre definire il nodo modbus ***Node***, e l'eventuale offset di indirizzo frame modbus ***Offset***. I comandi modbus ricevuti operano sul buffer di memoria il cui indirizzo è definito in ***Buffer*** e la dimensione in bytes è definita in ***Size***.

In ***IFTime*** occorre definire il tempo di interframe dei comandi modbus, cioè il tempo che intercorre tra la ricezione di un comando ed il comando successivo. Su linea seriale questo tempo coincide con il tempo di ricezione di 3 caratteri al baud rate definito.

Alla ricezione di ogni comando modbus corretto si attiva per un loop l'uscita ***Done***, in caso di errore comando viene attivata per un loop l'uscita ***Fault*** ed incrementato il valore in ***Errors***.

Enable (BOOL)	Comando di abilitazione blocco funzione.
File (FILEP)	Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.
Node (USINT)	Numero di nodo modbus (Range da 0 a 255).
Offset (UINT)	Offset su indirizzo modbus ricevuto nel frame dati (Range da 16#0000 a 16#FFFF).
Buffer (@USINT)	Indirizzo buffer dati su cui operano i comandi modbus.
Size (UINT)	Dimensione in byte del buffer dati su cui operano i comandi modbus.
IFTime (UDINT)	Tempo che intercorre tra la ricezione di un comando ed il comando successivo (µS). Se comunicazione su porta seriale il tempo deve essere definito in base al baud rate.

Baud rate	**Tempo**
300	112000
600	56000
1200	28000
2400	14000
4800	7000
9600	3430

Baud rate	**Tempo**
19200	1720
38400	860
57600	573
76800	429
115200	286

Done (BOOL)	Attivo per un loop alla ricezione di comando modbus.
Fault (BOOL)	Attivo per un loop su errore ricezione comando modbus.
Errors (UDINT)	Numero di errori riscontrati. Viene incrementato ad ogni nuovo errore, raggiunto il valore massimo il conteggio riparte da 0.

Comandi supportati

Il blocco funzione supporta solo alcuni comandi previsti dal protocollo modbus, i comandi supportati sono:

Codice	**Descrizione**
01	Read coil status (Massimo 250 coils)
02	Read input status (Massimo 250 coils)
03	Read holding registers (Massimo 125 registri)
04	Read input registers (Massimo 125 registri)
05	Force single coil
06	Preset single register
08	Loopback diagnostic test
0F	Force multiple coils (Massimo 250 coils)
10	Preset multiple registers (Massimo 125 registri)

Codici di errore

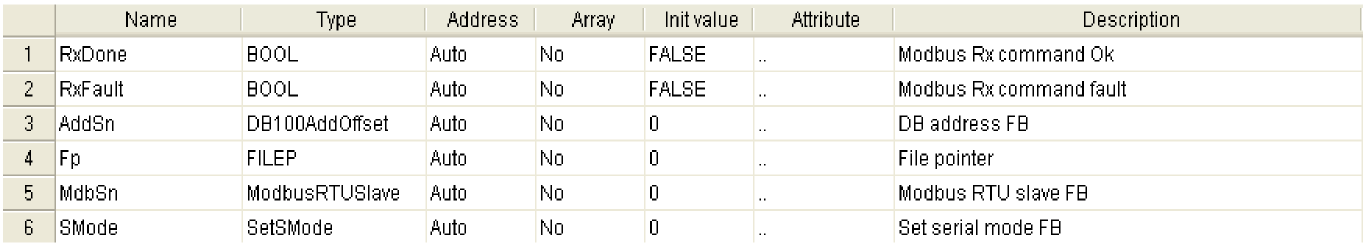
In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore. In caso di eccezione su comando modbus viene riportato il codice di errore ma non viene attivata l'uscita ***Fault***.

10019010	Valore di ***File*** non definito.
10019060	Errore esecuzione.
10019100	Errore in ricezione frame (Lunghezza frame modbus troppo lunga).
10019110	Errore in ricezione frame (Lunghezza frame modbus troppo corta).
10019120	Errore in ricezione frame (CRC modbus errato).
10019130	Errore in ricezione frame (Lunghezza frame modbus errata).
10019200	Errore trasmissione frame risposta
10019501	Eccezione 01.***Illegal function***, comando ricevuto non è tra quelli gestiti.
10019502	Eccezione 02. ***Illegal data address***, comando ricevuto ha indirizzo o numero dati fuori range.
10019503	Eccezione 03. ***Illegal data value***, comando ricevuto ha campo dati fuori range.
10019504	Eccezione 04.***Failure in associated device***, comando ricevuto contiene imprecisioni.

Esempi

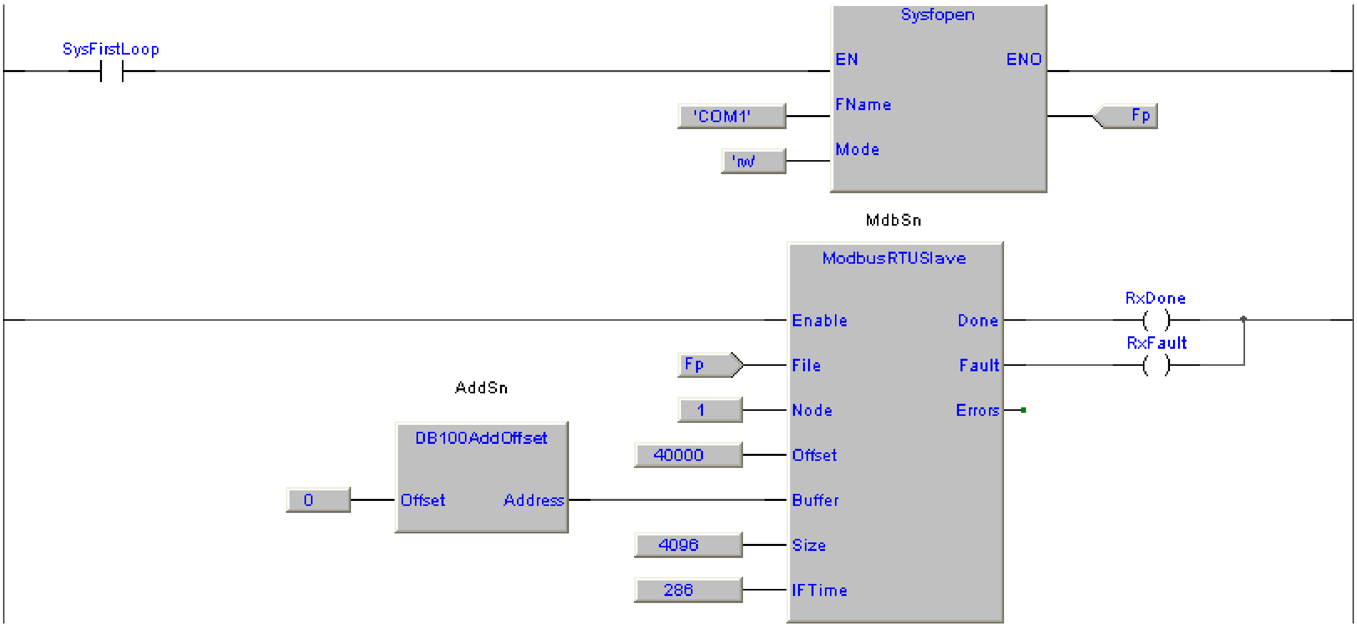
Viene gestito il protocollo modbus slave su porta seriale ***COM1***, si utilizza le impostazioni seriali di default ***115200, e, 8, 1***. I comandi modbus possono agire su tutta l'area della ***DB100***.

Definizione variabili



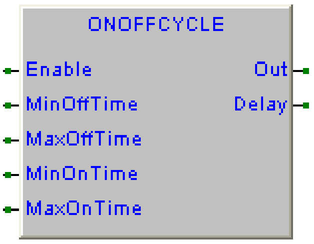
	Name	Type	Address	Array	Init value	Attribute	Description
1	RxDone	BOOL	Auto	No	FALSE	..	Modbus Rx command Ok
2	RxFault	BOOL	Auto	No	FALSE	..	Modbus Rx command fault
3	AddSn	DB100AddOffset	Auto	No	0	..	DB address FB
4	Fp	FILEP	Auto	No	0	..	File pointer
5	MdbSn	ModbusRTUSlave	Auto	No	0	..	Modbus RTU slave FB
6	SMode	SetSMode	Auto	No	0	..	Set serial mode FB

Esempio LD



7.13.7 ONOFFCYCLE, on/off cycle with random times

Type	Library	Version
FB	PLCUtyLib	SFR054A000



Questo blocco funzione esegue la temporizzazione di un ciclo On/Off con tempi random di On e di Off definibili tra valori minimo e massimo.

Attivando il comando di ***Enable*** l'uscita ***Out*** esegue un lampeggio On/Off con tempi random compresi tra i valori minimo e massimo definiti. Disabilitando l'ingresso l'uscita Out si disattiva.

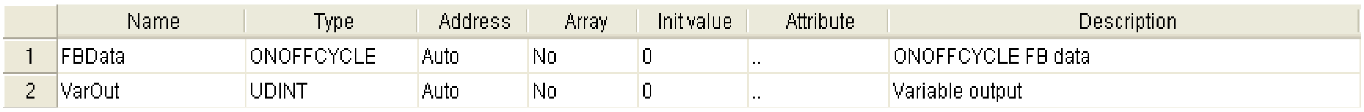
La variabile ***Delay*** ritorna il valore di ritardo attualmente attivo.

Enable (BOOL)	Comando di abilitazione.
MinOffTime (UDINT)	Valore minimo di tempo off comando (mS).
MaxOffTime (UDINT)	Valore massimo di tempo off comando (mS).
MinOnTime (UDINT)	Valore minimo di tempo on comando (mS).
MaxOnTime (UDINT)	Valore massimo di tempo on comando (mS).
Out (BOOL)	Stato comando On/Off in uscita.
Delay (UDINT)	Valore di tempo attualmente in temporizzazione (mS).

Esempi

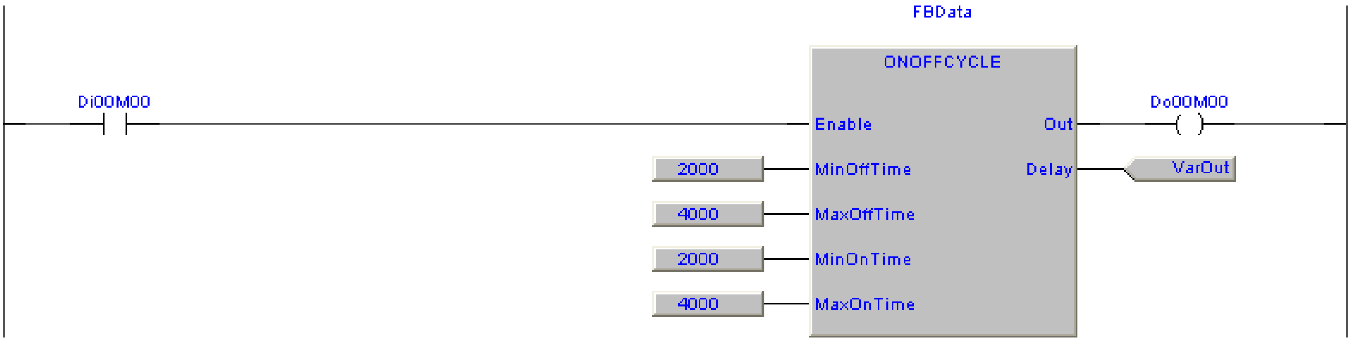
Viene eseguito il lampeggio della uscita ***Do00M00*** con tempi random variabili tra i 2 ed i 4 secondi.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	FBData	ONOFFCYCLE	Auto	No	0	..	ONOFFCYCLE FB data
2	VarOut	UDINT	Auto	No	0	..	Variable output

Esempio LD *(Ptp114a100)*



Esempio IL *(Ptp114a100)*

```
    CAL FBData (* Call the ONOFFCYCLE function block *)

    LD  Di00M00
    ST  FBData.Enable (* Transfer the digital input to Enable input *)

    LD  2000
    ST  FBData.MinOffTime (* Set the minimum off time *)

    LD  4000
    ST  FBData.MaxOffTime (* Set the maximum off time *)

    LD  2000
    ST  FBData.MinOnTime (* Set the minimum on time *)

    LD  4000
```

```
ST  FBData.MaxOnTime (* Set the maximum on time *)

LD  FBData.Out
ST  Do00M00 (* Copy the Out value to logic output *)

LD  FBData.Delay
ST  VarOut (* The Delay time is copied to variable *)
```

Esempio ST *(Ptp114a100)*

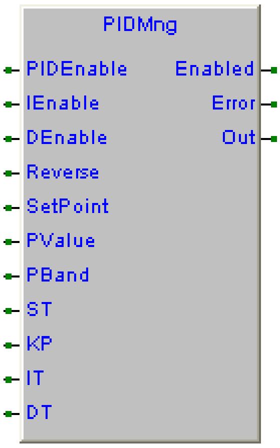
```
FBData(); (* Call the ONOFFCYCLE function block *)

FBData.Enable:=Di00M00; (* Transfer the digital input to Enable input *)
FBData.MinOffTime:=2000; (* Set the minimum off time *)
FBData.MaxOffTime:=4000; (* Set the maximum off time *)
FBData.MinOnTime:=2000; (* Set the minimum on time *)
FBData.MaxOnTime:=4000; (* Set the maximum on time *)

Do00M00:=FBData.Out; (* Copy the Out value to logic output *)
VarOut:=FBData.Delay; (* The Delay time is copied to variable *)
```

7.13.8 PIDMng, PID management

Type	Library	Version
FB	PLCUtyLib	SFR054A000

Questo blocco funzione esegue la regolazione PID. E' prevista la possibilità di abilitare singolarmente i vari tipi di azione (***P***)roporzionale (***I***)ntegrativa, (***D***)erivativa.

Un comando di ***Reverse*** permette di invertire il segno del segnale in uscita ***Out***.



PIDEnable (BOOL)	Abilitazione regolazione PID, attivando l'ingresso si abilita la regolazione. Disattivando l'ingresso si azzera il valore in uscita ***Out***.
IEnable (BOOL)	Abilitazione regolazione integrativa, attivando l'ingresso si abilita la regolazione integrativa.
DEnable (BOOL)	Abilitazione regolazione derivativa, attivando l'ingresso si abilita la regolazione derivativa.
Reverse (BOOL)	Inversione segno su valore in uscita ***Out***.
SetPoint (REAL)	Set point, il valore è espresso nell'unità di misura del processo da controllare.
PValue (REAL)	Valore acquisito dal processo, il valore è espresso nell'unità di misura del processo da controllare.
PBand (REAL)	Banda proporzionale, questo valore definisce il valore di errore oltre al quale la regolazione viene disabilitata forzando l'uscita ***Out*** al massimo ***100%***. Il valore è espresso nell'unità di misura del processo da controllare.
ST (REAL)	Tempo di scansione, occorre impostare il tempo in cui si desidera vengano eseguite le regolazioni integrativa e derivativa se abilitate, il valore è in ***mS***.
KP (REAL)	Costante proporzionale, si ricorda che più è elevato il valore più è pronta è la regolazione con un conseguente aumento del valore di overshot. Il valore è un numero.
IT (REAL)	Tempo integrativo, si ricorda che più è elevato il valore meno è veloce la regolazione integrativa a recuperare l'errore. Il valore è espresso in ***Sec***.
DT (REAL)	Tempo derivativo, si ricorda che più è elevato il valore più è veloce la regolazione derivativa a recuperare l'errore. Il valore è espresso in ***Sec***.
Enabled (BOOL)	Regolazione PID abilitata.
Error (BOOL)	Errore nella esecuzione.
OUT (REAL)	Valore di correzione in uscita dalla regolazione PID. Questo valore deve essere utilizzato per il comando del processo. Il valore è espresso in ***%***. Il range è compreso tra 0 e 100 %.

Codici di errore

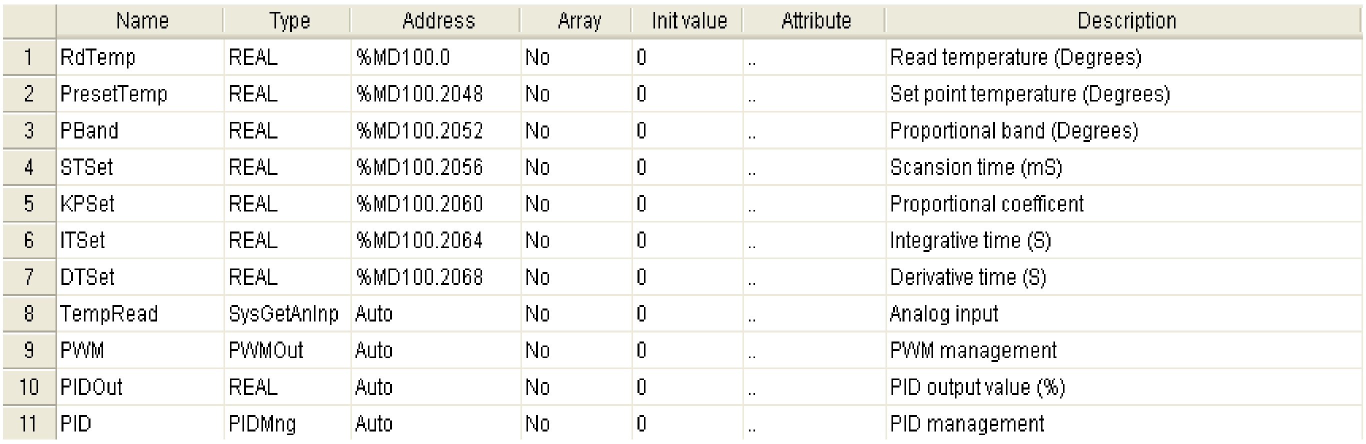
In caso di errore si attiva l'uscita ***Error***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

10012050 Non è stato definito valore di ***ST***.

Esempi

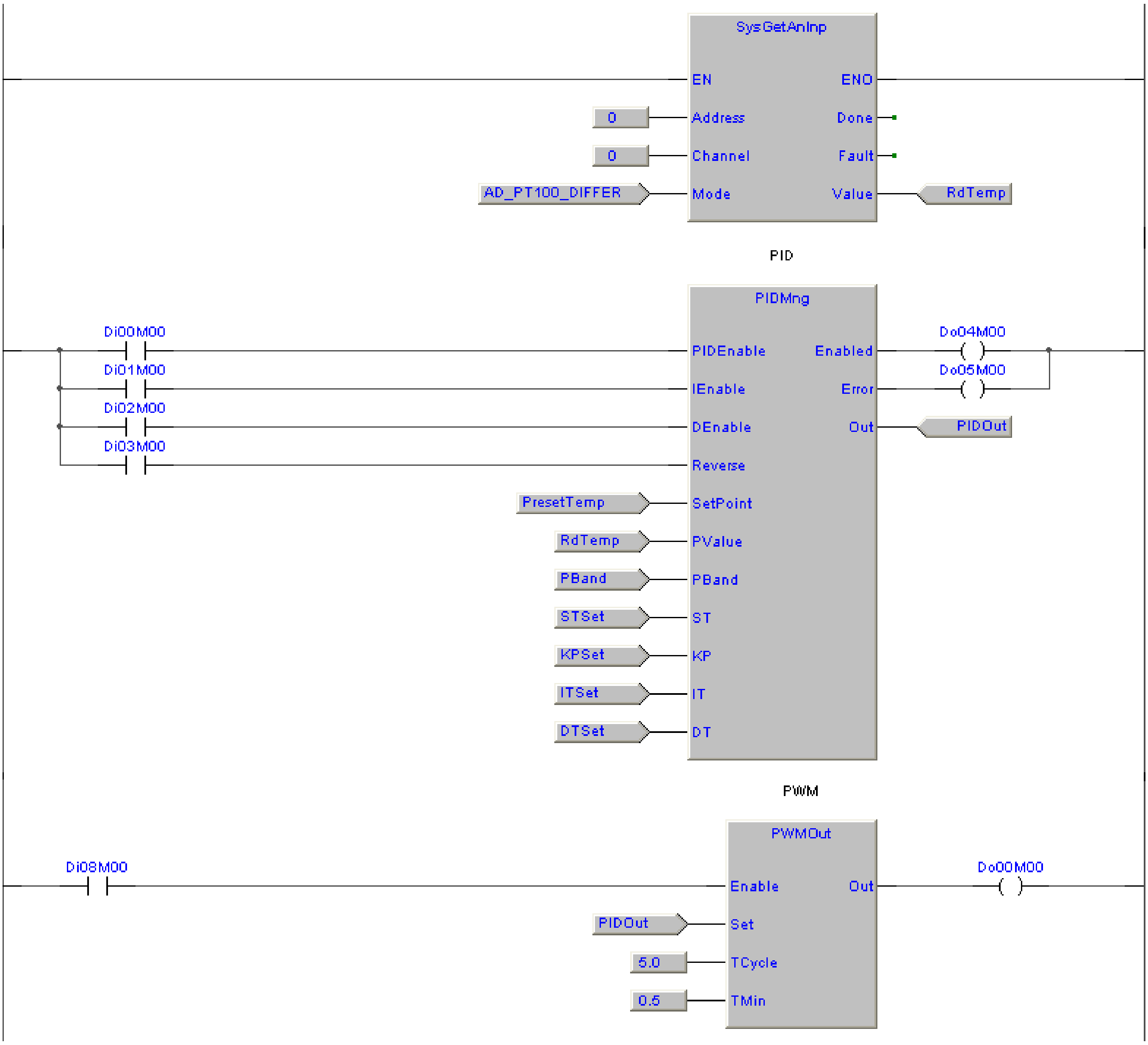
Nell'esempio è gestita una regolazione di temperatura su di un termoriscaldatore. Viene acquisita la sonda di temperatura da una Pt100 e viene gestita una uscita PWM ***Do00M00*** per il comando. Le costanti del loop PID sono allocate in memoria backup e sono mantenute allo spegnimento, inoltre sono accessibili da modbus.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	RdTemp	REAL	%MD100.0	No	0	..	Read temperature (Degrees)
2	PresetTemp	REAL	%MD100.2048	No	0	..	Set point temperature (Degrees)
3	PBand	REAL	%MD100.2052	No	0	..	Proportional band (Degrees)
4	STSet	REAL	%MD100.2056	No	0	..	Scansion time (mS)
5	KPSet	REAL	%MD100.2060	No	0	..	Proportional coefficent
6	ITSet	REAL	%MD100.2064	No	0	..	Integrative time (S)
7	DTSet	REAL	%MD100.2068	No	0	..	Derivative time (S)
8	TempRead	SysGetAnInp	Auto	No	0	..	Analog input
9	PWM	PWMOut	Auto	No	0	..	PWM management
10	PIDOut	REAL	Auto	No	0	..	PID output value (%)
11	PID	PIDMng	Auto	No	0	..	PID management

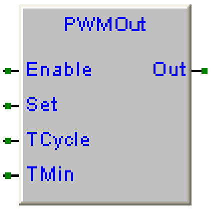
Esempio LD *(Ptp114a100)*



7.13.9 PWMOut, PWM output management

Type	Library	Version
FB	PLCUtyLib	SFR054A000

Questo blocco funzione esegue la gestione di una uscita PWM.

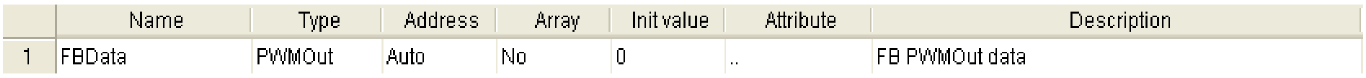


Enable (BOOL)	Abilitazione gestione uscita PWM, attivando l'ingresso si abilita la gestione. Disattivando l'ingresso si azzera l'uscita ***Out***.
SET (REAL)	Valore di set PWM, il valore è espresso in ***%***.
TCycle (REAL)	Tempo di di ciclo PWM, il valore è espresso in ***S***.
TMin (REAL)	Tempo minimo comando uscita ***Out***, il valore è espresso in ***S***.
Out (BOOL)	Uscita PWM.

Esempi

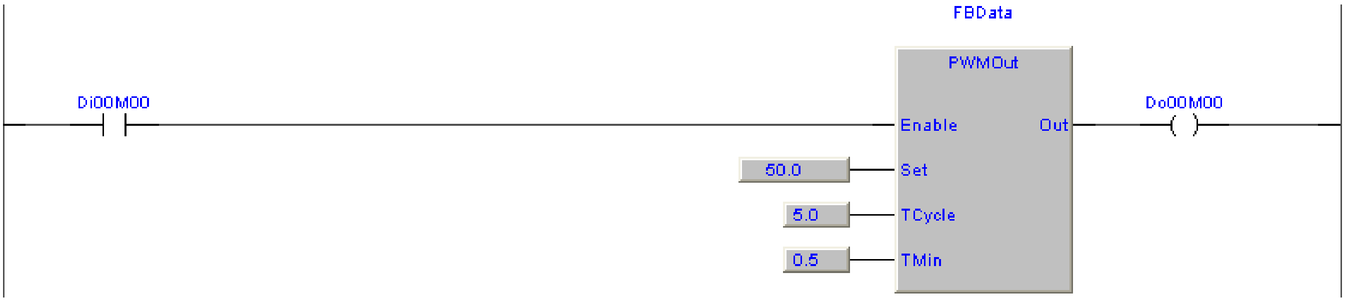
Nell'esempio è gestita una uscita PWM definendo un tempo di ciclo di 5 secondi con un tempo minimo di 0.5 secondi. Impostando come set point il valore 50% attivando l'ingresso ***Di00M00*** avremo che l'uscita ***Do00M00*** sarà attivata per 2.5 secondi e disattivata per 2,5 secondi.

Definizione variabili



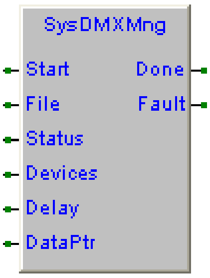
	Name	Type	Address	Array	Init value	Attribute	Description
1	FBData	PWMOut	Auto	No	0	..	FB PWMOut data

Esempio LD *(Ptp114a100)*



7.13.10 SysDMXMng, DMX management

Type	Library	Version
FB	Embedd	3.0



Questo blocco funzione esegue la gestione del protocollo DMX, questo è un blocco funzione protetto per utilizzarlo occorre richiedere il codice di protezione, vedi ***protezione funzioni e blocchi funzione***. E' comunque possibile utilizzarlo liberamente in modo test per 15 Min.

Attivando l'ingresso di ***Start*** viene inviato sulla porta seriale identificata da ***File*** un frame DMX che inizia con il valore di ***Status*** e segue con il valore di preset dei dispositivi definiti da ***Devices***. Il valore di preset dei vari dispositivi deve essere caricato in un array di dati il cui indirizzo è passato in ***DataPtr***. Mantenendo sempre attivo l'ingresso ***Start*** verranno inviati consecutivamente frames DMX.

Al termine dell'invio del comando DMX si attiverà per un loop di programma l'uscita ***Done***.

Start (BOOL)	Comando di invio frame DMX su porta seriale, si resetta automaticamente all'invio del frame.
File (FILEP)	Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.
Status (USINT)	Valore byte di stato inviato nel protocollo DMX prima dei byte di preset dispositivi.
Devices (UINT)	Numero di dispositivi connessi al bus DMX.
Delay (UINT)	Tempo di pausa trasmissione frames DMX (mSec)
DataPtr (@USINT)	Pointer all'array dati valori di preset dispositivi DMX.
Done (BOOL)	Attivo per un loop al termine dell'invio frame DMX del comando
Fault (BOOL)	Attivo in caso di errore nella gestione.

Codici di errore

In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

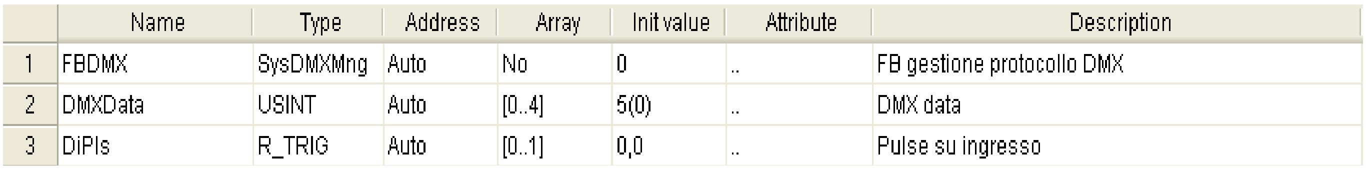
9979050	Errore allocazione blocco funzione.
9979060	Terminato spazio memoria rilocabile, non è possibile eseguire l''FB.
9979070	Errore versione blocco funzione.
9979085	FB protetta, terminato tempo funzionamento in modo demo.
9979200	Protocollo DMX non supportato dal dispositivo definito in ***File***.

Esempi

Dovendo gestire puntatori a memoria è preferibile utilizzare il blocco funzione all'interno di un programma ST, nell'esempio viene attivato il protocollo DMX sulla porta seriale ***COM1***. Vengono gestiti 5 dispositivi con indirizzi da 1 a 5. Il frame DMX è continuamente inviato ai dispositivi.

Attivando l'ingresso digitale ***Di00M00*** viene impostato il valore 0, su tutti i dispositivi. Attivando l'ingresso digitale ***Di01M00*** su dispositivo 1 viene impostato il valore 10, sul 2 il valore 20, e così via fino al quinto in cui viene impostato il valore 50.

Definizione variabili



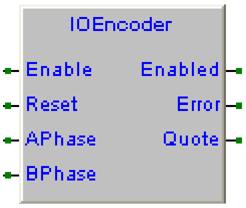
	Name	Type	Address	Array	Init value	Attribute	Description
1	FBDMX	SysDMXMng	Auto	No	0	..	FB gestione protocollo DMX
2	DMXData	USINT	Auto	[0..4]	5(0)	..	DMX data
3	DiPls	R_TRIG	Auto	[0..1]	0,0	..	Pulse su ingresso

Esempio ST

```
(* -------------------------------------------------------------------------- *)
(* ESEGUO APERTURA PORTA SERIALE                                              *)
(* -------------------------------------------------------------------------- *)
(* Here the COM1 port is opened in read/write. *)

    IF (FBDMX.File = NULL) THEN
        FBDMX.File:=Sysfopen('COM1', 'rw'); (* Port COM1 file pointer *)
    END_IF;

(* -------------------------------------------------------------------------- *)
(* ESEGUO ATTIVAZIONE COMANDI                                                 *)
(* -------------------------------------------------------------------------- *)
(* Attivazione comandi su input Di00M00. *)

    DiPls[0](CLK:=Di00M00);
    IF (DiPls[0].Q) THEN
        DMXData[0]:=0; (* Preset dispositivo con indirizzo 1 *)
        DMXData[1]:=0; (* Preset dispositivo con indirizzo 2 *)
        DMXData[2]:=0; (* Preset dispositivo con indirizzo 3 *)
        DMXData[3]:=0; (* Preset dispositivo con indirizzo 4 *)
        DMXData[4]:=0; (* Preset dispositivo con indirizzo 5 *)
        FBDMX.Start:=TRUE; (* Start *)
    END_IF;

(* Attivazione comandi su input Di01M00. *)

    DiPls[1](CLK:=Di01M00);
    IF (DiPls[1].Q) THEN
        DMXData[0]:=10; (* Preset dispositivo con indirizzo 1 *)
        DMXData[1]:=20; (* Preset dispositivo con indirizzo 2 *)
        DMXData[2]:=30; (* Preset dispositivo con indirizzo 3 *)
        DMXData[3]:=40; (* Preset dispositivo con indirizzo 4 *)
        DMXData[4]:=50; (* Preset dispositivo con indirizzo 5 *)
       FBDMX.Start:=TRUE; (* Start *)
    END_IF;

(* -------------------------------------------------------------------------- *)
(* ESEGUO GESTIONE PROTOCOLLO DMX                                             *)
(* -------------------------------------------------------------------------- *)
(* Gestione protocollo DMX. *)

    FBDMX.Status:=0; (* Status byte *)
    FBDMX.Devices:=5; (* Number of devices *)
    FBDMX.Delay:=0; (* Interframe delay (mSec) *)
    FBDMX.DataPtr:=ADR(DMXData); (* Data array pointer *)
    FBDMX(); (* FB gestione protocollo DMX *)
    IF (FBDMX.Done) THEN FBDMX.Start:=FALSE; END_IF;

(* [End of file] *)
```

7.13.11 IOEncoder, incremental encoder over I/O

Type	Library	Version
FB	PLCUtyLib	SFR054A400



Questo blocco funzione esegue la lettura di un encoder incrementale connesso agli ingressi logici. Basta appoggiare sui due ingressi ***APhase*** e ***BPhase*** del blocco funzione i due ingressi di acquisizione del canale ***A*** e del canale ***B*** di un encoder incrementale. Il blocco funzione esegue la quadratura dei segnali, il controllo della direzione di rotazione e gestisce il valore di ***Quote*** in uscita.

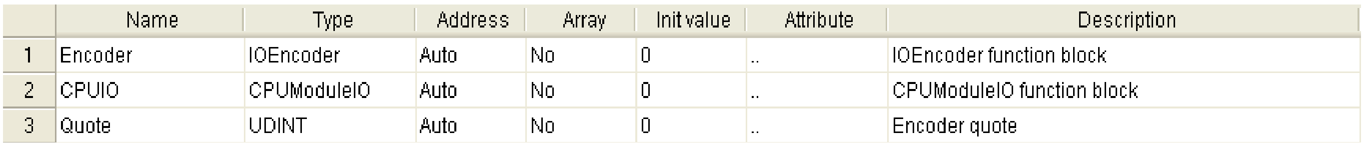
La quadratura dei segnali esegue la moltiplicazione per 4 delle tacche encoder quindi il valore di ***Quote*** al termine di un giro completo dell'encoder è pari al numero di tacche encoder moltiplicato per 4.

Enable (BOOL)	Abilitazione gestione conteggio encoder.
Reset (BOOL)	Comando di reset quota encoder. Attivando l'ingresso si azzera il valore di ***Quote***.
APhase (BOOL)	Ingresso canale ***A*** encoder.
BPhase (BOOL)	Ingresso canale ***B*** encoder.
Enabled (BOOL)	Conteggio encoder abilitato.
Error (BOOL)	Attivo per un loop su errore acquisizione encoder. Si attiva se la frequenza di ingresso dei segnali encoder è maggiore rispetto al tempo di esecuzione del blocco funzione.
Quote (UDINT)	Valore di quota encoder espresso in impulsi. Numero tacche giro encoder moltiplicato per 4.

Esempi

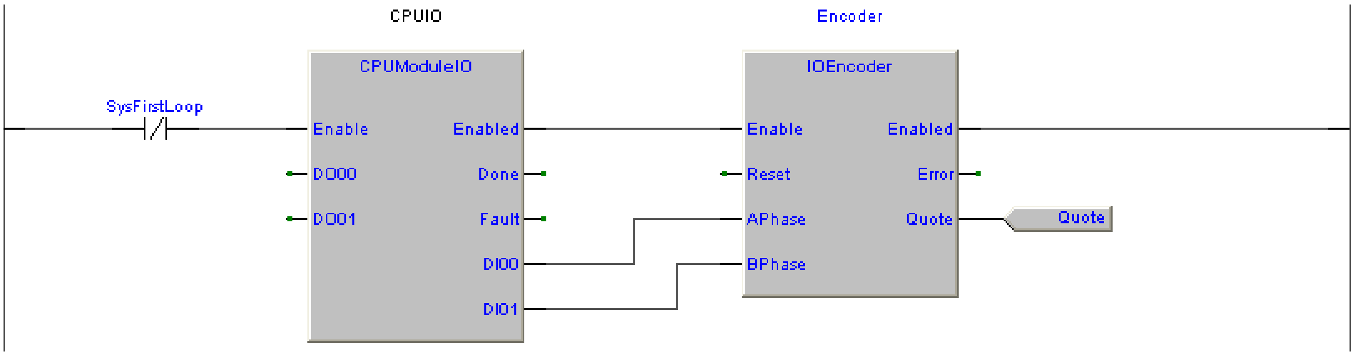
Nell'esempio è gestita l'acquisizione di un encoder incrementale connesso agli ingressi del modulo CPU. Ruotando di un giro l'encoder, il valore di ***Quote*** verrà incrementato se la rotazione è oraria (CW) oppure decrementato se la rotazione è antioraria (CCW), del numero di tacche giro moltiplicato per 4.

Definizione variabili



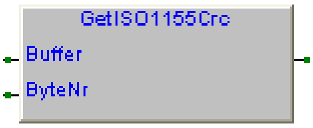
	Name	Type	Address	Array	Init value	Attribute	Description
1	Encoder	IOEncoder	Auto	No	0	..	IOEncoder function block
2	CPUIO	CPUModuleIO	Auto	No	0	..	CPUModuleIO function block
3	Quote	UDINT	Auto	No	0	..	Encoder quote

Esempio LD *(Ptp114a200)*



7.13.12 GetISO1155Crc, calculate CRC according ISO1155

Type	Library	Version
Function	PLCUtyLib	SFR054A400



Questa funzione esegue il calcolo del CRC ***Cyclic Redundancy Check***, (Controllo Ciclico di Ridondanza) su di un'area dati. Il calcolo è effettuato secondo le specifiche ***ISO 1155***.

Occorre passare alla funzione l'indirizzo del buffer di memoria ***Buffer*** ed il numero di bytes ***ByteNr*** su cui eseguire il calcolo del CRC.

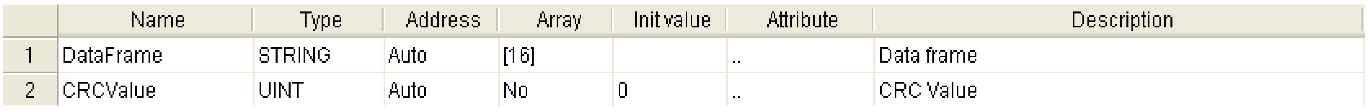
Buffer (@USINT)	Indirizzo dell'area di memoria su cui eseguire il calcolo del CRC.
ByteNr (UINT)	Numero di bytes su cui eseguire il calcolo del CRC a partire dall'indirizzo definito in ***Buffer***.
CRC (UINT)	Valore CRC calcolato.

Esempi

Viene calcolato il CRC di una richiesta di lettura del registro 1.8.1 da un contatore di energia elettrica secondo lo standard IEC 62056-2. Il frame di richiesta è ***'<SOH>R1<STX>1.8.1()<ETX><CRC>'***.

Il valore del CRC ritornato in ***CRCValue*** è 16#5A (90 decimale).

Definizione variabili



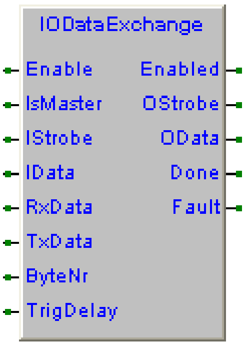
	Name	Type	Address	Array	Init value	Attribute	Description
1	DataFrame	STRING	Auto	[16]		..	Data frame
2	CRCValue	UINT	Auto	No	0	..	CRC Value

Esempio ST

```
(* ************************************************************************** *)
(* IEC1155 CRC CALCULATION                                                    *)
(* ************************************************************************** *)
(* Register read command '<SOH>R1<STX>1.8.1()<ETX><CRC>'. *)

DataFrame:='$01R1$021.8.1()$03'; (* Data frame *)
CRCValue:=GetISO1155Crc(ADR(DataFrame), 12); (* CRC Value *)
```

7.13.13 IODataExchange, exchange data by using logic I/O

Type	Library	Version
FB	PLCUtyLib	SFR054A500



Questo blocco funzione permette lo scambio di dati tra due sistemi, uno master ed uno slave, utilizzando una connessione tramite I/O logici. Sono utilizzati due ingressi e due uscite digitali per ogni sistema, è possibile definire il numero di bytes di dati da scambiarsi.

Occorre connettere l'uscita digitale ***OStrobe*** di un sistema con l'ingresso digitale ***IStrobe*** dell'altro sistema e l'uscita ***OData*** con l'ingresso digitale ***IData*** dell'altro.

Il trasferimento dati è bidirezionale, i dati presenti nel buffer ***TxData*** di un sistema sono trasferiti nel buffer ***RxData*** dell'altro sistema e viceversa, per il numero di bytes definito in ***ByteNr***. La comunicazione è verificata mediante l'invio di un CRC secondo lo standard ISO 1155.

Ad ogni ***fine*** trasferimento dati si attiva per un loop l'uscita ***Done***, sulla sua attivazione occorre provvedere a trasferire i dati da trasmettere nel buffer di trasmissione e leggere i dati dal buffer di ricezione.

In caso di ***errore*** nella comunicazione si attiva per un loop l'uscita ***Fault***, ed i due sistemi si risincronizzano per riprendere una nuova trasmissione.

Enable (BOOL)	Abilitazione gestione comunicazione.
IsMaster (BOOL)	***TRUE:*** Modo master, ***FALSE:*** Modo slave.
IStrobe (BOOL)	Occorre appoggiare l'ingresso digitale di strobe.
IData (BOOL)	Occorre appoggiare l'ingresso digitale di dato.
RxData (UDINT)	Indirizzo buffer dati ricevuti.
TxData (UDINT)	Indirizzo buffer dati da trasmettere.
ByteNr (USINT)	Numero bytes da scambiare con altro sistema (Da 1 a 30).
TrigDelay (UINT)	Tempo attesa tra uscita dato ***OData*** ed uscita strobe ***OStrobe*** (Da 0 a 30 mS).
OStrobe (BOOL)	Da appoggiare su uscita digitale di strobe.
OData (BOOL)	Da appoggiare su uscita digitale di dato.
Done (BOOL)	Si attiva per un loop al termine dello scambio dati.
Fault (BOOL)	Si attiva per un loop in caso di errore su scambio dati.

Codici di errore

In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

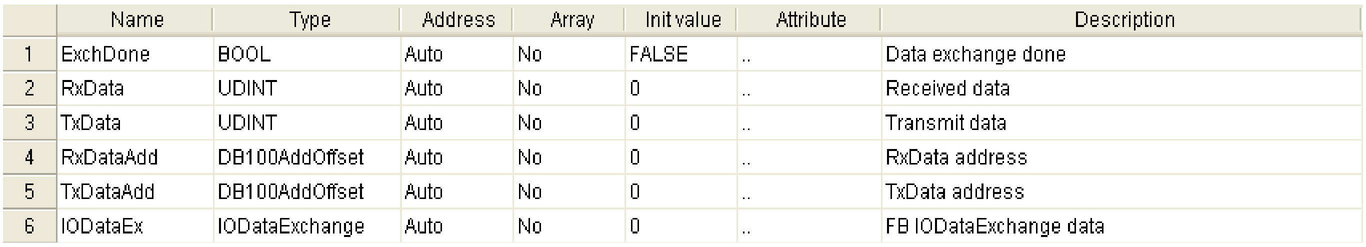
10011080	Errore definizione valore ***ByteNr***.
10011082	Errore definizione valore ***TrigDelay***.
10011100~1	Timeout attesa attivazione segnale ***IStrobe***.
10011110~1	Timeout attesa disattivazione segnale ***IStrobe***.
10011200~1	Errore CRC dati ricevuti.

Esempi

Utilizzando due sistemi attivando modo master (***Di01M00*** attivo) su di un sistema e modo slave (***Di01M00*** disattivo) sull'altro, è possibile eseguire lo scambio di 4 bytes di memoria tra i sistemi. I 4 bytes allocati ad indirizzo ***MD100.0*** di un sistema saranno trasferiti su 4 bytes allocati ad indirizzo ***MD100.16*** dell'altro sistema.

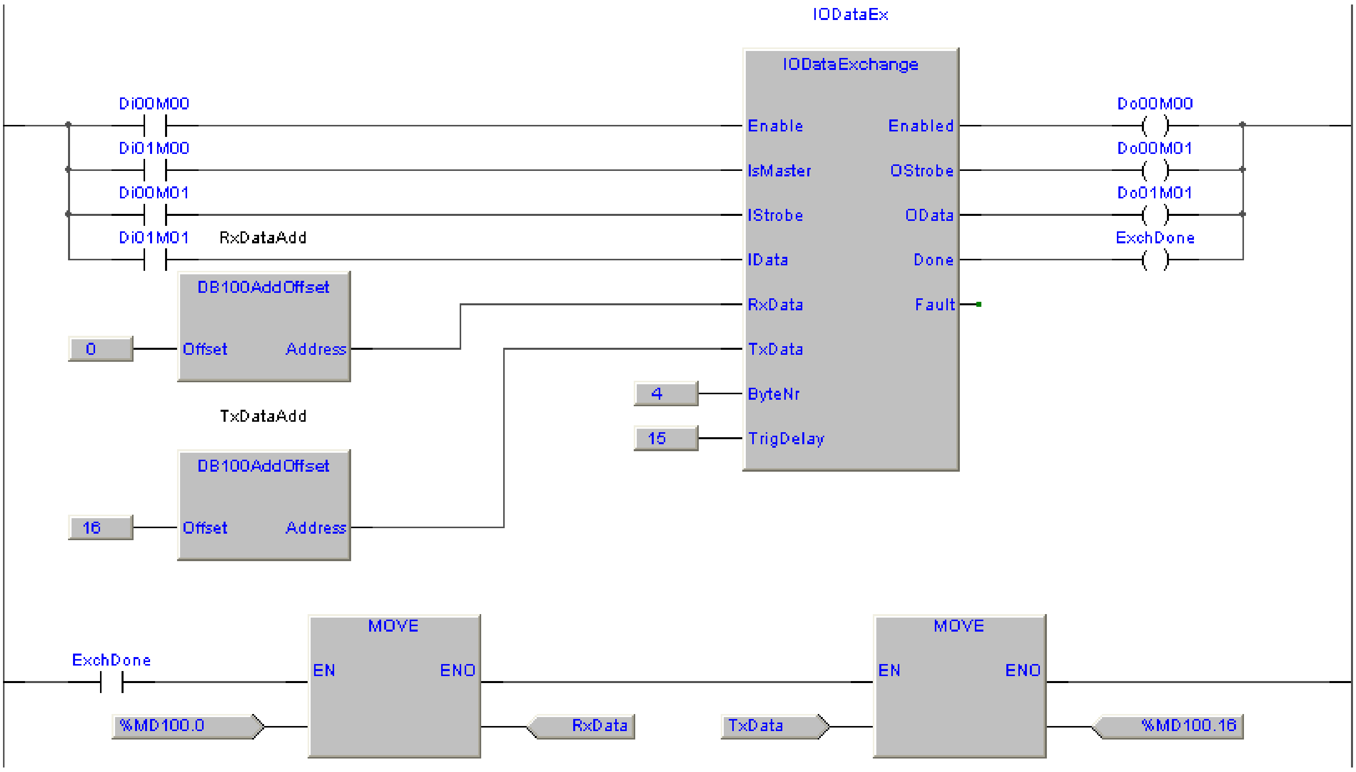
Al termine del trasferimento, i dati ricevuti dalla memoria ***MD100.0*** sono trasferiti nella variabile ***RxData***, mentre la variabile ***TxData*** è trasferita in memoria ***MD100.16***.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	ExchDone	BOOL	Auto	No	FALSE	..	Data exchange done
2	RxData	UDINT	Auto	No	0	..	Received data
3	TxData	UDINT	Auto	No	0	..	Transmit data
4	RxDataAdd	DB100AddOffset	Auto	No	0	..	RxData address
5	TxDataAdd	DB100AddOffset	Auto	No	0	..	TxData address
6	IODataEx	IODataExchange	Auto	No	0	..	FB IODataExchange data

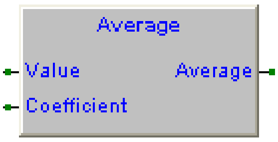
Esempio LD *(Ptp121A000)*



7.13.14 Average, value average

Type	Library	Version
FB	PLCUtyLib	SFR054A800

Questo blocco funzione esegue la media su di un valore. L'azione di media è definita da un parametro ***Coefficient***, maggiore è il valore del parametro e maggiore sarà l'azione di media sul valore in uscita ***Average***.

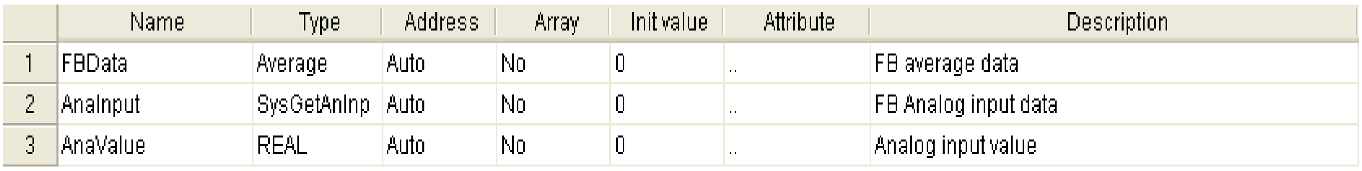


Value (REAL)	Valore su cui effettuare l'azione di media
Coefficient (REAL)	Valore del coefficiente di media.
Average (REAL)	Valore mediato in uscita.

Esempi

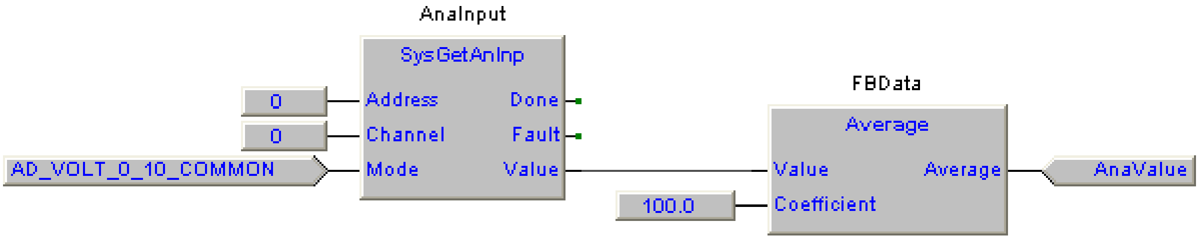
Viene eseguita una acquisizione analogica dall'ingresso ***0*** del modulo con indirizzo ***0***, in modo 0÷10 volt. Il valore acquisito viene mediato e poi trasferito nella variabile ***AnaValue***.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	FBData	Average	Auto	No	0	..	FB average data
2	AnaInput	SysGetAnInp	Auto	No	0	..	FB Analog input data
3	AnaValue	REAL	Auto	No	0	..	Analog input value

Esempio LD *(Ptp114A500)*



7.14 Protocollo DLMS, o IEC 62056-21

Con il nuovo protocollo standard DLMS (Device Language Message Specification), la comunicazione con i sistemi di metering viene immensamente semplificata. Questo protocollo ha una struttura orientata agli ***Oggetti*** che rende possibile leggere con la stessa identica modalità dati applicativi provenienti da contatori di diversi costruttori.

Lo standard IEC 61107 o IEC 62056-21 è uno standard internazionale che descrive il protocollo DLMS per la lettura da parte di un computer dei dati da contatori tariffari di energia elettrica, acqua e gas.

Il protocollo prevede una fase di ***Sign-On*** con il contatore durante la quale occorre fornire un codice di accesso (Solitamente il numero di serie del contatore), ed il contatore fornisce una password in uscita che può essere utilizzata per criptare i dati.

Terminata questa fase è possibile richiedere al contatore il valore dei suoi registri utilizzando i codici di identificazione ***OBIS*** a 5 caratteri (IEC 62056-61).

Per la famiglia SlimLine abbiamo sviluppato un apposito blocco funzione che automatizza tutte le operazioni, occorre passare il numero di serie del contatore ed il codice OBIS del registro da leggere. Il blocco funzione esegue il Sign-On sul contatore e ritorna il valore del registro indicato.

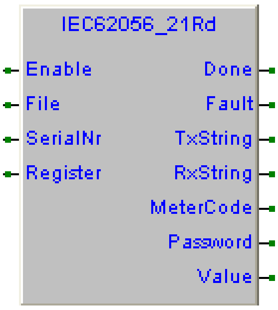
Interfaccia con il contatore

Per interfacciarsi con il contatore è possibile utilizzare un apposito accoppiatore ottico che si appoggia alla finestra di lettura del contatore e si connette ad una delle porte seriali dello SlimLine.

Oppure nel caso di contatori predisposti con l'uscita RS485 è possibile connettersi direttamente alla porta RS485 dello SlimLine.

7.14.1 IEC62056_21Rd, IEC62056-21 protocol read

Type	Library	Version
FB	PLCUtyLib	SFR054A700



Questo blocco funzione esegue la gestione della lettura di registri da sistemi di metering utilizzando il protocollo IEC62056-21.Questo è un blocco funzione protetto per utilizzarlo occorre richiedere il codice di protezione, vedi ***protezione funzioni e blocchi funzione***. E' comunque possibile utilizzarlo liberamente in modo test per 30 Min.

Occorre in ***SerialNr*** definire il numero seriale del contatore (Utilizzato come chiave di accesso alla lettura) e in ***Register*** l'indirizzo del registro da leggere secondo la normativa OBIS. Se la lettura ha esito positivo viene attivata l'uscita ***Done*** e le variabili ***MeterCode***, ***Password*** e ***Value*** sono valorizzate con i dati letti dal contatore.

Enable (BOOL)	Attivando l'ingresso viene gestita la lettura del contatore.
File (FILEP)	Pointer al file della risorsa così come ritornato dalla funzione ***Sysfopen***.
SerialNr (STRING[16])	Numero di serie del contatore, viene utilizzato come chiave di accesso.
Register (STRING[16])	Indirizzo registro da leggere secondo la codifica OBIS.
Done (BOOL)	Viene attivato per un loop al termine della acquisizione.
Fault (BOOL)	Viene attivato per un loop in caso di errore nella sequenza di acquisizione.
TxString (STRING[32])	Contiene la stringa di comando inviata al contatore, può essere utilizzato in debug per verificare i comandi inviati.
RxString (STRING[32])	Contiene la stringa di risposta ritornata dal contatore, può essere utilizzato in debug per verificare le risposte ricevute.
MeterCode (STRING[32])	Contiene stringa con il codice del contatore acquisita durante fase di acceso (Sign-on).
Password (UDINT)	Contiene valore password acquisita dal contatore durante fase di acceso (Sign-on).
Value (STRING[32])	Contiene stringa con valore registro richiesto acquisita dal contatore.

Codici di errore

In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

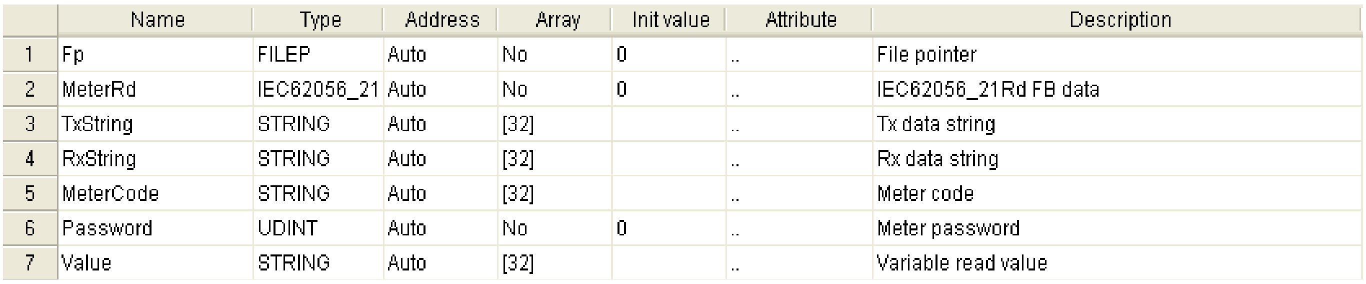
10016010	Valore di ***File*** non definito.
10016020	FB protetta, terminato tempo funzionamento in modo demo.
10016050	Timeout esecuzione.
10016070	Errore case gestione.
10016100~1	Errore ricezione tipo da contatore.
10016110~2	Errore ricezione password da contatore.
10016120~2	Errore ricezione valore parametro da contatore.
10016200	Overflow ricezione stringa da contatore.

Esempi

E' disponibile un programma di esempio Ptp122*000 che esegue la lettura da un contatore di energia di 3 registri. A titolo indicativo diamo un esempio di massima per la lettura di un registro.

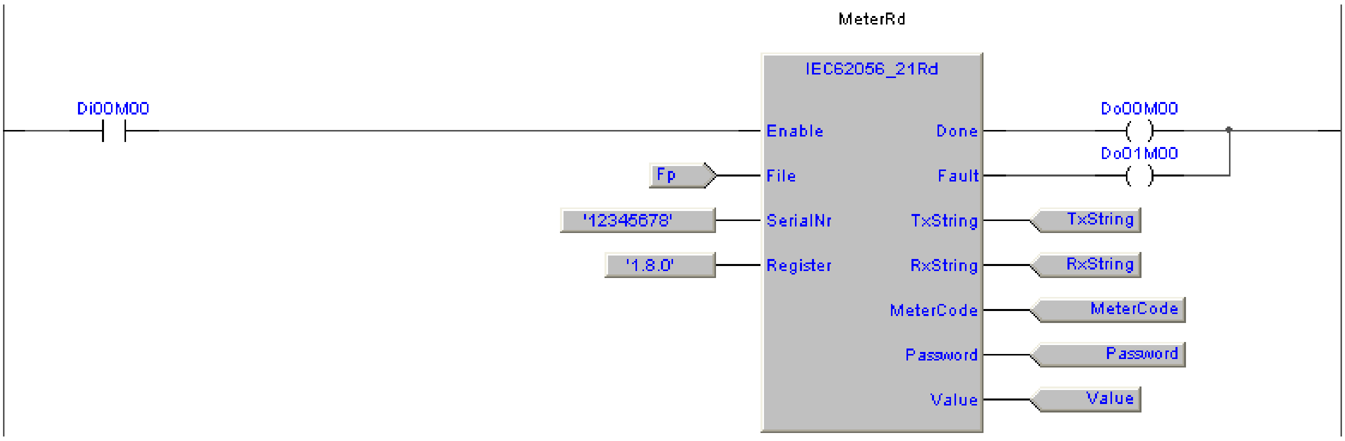
Su attivazione dell'ingresso digitale ***Di00M00*** viene eseguita la lettura del registro ***1.8.0*** (Potenza in Kw). Se la lettura ha esito positivo si attiva per un loop l'uscita digitale ***Di00M00***. Le variabili ***MeterCode***, ***Password*** e ***Value***, saranno valorizzate con i valori letti dal contatore.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	File pointer
2	MeterRd	IEC62056_21	Auto	No	0	..	IEC62056_21Rd FB data
3	TxString	STRING	Auto	[32]		..	Tx data string
4	RxString	STRING	Auto	[32]		..	Rx data string
5	MeterCode	STRING	Auto	[32]		..	Meter code
6	Password	UDINT	Auto	No	0	..	Meter password
7	Value	STRING	Auto	[32]		..	Variable read value

Esempio LD *(Ptp114A000)*



7.15 Funzioni ed FB gestione modem (eModemLib)

Le funzioni ed i blocchi funzione per la gestione del modem utilizzano un modem GSM connesso ad un terminale di I/O del sistema (Tipicamente è utilizzata una porta seriale). Nel modem deve essere inserita una tessera SIM ***non protetta dal codice PIN***.

Per utilizzare la gestione del modem occorre importare la libreria ***SFR057**00*** nel proprio progetto, si rimanda al capitolo relativo all'import delle librerie per ulteriori informazioni in merito.

Nella descrizioni successive si fa riferimento alle seguenti definizioni generali.

Numero di telefono

Il numero di telefono consiste in una stringa lunga da 10 a 16 caratteri numerici conforme al seguente formato:

Prefisso internazionale senza lo zero davanti (es. +39 per Italia, +49 per Germania, +44 per Gran Bretagna ecc.)
Codice dell’operatore mobile (es. 338, 320, 347, ecc.)
Numero di telefono (es. 7589951)

Esempio: +393337589951,+3933812345,+49172123456

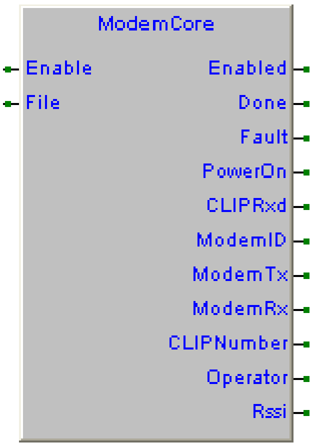
Messaggio SMS

Un messaggio SMS può essere lungo fino a 160 caratteri alfanumerici facenti parte del seguente set:

A…Z, a…z, 0…9, Spazio bianco, sono da evitare tutti gli altri caratteri.

7.15.1 ModemCore, modem core management

Type	Library	Version
FB	eModemLib	SFR057A100



Questo blocco funzione gestisce un modem connesso al dispositivo di I/O definito in ***File***, questo è un blocco funzione protetto per utilizzarlo occorre richiedere il codice di protezione, vedi ***protezione funzioni e blocchi funzione***. E' comunque possibile utilizzarlo liberamente in modo test per 30 Min.

L'FB gestisce il dialogo con il modem, ne esegue l'inizializzazione e ne controlla lo stato, controlla se il modem è connesso alla rete GSM e ritorna l'operatore di rete ***Operator*** ed il livello del segnale ***Rssi***. Nel caso in cui il modem si sganci dalla rete l'FB provvede al suo riaggancio automatico.

L'uscita ***Done*** si attiva se il modem è correttamente inizializzato, mentre l'uscita ***Fault*** si attiva per un loop di programma in caso di errori di gestione.

E' previsto un comando ***PowerOn*** per la gestione della alimentazione del modem, in questo modo l'FB può spegnere e riaccendere il modem in caso riscontri una non funzionalità dello stesso.

L'FB ritorna un ***ModemID*** che deve essere passato alle FB collegate (Esempio invio SMS, ricezione SMS, ecc.).

Le uscite ***ModemTx*** e ***ModemRx*** riportano i comandi inviati e ricevuti dal modem, in questo modo è possibile visualizzare in debug la comunicazione con il modem permettendo di visualizzare eventuali errori nell'interfaccia con il modem.

Su ricezione chiamata telefonica viene rilevato il CLIP del chiamante che è ritornato in uscita ***CLIPNumber***, contemporaneamente ad ogni squillo del telefono si attiva per un loop di programma l'uscita ***CLIPRxd***.

Enable (BOOL)	Abilitazione blocco funzione, attivandolo viene gestito il modem.
File (FILEP)	Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.
Enabled (BOOL)	Blocco funzione abilitato.
Done (BOOL)	Modem correttamente inizializzato e funzionante.
Fault (BOOL)	Attivo per un loop di programma se errore gestione modem.
PowerOn (BOOL)	Comando di gestione uscita alimentazione modem.
CLIPRxd (BOOL)	Attivo per un loop di programma ad ogni ricezione CLIP (Tipicamente ad ogni RING del modem).
ModemID (UDINT)	ID modem da passare alle FB collegate (Esempio ***ModemSMSSend***, ***ModemSMSReceive***, ecc.).
ModemTx (STRING[256])	Contiene la stringa di comando inviata al modem, può essere utilizzato in debug per verificare i comandi inviati al modem.
ModemRx (STRING[256])	Contiene la stringa di risposta ritornata dal modem, può essere utilizzato in debug per verificare le risposte ricevute dal modem.
CLIPNumber (STRING[16])	Contiene la stringa con il numero di CLIP ricevuto.
Operator (STRING[16])	Contiene la stringa con il nome dell'operatore telefonico.
Rssi (USINT)	Valore potenza segnale radio.

Codici di errore

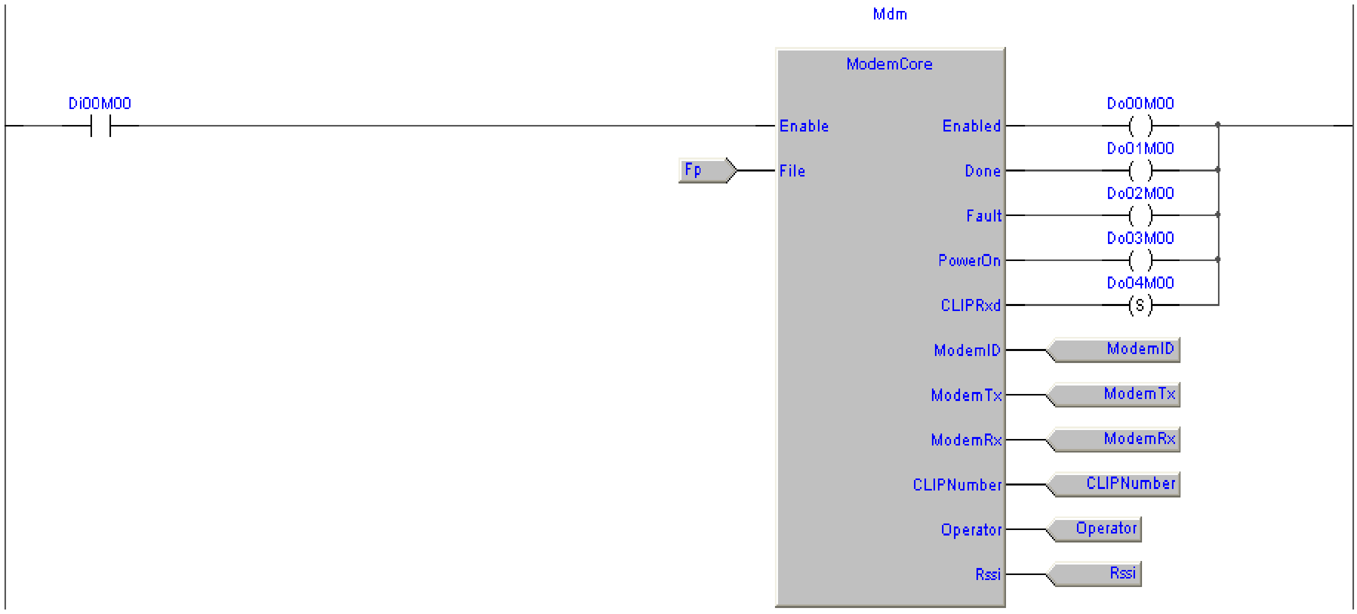
In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

Codice	Descrizione
10002010	Valore di ***File*** non definito.
10002020	FB protetta, terminato tempo funzionamento in modo demo.
10002050	Timeout esecuzione.
10002100~9	Errore ricezione CLIP.
10002150~9	Errore nelle sequenze power on del modem.
10002200~1	Errore nelle sequenze di controllo del modem.
10002210~7	Errore nella acquisizione dell'operatore telefonico.
10002220~2	Errore nella acquisizione del livello del segnale.
10002300~4	Errore nell'invio messaggio SMS.
10002350~8	Errore nella ricezione del messaggio SMS.

Esempi

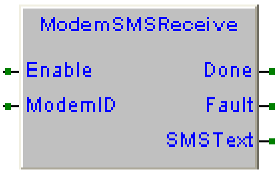
Nell'esempio è gestito un modem connesso al terminale di I/O definito nella variabile ***Fp***, per la definizione delle variabili e per una migliore comprensione del funzionamento si rimanda agli esempi successivi.

Esempio LD



7.15.2 ModemSMSReceive, receive a SMS message

Type	Library	Version
FB	eModemLib	SFR057A100



Questo blocco funzione esegue la ricezione di un messaggio SMS, si collega al blocco funzione di gestione modem ***ModemCore***, occorre passare il ***ModemID*** in uscita dal blocco funzione di gestione modem.

Alla ricezione di un messaggio SMS si attiva per un loop di programma l'uscita ***Done***, sull'uscita ***SMSText*** viene ritornato il messaggio ricevuto, all'uscita ***CLIPNumber*** della FB ***ModemCore*** è ritornato il numero di telefono da cui il messaggio è stato ricevuto. Il testo del messaggio ricevuto rimane presente in uscita sino alla ricezione di un altro messaggio.

Enable (BOOL)	Abilita la ricezione dei messaggi SMS.
ModemID (UDINT)	ID modem fornito in uscita dalla ***ModemCore***.
Done (BOOL)	Attivo per un loop se ricevuto messaggio SMS.
Fault (BOOL)	Attivo per un loop se errore.
Text (STRING[160])	Testo del messaggio SMS ricevuto.

Codici di errore

In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

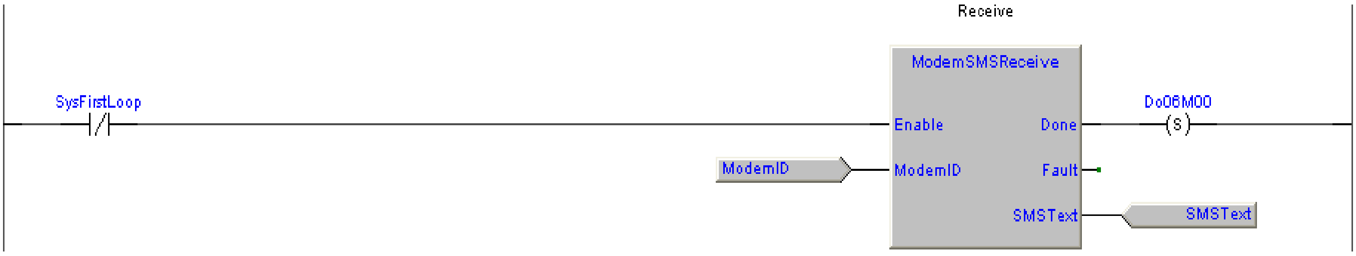
10003010 ***ModemID*** non definito.

10003020 ***ModemID*** non corretto.

Esempi

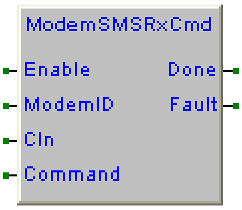
Nell'esempio è gestita la ricezione di un messaggio SMS dal modem definito nella variabile ***ModemID***, per la definizione delle variabili e per una migliore comprensione del funzionamento si rimanda agli esempi successivi.

Esempio LD



7.15.3 ModemSMSRxCmd, receive a SMS command

Type	Library	Version
FB	eModemLib	SFR057A100



Questo blocco funzione esegue la ricezione di un comando tramite un messaggio SMS, si collega al blocco funzione di gestione modem ***ModemCore***, occorre passare il ***ModemID*** in uscita dal blocco funzione di gestione modem.

Alla ricezione di un messaggio SMS se nel testo del messaggio è presente la stringa definita in ***Command***, si attiva per un loop di programma l'uscita ***Done***, all'uscita ***CLIPNumber*** della FB ***ModemCore*** è ritornato il numero di telefono da cui il messaggio è stato ricevuto.

Attivando ***Cin*** il controllo sulla stringa definita in ***Command*** verrà fatto non considerando il case (Maiuscolo/minuscolo) dei caratteri.

Enable (BOOL)	Abilita la ricezione del comando.
ModemID (UDINT)	ID modem fornito in uscita dalla ***ModemCore***.
CIn (BOOL)	Se attivo, controllo di ***Command*** non considerando case (Maiuscolo/minuscolo) dei caratteri.
Command (STRING[32])	Testo comando da eseguire.
Done (BOOL)	Attivo per un loop se ricevuto messaggio SMS contenente il testo indicato in ***Command***.
Fault (BOOL)	Attivo per un loop se errore.

Codici di errore

In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

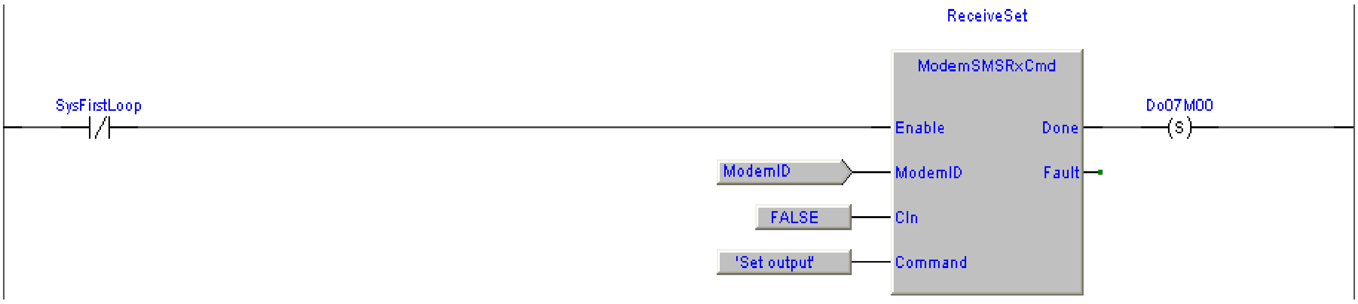
10004010 ***ModemID*** non definito.

10004020 ***ModemID*** non corretto.

Esempi

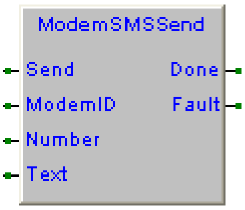
Nell'esempio è gestita la ricezione di un messaggio SMS dal modem definito nella variabile ***ModemID***, per la definizione delle variabili e per una migliore comprensione del funzionamento si rimanda agli esempi successivi.

Esempio LD



7.15.4 ModemSMSSend, send a SMS message

Type	Library	Version
FB	eModemLib	SFR057A100



Questo blocco funzione esegue l'invio di un messaggio SMS, si collega al blocco funzione di gestione modem ***ModemCore***, occorre passare alla FB il ***ModemID*** in uscita dal blocco funzione di gestione modem.

Su fronte attivazione ingresso di ***Send*** viene prenotato l'invio del messaggio, non appena sarà possibile il messaggio definito in ***Text*** verrà inviato al numero definito in ***Number***. Terminato l'invio verrà attivata per un loop di programma l'uscita ***Done***.

Send (BOOL)	Sul fronte di attivazione comanda l'invio del messaggio SMS. ***Attenzione!*** Il messaggio sarà inviato non appena il modem è libero per l'invio.
ModemID (UDINT)	ID modem fornito in uscita dalla ***ModemCore***.
Number (STRING[16])	Numero di telefono a cui eseguire l'invio del messaggio.
Text (STRING[160])	Testo messaggio da inviare.
Done (BOOL)	Attivo per un loop al termine dell'invio del messaggio SMS.
Fault (BOOL)	Attivo per un loop se errore invio messaggio SMS.

Codici di errore

In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

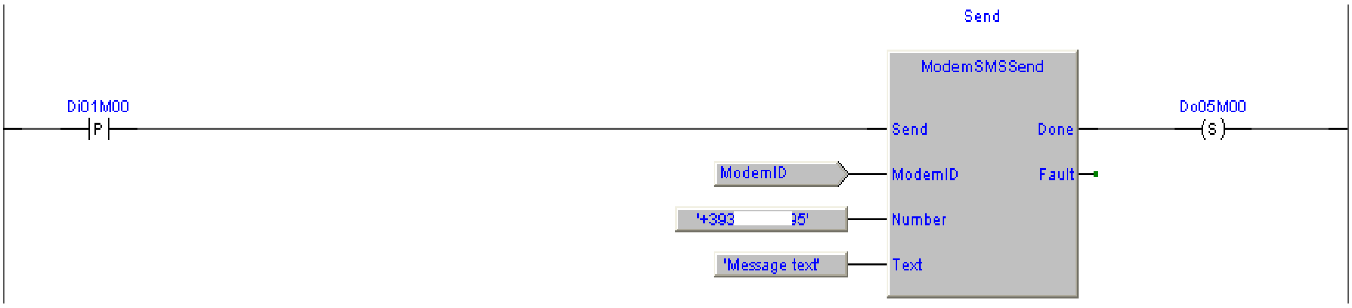
10005010 ***ModemID*** non definito.

10005020 ***ModemID*** non corretto.

Esempi

Nell'esempio è gestito l'invio di un messaggio SMS sul modem definito nella variabile ***ModemID***, per la definizione delle variabili e per una migliore comprensione del funzionamento si rimanda agli esempi successivi.

Esempio LD



7.16 Funzioni ed FB gestione One-Wire (ePLC1WireLib)

La rete da campo 1 Wire® é un protocollo standard basato su di un solo filo di comunicazione, come indica lo stesso nome, che include numerosi dispositivi e sensori frequentemente utilizzati nel campo dell'automazione industriale e domestica.

I dispositivi sono interconnessi da soli due fili, uno per la massa ed uno per il segnale e l'alimentazione; su questi due fili possono essere collegati tutti i dispositivi in rete scegliendo la disposizione fisica necessaria.

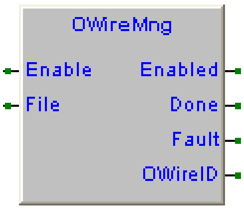
Il protocollo 1 Wire® é dotato di tutte le modalità di comunicazione che consentono di ottenere un elevato trasferimento dati ed una sicurezza intrinseca sulla loro validità. Questo avviene grazie a tecniche di indirizzamento univoche, CRC polinomiali di controllo, numerosi comandi di verifica e complessi algoritmi di gestione.

7.16.1 OWireMng, One-Wire management

Type	Library	Version
FB	ePLC1WireLib	SFR059A000

Questo blocco funzione gestisce il convertitore Seriale/One-Wire connesso al dispositivo di I/O definito in ***File***, l'FB gestisce l'inizializzazione e la gestione del convertitore.

L'uscita ***Done*** si attiva se il convertitore è correttamente inizializzato, l'uscita ***Fault*** si attiva per un loop di programma in caso di errori di gestione. L'FB ritorna un ***OWireID*** che deve essere passato alle FB collegate (Esempio lettura ROM code, acquisizione temperatura, ecc.).



Enable (BOOL)	Abilitazione blocco funzione, attivandolo viene gestito il convertitore Seriale/One-Wire.
File (FILEP)	Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.
Enabled (BOOL)	Blocco funzione abilitato.
Done (BOOL)	Convertitore Seriale/One-Wire correttamente inizializzato e funzionante.
Fault (BOOL)	Attivo per un loop di programma se errore gestione convertitore.
OWireID (UDINT)	ID One-Wire da passare alle FB collegate (Esempio ***OWRdIdentifier***, ***OWRdTemperature***, ecc.).

Codici di errore

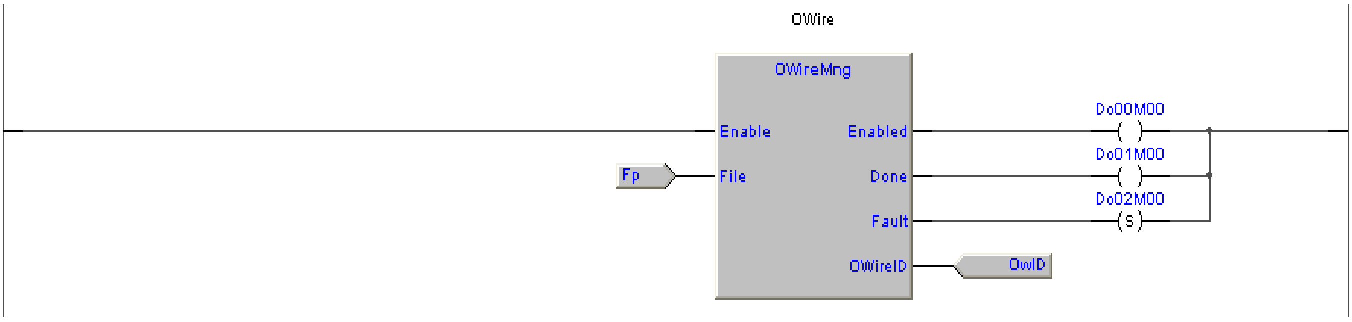
In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

10008010	Valore di ***File*** non definito.
10008200	Timeout invio stringa comando.
10008300~9	Errore nelle configurazione convertitore.
10008400~1	Errore nella verifica configurazione.
10008500~2	Errore nelle sequenze indirizzamento device One-Wire.
10008600	Errore risposta a comando di reset pulse.
10008601	Bus One-Wire in cortocircuito.
10008602	Errore dispositivi su bus One-Wire.
10008603	Nessun dispositivo su bus One-Wire.

Esempi

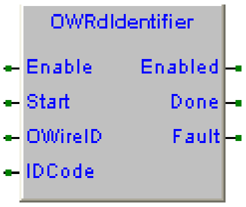
Nell'esempio è gestito un convertitore Seriale/One-Wire connesso al terminale di I/O definito nella variabile ***Fp***, per la definizione delle variabili e per una migliore comprensione del funzionamento si rimanda agli esempi successivi.

Esempio LD



7.16.2 OWRdIdentifier, One-Wire read ROM identifier

Type	Library	Version
FB	ePLC1WireLib	SFR059A000



Questo blocco funzione esegue la lettura del codice di identificazione di un dispositivo One-Wire, si collega al blocco funzione ***OWireMng*** di gestione convertitore Seriale/One-Wire. Occorre passare ***OWireID*** in uscita dal blocco funzione di gestione convertitore.

Attivando il comando di ***Start***, viene eseguita la lettura del ROM ID dal dispositivo connesso al bus One-Wire ***Attenzione! Bisogna avere un solo dispositivo connesso al bus***. Se la lettura ha esito positivo si attiva per un loop di programma l'uscita ***Done*** e gli 8 bytes del codice letto sono trasferiti nell'array indirizzato.

Enable (BOOL)	Abilita il blocco funzione.
Start (BOOL)	Attivando l'ingresso viene eseguita la lettura del ROM ID.
OWireID (UDINT)	ID One-Wire fornito in uscita dal blocco funzione ***OWireMng***.
IDCode (@USINT)	Puntatore ad array di memorizzazione ROM ID letto, l'array deve essere almeno 8 bytes.
Enabled (BOOL)	Blocco funzione abilitato.
Done (BOOL)	Attivo per un loop al termine della lettura del ROM ID.
Fault (BOOL)	Attivo per un loop se errore.

Codici di errore

In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

10009010	***OWireID*** non definito.
10009020	***OWireID*** non corretto.
10009100	FB ***OWireMng***, gestione convertitore Seriale/One-Wire, impegnata.
10009200~2	Errore gestione sequenze One-Wire lettura ID.

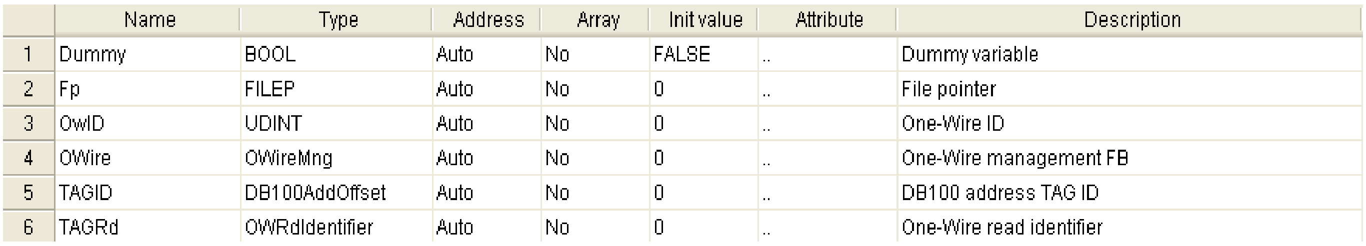
Esempi

Ecco un semplice esempio di un programma per la gestione di dispositivi iButton per il riconoscimento personale. Inserendo il TAG nel lettore viene eseguita la lettura del ROM identifier, il valore acquisito è trasferito in un array di 8 bytes allocato ad indirizzo ***MD100.0***.

Ogni 100 mS viene eseguita l'acquisizione, se un TAG è inserito nel lettore viene attivata l'uscita ***Do00M00***.

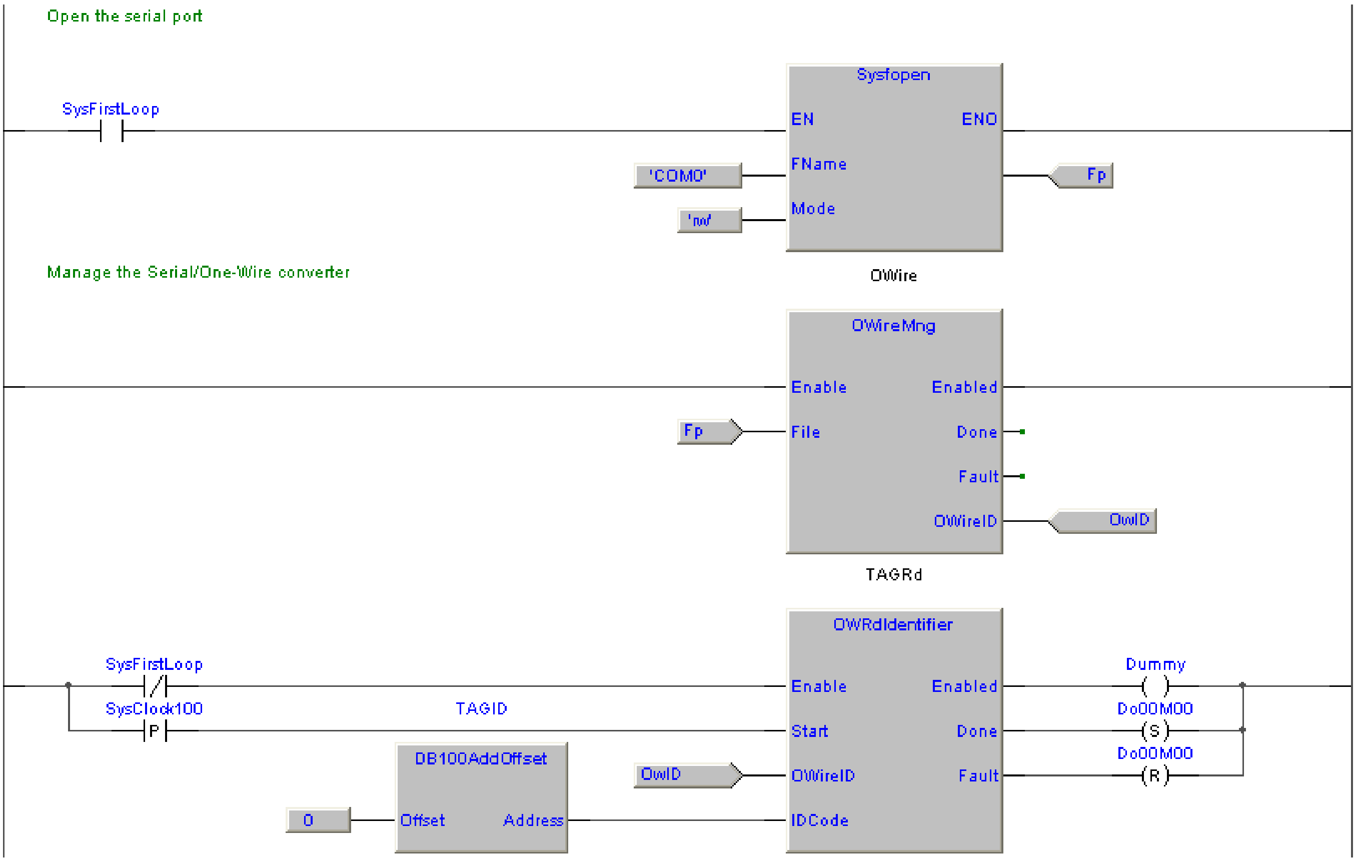
Per semplicità nel programma non viene eseguito alcun controllo sull'ID letto, ma in un sistema di controllo accessi ad esempio è possibile dall'ID letto identificare la persona ed abilitare o no l'accesso.

Definizione variabili



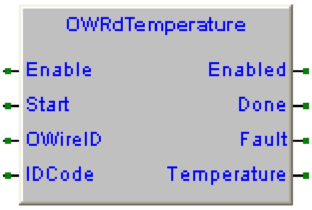
	Name	Type	Address	Array	Init value	Attribute	Description
1	Dummy	BOOL	Auto	No	FALSE	..	Dummy variable
2	Fp	FILEP	Auto	No	0	..	File pointer
3	OwID	UDINT	Auto	No	0	..	One-Wire ID
4	OWire	OWireMng	Auto	No	0	..	One-Wire management FB
5	TAGID	DB100AddOffset	Auto	No	0	..	DB100 address TAG ID
6	TAGRd	OWRdIdentifier	Auto	No	0	..	One-Wire read identifier

Esempio LD *(Ptp120A000)*



7.16.3 OWRdTemperature, One-Wire read temperature

Type	Library	Version
FB	ePLC1WireLib	SFR059A000



Questo blocco funzione esegue gestione di un sensore One-Wire di acquisizione temperatura (Maxim DS18B20), si collega al blocco funzione ***OWireMng*** di gestione convertitore Seriale/One-Wire. Occorre passare ***OWireID*** in uscita dal blocco funzione di gestione convertitore.

Attivando il comando di ***Start***, viene eseguita la lettura del valore di temperatura dal dispositivo connesso al bus One-Wire. Se la lettura ha esito positivo si attiva per un loop di programma l'uscita ***Done*** e su ***Temperature***, sarà riportato il valore di temperatura acquisito. L'uscita ***Fault*** si attiva per un loop di programma in caso di errori di gestione.

Se sul bus One-Wire è connesso un unico dispositivo, si può evitare di settare ***IDCode*** oppure si può forzare a ***0***. Se invece sul bus One-Wire sono presenti più dispositivi parallelati, in ***IDCode*** occorre definire l'indirizzo dell'array di 8 bytes che contiene il ROM ID del dispositivo che si vuole acquisire.

Enable (BOOL)	Abilita il blocco funzione.
Start (BOOL)	Attivando l'ingresso viene eseguita la lettura della temperatura.
OWireID (UDINT)	ID One-Wire fornito in uscita dal blocco funzione ***OWireMng***.
IDCode (@USINT)	Puntatore ad array definizione ROM ID dispositivo da acquisire.
Enabled (BOOL)	Blocco funzione abilitato.
Done (BOOL)	Attivo per un loop al termine della lettura temperatura.
Fault (BOOL)	Attivo per un loop se errore.
Temperature (REAL)	Valore di temperatura acquisito (°C). Range di lettura da -55 (°C) a +125 (°C). Precisione ±0.5 (°C) tra -10 (°C) e +85 (°C). Risoluzione di lettura 0.0625 (°C).

Codici di errore

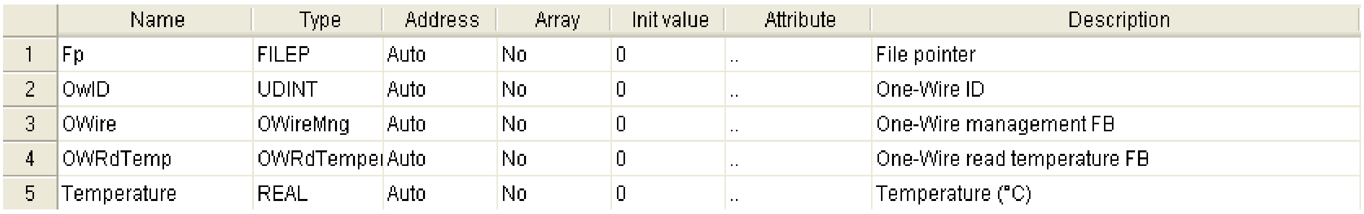
In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

10010010	***OWireID*** non definito.
10010020	***OWireID*** non corretto.
10010100	FB ***OWireMng***, gestione convertitore Seriale/One-Wire, impegnata.
10010200~5	Errore nelle sequenze acquisizione temperatura.

Esempi

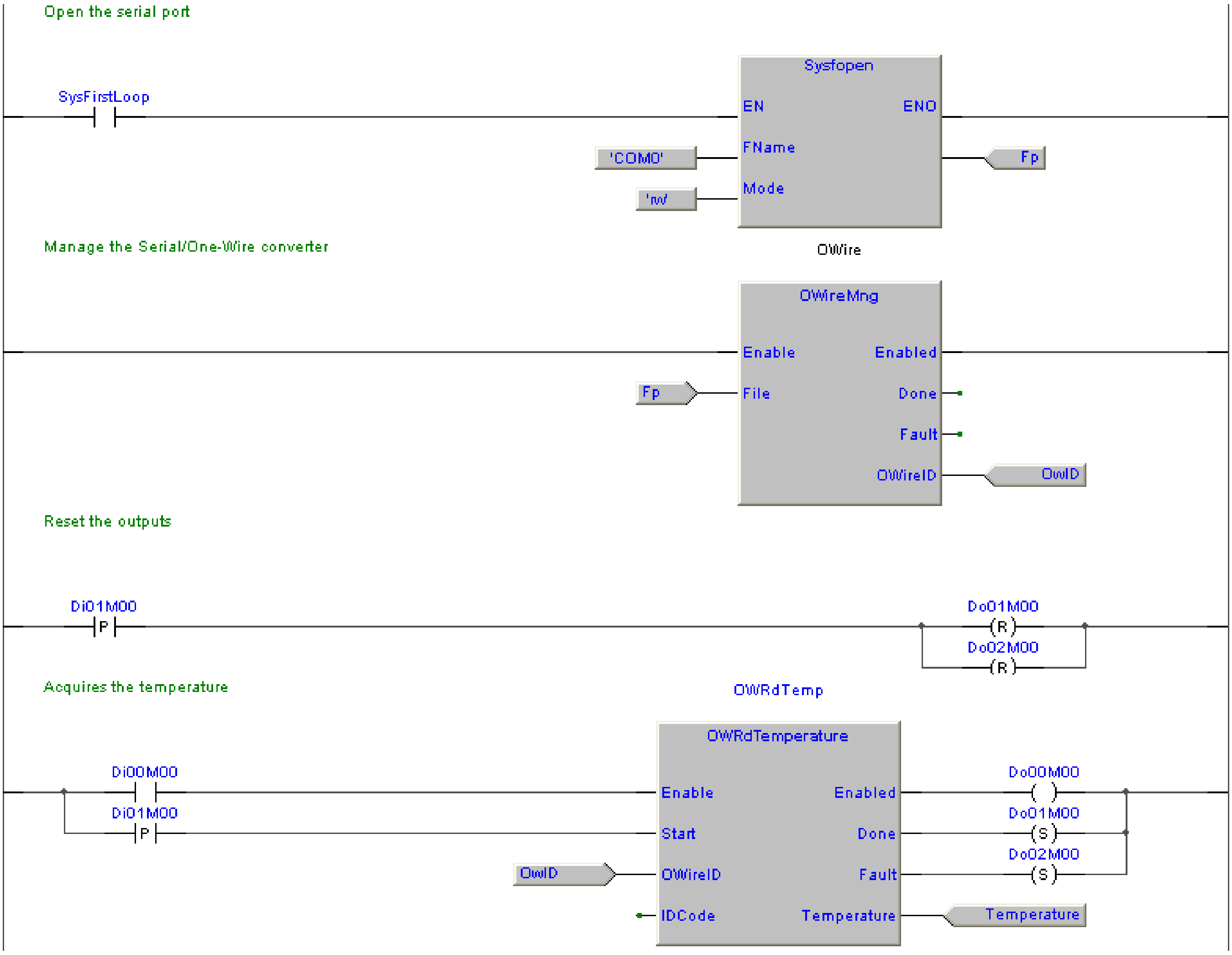
Viene eseguita la lettura della temperatura da un dispositivo One-Wire. Non essendo definito ***IDCode*** viene acquisito qualsiasi dispositivo presente sul bus One-Wire ***Attenzione! Deve essere presente un solo dispositivo sul bus***. Ad ogni attivazione ingresso ***Di01M00*** viene eseguita l'acquisizione, se esecuzione corretta viene attivata l'uscita ***Do01M00*** ed il valore acquisito è trasferito nella variabile ***Temperature***.

Definizione variabili



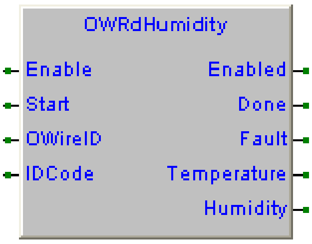
	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	File pointer
2	OwID	UDINT	Auto	No	0	..	One-Wire ID
3	OWire	OWireMng	Auto	No	0	..	One-Wire management FB
4	OWRdTemp	OWRdTempe	Auto	No	0	..	One-Wire read temperature FB
5	Temperature	REAL	Auto	No	0	..	Temperature (°C)

Esempio LD *(Ptp120A000)*



7.16.4 OWRdHumidity, One-Wire read humidity

Type	Library	Version
FB	ePLC1WireLib	SFR059B000



Questo blocco funzione esegue gestione di un sensore One-Wire di acquisizione umidità e temperatura basato (Maxim DS2438). Si collega al blocco funzione ***OWireMng*** di gestione convertitore Seriale/One-Wire. Occorre passare ***OWireID*** in uscita dal blocco funzione di gestione convertitore.

Attivando il comando di ***Start***, viene eseguita la lettura del valore di temperatura ed umidità dal dispositivo connesso al bus One-Wire. Se la lettura ha esito positivo si attiva per un loop di programma l'uscita ***Done***, su ***Temperature*** e ***Humidity***, saranno ritornati i valori di temperatura e umidità acquisiti. L'uscita ***Fault*** si attiva per un loop di programma in caso di errori di gestione.

Se sul bus One-Wire è connesso un unico dispositivo è possibile forzare a ***0*** la definizione in ***IDCode*** del ROM ID, se invece sul bus One-Wire sono presenti più dispositivi parallelati, occorre definire in ***IDCode*** l'indirizzo dell'array di 8 bytes che contiene il ROM ID del dispositivo che si vuole acquisire.

Enable (BOOL)	Abilita il blocco funzione.
Start (BOOL)	Attivando l'ingresso viene eseguita la lettura della temperatura e umidità.
OWireID (UDINT)	ID One-Wire fornito in uscita dal blocco funzione ***OWireMng***.
IDCode (@USINT)	Puntatore ad array definizione ROM ID dispositivo da acquisire.
Enabled (BOOL)	Blocco funzione abilitato.
Done (BOOL)	Attivo per un loop al termine della lettura temperatura.
Fault (BOOL)	Attivo per un loop se errore.
Temperature (REAL)	Valore di temperatura acquisito (°C). Range di lettura da -55 (°C) a +125 (°C). Precisione ±0.5 (°C) tra -10 (°C) e +85 (°C). Risoluzione di lettura 0.03125 (°C).
Humidity (REAL)	Valore di umidità acquisito (RH%).

Codici di errore

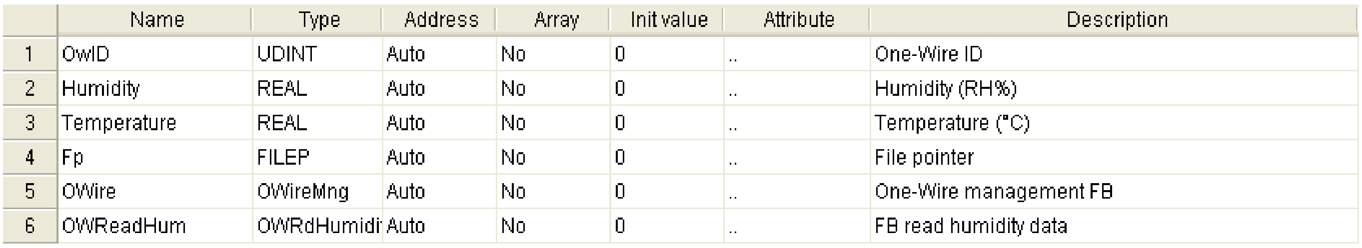
In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

10015010	***OWireID*** non definito.
10015020	***OWireID*** non corretto.
10015100	FB ***OWireMng***, gestione convertitore Seriale/One-Wire, impegnata.
10015200~3	Errore nelle sequenze conversione temperatura.
10015300~8	Errore nelle sequenze acquisizione tensione alimentazione sensore.
10015400~8	Errore nelle sequenze acquisizione sensore umidità.

Esempi

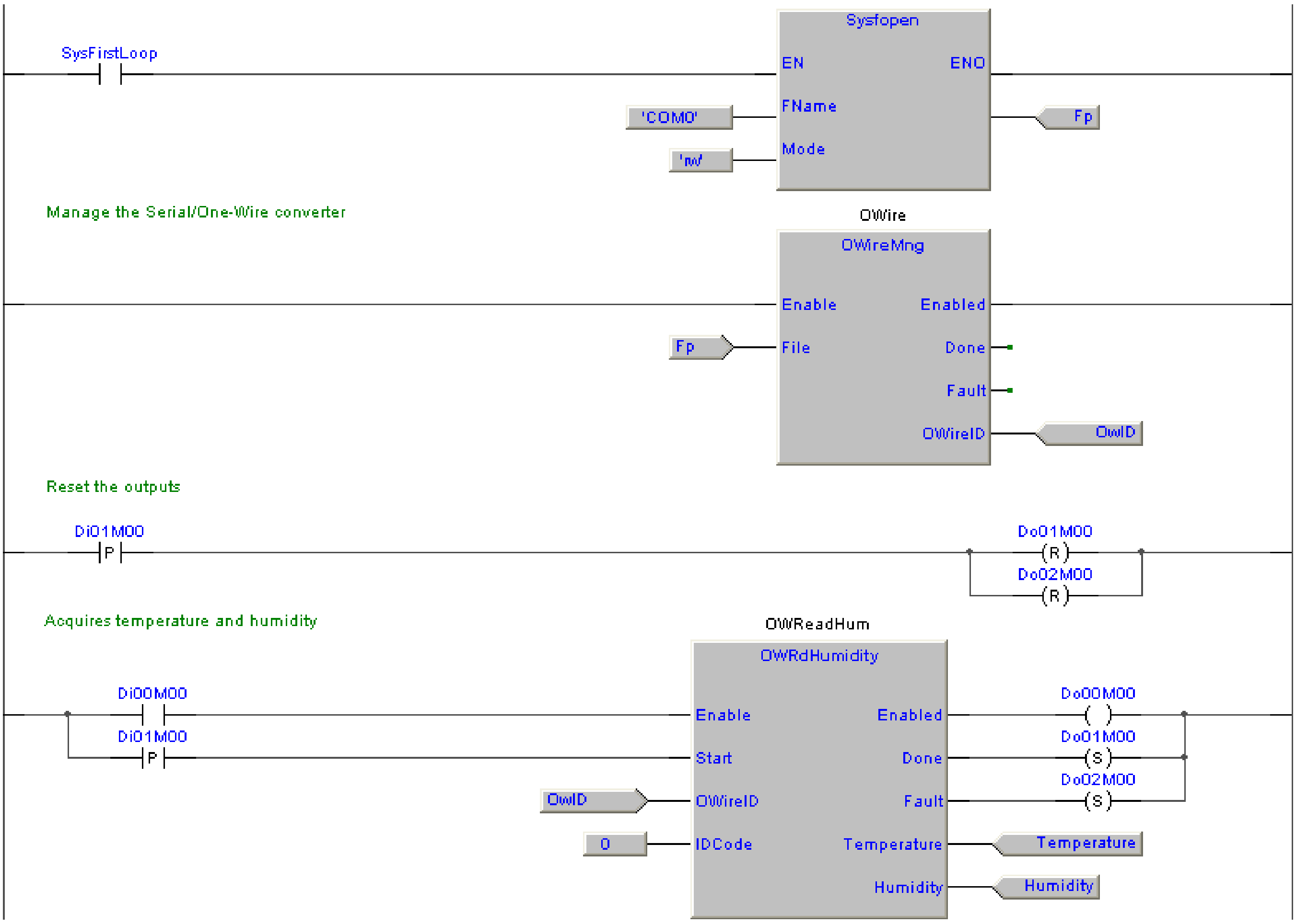
Viene eseguita la lettura della temperatura ed umidità da un dispositivo One-Wire. Non essendo definito ***IDCode*** viene acquisito qualsiasi dispositivo presente sul bus One-Wire ***Attenzione! Deve essere presente un solo dispositivo sul bus***. Ad ogni attivazione ingresso ***Di01M00*** viene eseguita l'acquisizione, se esecuzione corretta viene attivata l'uscita ***Do01M00*** ed i valori acquisiti sono trasferiti nelle variabili ***Temperature*** ed ***Humidity***.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	OwID	UDINT	Auto	No	0	..	One-Wire ID
2	Humidity	REAL	Auto	No	0	..	Humidity (RH%)
3	Temperature	REAL	Auto	No	0	..	Temperature (°C)
4	Fp	FILEP	Auto	No	0	..	File pointer
5	OWire	OWireMng	Auto	No	0	..	One-Wire management FB
6	OWReadHum	OWRdHumidi	Auto	No	0	..	FB read humidity data

Esempio LD *(Ptp120A100)*

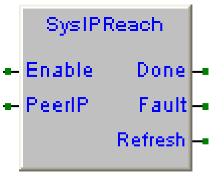


7.17 Funzioni ed FB gestione networking

Da linguaggio IEC sono disponibili funzioni e blocchi funzione per la gestione networking.

7.17.1 SysIPReach, IP address is reachable

Type	Library	Version
FB	Embedded	6.0



Questo blocco funzione esegue controllo se un indirizzo IP è raggiungibile, se indirizzo è già presente nella tabella ARP del sistema viene ritornato ***Done***.

In caso contrario viene eseguita una richiesta ARP sulla rete e se il dispositivo con l'indirizzo IP definito viene trovato, è attivata l'uscita ***Done*** e aggiornata la tabella ARP.

La variabile ***Refresh*** ritorna la percentuale di tempo trascorsa dall'ultimo aggiornamento della tabella ARP del sistema con l'indirizzo IP definito.

Enable (BOOL)	Abilitazione blocco funzione, attivandolo si forza socket in condizione di listening.
PeerIP (STRING[15])	Stringa di definizione indirizzo IP di cui eseguire la ricerca.
Done (BOOL)	Attivo se indirizzo IP è raggiungibile (Voce presente in tabella ARP).
Fault (BOOL)	Attivo per un loop di programma se errore gestione.
Refresh (USINT)	Percentuale di tempo da ultimo aggiornamento tabella ARP.

Codici di errore

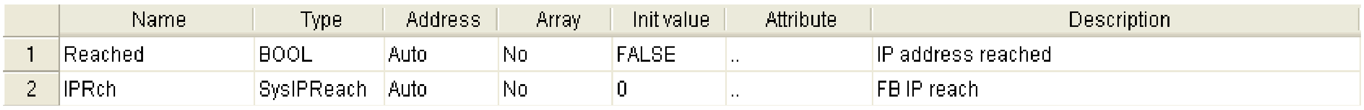
In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

Codice	Descrizione
9974050	Errore allocazione blocco funzione
9974060	Terminato spazio memoria rilocabile, non è possibile eseguire l'"FB.
9974070	Errore versione blocco funzione.
9974100	Errore indirizzo IP definito ***PeerIP***.
9974200	Errore invio richiesta ARP.

Esempi

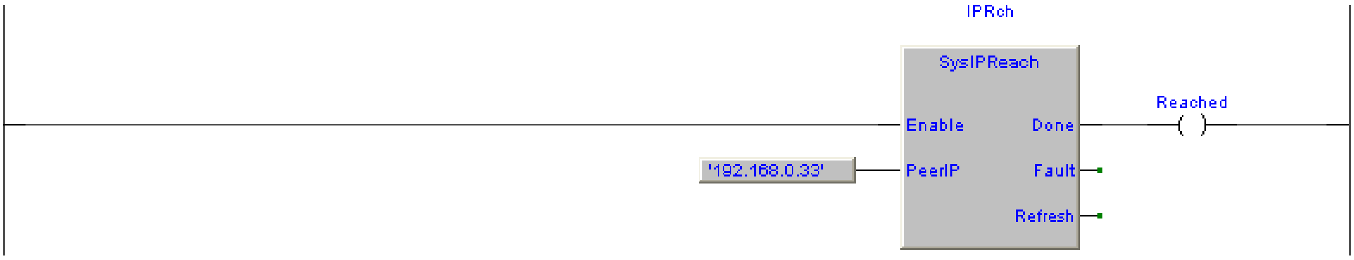
Nell'esempio viene controllato se l'indirizzo IP ***192.168.0.33*** è raggiungibile, in tal caso si attiva l'uscita ***Reached***.

Definizione variabili



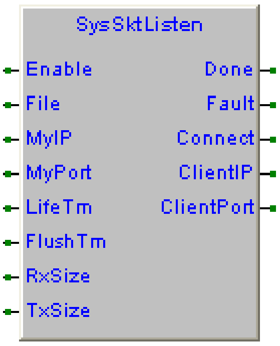
	Name	Type	Address	Array	Init value	Attribute	Description
1	Reached	BOOL	Auto	No	FALSE	..	IP address reached
2	IPRch	SysIPReach	Auto	No	0	..	FB IP reach

Esempio LD



7.17.2 SysSktListen, Socket listen

Type	Library	Version
FB	Embedded	6.0



Questo blocco funzione forza il socket nella condizione di listening, occorre passare alla FB un flusso dati ***stream*** indicato dal parametro ***File***, precedentemente aperto dalla funzione ***Sysfopen***.

I parametri ***MyIP*** e ***MyPort*** indicano l'interfaccia di rete e la porta su cui il socket è in ascolto, ***MyIP*** può essere lasciato non connesso ed in tal caso viene utilizzata l'interfaccia ethernet.

I parametri ***LifeTm***, ***FlushTm***, ***RxSize***, ***TxSize***, devono essere definiti solo se si tratta di socket TCP, possono essere lasciati non connessi nel caso di socket UDP.

L'uscita ***Done*** si attiva se tutti i parametri sono corretti ed il socket è stato messo in condizione di listening. Quando un client si connette (Solo socket TCP) si attiva l'uscita ***Connect*** e nelle variabili ***ClientIP*** e ***ClientPort*** sono ritornati l'indirizzo IP e la porta connessa al socket.

Enable (BOOL)	Abilitazione blocco funzione, attivandolo si forza socket in condizione di listening.
File (FILEP)	Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.
MyIP (STRING[15])	Stringa di definizione indirizzo IP interfaccia di rete su cui il socket è gestito. Lasciandolo non connesso o definendo ***'255.255.255.255'*** sarà utilizzata interfaccia ethernet.
MyPort (UINT])	Porta su cui sarà posto in ascolto il socket.
LifeTm (UINT])	Tempo di vita socket, se non sono ricevuti o inviati dati dopo il tempo definito il socket viene automaticamente chiuso (Sec) (Solo per socket TCP).
FlushTm (UINT])	Tempo di flush dati, se non sono caricati dati nel socket dopo il tempo definito i dati presenti vengono automaticmente inviati (mS) (Solo per socket TCP).
RxSize (UINT])	Dimensione buffer ricezione dati (Solo per socket TCP).
TxSize (UINT])	Dimensione buffer trasmissione dati (Solo per socket TCP).
Done (BOOL)	Attivo se socket in condizione di listening.
Fault (BOOL)	Attivo per un loop di programma se errore gestione.
Connect (BOOL)	Si attiva se un client si connette al socket (Solo per socket TCP).
ClientIP (STRING[15])	Stringa di definizione indirizzo IP del client connesso al socket (Solo per socket TCP).
ClientPort (UINT])	Porta del client attualmente connesso al socket (Solo per socket TCP).

Codici di errore

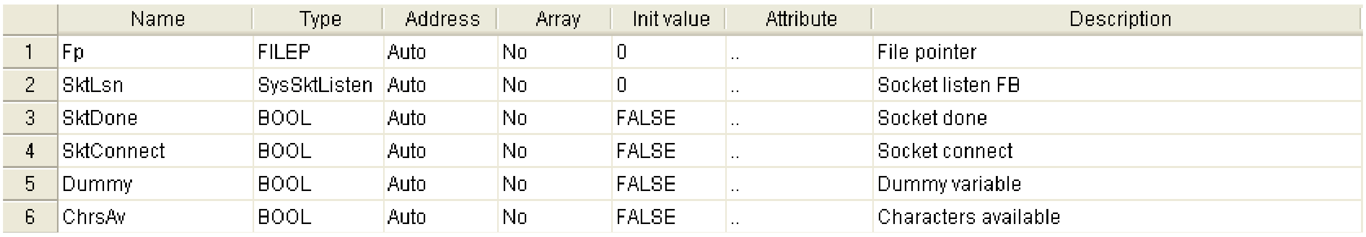
In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

Codice	Descrizione
9977050	Errore allocazione blocco funzione
9977060	Terminato spazio memoria rilocabile, non è possibile eseguire l''FB.
9977070	Errore versione blocco funzione.
9977100	Valore di ***File*** non definito.
9977110	Tipo di ***stream*** definito in ***File*** non corretto.
9977150	Errore indirizzo IP dispositivo client ***ClientIP***.
9977200	Errore indirizzo IP interfaccia di rete ***MyIP***.
9977300	Valore dimensione buffer ricezione ***RxSize*** fuori range.
9977310	Valore dimensione buffer trasmissione ***TxSize*** fuori range.
9977350	Errore nel set dei parametri TCP.
9977400	Errore set socket in listening.

Esempi

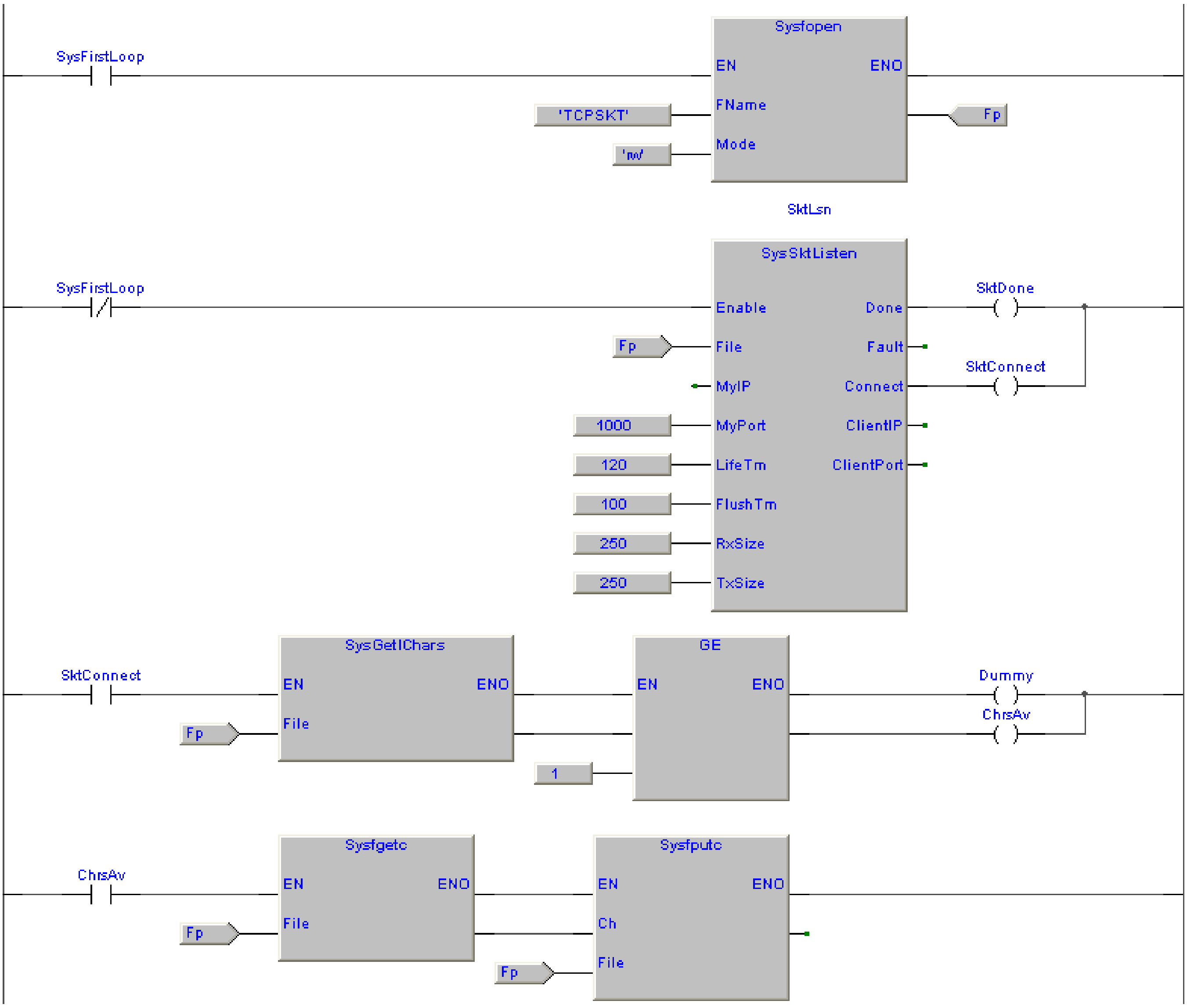
Nell'esempio è posto in ascolto un socket TCP sulla porta 1000. Se ci si connette con un client telnet (Esempio Hyperterminal) al sistema SlimLine sulla porta 1000, si attiverà la variabile ***SktConnect***. Inviando caratteri dalla finestra del terminale telnet, si attiverà la variabile ***ChrsAv***, i caratteri inviati saranno ricevuti dalla funzione ***Sysfgetc*** e inviati in echo verso il client telnet dalla funzione ***Sysfputc***.

Definizione variabili



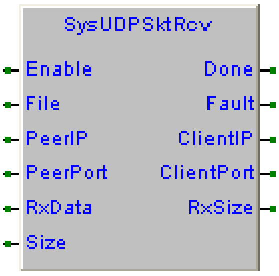
	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	File pointer
2	SktLsn	SysSktListen	Auto	No	0	..	Socket listen FB
3	SktDone	BOOL	Auto	No	FALSE	..	Socket done
4	SktConnect	BOOL	Auto	No	FALSE	..	Socket connect
5	Dummy	BOOL	Auto	No	FALSE	..	Dummy variable
6	ChrsAv	BOOL	Auto	No	FALSE	..	Characters available

Esempio LD *(Ptp119a200)*



7.17.3 SysUDPSktRcv, UDP socket receive

Type	Library	Version
FB	Embedded	6.0



Questo blocco funzione esegue la ricezione dati da un socket UDP, occorre passare alla FB un flusso dati ***stream*** indicato dal parametro ***File***, precedentemente aperto dalla funzione ***Sysfopen*** ed il socket deve essere stato posto in condizione di listening dalla funzione ***SysSktListen***.

I parametri ***PeerIP*** e ***PeerPort*** indicano l'indirizzo IP e la porta da cui sono accettati i dati, se non connessi sono accettate connessioni da tutti gli IP e da tutte le porte.

Nel parametro ***RxData*** bisogna definire l'indirizzo del buffer di memoria in cui verranno trasferiti i dati ricevuti, ed in ***Size*** occorre definire la dimensione del buffer.

Su ricezione dati si attiva l'uscita ***Done*** e nelle variabili ***ClientIP*** e ***ClientPort*** sono ritornati l'indirizzo IP e la porta da cui sono stati ricevuti i dati, mentre in ***RxSize*** è ritornato il numero di bytes dati ricevuti.

Enable (BOOL)	Abilitazione blocco funzione.
File (FILEP)	Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.
PeerIP (STRING[15])	Stringa di definizione indirizzo IP da cui saranno accettate le connessioni. Lasciandolo non connesso o definendo ***'255.255.255.255'*** saranno accettate connessioni da tutti gli IP.
PeerPort (UINT])	Porta da cui saranno accettate le connessioni, Lasciandolo non connesso o definendo ***65536*** saranno accettate connessioni da tutte le porte.
RxData (@USINT])	Puntatore al buffer dove devono essere trasferiti i dati ricevuti.
Size (UINT])	Dimensione buffer ricezione dati.
Done (BOOL)	Attivo per un loop di programma su ricezione dati.
Fault (BOOL)	Attivo per un loop di programma se errore gestione.
ClientIP (STRING[15])	Stringa di definizione indirizzo IP del client da cui sono stati ricevuti i dati.
ClientPort (UINT])	Porta del client da cui sono stati ricevuti i dati.
RxSize (UINT])	Numero di bytes di dato ricevuti.

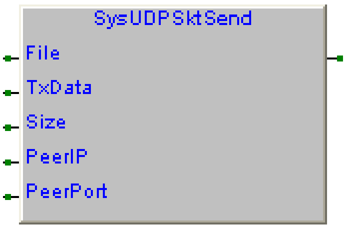
Codici di errore

In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

Codice	**Descrizione**
9975050	Errore allocazione blocco funzione
9975060	Terminato spazio memoria rilocabile, non è possibile eseguire l''FB.
9975070	Errore versione blocco funzione.
9975100	Valore di ***File*** non definito.
9975110	Tipo di ***stream*** definito in ***File*** non corretto.
9975200	Errore indirizzo IP connessioni accettate ***PeerIP***.
9975300	Errore ricezione dati da socket UDP
9975350	Errore indirizzo IP client ***ClientIP***.

7.17.4 SysUDPSktSend, UDP socket send

Type	Library	Version
Function	Embedded	6.0



Questa funzione esegue la trasmissione dati su di un socket UDP, occorre passare un flusso dati ***stream*** indicato dal parametro ***File***, precedentemente aperto dalla funzione ***Sysfopen***.

Nel parametro ***TxData*** bisogna definire l'indirizzo del buffer di memoria che contiene i dati da trasmettere, ed in ***Size*** occorre definire il numero di bytes di dati da trasmettere.

I parametri ***PeerIP*** e ***PeerPort*** indicano l'indirizzo IP e la porta a cui saranno inviati i dati.

Se la trasmissione è riuscita verrà ritornato il numero di bytes trasmessi (Solitamente uguale al valore definito in ***Size***), in caso di errore viene ritornato ***EOF***.

Parametri funzione:

File (FILEP)	Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.
TxData (@USINT])	Puntatore al buffer che contiene i dati da trasmettere.
Size (UINT])	Numero di bytes dati da trasmettere.
PeerIP (STRING[15])	Stringa di definizione indirizzo IP a cui trasmettere i dati.
PeerPort (UINT])	Porta a cui trasmettere i dati.

La funzione ritorna:

(UINT)	Numero bytes trasmessi, ***EOF*** in caso di errore

Codici di errore

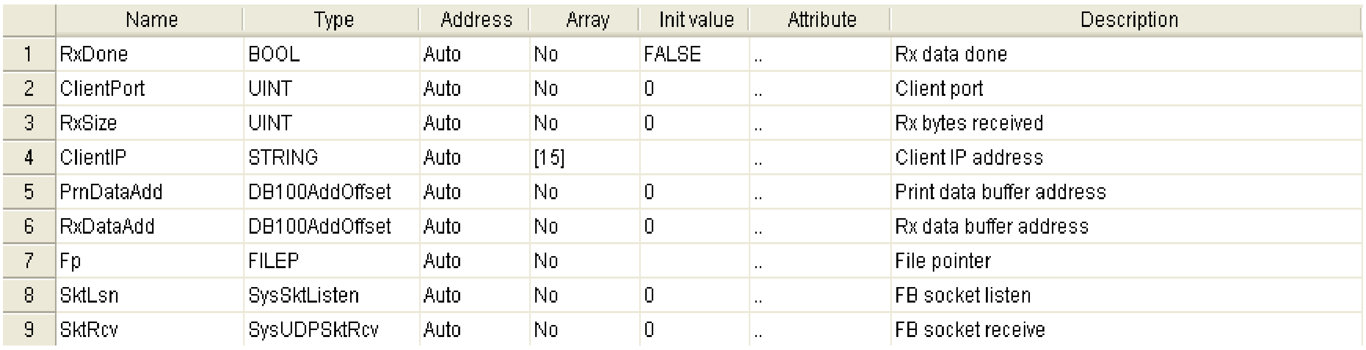
In caso di errore la funzione torna con ***EOF***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

Codice	**Descrizione**
9976010	Valore di ***File*** non definito.
9976050	Tipo di ***stream*** definito in ***File*** non corretto.
9976100	Errore indirizzo IP connessioni accettate ***PeerIP***.
9976200	Errore trasmissione dati su socket UDP

Esempi

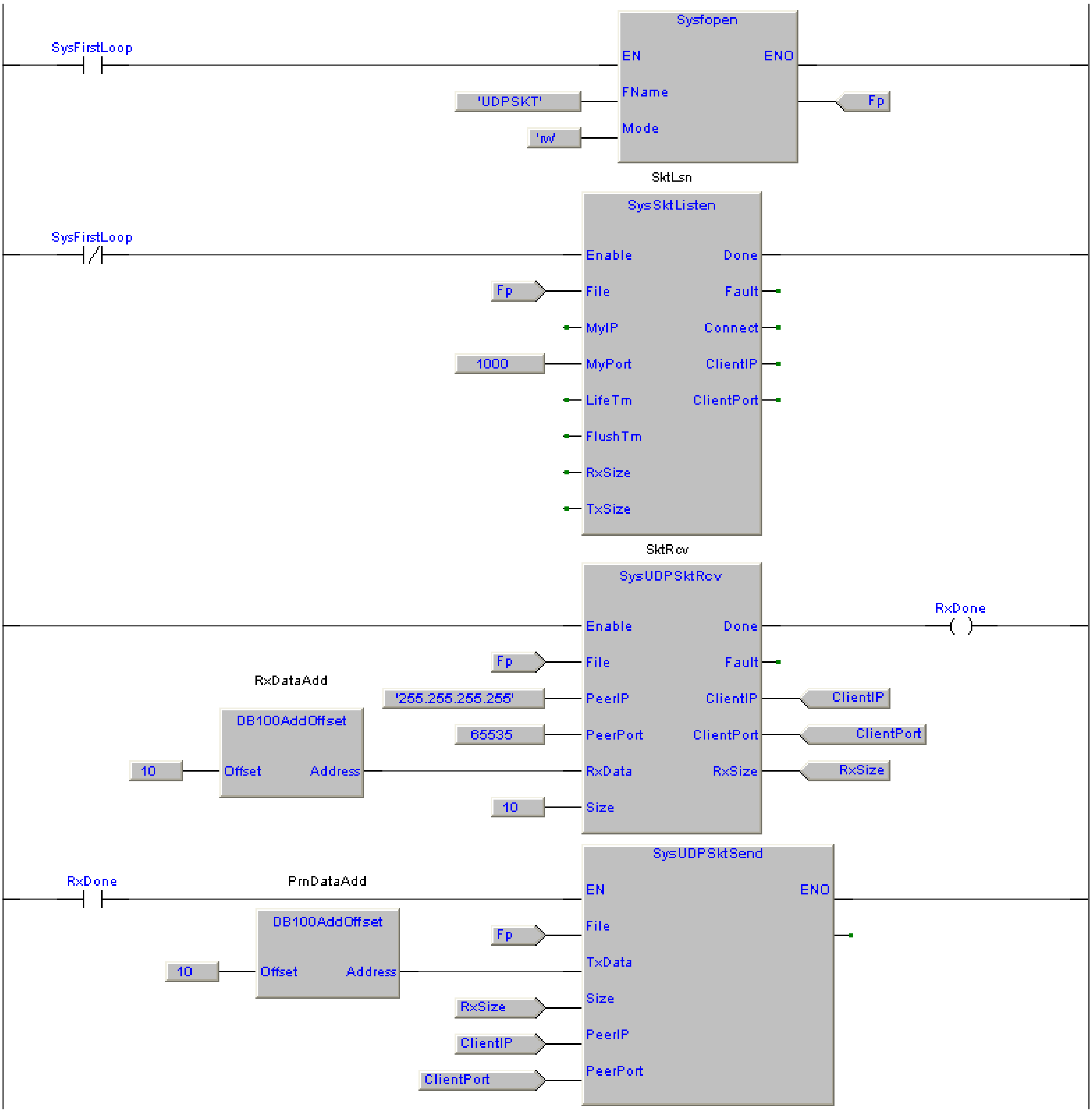
Nell'esempio inviando caratteri al sistema SlimLine sulla porta 1000 da una connessione UDP, i caratteri inviati saranno ritrasmessi sulla porta UDP del sistema client da cui sono stati ricevuti.

Definizione variabili



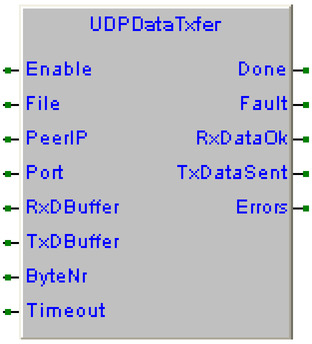
	Name	Type	Address	Array	Init value	Attribute	Description
1	RxDone	BOOL	Auto	No	FALSE	..	Rx data done
2	ClientPort	UINT	Auto	No	0	..	Client port
3	RxSize	UINT	Auto	No	0	..	Rx bytes received
4	ClientIP	STRING	Auto	[15]		..	Client IP address
5	PrnDataAdd	DB100AddOffset	Auto	No	0	..	Print data buffer address
6	RxDataAdd	DB100AddOffset	Auto	No	0	..	Rx data buffer address
7	Fp	FILEP	Auto	No		..	File pointer
8	SktLsn	SysSktListen	Auto	No	0	..	FB socket listen
9	SktRcv	SysUDPSktRcv	Auto	No	0	..	FB socket receive

Esempio LD *(Ptp119a200)*



7.17.5 UDPDataTxfer, UDP data transfer

Type	Library	Version
FB	PLCUtyLib	SFR054A700



Questo blocco funzione esegue il trasferimento di un blocco di memoria tra due sistemi utilizzando una connessione UDP su rete ethernet. Occorre passare alla FB un flusso dati ***stream*** indicato dal parametro ***File***, precedentemente aperto dalla funzione ***Sysfopen*** ed il socket deve essere stato posto in condizione di listening dalla funzione ***SysSktListen***.

Il parametro ***PeerIP*** indica l'indirizzo IP del sistema con cui avviene il trasferimento dati, ***Port*** indica la porta tramite la quale il trasferimento avviene (Deve assumere lo stesso valore su entrambi i sistemi).

Il parametro ***Timeout*** definisce il tempo massimo per il trasferimento dei dati, l'invio dei dati si conclude con la ricezione di un acknowledge da parte dell'altro sistema, un ciclo di invio dati e ricezione acknowledge richiede 2 loop di esecuzione programma. Se dopo l'invio non viene ricevuto Ack entro un tempo pari a ***Timeout/4***, viene effettuato un altro invio e cosi di seguito fino allo scadere del tempo definito. Per garantire almeno 3 retries si consiglia di ***impostare come tempo di timeout un valore pari a 10 volte il tempo massimo di loop*** (Scegliendo quello maggiore tra i due sistemi in comunicazione).

L'invio dei dati è automatico sulla variazione di uno qualsiasi dei bytes del buffer di trasmissione, per garantire il controllo sul collegamento tra i due sistemi, ogni tempo pari a ***Timeout*** viene comunque eseguito un invio del buffer di memoria.

Se i due sistemi sono in comunicazione si attiva l'uscita ***Done***, ***RxDataOk*** si attiva per un loop ad ogni ricezione del buffer dati dall'altro sistema, mentre ***TxDataSent*** si attiva per un loop al termine della trasmissione del buffer dati verso l'altro sistema.

Enable (BOOL)	Abilitazione blocco funzione.
File (FILEP)	Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.
PeerIP (STRING[15])	Stringa di definizione indirizzo IP del sistema con cui avviene il trasferimento dati.
Port (UINT])	Porta tramite la quale avviene il trasferimento dati (Stesso valore su entrambi i sistemi).
RxDBuffer (@USINT])	Puntatore al buffer dove devono essere trasferiti i dati ricevuti.
TxDBuffer (@USINT])	Puntatore al buffer dove sono presenti i dati da trasmettere.
ByteNr (UINT])	Numero di bytes scambiati.
Timeout (UINT])	Tempo massimo per il trasferimento del buffer dati (mS).
Done (BOOL)	Attivo se i due sistemi sono in comunicazione tra di loro.
Fault (BOOL)	Attivo per un loop di programma se errore gestione.
RxDataOk (BOOL)	Attivo per un loop di programma su ricezione buffer dati da altro sistema.
TxDataSent (BOOL)	Attivo per un loop di programma al termine trasmissione buffer dati verso altro sistema.
Errors (UINT])	Numero di errori, incrementato ad ogni nuovo errore, raggiunto valore massimo riparte da 0.

Codici di errore

In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

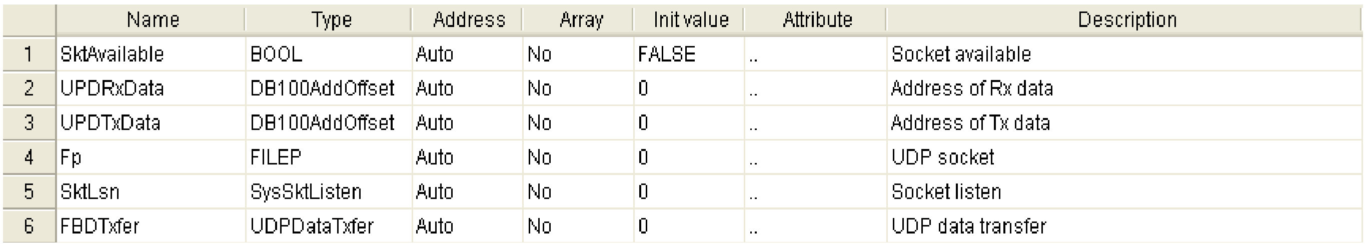
Codice	**Descrizione**
10014050	Valore di ***File*** non definito.
10014100	Terminato spazio memoria rilocabile, non è possibile eseguire l'"FB.
10014200~1	Errore ricezione frame dati blocco di memoria.
10014300~2	Errore ricezione frame acknowledge.
10014400	Ricevuto comando non gestito.
10014500	Timeout invio frame dati blocco di memoria.
10014600	Errore sequenze di trasmissione.

Esempi

Nell'esempio viene trasferito un blocco di memoria di 16 bytes allocati su ***MX100.16*** verso il sistema con IP 192.168.0.126, i dati ricevuti sono trasferiti a ***MX100.32***. Per testarne il funzionamento occorre trasferire lo stesso programma sul sistema con IP 192.168.0.126 definendo opportunamente la variabile ***PeerIP***.

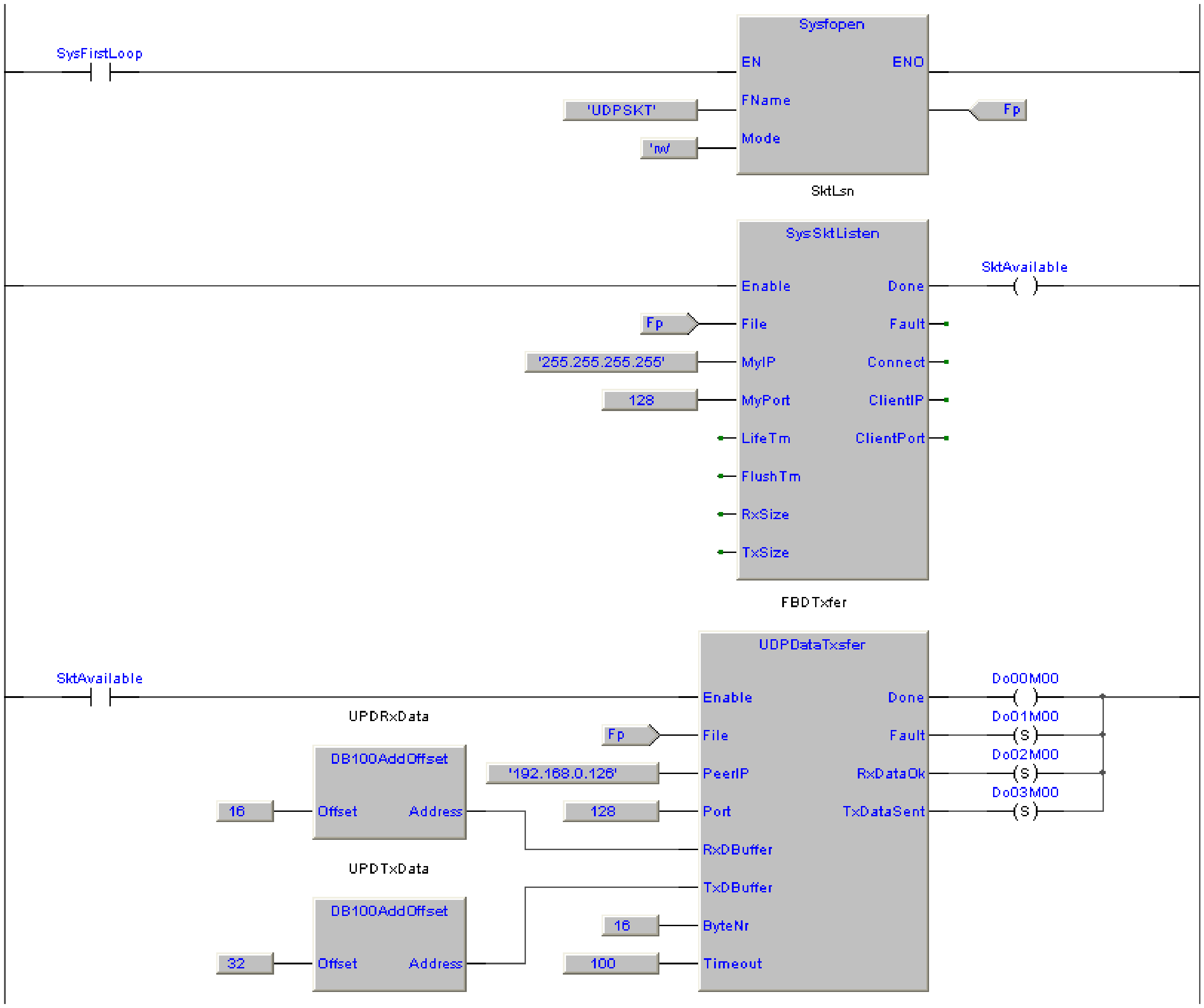
L'uscita ***Do00M00*** è attiva se i due sistemi sono sincronizzati tra di loro.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	SktAvailable	BOOL	Auto	No	FALSE	..	Socket available
2	UPDRxData	DB100AddOffset	Auto	No	0	..	Address of Rx data
3	UPDTxData	DB100AddOffset	Auto	No	0	..	Address of Tx data
4	Fp	FILEP	Auto	No	0	..	UDP socket
5	SktLsn	SysSktListen	Auto	No	0	..	Socket listen
6	FBDTxfer	UDPDataTxfer	Auto	No	0	..	UDP data transfer

Esempio LD *(Ptp119a300)*



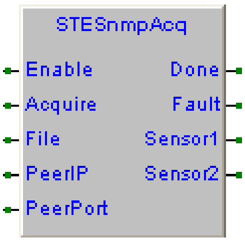
7.18 Funzioni ed FB supporto prodotti Hw Group (eHwGSpLib)

La ditta della repubblica Ceca Hw Group http://www.hw-group.com produce dispositivi per Networking e prodotti per telecontrollo, monitoraggio e gestione dati.

Tutti i prodotti Hw Group dispongono di connettività su rete ethernet con protocolli TCP/IP, UDP, SNMP, ed per facilitare la connessione di questi prodotti con l'ambiente di sviluppo LogicLab, sono fornite funzioni e blocchi funzioni specifici.

7.18.1 STESnmpAcq, STE termometer acquisition over SNMP

Type	Library	Version
FB	eHwGSpLib	SFR060A000



Questo blocco funzione gestisce l'acquisizione del valore di temperatura delle due sonde connesse al termometro IP STE. La connessione tra il termometro e lo SlimLine avviene su rete ethernet utilizzando il protocollo SNMP.

Occorre passare alla FB un flusso dati ***stream*** indicato dal parametro ***File***, precedentemente aperto dalla funzione ***Sysfopen*** come socket UDP e posto in ascolto con il blocco funzione ***SysSktListen***.

Su fronte attivazione del comando ***Acquire***, viene effettuata la lettura SNMP dal termometro STE definito da indirizzo IP **PeerIP**, su porta ***PeerPort*** (Di default la porta SNMP è la 161). Se il comando ***Acquire*** è mantenuto attivo, la lettura viene effettuata in modo ciclico.

L'uscita ***Done*** si attiva per un loop al termine della acquisizione dei due valori di temperatura.

Enable (BOOL)	Abilitazione blocco funzione.
Acquire (BOOL)	Comando acquisizione termometro STE. Sul fronte di attivazione si esegue la lettura del valore di temperatura. Mantenuto attivo la lettura viene effettuata in modo ciclico.
File (FILEP)	Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.
PeerIP (STRING[15])	Stringa di definizione indirizzo IP del termometro IP.
PeerPort (UINT])	Porta utilizzata per la connessione (Di default la porta SNMP è la 161).
Done (BOOL)	Attivo per un loop di programma su fine lettura dati.
Fault (BOOL)	Attivo per un loop di programma se errore gestione.
Sensor1 (REAL)	Valore di temperatura letto dal sensore 1 (°C).
Sensor2 (REAL)	Valore di temperatura letto dal sensore 2 (°C).

Codici di errore

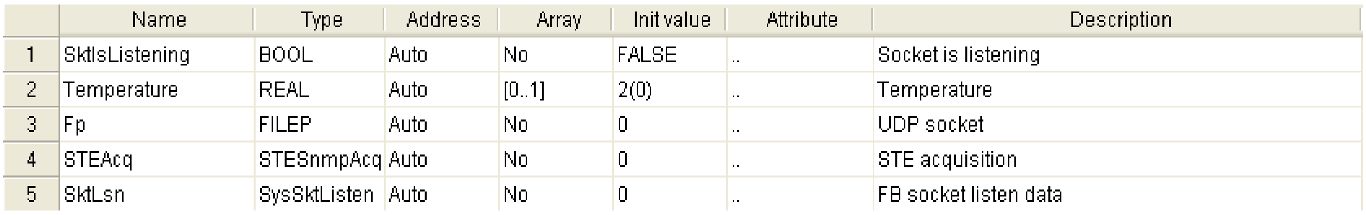
In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

10013010	Valore di ***File*** non definito.
10013050	Timeout esecuzione.
10013060	Errore case gestione lettura.
10013100	Errore controllo indirizzo IP del dispositivo STE.
10013120	Errore ricezione dati da dispositivo STE.
10013200~1	Errore lettura sensore 1.
10013300~1	Errore lettura sensore 2.

Esempi

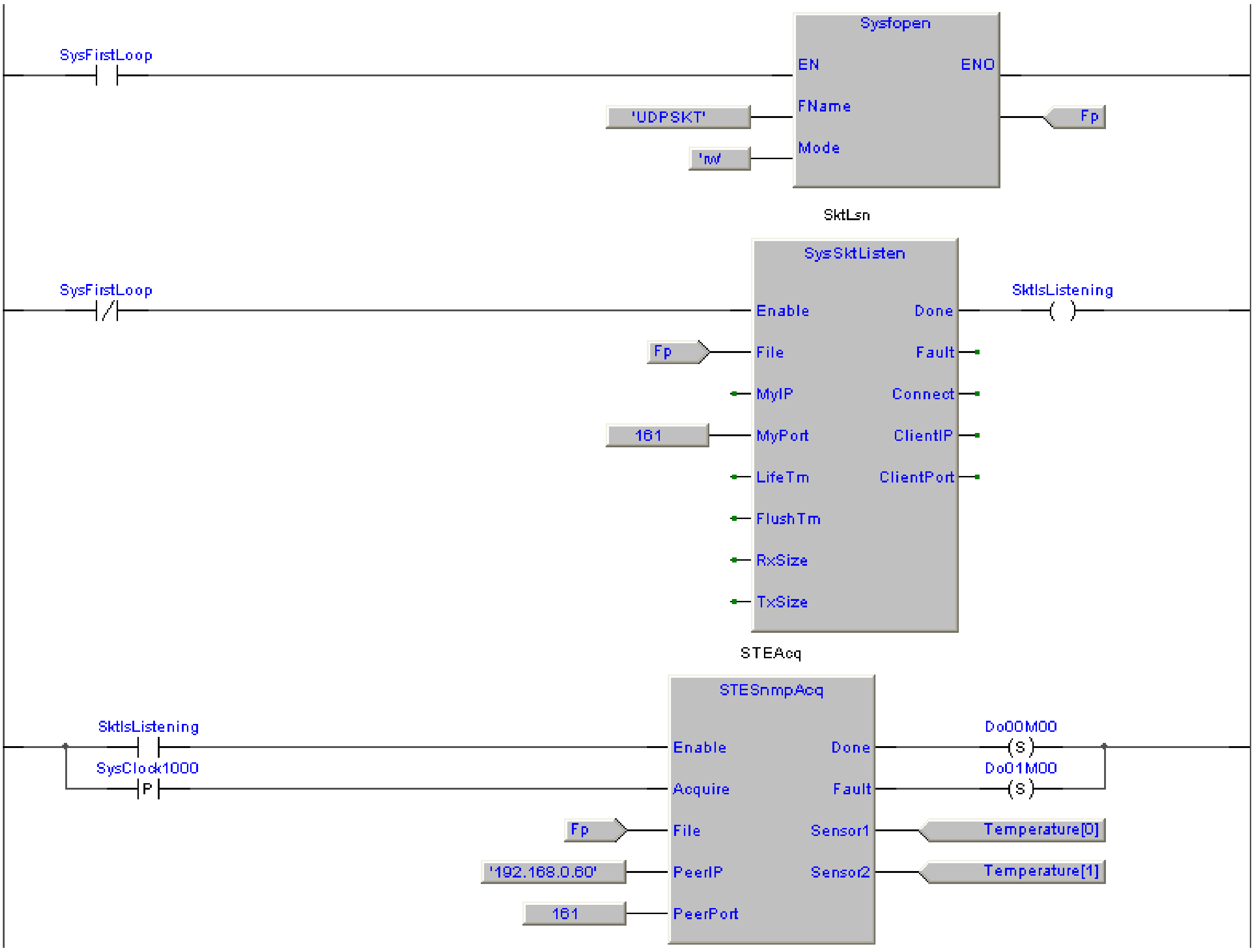
Nell'esempio è gestita l'acquisizione dei due valori di temperatura da un termometro STE ogni secondo. Il valore di temperatura in gradi centigradi è ritornato sulle variabili ***Temperature[0]*** e ***Temperature[1]***. L'uscita logica ***Do00M00*** si attiva alla prima esecuzione della acquisizione, mentre l'uscita logica ***Do01M00*** si attiva in caso di errore di acquisizione.

Definizione variabili



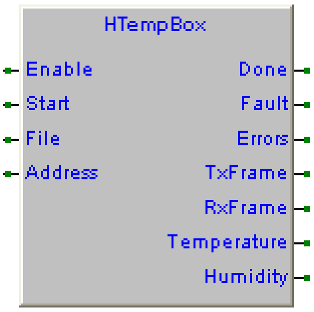
	Name	Type	Address	Array	Init value	Attribute	Description
1	SktIsListening	BOOL	Auto	No	FALSE	..	Socket is listening
2	Temperature	REAL	Auto	[0..1]	2(0)	..	Temperature
3	Fp	FILEP	Auto	No	0	..	UDP socket
4	STEAcq	STESnmpAcq	Auto	No	0	..	STE acquisition
5	SktLsn	SysSktListen	Auto	No	0	..	FB socket listen data

Esempio LD



7.18.2 HTempBox, HTemp Box2-485 acquisition

Type	Library	Version
FB	eHwGSpLib	SFR060A100



Questo blocco funzione gestisce l'acquisizione del valore di temperatura e di umidità da un HTemp Box2-485 connesso con lo SlimLine in porta seriale RS485.

Occorre passare alla FB il puntatore al file di porta seriale ***stream*** indicato dal parametro ***File***, precedentemente aperto dalla funzione ***Sysfopen***.

Su fronte attivazione del comando ***Start***, viene effettuata la lettura del valore di temperatura e umidità dal convertitore HTemp connesso alla porta seriale definita. Se il comando ***Start*** è mantenuto attivo, la lettura viene effettuata in modo ciclico.

L'uscita ***Done*** si attiva per un loop al termine della acquisizione dei valori di temperatura e di umidità.

Enable (BOOL)	Abilitazione blocco funzione.
Start (BOOL)	Comando acquisizione da HTemp. Sul fronte di attivazione si esegue la lettura del valore di temperatura e umidità. Mantenuto attivo la lettura viene effettuata in modo ciclico.
File (FILEP)	Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.
Address (STRING[1])	Stringa di definizione indirizzo dispositivo.
Done (BOOL)	Attivo per un loop di programma su fine lettura dati.
Fault (BOOL)	Attivo per un loop di programma se errore gestione.
Errors (UDINT)	Numero di errori, incrementato ad ogni nuovo errore, raggiunto valore massimo riparte da 0.
TxFrame (STRING[8])	Contiene il frame inviato al dispositivo, può essere utilizzato in debug.
RxFrame (STRING[16])	Contiene il frame ricevuto dal dispositivo, può essere utilizzato in debug.
Temperature (REAL)	Valore di temperatura (°C).
Humidity (REAL)	Valore di umidità (%).

Codici di errore

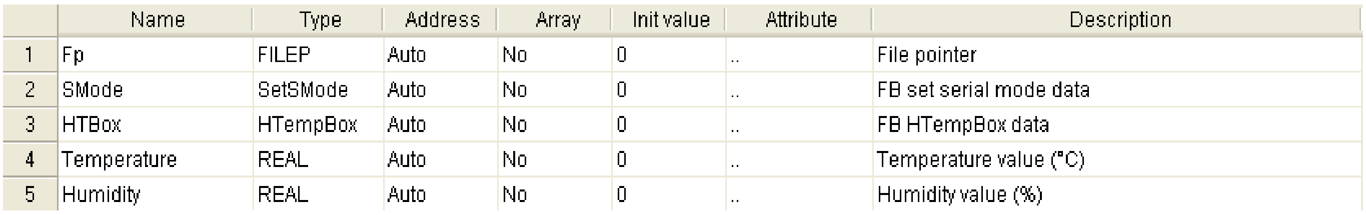
In caso di errore si attiva l'uscita ***Fault***, il valore di ***Errors*** si incrementa e con ***SysGetLastError*** è possibile rilevare il codice di errore.

10032010	Valore di ***File*** non definito.
10032050	Timeout esecuzione.
10032060	Errore case gestione lettura.
10032100	Errore controllo indirizzo del dispositivo HTemp.
10032120	Errore lettura valore di temperatura.
10032150	Errore lettura valore di umidità.
10013200~1	Errore nella gestione del protocollo di comunicazione.

Esempi

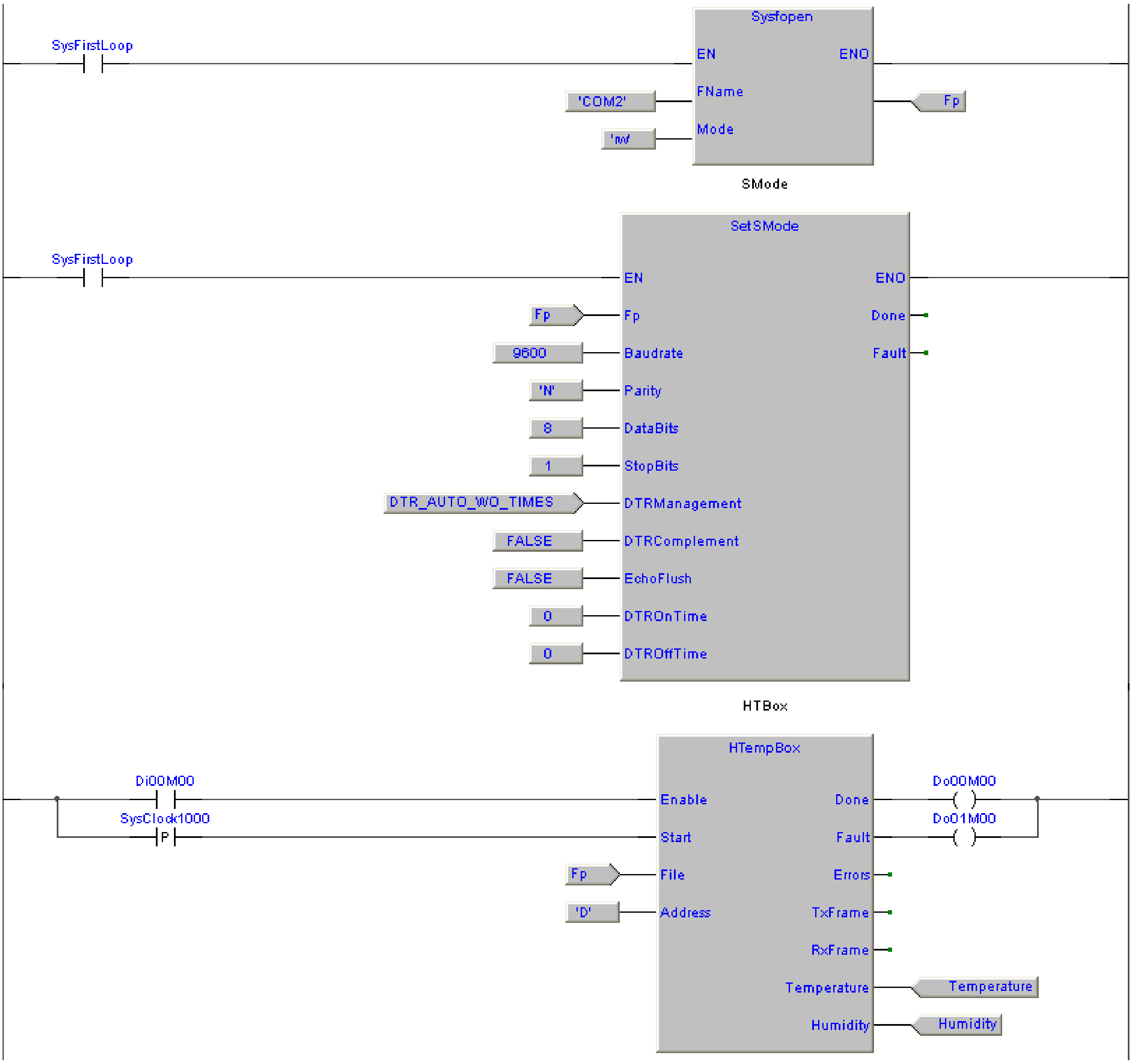
Nell'esempio è gestita l'acquisizione del valore di temperatura e di umidità da un HTemp ogni secondo. Il valore di temperatura in gradi centigradi è ritornato nella variabile ***Temperature*** ed il valore di umidità in % è ritornato nella variabile ***Humidity***.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	File pointer
2	SMode	SetSMode	Auto	No	0	..	FB set serial mode data
3	HTBox	HTempBox	Auto	No	0	..	FB HTempBox data
4	Temperature	REAL	Auto	No	0	..	Temperature value (°C)
5	Humidity	REAL	Auto	No	0	..	Humidity value (%)

Esempio LD



7.19 Funzioni ed FB supporto protocollo NMEA (eNMEALib)

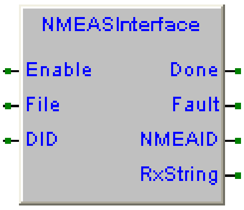
NMEA 0183 (O più comunemente NMEA) è uno standard di comunicazione di dati utilizzato soprattutto in nautica e nella comunicazione di dati satellitari GPS. L'ente che gestisce e sviluppa il protocollo è la National Marine Electronics Association.

Questo protocollo si basa sul principio che la fonte, detta talker, può soltanto inviare i dati (sentences) e la ricevente, detta listener, può soltanto riceverli.

La libreria ***eNMEALib*** fornisce una serie di funzioni e blocchi funzione per gestire le sentenze NMEA, in pratica è possibile realizzare programmi con l'ambiente di sviluppo LogicLab che si comportano come listeners di sentenze NMEA.

7.19.1 NMEASInterface, NMEA system interface

Type	Library	Version
FB	eNMEALib	SFR061A000



Questo blocco funzione gestisce l'interfaccia verso un dispositivo che invia sentenze NMEA connesso al dispositivo di I/O definito in ***File***, questo è un blocco funzione protetto per utilizzarlo occorre richiedere il codice di protezione, vedi ***protezione funzioni e blocchi funzione***. E' comunque possibile utilizzarlo liberamente in modo test per 30 Min.

L'FB riceve le sentenze NMEA dal dispositivo, ne controlla il prefisso comparandolo con la stringa definita in ***DID***, controlla se la sentenza ricevuta è corretta (Controllo sul CRC). L'uscita ***Done*** si attiva per un loop ad ogni ricezione di sentenza NMEA corretta.

L'FB ritorna un ***NMEAID*** che deve essere passato alle FB collegate (FB di gestione sentenze NMEA). L'uscita ***RxString*** riportano la stringa ricevuta dal dispositivo, in questo modo è possibile visualizzare in debug la comunicazione con il dispositivo permettendo di visualizzare eventuali errori.

Enable (BOOL)	Abilitazione blocco funzione.
File (FILEP)	Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.
DID (STRING[2])	Stringa di definizione prefisso dispositivo.
Done (BOOL)	Attivo per un loop di programma su ricezione sentenza corretta.
Fault (BOOL)	Attivo per un loop di programma se errore gestione.
NMEAID (UDINT)	ID interfaccia con sistema NMEA da passare alle FB collegate.
RxString (STRING[82])	Contiene la stringa ricevuta dal dispositivo, può essere utilizzato in debug per verificare le sentenze ricevute.

Codici di errore

In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

10017010	Valore di ***File*** non definito.
10017020	FB protetta, terminato tempo funzionamento in modo demo.
10017050	Timeout esecuzione.
10017070	Errore case gestione.
10017100~4	Errore ricezione sentenza NMEA.

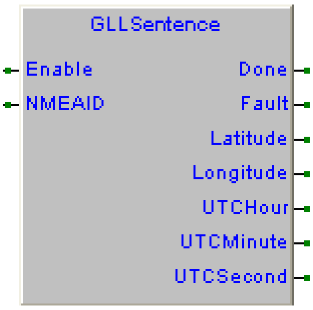
7.19.2 GLLSentence, Geographic Position sentence

Type	Library	Version
FB	eNMEALib	SFR061A000

Questo blocco funzione esegue la ricezione della sentenza GLL Geographic Position, si collega al blocco funzione ***NMEASInterface*** di gestione dispositivo NMEA. Occorre passare ***NMEAID*** in uscita dal blocco funzione di gestione dispositivo.

La sentenza GLL contiene le informazioni di latitudine, longitudine ora e fix, esempio di sentenza ***$IIGLL,4419.0173,N,00829.6653,E,084550.00,A,2*09***.

L'FB controlla correttezza dei campi della sentenza e ne estrae le informazioni di latitudine, longitudine e tempo. L'uscita ***Done*** si attiva per un loop ad ogni ricezione di sentenza GLL corretta.



Enable (BOOL)	Abilitazione blocco funzione.
NMEAID (UDINT)	ID interfaccia con sistema NMEA fornito in uscita dal blocco funzione ***NMEASInterface***.
Done (BOOL)	Attivo per un loop di programma su ricezione sentenza GLL corretta.
Fault (BOOL)	Attivo per un loop di programma se errore sentenza.
Latitude (REAL)	Valore di latitudine indicato nella sentenza, il valore è espresso in frazione di gradi. Valori positivi indicano latitudine nord, valori negativi latitudine sud.
Longitude (REAL)	Valore di longitudine indicato nella sentenza, il valore è espresso in frazione di gradi. Valori positivi indicano longitudine est, valori negativi longitudine ovest.
UTCHour (USINT)	Valore di ora UTC indicato nella sentenza.
UTCMinute (USINT)	Valore di minuti UTC indicato nella sentenza.
UTCSecond (USINT)	Valore di secondi UTC indicato nella sentenza.

Codici di errore

In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

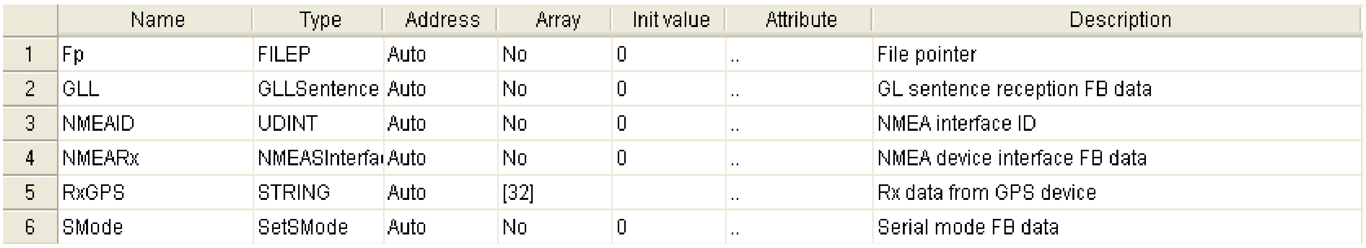
10018010	***NMEAID*** non definito.
10018020	***NMEAID*** non corretto.
10018100~2	Errore nel valore di latitudine.
10018200~2	Errore nel valore di longitudine.
10018300~2	Errore nel valore ora UTC.

Esempi

E' disponibile un programma di esempio Ptp123*000 che gestisce l'interfaccia verso un navigatore satellitare con l'interpretazione di alcune sentenze NMEA.

Nell'esempio riportato è gestita la ricezione di una sentenza GLL.

Definizione variabili

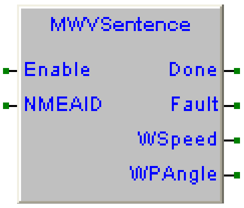


	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	File pointer
2	GLL	GLLSentence	Auto	No	0	..	GL sentence reception FB data
3	NMEAID	UDINT	Auto	No	0	..	NMEA interface ID
4	NMEARx	NMEASInterfa	Auto	No	0	..	NMEA device interface FB data
5	RxGPS	STRING	Auto	[32]		..	Rx data from GPS device
6	SMode	SetSMode	Auto	No	0	..	Serial mode FB data

Esempio LD

7.19.3 MWVSentence, Wind Speed and Angle sentence

Type	Library	Version
FB	eNMEALib	SFR061A000



Questo blocco funzione esegue la ricezione della sentenza MWV wind speed and angle, si collega al blocco funzione ***NMEASInterface*** di gestione dispositivo NMEA. Occorre passare ***NMEAID*** in uscita dal blocco funzione di gestione dispositivo.

La sentenza MWV contiene le informazioni di velocità e direzione del vento, esempio di sentenza ***$IIMWV,120.09,R,4.53,N,A*35***.

L'FB controlla correttezza dei campi della sentenza e ne estrae le informazioni di velocità e direzione. L'uscita ***Done*** si attiva per un loop ad ogni ricezione di sentenza MWv corretta.

Enable (BOOL)	Abilitazione blocco funzione.
NMEAID (UDINT)	ID interfaccia con sistema NMEA fornito in uscita dal blocco funzione ***NMEASInterface***.
Done (BOOL)	Attivo per un loop di programma su ricezione sentenza MWV corretta.
Fault (BOOL)	Attivo per un loop di programma se errore sentenza.
WSpeed (REAL)	Valore di velocità del vento (Nodi).
WPAngle (REAL)	Valore angolo polare (Relative) direzione vento.

Codici di errore

In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

10020010 ***NMEAID*** non definito.

10020020 ***NMEAID*** non corretto.

10020100 Errore nel valore di velocità vento.

7.20 Funzioni ed FB supporto inverter Power One (ePowerOneLib)

Power One è uno dei principali produttori mondiale di sistemi di alimentazione. Power One è di diritto anche nel settore delle energie alternative con applicazioni per sistemi eolici ed inverter fotovoltaici. Oggi una strategia convincente nell’ambito delle energie alternative non può prescindere dallo sviluppo di soluzioni per il risparmio energetico.

La linea di Inverter fotovoltaici Aurora, comprende sia modelli per la connessione in rete sia isolati, con o senza trasformatore e concepiti per applicazioni da esterno e da interno. Tutti i prodotti della gamma si posizionano per soluzioni di progetto e tecnologia costruttiva ai vertici del mercato e sono caratterizzati da elevatissima affidabilità, innovazione ed efficienza.

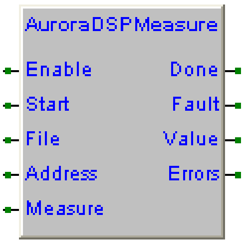
Inverter Aurora

Alta efficienza di conversione e estrema facilità di manutenzione grazie alla possibilità di inserzione e disinserzione rapida dei moduli fotovoltaici. La scalabilità del sistema grazie alla architettura "Add-on" consente di coprire un’ampia gamma di applicazioni (fino a 300kW su singolo armadio).

Disponibile anche la versione senza trasformatore BT per connessione diretta ad una cella di media tensione (con trasf. MT).

7.20.1 AuroraDSPMeasure, Aurora measure request to DSP

Type	Library	Version
FB	ePowerOneLib	SFR062A000



Questo blocco funzione esegue la lettura delle misure dal DSP di un inverter Aurora della Power One, connesso al dispositivo di I/O definito in ***File***. Questo è un blocco funzione protetto per utilizzarlo occorre richiedere il codice di protezione, vedi ***protezione funzioni e blocchi funzione***. E' comunque possibile utilizzarlo liberamente in modo test per 30 Min. Viene utilizzato il FB ***CRCPolinomial*** per il calcolo del CRC dei frame dati da e verso l'inverter.

La connessione con gli inverters è in RS485 multidrop, occorre definire in ***Address*** l'indirizzo dell'inverter con cui si vuole dialogare. In ***Measure*** occorre indicare il codice della misura da leggere (Vedi codici misura).

Attivando l'ingresso Start viene eseguita la lettura della misura indicata, terminata la lettura viene attivata per un loop l'uscita ***Done***, in caso di errore esecuzione viene attivata per un loop l'uscita ***Fault*** ed incrementato il valore in ***Errors***.

Enable (BOOL)	Comando di abilitazione blocco funzione.
Start (BOOL)	Comando di esecuzione lettura misura.
File (FILEP)	Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.
Address (USINT)	Indirizzo inverter (Range da 0 a 255).
Measure (USINT)	Tipo misura da effettuare su inverter (Vedi codici misura).
Done (BOOL)	Attivo per un loop al termine della esecuzione del comando.
Fault (BOOL)	Attivo per un loop su errore esecuzione del comando.
Value (REAL)	Valore misura acquisito da inverter (E' nella relativa unità di misura).
Errors (UDINT)	Numero di errori, incrementato ad ogni nuovo errore, raggiunto valore massimo riparte da 0.

Codici misura

Nella variabile ***Measure*** occorre definire il codice della misura da effettuare dall'inverter secondo la tabella.

Codice	Descrizione	Um
1	Grid Voltage (For three-phases systems is the mean)	V
2	Grid Current (For three-phases systems is the mean)	A
3	Grid Power (For three-phases systems is the mean)	W
4	Frequency (For three-phases systems is the mean)	Hz
5	Vbulk (For Inverter with more Bulk is the sum)	V
6	Ileak (Dc/Dc)	A
7	Ileak (Inverter)	A
21	Inverter Temperature	°C
22	Booster Temperature	°C
23	Input 1 Voltage (Input Voltage for single channel module)	V
25	Input 1 Current (Input Current for single channel module)	A
26	Input 2 Voltage (Input Voltage for single channel module)	V
27	Input 2 Current (Input Current for single channel module)	A
28	Grid Voltage (Dc/Dc)	V
29	Grid Frequency (Dc/Dc)	Hz

Codice	Descrizione	Um
30	Isolation Resistance (Riso)	
31	Vbulk (Dc/Dc)	V
32	Average Grid Voltage (VgridAvg)	V
33	VbulkMid	V
34	Power Peak	W
35	Power Peak Today	W
36	Grid Voltage neutral	V
37	Wind Generator Frequency	Hz
38	Grid Voltage neutral-phase	V
39	Grid Current phase r	A
40	Grid Current phase s	A
41	Grid Current phase t	A
42	Frequency phase r	Hz
43	Frequency phase s	Hz
44	Frequency phase t	Hz
45	Vbulk +	V
46	Vbulk -	V
47	Supervisor Temperature	°C
48	Alim. Temperature	°C
49	Heat Sink Temperature	°C
61	Grid Voltage phase r	V
62	Grid Voltage phase s	V
63	Grid Voltage phase t	V

Codici di errore

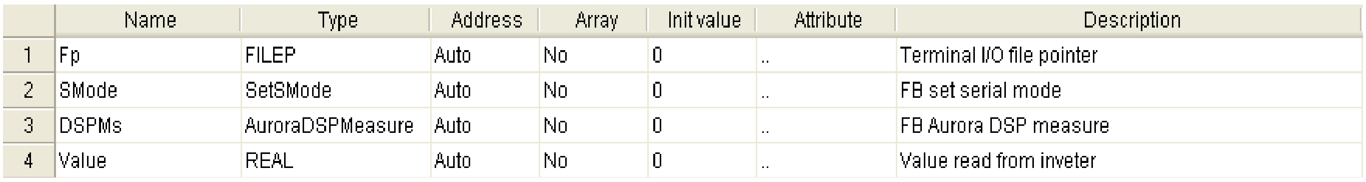
In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

10030010	Valore di ***File*** non definito.
10030020	FB protetta, terminato tempo funzionamento in modo demo.
10030050	Timeout esecuzione.
10030070	Errore case gestione.
10030100	Errore CRC risposta da inverter Aurora.
10030200	Errore ricezione “Transmission state” da inverter Aurora.
10030251	Errore da inverter Aurora “Command is not implemented”.
10030252	Errore da inverter Aurora “Variable does not exist”.
10030253	Errore da inverter Aurora “Variable value is out of range”.
10030254	Errore da inverter Aurora “EEprom not accessible”.
10030255	Errore da inverter Aurora “Not Toggled Service Mode”.
10030256	Errore da inverter Aurora “Can not send the command to internal micro”.
10030257	Errore da inverter Aurora “Command not Executed”.
10030258	Errore da inverter Aurora “The variable is not available, retry”.

Esempi

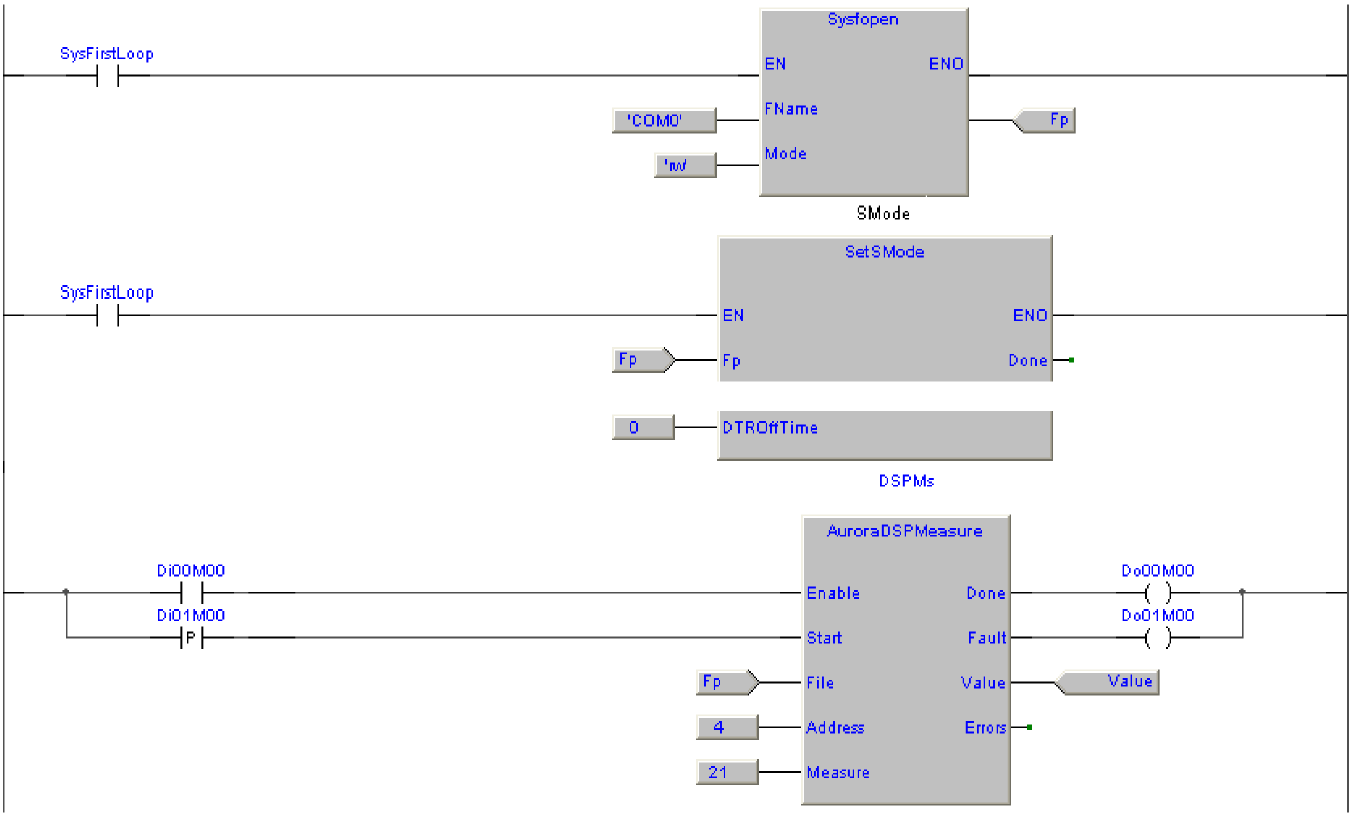
Viene eseguita la lettura della misura 21 (Inverter Temperature) dall'inverter con indirizzo 4, il valore ritornato è trasferito nella variabile ***Value***. Di default la porta seriale và impostata a ***19200, n 8, 1***.

Definizione variabili



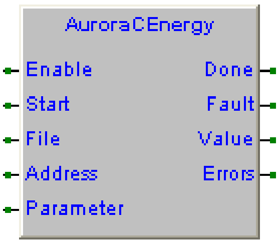
	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	Terminal I/O file pointer
2	SMode	SetSMode	Auto	No	0	..	FB set serial mode
3	DSPMs	AuroraDSPMeasure	Auto	No	0	..	FB Aurora DSP measure
4	Value	REAL	Auto	No	0	..	Value read from inveter

Esempio LD



7.20.2 AuroraCEnergy, Aurora cumulated energy reading

Type	Library	Version
FB	ePowerOneLib	SFR062A000



Questo blocco funzione esegue la lettura della energia generata da un inverter Aurora della Power One, connesso al dispositivo di I/O definito in ***File***. Questo è un blocco funzione protetto per utilizzarlo occorre richiedere il codice di protezione, vedi ***protezione funzioni e blocchi funzione***. E' comunque possibile utilizzarlo liberamente in modo test per 30 Min. Viene utilizzato il FB ***CRCPolinomial*** per il calcolo del CRC dei frame dati da e verso l'inverter.

La connessione con gli inverters è in RS485 multidrop, occorre definire in ***Address*** l'indirizzo dell'inverter con cui si vuole dialogare. In ***Parameter*** occorre indicare il parametro da leggere (Vedi codici parametro).

Attivando l'ingresso Start viene eseguita la lettura della misura indicata, terminata la lettura viene attivata per un loop l'uscita ***Done***, in caso di errore esecuzione viene attivata per un loop l'uscita ***Fault*** ed incrementato il valore in ***Errors***.

Enable (BOOL)	Comando di abilitazione blocco funzione.
Start (BOOL)	Comando di esecuzione lettura misura.
File (FILEP)	Flusso dati ***stream*** ritornato dalla funzione ***Sysfopen***.
Address (USINT)	Indirizzo inverter (Range da 0 a 255).
Parameter (USINT)	Codice parametro da acquisire da inverter (Vedi codici parametro).
Done (BOOL)	Attivo per un loop al termine della esecuzione del comando.
Fault (BOOL)	Attivo per un loop su errore esecuzione del comando.
Value (UDINT)	Valore parametro acquisito da inverter (E' nella relativa unità di misura).
Errors (UDINT)	Numero di errori, incrementato ad ogni nuovo errore, raggiunto valore massimo riparte da 0.

Codici parametro

Nella variabile ***Parameter*** occorre definire il codice del parametro da leggere dall'inverter secondo la tabella.

Codice	Descrizione	Um
0	Daily energy	Kw
1	Weekly Energy	Kw
3	Month Energy (Energy from the first day of current calendar month)	Kw
4	Year Energy (Energy from the first day of current calendar year)	Kw
5	Total Energy (Total lifetime)	Kw
6	Partial Energy (Cumulated since reset)	Kw

Codici di errore

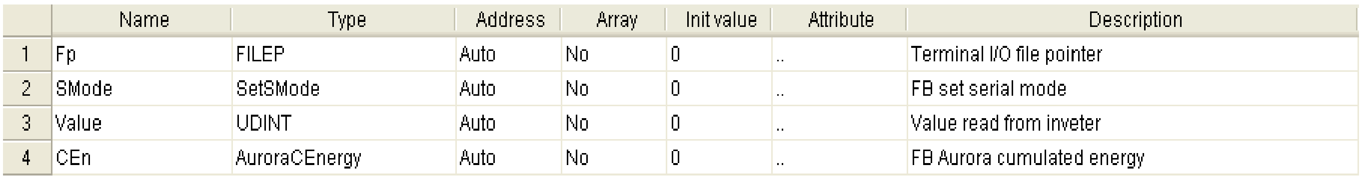
In caso di errore si attiva l'uscita ***Fault***, con ***SysGetLastError*** è possibile rilevare il codice di errore.

10031010	Valore di ***File*** non definito.
10031020	FB protetta, terminato tempo funzionamento in modo demo.
10031050	Timeout esecuzione.
10031060	Codice parametro errato.
10031070	Errore case gestione.
10031100	Errore CRC risposta da inverter Aurora.

Esempi

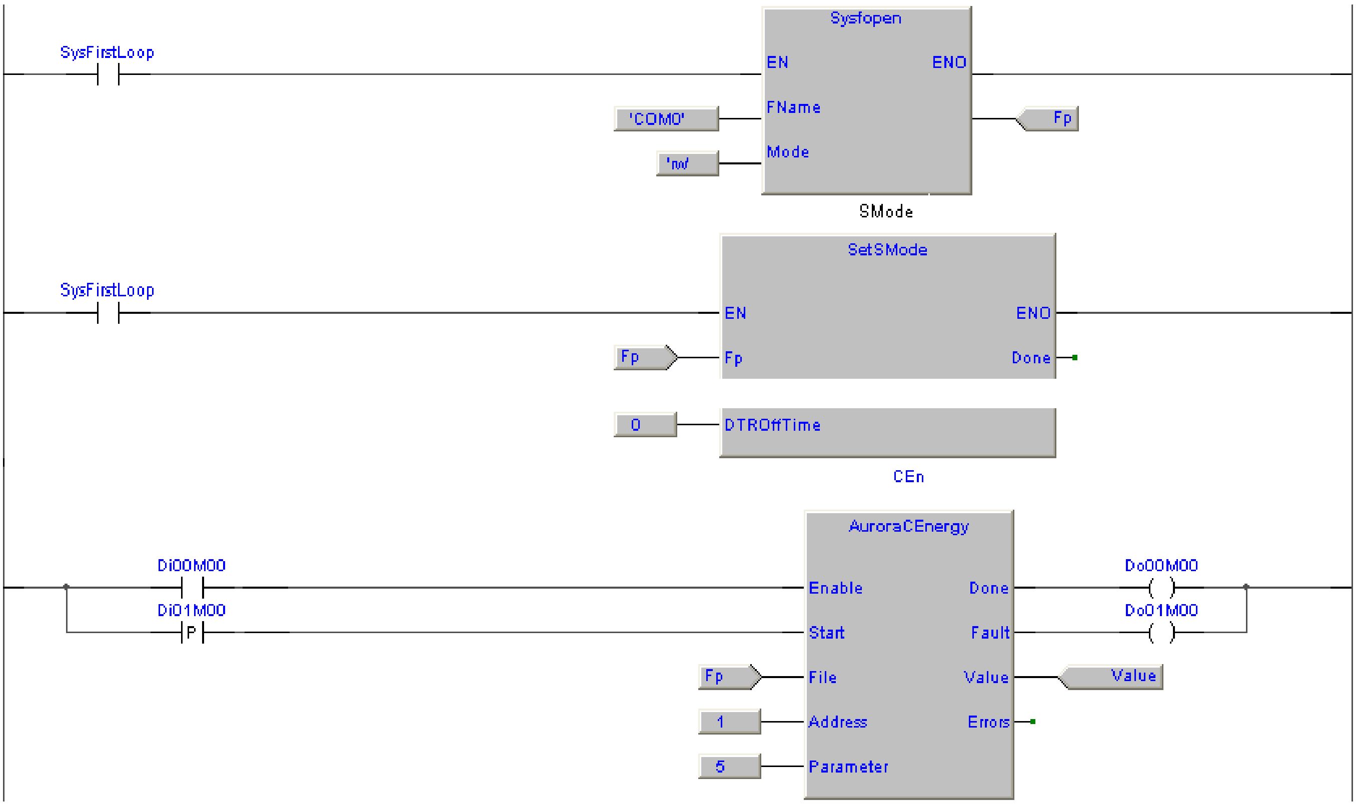
Viene eseguita la lettura del totale energia prodotta dall'inverter con indirizzo 1, il valore ritornato è trasferito nella variabile ***Value***. Di default la porta seriale và impostata a ***19200, n 8, 1***.

Definizione variabili



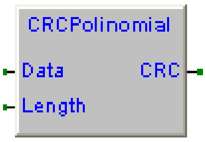
	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	Terminal I/O file pointer
2	SMode	SetSMode	Auto	No	0	..	FB set serial mode
3	Value	UDINT	Auto	No	0	..	Value read from inveter
4	CEn	AuroraCEnergy	Auto	No	0	..	FB Aurora cumulated energy

Esempio LD



7.20.3 CRCPolinomial, CRC polinomial calculation

Type	Library	Version
FB	ePowerOneLib	SFR062A000



Questo blocco funzione esegue il calcolo del CRC su di un array di dati in accordo allo standard CCITT. Questo tipo di CRC è utilizzato come controllo sul frame dati da e verso l'inverter Aurora.

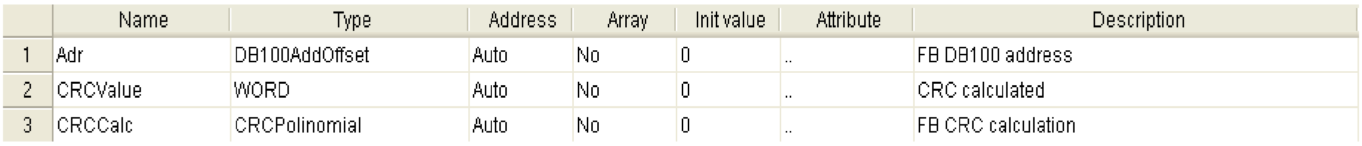
In ***Data*** occorre indicare l'indirizzo dell'array di dati su cui calcolare il CRC, ***Length*** indica la lunghezza dell'array in byte. In ***CRC*** è ritornato il valore del CRC calcolato.

Data (@USINT)	Indirizzo array dati su cui eseguire il calcolo del CRC.
Length (USINT)	Lunghezza array in bytes.
CRC (UINT)	CRC calcolato.

Esempi

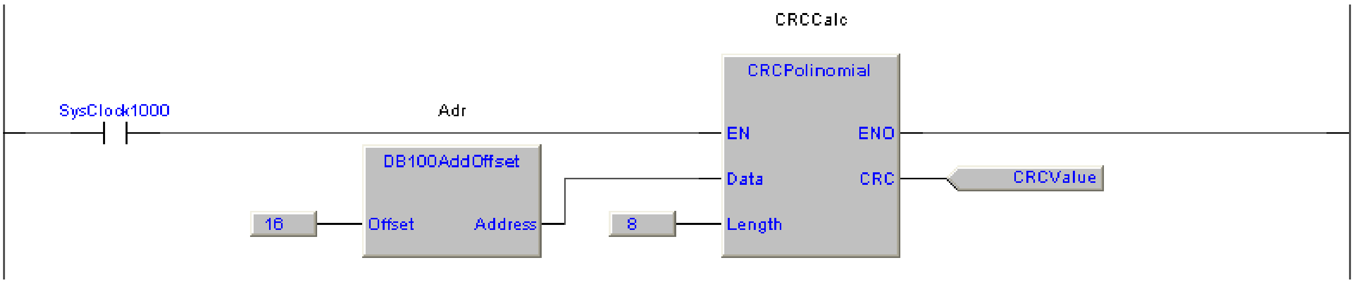
Viene eseguito il calcolo del CRC su di un array di dati. Supponendo di avere un array di 8 bytes allocato in DB100 all'indirizzo 16 che contiene i valori 16#04, 16#3B, 16#1B, 16#00, 16#00, 16#00, 16#00, 16#00 , il CRC calcolato sarà 16#5AF0.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	Adr	DB100AddOffset	Auto	No	0	..	FB DB100 address
2	CRCValue	WORD	Auto	No	0	..	CRC calculated
3	CRCCalc	CRCPolinomial	Auto	No	0	..	FB CRC calculation

Esempio LD



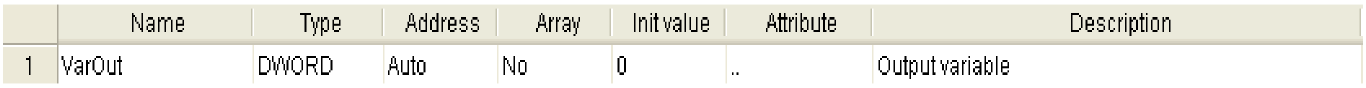
8 Tips and tricks

8.1 Swap variabile DWORD

Ecco come utilizzare la funzione ***ROL*** per eseguire lo swap su variabile ***DWORD***.

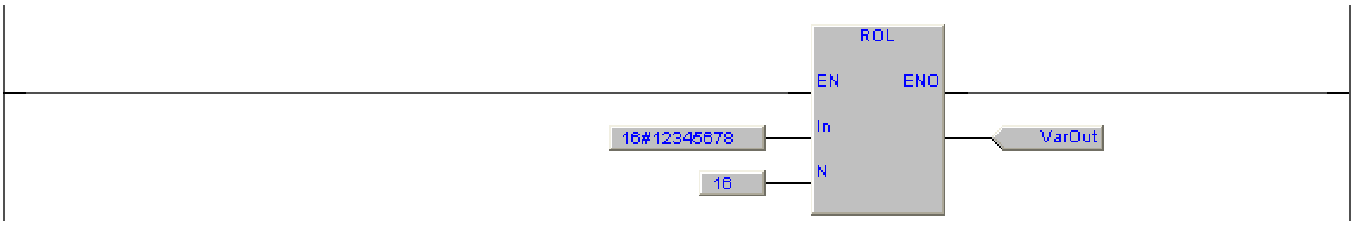
Nell'esempio Il valore ***16#12345678*** viene trasformato nel valore ***16#56781234*** e trasferito nella variabile **VarOut**.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	VarOut	DWORD	Auto	No	0	..	Output variable

Esempio LD



Esempio IL

```
LD  16#12345678
ROL 16
ST  VarOut (* Output variable *)
```

Esempio ST

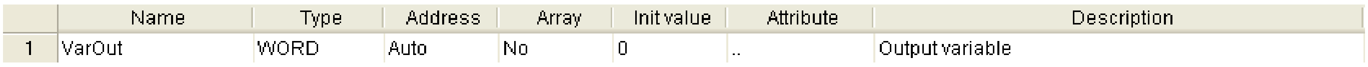
```
VarOut:=ROL(16#12345678, 16); (* Output variable *)
```

8.2 Swap variabile WORD

Ecco come utilizzare la funzione ***ROL*** per eseguire lo swap su variabile ***WORD***.

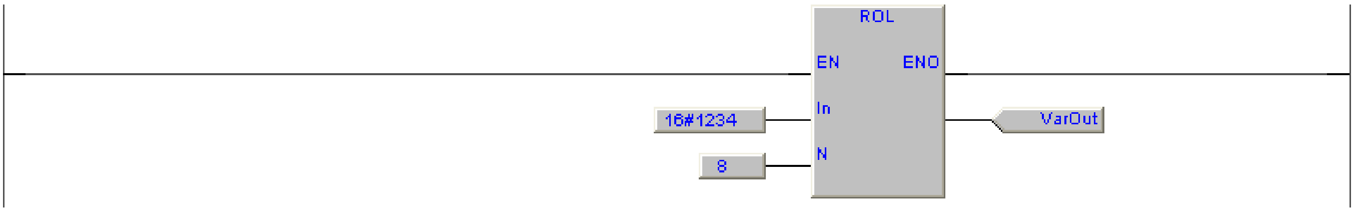
Nell'esempio Il valore ***16#1234*** viene trasformato nel valore ***16#3412*** e trasferito nella variabile **VarOut**.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	VarOut	WORD	Auto	No	0	..	Output variable

Esempio LD



Esempio IL

```
LD  16#1234
ROL 8
ST  VarOut (* Output variable *)
```

Esempio ST

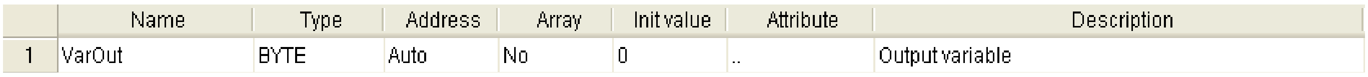
```
VarOut:=ROL(16#1234, 8); (* Output variable *)
```

8.3 Swap variabile BYTE

Ecco come utilizzare la funzione ***ROL*** per eseguire lo swap su variabile ***BYTE***.

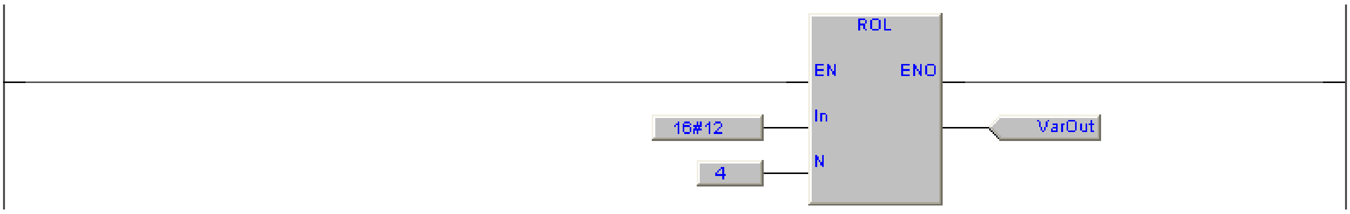
Nell'esempio Il valore ***16#12*** viene trasformato nel valore ***16#21*** e trasferito nella variabile **VarOut**.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	VarOut	BYTE	Auto	No	0	..	Output variable

Esempio LD



Esempio IL

```
LD  16#12
ROL 4
ST  VarOut (* Output variable *)
```

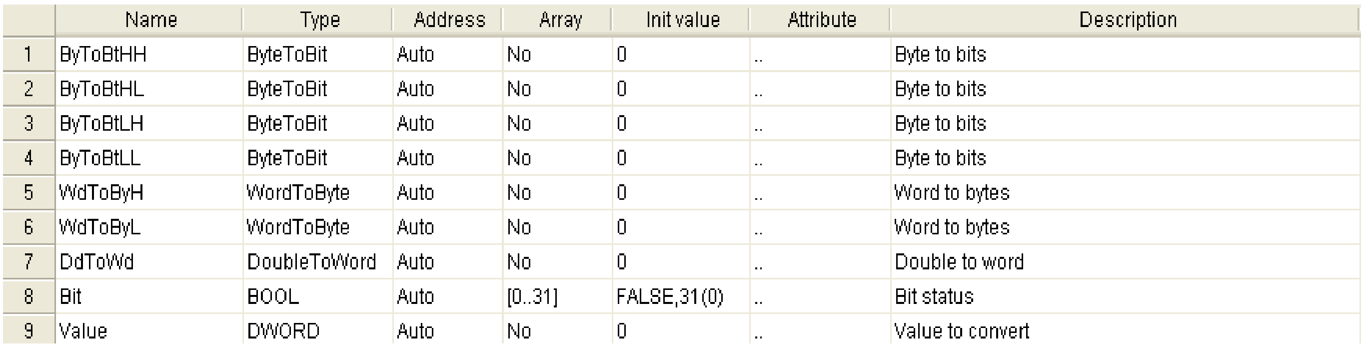
Esempio ST

```
VarOut:=ROL(16#12, 4); (* Output variable *)
```

8.4 Espandere DWORD in 32 BOOL

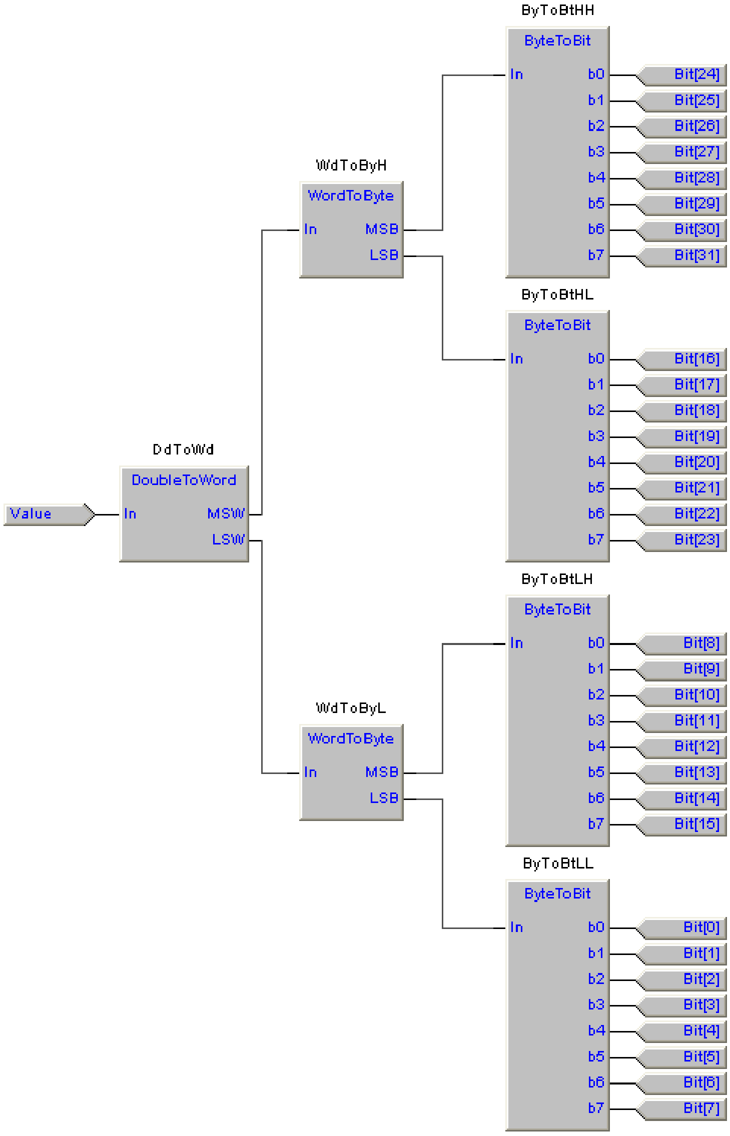
Ecco un come utilizzando i blocchi funzione ***DoubleToWord***, ***WordToByte***, ***ByteToBit*** sia possibile espandere una variabile ***DWORD*** in 32 variabili ***BOOL***.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	ByToBtHH	ByteToBit	Auto	No	0	..	Byte to bits
2	ByToBtHL	ByteToBit	Auto	No	0	..	Byte to bits
3	ByToBtLH	ByteToBit	Auto	No	0	..	Byte to bits
4	ByToBtLL	ByteToBit	Auto	No	0	..	Byte to bits
5	WdToByH	WordToByte	Auto	No	0	..	Word to bytes
6	WdToByL	WordToByte	Auto	No	0	..	Word to bytes
7	DdToWd	DoubleToWord	Auto	No	0	..	Double to word
8	Bit	BOOL	Auto	[0..31]	FALSE,31(0)	..	Bit status
9	Value	DWORD	Auto	No	0	..	Value to convert

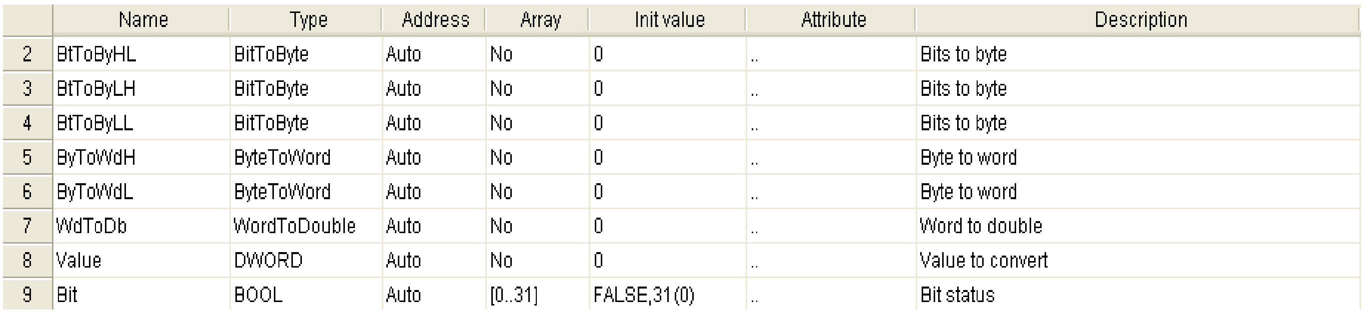
Esempio FBD *(Ptp114a200)*



8.5 Comprimere 32 BOOL in DWORD

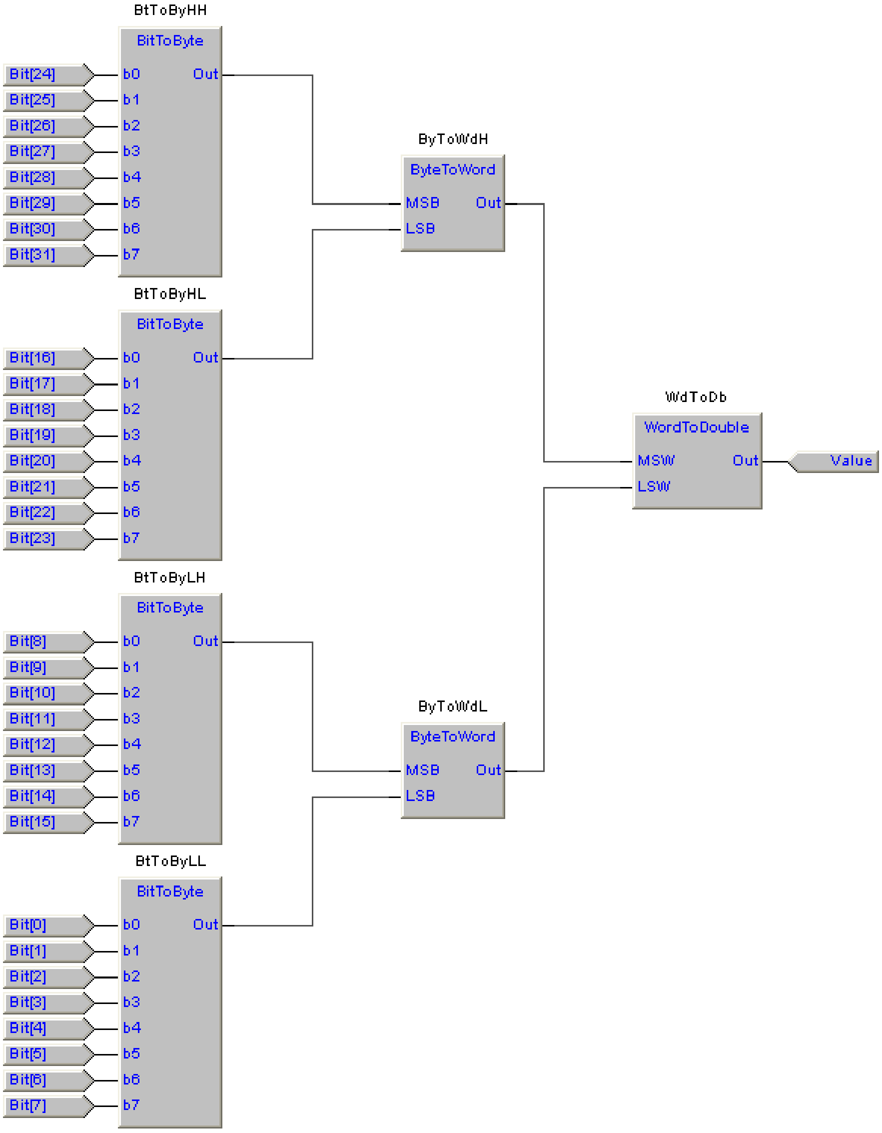
Ecco come utilizzando i blocchi funzione ***BitToByte***, ***ByteToWord***, ***WordToDouble*** sia possibile comprimere 32 variabili ***BOOL*** in una variabile ***DWORD***.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
2	BtToByHL	BitToByte	Auto	No	0	..	Bits to byte
3	BtToByLH	BitToByte	Auto	No	0	..	Bits to byte
4	BtToByLL	BitToByte	Auto	No	0	..	Bits to byte
5	ByToWdH	ByteToWord	Auto	No	0	..	Byte to word
6	ByToWdL	ByteToWord	Auto	No	0	..	Byte to word
7	WdToDb	WordToDouble	Auto	No	0	..	Word to double
8	Value	DWORD	Auto	No	0	..	Value to convert
9	Bit	BOOL	Auto	[0..31]	FALSE,31(0)	..	Bit status

Esempio FBD *(Ptp114a200)*



8.6 Definire caratteri ascii non stampabili

Nella gestione di protocolli di comunicazione e/o per impostare modalità di stampa su stampanti necessita eseguire l'output di caratteri ascii non stampabili, cioè caratteri con codici inferiori al 16#20 o superiori al 16#7F.

Per la definizione dei caratteri ascii stampabili basta includere tra apici singoli i caratteri (Esempio ***'abcd'***).

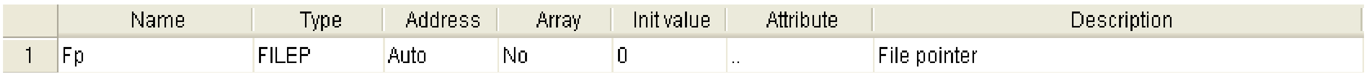
Per i caratteri non stampabili, occorre anteporre al valore esadecimale del carattere il simbolo $, quindi per il carattere di <STX> 16#02 avremo la definizione ***'$02'***, per <ETX> ***'$03'*** e così di seguito.

Ricordo che alcuni caratteri di controllo come il line feed, codice 16#0A, sia possibile definirli sia come ***'$0A'*** che come ***'$l'***. Il carriage return, codice 16#0D, è possibile definirlo sia come ***'$0D'*** che come ***'$r'***. Riporto tabella esplicativa.

Sequenza	Significato	Esadecimale	Esempio
$$	Carattere $	16#24	’I paid $$5 for this’
$'	Apostrofo	16#27	’Enter $’Y$’ for YES’
$l	Line feed	16#0A	’next $l line’
$r	Carriage return	16#0D	'Hello$r'
$n	New line	16#0D0A	’This is a line$n’
$p	New page	16#0C	’last line $p first line’
$t	Tabulazione	16#09	’name$tsize$tdate’
$hh		16#hh	’ABCD = $41$42$43$44’

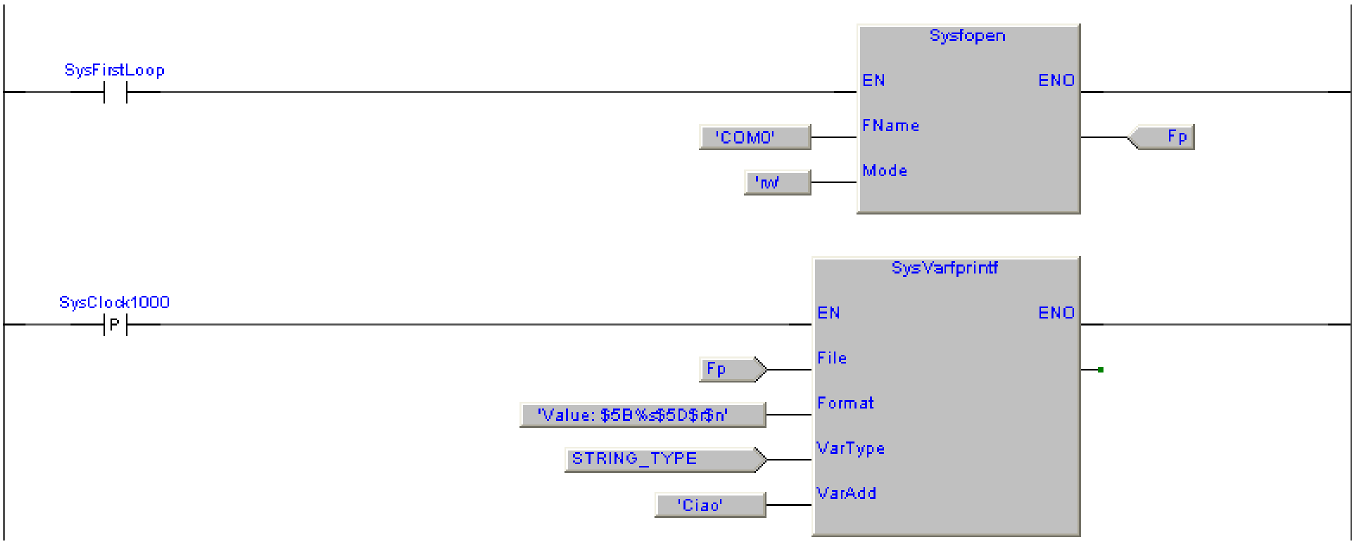
Ecco un esempio di utilizzo della funzione ***SysVarfprintf*** per definire oltre ai caratteri stampabili anche i caratteri non stampabili ed inviarli verso lo stream di uscita. In questo esempio viene inviato verso la porta seriale ***COM0*** la stringa ***[Ciao]*** seguita da carriage return e line feed.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	File pointer

Esempio LD

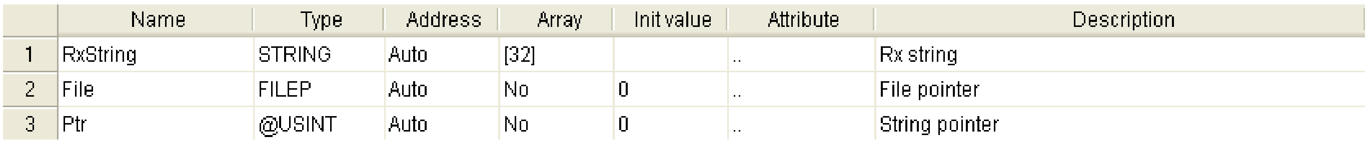


8.7 Rx/Tx dati su stream

Come si è visto con la funzione ***Sysfopen*** è possibile definire un collegamento tra una risorsa di I/O ed un flusso di dati ***stream*** da cui è possibile gestire la ricezione e/o la trasmissione di dati.

Per la ricezione dei dati in ingresso dallo stream si utilizza la funzione per controllo se dati presenti ***SysGetIChars*** e la funzione per la lettura degli stessi ***Sysfgetc***.

Definizione variabili



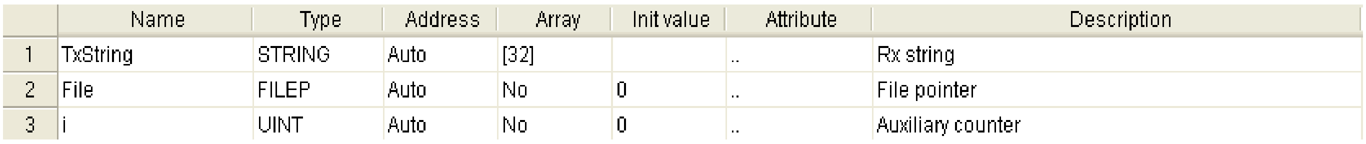
	Name	Type	Address	Array	Init value	Attribute	Description
1	RxString	STRING	Auto	[32]		..	Rx string
2	File	FILEP	Auto	No	0	..	File pointer
3	Ptr	@USINT	Auto	No	0	..	String pointer

Esempio ST

```
(* Rx data from stream. *)

Ptr:=ADR(RxString); (* String pointer *)

WHILE (TO_BOOL(SysGetIChars(File))) DO
    @Ptr:=TO_USINT(Sysfgetc(File)); (* Rx string *)
    Ptr:=Ptr+1; (* String pointer *)

    (* Check if string pointer overflow. *)

    IF (Ptr > ADR(RxString)+31) THEN EXIT; END_IF;
END_WHILE;
```

Per la trasmissione dei dati in uscita dallo ***stream*** si utilizza la funzione che controlla se spazio disponibile ***SysGetOSpace***, e se lo spazio è sufficiente a contenere la stringa, o come nell'esempio, se il buffer di uscita è vuoto è possibile trasferire la stringa sullo stream con la funzione ***SysVarfprintf***.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	TxString	STRING	Auto	[32]		..	Rx string
2	File	FILEP	Auto	No	0	..	File pointer
3	i	UINT	Auto	No	0	..	Auxiliary counter

Esempio ST

```
(* Tx data to stream. *)

IF (TO_UDINT(SysGetOSpace(File)) = SysGetTxBSize(File)) THEN
    i:=TO_UINT(SysVarfprintf(File, '%s', STRING_TYPE, ADR(TxString)));
END_IF;
```

9 Appendici

9.1 Tabella istruzioni IL

Istruzione	Operandi	Descrizione
LD	Tutti	Carica il valore operando nell'accumulatore
LDN	Tutti	Carica il valore negato operando nell'accumulatore
ST	Tutti	Trasferisce il valore dell'accumulatore nell'operando
STN	Tutti	Trasferisce il valore negato dell'accumulatore nell'operando
S	BOOL	Setta l'operando (Accetta solo BOOL) se l'accumulatore è TRUE
R	BOOL	Resetta l'operando (Accetta solo BOOL) se l'accumulatore è TRUE
AND	Tutti meno REAL	AND a bit tra accumulatore e valore operando, risultato in accumulatore
ANDN	Tutti meno REAL	AND a bit tra accumulatore e valore negato operando, risultato in accumulatore
OR	Tutti meno REAL	OR a bit tra accumulatore e valore operando, risultato in accumulatore
ORN	Tutti meno REAL	OR a bit tra accumulatore e valore negato operando, risultato in accumulatore
XOR	Tutti meno REAL	XOR a bit tra accumulatore e valore operando, risultato in accumulatore
XORN	Tutti meno REAL	XOR a bit tra accumulatore e valore negato operando, risultato in accumulatore
NOT		Esegue l'inversione a bit del valore in accumulatore
ADD	Tutti meno BOOL	Somma tra accumulatore e valore operando, risultato in accumulatore
SUB	Tutti meno BOOL	Sottrazione tra accumulatore e valore operando, risultato in accumulatore
MUL	Tutti meno BOOL	Moltiplicazione tra accumulatore e valore operando, risultato in accumulatore
DIV	Tutti meno BOOL	Divisione tra accumulatore e valore operando, risultato in accumulatore
MOD	Tutti meno BOOL	Ritorna il modulo della divisione nell'accumulatore
GT	Tutti meno BOOL	Controlla se accumulatore > operando, risultato (BOOL) in accumulatore
GE	Tutti meno BOOL	Controlla se accumulatore >= operando, risultato (BOOL) in accumulatore
EQ	Tutti meno BOOL	Controlla se accumulatore = operando, risultato (BOOL) in accumulatore
NE	Tutti meno BOOL	Controlla se accumulatore <> operando, risultato (BOOL) in accumulatore
LE	Tutti meno BOOL	Controlla se accumulatore <= operando, risultato (BOOL) in accumulatore
LT	Tutti meno BOOL	Controlla se accumulatore < operando, risultato (BOOL) in accumulatore
JMP	Etichetta	Salta incondizionatamente su etichetta
JMPC	Etichetta	Salta su etichetta se accumulatore diverso da zero
JMPCN	Etichetta	Salta su etichetta se accumulatore uguale a zero
CAL	FB	Esegue incondizionatamente il blocco funzione
CALC	FB	Esegue blocco funzione se accumulatore diverso da zero
CALCN	FB	Esegue blocco funzione se accumulatore uguale a zero
RET		Ritorna incondizionatamente al programma che ha eseguito CALL
RETC		Ritorna al programma che ha eseguito CALL se accumulatore diverso da zero

9.2 Operatori linguaggio ST

Nella tabella seguente sono riportati gli operatori utilizzabili nel linguaggio ST. Gli operatori sono riportati in tabella in base alla loro priorità, dall'alto verso il basso, quindi le parentesi hanno priorità maggiore su tutti gli altri operatori.

Operatore	**Simbolo**	**Esempio**
Parenthesization	(Espressione)	
Function evaluation	Funzione(Argomenti)	`LN(A), MAX(X,Y), etc.`
Negation	-	
Complement	NOT	
Exponentiation	**	
Multiply	*	
Divide	/	
Modulo	MOD	
Add	+	
Subtract	-	
Comparison	< , > , <= , >=	
Equality	=	
Inequality	<>	
Boolean AND	&	
Boolean AND	AND	
Boolean Exclusive OR	XOR	
Boolean OR	OR	

9.3 Statements linguaggio ST

Nella tabella seguente sono riportati gli operatori utilizzabili nel linguaggio ST. Gli operatori sono riportati in tabella in base alla loro priorità, dall'alto verso il basso, quindi le parentesi hanno priorità maggiore su tutti gli altri operatori.

Statement	**Esempio**
Assignment	`A:=B; CV:=CV+1; C:=SIN(X);`
FB Invocation and output usage	`CMD_TMR(IN:=%IX5, PT:=T#300ms);` `A:=CMD_TMR.Q;`
RETURN	`RETURN;`

IF

```
D:=B*B-4*A*C;

IF D < 0.0 THEN NROOTS:=0;
ELSIF D=0.0 THEN
    NROOTS:=1;
    X1:=-B/(2.0*A);
ELSE
    NROOTS:=2;
    X1:=(-B+SQRT(D))/(2.0*A);
    X2:=(-B-SQRT(D))/(2.0*A);
END_IF;
```

CASE

```
TW:=BCD_TO_INT(THUMBWHEEL);
TW_ERROR:=0;

CASE TW OF
    1,5: DISPLAY:=OVEN_TEMP;
    2: DISPLAY:=MOTOR_SPEED;
    3: DISPLAY:=GROSS-TARE;
    4,6..10: DISPLAY:=STATUS(TW-4);
ELSE
    DISPLAY:=0;
    TW_ERROR:=1;
END_CASE;

QW100:=INT_TO_BCD(DISPLAY);
```

FOR

```
J:=101;

FOR I:=1 TO 100 BY 2 DO
    IF WORDS[I]='KEY' THEN
        J:=I;
        EXIT;
    END_IF;
END_FOR;
```

WHILE

```
J:=1;

WHILE J <= 100 & WORDS[J]<>'KEY' DO
    J:=J+2;
END_WHILE;
```

REPEAT

```
J:=-1;

REPEAT
    J:=J+2;
UNTIL J=101 OR WORDS[J]='KEY'
END_REPEAT ;
```

EXIT	`EXIT;`
Empty Statement	`;`

9.4 Conversione tipo dati

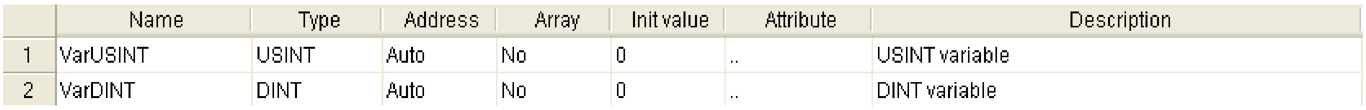
Nella stesura di programmi capita frequentemente di dover eseguire una conversione di tipo (Detto anche ***casting***), in pratica ci si riferisce all'operazione di passaggio di una variabile da un tipo di dato ad un altro. Nella programmazione IEC con LogicLab sono previste apposite funzioni di conversione di tipo, vediamole.

Name	**Input type**	**Output type**	**Function**
DINT_TO_INT	DINT	INT	Converts a long integer (32 bits, signed) into an integer (16 bits, signed)
INT_TO_DINT	INT	DINT	Converts an integer (16 bits, signed) into a long integer (32 bits, signed)
TO_BOOL	Any	BOOL	Converts any data type into a boolean
TO_SINT	Any	SINT	Converts any data type into a short integer (8 bits, signed)
TO_USINT	Any	USINT	Converts any data type into an unsigned short integer (8 bits, unsigned)
TO_INT	Any	INT	Converts any data type into an integer (16 bits, signed)
TO_UINT	Any	UINT	Converts any data type into an unsigned integer (16 bits, unsigned)
TO_DINT	Any	DINT	Converts any data type into a long integer (32 bits, signed)
TO_UDINT	Any	UDINT	Converts any data type into an unsigned long integer (32 bits, unsigned)
TO_REAL	Any	REAL	Converts any data type into a floating point (32 bits, signed)

Esempi

Conversione di una variabile di tipo DINT in una variabile di tipo USINT nei diversi linguaggi di programmazione. Naturalmente se il valore della variabile ***VarDINT*** supera il valore 255 (Limite della variabile ***VarUSINT***), verrà ritornato il resto della divisione per il limite.

Definizione variabili



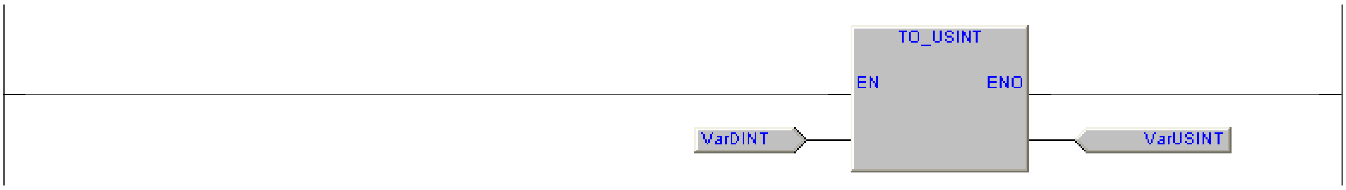
	Name	Type	Address	Array	Init value	Attribute	Description
1	VarUSINT	USINT	Auto	No	0	..	USINT variable
2	VarDINT	DINT	Auto	No	0	..	DINT variable

Esempio IL

```
LD   VarDINT (* DINT variable *)
TO_USINT
ST   VarUSINT (* USINT variable *)
```

Esempio FBD

Esempio LD



Esempio ST

```
VarUSINT:=TO_USINT(VarDINT); (* USINT variable *)
```

9.5 Errori di esecuzione

Alcune funzione e/o blocchi funzione possono avere errori di esecuzione, tipicamente è ritornata una flag di fault che indica l'errore. Per acquisire il codice di errore utilizzare la funzione ***SysGetLastError***, ritorna il codice dell'ultimo errore, và eseguita immediatamente dopo la funzione di cui si vuole controllare l'errore. Da debug è possibile controllare il valore della variabile ***SysLastError*** che sarà ***0*** se nessun errore oppure ritornerà il valore dell'ultimo errore riscontrato nella esecuzione.

ID	Range errore	Funzione o FB
9958	9958000 ÷ 9958999	Sysfseek, file seek
9959	9959000 ÷ 9959999	Sysfilelength, file lengh
9960	9960000 ÷ 9960999	Sysrename, file rename
9961	9961000 ÷ 9961999	Sysremove, file remove
9962	9962000 ÷ 9962999	SysFOBfFlush, file output buffer flush
9963	9963000 ÷ 9963999	SysFOBfClear, file output buffer clear
9964	9964000 ÷ 9964999	SysFIBfClear, file input buffer clear
9965	9965000 ÷ 9965999	SysGetTxBSize, get file Tx output buffer size
9966	9966000 ÷ 9966999	SysGetRxBSize, get file Rx input buffer size
9967	9967000 ÷ 9967999	SysGetOSpace, get output available space on file
9968	9968000 ÷ 9968999	SysGetIChars, get input available characters from file
9969	9969000 ÷ 9969999	Sysfwrite, write data to file
9970	9970000 ÷ 9970999	Sysfread, read data from file
9971	9971000 ÷ 9971999	Sysfputc, put character to file
9972	9972000 ÷ 9972999	Sysfgetc, get character from file
9973	9973000 ÷ 9973999	Sysfclose, file close
9974	9974000 ÷ 9974999	SysIPReach, IP address is reachable
9975	9975000 ÷ 9975999	SysUDPSktRcv, UDP socket receive
9976	9976000 ÷ 9976999	SysUDPSktSend, UDP socket send
9977	9977000 ÷ 9977999	SysSktListen, socket listen
9978	9978000 ÷ 9978999	SysGetCrc, get CRC value
9979	9979000 ÷ 9979999	SysDMXMng, DMX management
9980	9980000 ÷ 9980999	SysGetEncoder, get encoder input
9981	9981000 ÷ 9981999	SysGetCounter, get counter
9982	9982000 ÷ 9982999	SysSetAnOut, set analog output
9983	9983000 ÷ 9983999	SysGetAnInp, get analog input
9984	9984000 ÷ 9984999	SysSetPhrDO, set peripheral digital output
9985	9985000 ÷ 9985999	SysGetPhrDI, get peripheral digital input
9986	9986000 ÷ 9986999	SysETimeToDate, epoch time to date conversion
9987	9987000 ÷ 9987999	SysDateToETime, date to epoch time conversion
9988	9988000 ÷ 9988999	SysPhrVWr, write variable to peripheral module
9989	9989000 ÷ 9989999	SysPhrVRd, read variable from peripheral module
9990	9990000 ÷ 9990999	SysPhrInfos, get infos from peripheral modules
9991	9991000 ÷ 9991999	SysPCodeAccept, accepts the protection code
9992	9992000 ÷ 9992999	SysSetSerialDTR, set DTR signal status

9993	9993000 ÷ 9993999	SysGetSerialCTS, get serial CTS signal status
9994	9994000 ÷ 9994999	SysSetSerialMode, set serial mode
9995	9995000 ÷ 9995999	SysGetSerialMode, get serial mode
9996	9996000 ÷ 9996999	Sysfopen, file open
9997	9997000 ÷ 9997999	SysVarsnprintf, variable print to string
9998	9998000 ÷ 9998999	SysVarfprintf, variable print to file
9999	9999000 ÷ 9999999	SysVarsscanf, extracts values from string
10000	10000000 ÷ 10000999	MDBRTUMASTER, modbus Rtu master
10001	10001000 ÷ 10001999	CPUModuleIO, CPU module I/O management
10002	10002000 ÷ 10002999	ModemCore, modem core management
10003	10003000 ÷ 10003999	ModemSMSReceive, receive a SMS message
10004	10004000 ÷ 10004999	ModemSMSRxCmd, receive a SMS command
10005	10005000 ÷ 10005999	ModemSMSSend, send a SMS message
10006	10006000 ÷ 10006999	SetSMode, Set serial mode
10007	10007000 ÷ 10007999	ModbusRTUMaster, modbus RTU master
10008	10008000 ÷ 10008999	OwireMng, One-Wire management
10009	10009000 ÷ 10009999	OWRdIdentifier, One-Wire read ROM identifier
10010	10010000 ÷ 10010999	OWRdTemperature, One-Wire read temperature
10011	10011000 ÷ 10011999	IODataExchange, exchange data by using logic I/O
10012	10012000 ÷ 10012999	PIDMng, PID management
10013	10013000 ÷ 10013999	STESnmpAcq, STE termometer acquisition over SNMP
10014	10014000 ÷ 10014999	UDPDataTxfer, UDP data transfer
10015	10015000 ÷ 10015999	OWRdHumidity, One-Wire read humidity
10016	10016000 ÷ 10016999	IEC62056_21Rd, IEC62056-21 protocol read
10017	10017000 ÷ 10017999	NMEASInterface, NMEA system interface
10018	10018000 ÷ 10018999	GLLSentence, Geographic Position sentence
10019	10019000 ÷ 10019999	ModbusRTUSlave, modbus Rtu slave
10020	10020000 ÷ 10020999	MWVSentence, Wind Speed and Angle sentence
10030	10030000 ÷ 10030999	AuroraDSPMeasure, Aurora measure request to DSP
10031	10031000 ÷ 10031999	AuroraCEnergy, Aurora cumulated energy reading
10032	10032000 ÷ 10032999	HTempBox, HTemp Box2-485 acquisition

9.6 Tabella codici Ascii

9.6.1 Tabella codici ASCII standard

Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char
0	00	Null	32	20	Space	64	40	@	96	60	`
1	01	Start of heading	33	21	!	65	41	A	97	61	a
2	02	Start of text	34	22	"	66	42	B	98	62	b
3	03	End of text	35	23	#	67	43	C	99	63	c
4	04	End of transmit	36	24	$	68	44	D	100	64	d
5	05	Enquiry	37	25	%	69	45	E	101	65	e
6	06	Acknowledge	38	26	&	70	46	F	102	66	f
7	07	Audible bell	39	27	'	71	47	G	103	67	g
8	08	Backspace	40	28	(	72	48	H	104	68	h
9	09	Horizontal tab	41	29	)	73	49	I	105	69	i
10	0A	Line feed	42	2A	*	74	4A	J	106	6A	j
11	0B	Vertical tab	43	2B	+	75	4B	K	107	6B	k
12	0C	Form feed	44	2C	,	76	4C	L	108	6C	l
13	0D	Carriage return	45	2D	-	77	4D	M	109	6D	m
14	0E	Shift out	46	2E	.	78	4E	N	110	6E	n
15	0F	Shift in	47	2F	/	79	4F	O	111	6F	o
16	10	Data link escape	48	30	0	80	50	P	112	70	p
17	11	Device control 1	49	31	1	81	51	Q	113	71	q
18	12	Device control 2	50	32	2	82	52	R	114	72	r
19	13	Device control 3	51	33	3	83	53	S	115	73	s
20	14	Device control 4	52	34	4	84	54	T	116	74	t
21	15	Neg. acknowledge	53	35	5	85	55	U	117	75	u
22	16	Synchronous idle	54	36	6	86	56	V	118	76	v
23	17	End trans. block	55	37	7	87	57	W	119	77	w
24	18	Cancel	56	38	8	88	58	X	120	78	x
25	19	End of medium	57	39	9	89	59	Y	121	79	y
26	1A	Substitution	58	3A	:	90	5A	Z	122	7A	z
27	1B	Escape	59	3B	;	91	5B	[	123	7B	{
28	1C	File separator	60	3C	<	92	5C	\	124	7C	|
29	1D	Group separator	61	3D	=	93	5D	]	125	7D	}
30	1E	Record separator	62	3E	>	94	5E	^	126	7E	~
31	1F	Unit separator	63	3F	?	95	5F	_	127	7F	□

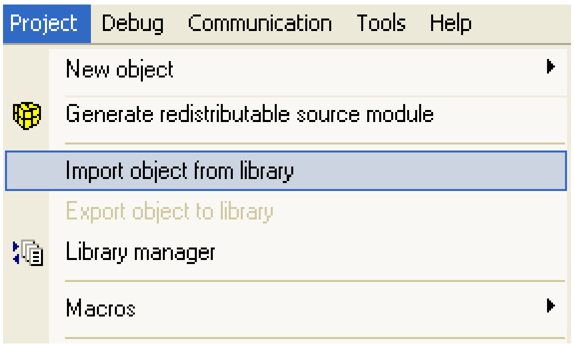
9.6.2 Tabella codici ASCII estesi

Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char
0	00	Null	32	20	Space	64	40	@	96	60	`
1	01	Start of heading	33	21	!	65	41	A	97	61	a
2	02	Start of text	34	22	"	66	42	B	98	62	b
3	03	End of text	35	23	#	67	43	C	99	63	c
4	04	End of transmit	36	24	$	68	44	D	100	64	d
5	05	Enquiry	37	25	%	69	45	E	101	65	e
6	06	Acknowledge	38	26	&	70	46	F	102	66	f
7	07	Audible bell	39	27	'	71	47	G	103	67	g
8	08	Backspace	40	28	(	72	48	H	104	68	h
9	09	Horizontal tab	41	29	)	73	49	I	105	69	i
10	0A	Line feed	42	2A	*	74	4A	J	106	6A	j
11	0B	Vertical tab	43	2B	+	75	4B	K	107	6B	k
12	0C	Form feed	44	2C	,	76	4C	L	108	6C	l
13	0D	Carriage return	45	2D	-	77	4D	M	109	6D	m
14	0E	Shift out	46	2E	.	78	4E	N	110	6E	n
15	0F	Shift in	47	2F	/	79	4F	O	111	6F	o
16	10	Data link escape	48	30	0	80	50	P	112	70	p
17	11	Device control 1	49	31	1	81	51	Q	113	71	q
18	12	Device control 2	50	32	2	82	52	R	114	72	r
19	13	Device control 3	51	33	3	83	53	S	115	73	s
20	14	Device control 4	52	34	4	84	54	T	116	74	t
21	15	Neg. acknowledge	53	35	5	85	55	U	117	75	u
22	16	Synchronous idle	54	36	6	86	56	V	118	76	v
23	17	End trans. block	55	37	7	87	57	W	119	77	w
24	18	Cancel	56	38	8	88	58	X	120	78	x
25	19	End of medium	57	39	9	89	59	Y	121	79	y
26	1A	Substitution	58	3A	:	90	5A	Z	122	7A	z
27	1B	Escape	59	3B	;	91	5B	[	123	7B	{
28	1C	File separator	60	3C	<	92	5C	\	124	7C	|
29	1D	Group separator	61	3D	=	93	5D	]	125	7D	}
30	1E	Record separator	62	3E	>	94	5E	^	126	7E	~
31	1F	Unit separator	63	3F	?	95	5F	_	127	7F	□

10 Esempi di programmazione

10.1 Biblioteca esempi

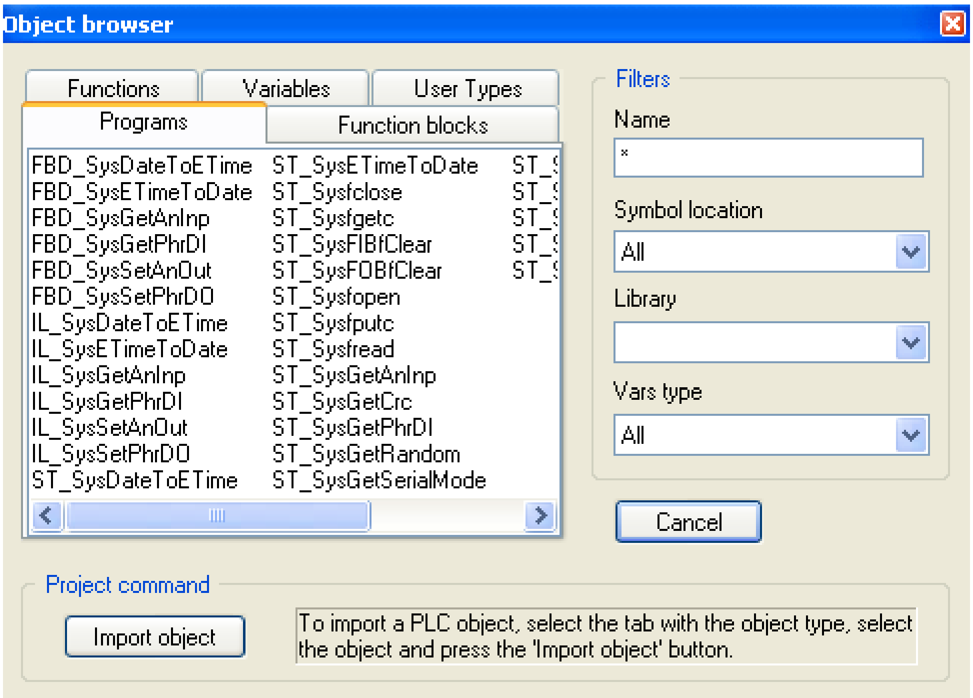
Per permettere all'utente di disporre di esempi da utilizzare per lo sviluppo dei proprii programmi quasi tutti gli esempi riportati sul manuale sono forniti in programmi dimostrativi. I programmi dimostrativi sono codificati con il suffisso PTP, accanto ad ogni esempio . Se si desidera includere nel proprio progetto un file di esempio del manuale occorre dal menù ***Project*** scegliere la voce ***Import object from library***. Si aprirà un dialog box che permette di selezionare la libreria da cui estrarre il programma da importare.



Scegliere il file di libreria desiderato (Esempio ***Ptp116*000.pll***) si aprirà la finestra con l'elenco degli oggetti presenti all'interno da cui sarà possibile selezionare gli oggetti desiderati.

Evidenziando gli oggetti e agendo sul tasto ***Import Object***, gli oggetti selezionati saranno inclusi nel proprio progetto.

Oltre ai programmi è possibile importare dalla libreria anche le variabili. In questo modo si potranno importare tutte le definizioni degli I/O logici come indicato nella tabella di definizione.



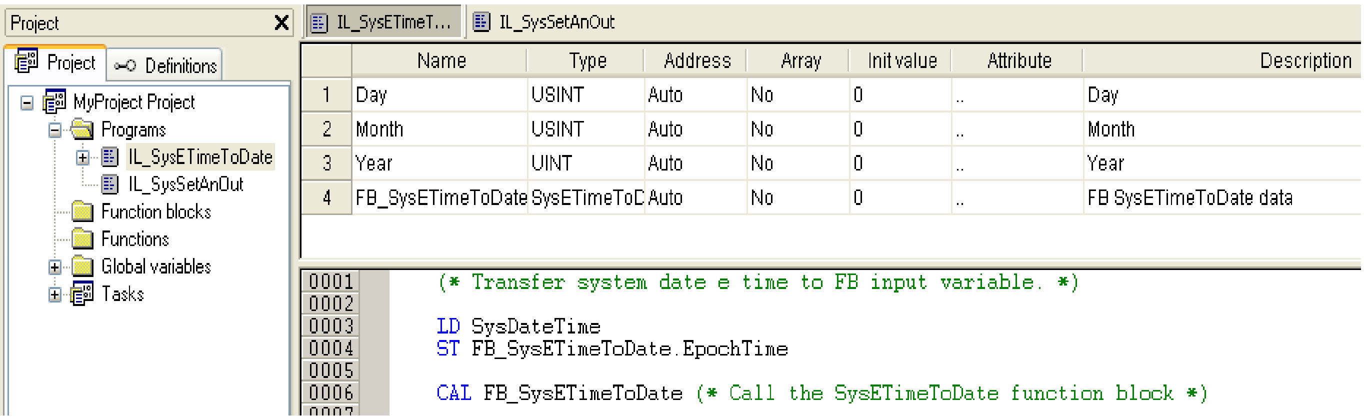
Name: *

Symbol location: All

Vars type: All

To import a PLC object, select the tab with the object type, select the object and press the 'Import object' button.

Una volta inclusi nel progetto gli esempi, sarà possibile utilizzarli direttamente, oppure con con semplici operazioni di cut and paste incollare parti di codice sorgente dal progetto di esempio.

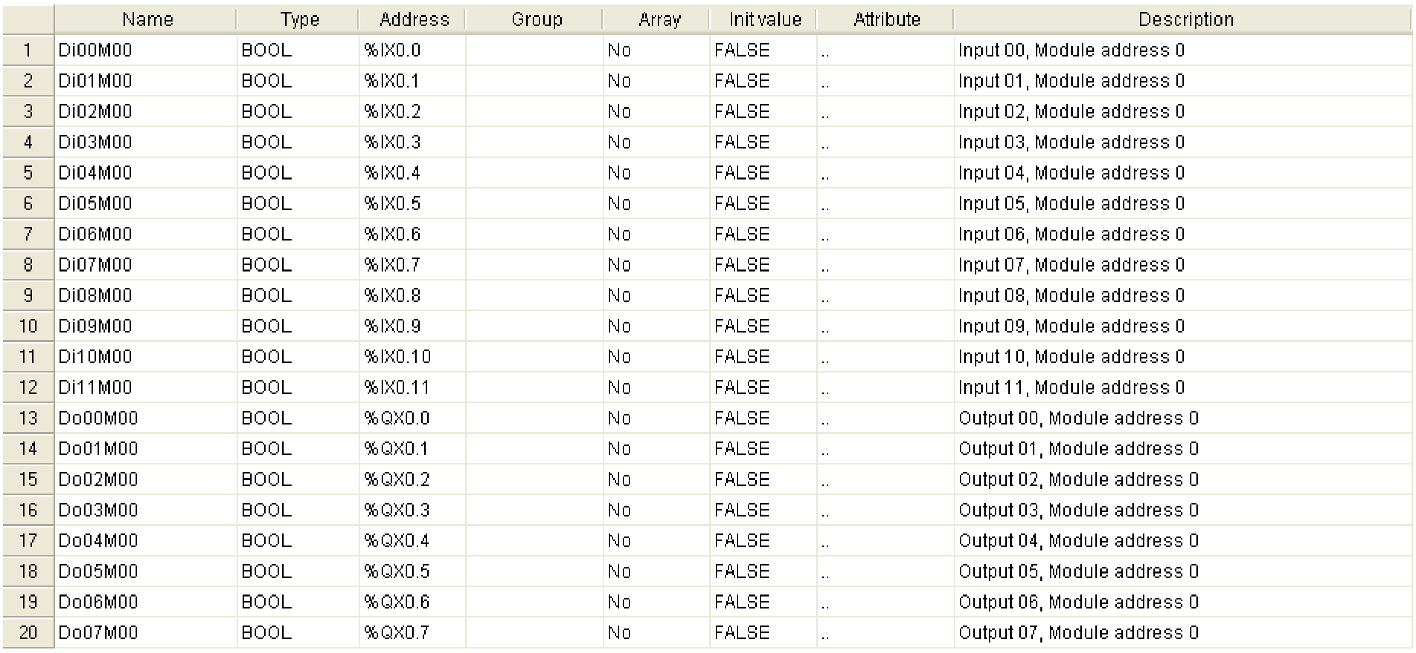


	Name	Type	Address	Array	Init value	Attribute	Description
1	Day	USINT	Auto	No	0	..	Day
2	Month	USINT	Auto	No	0	..	Month
3	Year	UINT	Auto	No	0	..	Year
4	FB_SysETimeToDate	SysETimeToD	Auto	No	0	..	FB SysETimeToDate data

```
(* Transfer system date e time to FB input variable. *)

LD SysDateTime
ST FB_SysETimeToDate.EpochTime

CAL FB_SysETimeToDate (* Call the SysETimeToDate function block *)
```

10.2 Definizioni I/O logici negli esempi

Tutti gli esempi riportati in questo manuale sono stati realizzati utilizzando un sistema configurato con un modulo CPU SlimLine tipo MPS046A100 abbinato ad un modulo Mixed I/O PCB122*100 (Impostato con address 0). Tutti gli I/O del modulo sono stati abbinati a variabili mnemoniche. Gli ingressi sono denominati ***Di0xM00*** e le uscite ***Do0xM00*** come evidente nella tabella di definizione.

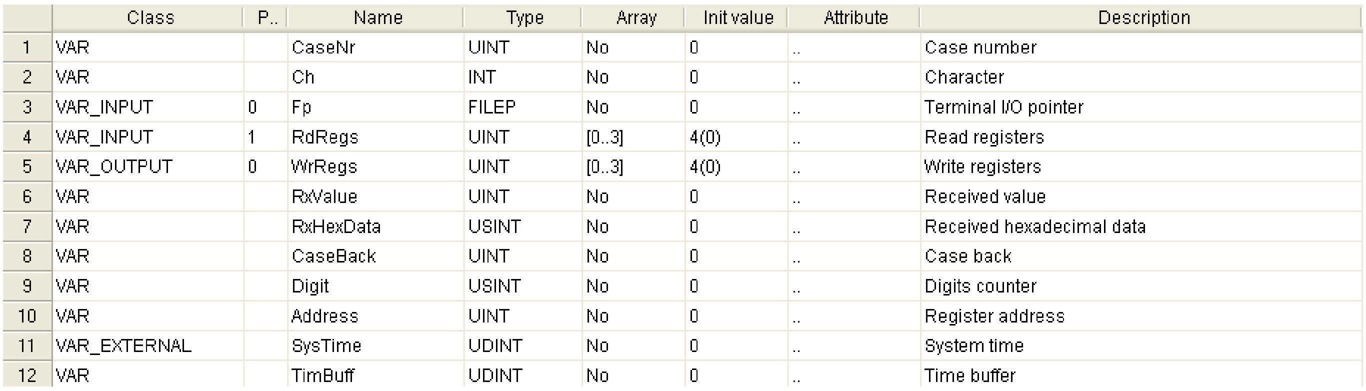


	Name	Type	Address	Group	Array	Init value	Attribute	Description
1	Di00M00	BOOL	%IX0.0		No	FALSE	..	Input 00, Module address 0
2	Di01M00	BOOL	%IX0.1		No	FALSE	..	Input 01, Module address 0
3	Di02M00	BOOL	%IX0.2		No	FALSE	..	Input 02, Module address 0
4	Di03M00	BOOL	%IX0.3		No	FALSE	..	Input 03, Module address 0
5	Di04M00	BOOL	%IX0.4		No	FALSE	..	Input 04, Module address 0
6	Di05M00	BOOL	%IX0.5		No	FALSE	..	Input 05, Module address 0
7	Di06M00	BOOL	%IX0.6		No	FALSE	..	Input 06, Module address 0
8	Di07M00	BOOL	%IX0.7		No	FALSE	..	Input 07, Module address 0
9	Di08M00	BOOL	%IX0.8		No	FALSE	..	Input 08, Module address 0
10	Di09M00	BOOL	%IX0.9		No	FALSE	..	Input 09, Module address 0
11	Di10M00	BOOL	%IX0.10		No	FALSE	..	Input 10, Module address 0
12	Di11M00	BOOL	%IX0.11		No	FALSE	..	Input 11, Module address 0
13	Do00M00	BOOL	%QX0.0		No	FALSE	..	Output 00, Module address 0
14	Do01M00	BOOL	%QX0.1		No	FALSE	..	Output 01, Module address 0
15	Do02M00	BOOL	%QX0.2		No	FALSE	..	Output 02, Module address 0
16	Do03M00	BOOL	%QX0.3		No	FALSE	..	Output 03, Module address 0
17	Do04M00	BOOL	%QX0.4		No	FALSE	..	Output 04, Module address 0
18	Do05M00	BOOL	%QX0.5		No	FALSE	..	Output 05, Module address 0
19	Do06M00	BOOL	%QX0.6		No	FALSE	..	Output 06, Module address 0
20	Do07M00	BOOL	%QX0.7		No	FALSE	..	Output 07, Module address 0

10.3 FB gestione lettura/scrittura registri

Per meglio comprendere il funzionamento delle funzioni di gestione I/O su dispositivo ecco l'implementazione di un blocco funzione per la lettura e scrittura di registri da porta seriale. Il programma in codice sorgente ***FBRdWrRegisters*** si trova nel ***Ptp116*000***.

Definizione variabili



	Class	P..	Name	Type	Array	Init value	Attribute	Description
1	VAR		CaseNr	UINT	No	0	..	Case number
2	VAR		Ch	INT	No	0	..	Character
3	VAR_INPUT	0	Fp	FILEP	No	0	..	Terminal I/O pointer
4	VAR_INPUT	1	RdRegs	UINT	[0..3]	4(0)	..	Read registers
5	VAR_OUTPUT	0	WrRegs	UINT	[0..3]	4(0)	..	Write registers
6	VAR		RxValue	UINT	No	0	..	Received value
7	VAR		RxHexData	USINT	No	0	..	Received hexadecimal data
8	VAR		CaseBack	UINT	No	0	..	Case back
9	VAR		Digit	USINT	No	0	..	Digits counter
10	VAR		Address	UINT	No	0	..	Register address
11	VAR_EXTERNAL		SysTime	UDINT	No	0	..	System time
12	VAR		TimBuff	UDINT	No	0	..	Time buffer

Codice sorgente blocco funzione in ST

```
(* ************************************************************************** *)
(* READ/WRITE REGISTERS FUNCTION BLOCK                                        *)
(* ************************************************************************** *)

    (* ---------------------------------------------------------------------- *)
    (* TIMEOUT MANAGEMENT                                                     *)
    (* ---------------------------------------------------------------------- *)
    (* If the command does not terminate in 1 Second it's aborted. *)

    IF (CaseNr = 0) THEN TimBuff:=SysTime; END_IF;
    IF (SysTime > (TimBuff+1000)) THEN CaseNr:=0; END_IF;

    (* ###################################################################### *)
    (* MANAGEMENT CASES                                                       *)
    (* ###################################################################### *)

    CASE (CaseNr) OF

        (* ------------------------------------------------------------------ *)
        (* WAITING READ/WRITE COMMAND                                         *)
        (* ------------------------------------------------------------------ *)
        (* The read command is "?Rxx" followed by <CR>. *)

        16#0000:
        WHILE (TO_BOOL(SysGetIChars(Fp))) DO
            Ch:=Sysfgetc(Fp); (* Character *)

            (* The read command starts with '?' character. *)

            IF (Ch = 63) THEN CaseNr:=16#0100; RETURN; END_IF;

            (* The write command starts with '!' character. *)

            IF (Ch = 33) THEN CaseNr:=16#0110; RETURN; END_IF;
        END_WHILE;

        (* ------------------------------------------------------------------ *)
        (* MANAGE THE READ COMMAND                                            *)
        (* ------------------------------------------------------------------ *)
        (* The read command proceed with 'R' character and with the register *)
        (* adress. *)

        16#0100:
        WHILE (TO_BOOL(SysGetIChars(Fp))) DO
            IF (Sysfgetc(Fp) = 82) THEN
                CaseBack:=CaseNr+1; (* Case back *)
                CaseNr:=16#0200; (* Set the case number to receive address *)
                RETURN;
            END_IF;
```

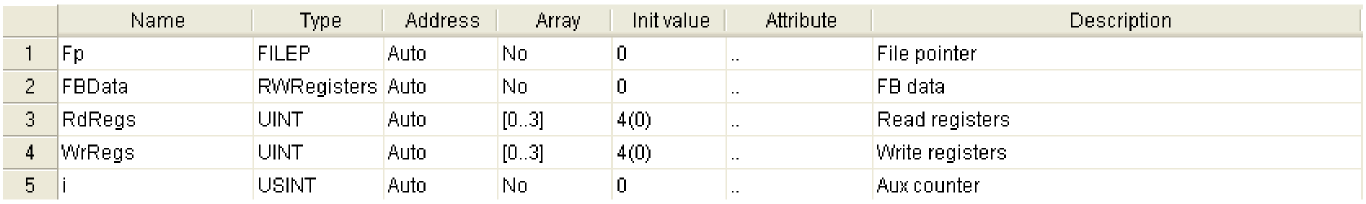
```
END_WHILE;

(* ------------------------------------------------------------------ *)
(* Print out the register address and value. *)

16#0101:
Address:=RxValue; (* Register address *)
IF (Address <= 3) THEN
    Ch:=SysVarfprintf(Fp, 'Address:%04X ', UINT_TYPE, ADR(Address));
    Ch:=SysVarfprintf(Fp, 'Value:%04X$r$n', UINT_TYPE, ADR(RdRegs[Address]));
END_IF;
CaseNr:=0; (* Case number *)

(* ------------------------------------------------------------------ *)
(* MANAGE THE WRITE COMMAND                                            *)
(* ------------------------------------------------------------------ *)
(* The write command proceed with 'W' character, the register address *)
(* and the value to be written. *)

16#0110:
WHILE (TO_BOOL(SysGetIChars(Fp))) DO
    IF (Sysfgetc(Fp) = 87) THEN
        CaseBack:=CaseNr+1; (* Case back *)
        CaseNr:=16#0200; (* Set the case number to receive address *)
        RETURN;
    END_IF;
END_WHILE;

(* ------------------------------------------------------------------ *)
(* Receive the value. *)

16#0111:
Address:=RxValue; (* Register address *)
CaseBack:=CaseNr+1; (* Case back *)
CaseNr:=16#0200; (* Set the case number to receive value *)

(* ------------------------------------------------------------------ *)
(* Print out the register address and value. *)

16#0112:
IF (Address <= 3) THEN
    Ch:=SysVarfprintf(Fp, 'Address:%04X ', UINT_TYPE, ADR(Address));
    Ch:=SysVarfprintf(Fp, 'Value:%04X$r$n', UINT_TYPE, ADR(RxValue));
    RdRegs[Address]:=RxValue;
END_IF;
CaseNr:=0; (* Case number *)

(* ------------------------------------------------------------------ *)
(* MANAGE THE DATA RECEPTION                                           *)
(* ------------------------------------------------------------------ *)
(* In the following cases the data is received, reception ends when a *)
(* ' ' or '\r' is been received, or if the maximum of an integer (4 *)
(* digits) is received. *)
(* ------------------------------------------------------------------ *)
(* Initialize the data reception. *)

16#0200:
Digit:=0; (* Digits counter *)
RxValue:=0; (* Received value *)
CaseNr:=CaseNr+1; (* Case number *)

(* ------------------------------------------------------------------ *)
(* Data reception. *)

16#0201:
WHILE (TO_BOOL(SysGetIChars(Fp))) DO

    Ch:=Sysfgetc(Fp); (* Character *)

    (* Skips the ' ' characters before the number. *)

    IF ((Digit =0) AND (Ch = 32)) THEN RETURN; END_IF;

    (* If ' ' or '\r' is been received continue. *)

    IF (Ch = 13) THEN CaseNr:=CaseBack; RETURN; END_IF;
    IF (Ch = 32) THEN CaseNr:=CaseBack; RETURN; END_IF;
```

```
            (* Check if is an hexadecimal character, if not is an error. *)

            IF ((Ch < 16#30) OR (Ch > 16#39)) AND ((Ch < 16#41) OR (Ch > 16#46)) THEN
                CaseNr:=0; (* Case number *)
                RETURN;
            END_IF;

            (* Convert the received character to a number. *)

            IF ((Ch >= 16#30) AND (Ch <= 16#39)) THEN RxHexData:=TO_USINT(Ch)-16#30; END_IF;
            IF ((Ch >= 16#41) AND (Ch <= 16#46)) THEN RxHexData:=TO_USINT(Ch)-16#37; END_IF;

            (* Transfer data received in RxValue. *)

            CASE (Digit) OF
                16#00: RxValue:=RxHexData; (* Received value *)
                16#01: RxValue:=(RxValue*16)+RxHexData; (* Received value *)
                16#02: RxValue:=(RxValue*16)+RxHexData; (* Received value *)
                16#03: RxValue:=(RxValue*16)+RxHexData; (* Received value *)
            ELSE
                CaseNr:=0; (* Case number *)
                RETURN;
            END_CASE;

            Digit:=Digit+1; (* Digits counter *)
        END_WHILE;

    END_CASE;

(* [End of file] *)
```

10.3.1 Utilizzo FB Lettura/Scrittura registri

Per utilizzare il blocco funzione è possibile realizzare un semplice programma in ST che lo richiama.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	Fp	FILEP	Auto	No	0	..	File pointer
2	FBData	RWRegisters	Auto	No	0	..	FB data
3	RdRegs	UINT	Auto	[0..3]	4(0)	..	Read registers
4	WrRegs	UINT	Auto	[0..3]	4(0)	..	Write registers
5	i	USINT	Auto	No	0	..	Aux counter

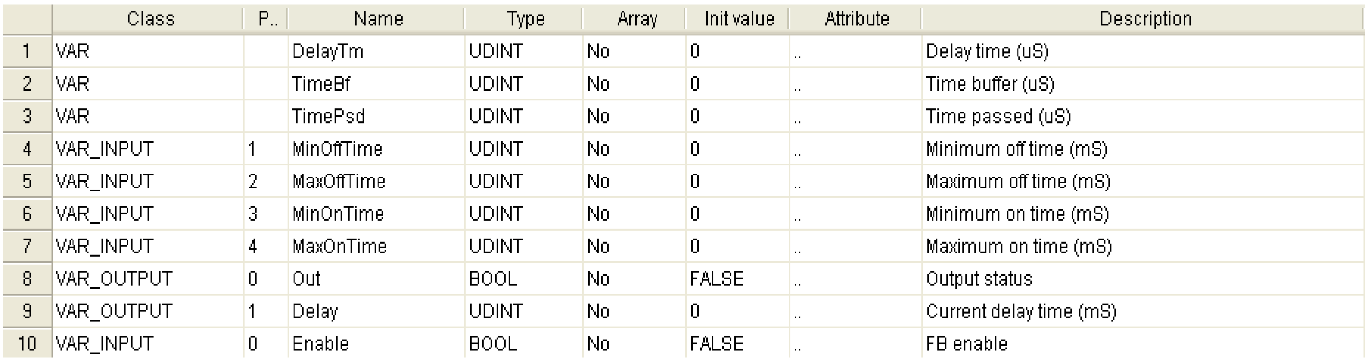
Esempio ST

```
(* ************************************************************************** *)
(* READ/WRITE REGISTERS FUNCTION BLOCK USE                                    *)
(* ************************************************************************** *)

(* Here the COM0 port is opened in read/write. *)

    IF (FBData.Fp = NULL) THEN
        FBData.Fp:=Sysfopen('COM0', 'rw'); (* Port COM0 file pointer *)
    END_IF;

(* If the COM0 port is opened the function block is executed. *)

    IF (FBData.Fp <> NULL) THEN
        FBData();
    END_IF;

(* Copy the read/write registers. *)

    FOR i:=0 TO (3) BY 1 DO
        FBData.RdRegs[i]:=RdRegs[i];
        WrRegs[i]:=FBData.WrRegs[i];
    END_FOR;

(* [End of file] *)
```

10.4 FB gestione ciclo On/Off con tempi random

Esempio di blocco funzione che utilizzando le funzioni ***SysGetSysTime*** e ***SysGetRandom*** permette di realizzare la gestione di una uscita lampeggiante con tempi di On/Off variabili in modo random entro tempi minimo e massimo definiti. Il programma in codice sorgente ***FBOnOffCycle*** si trova nel ***Ptp116*000***.

Definizione variabili



	Class	P..	Name	Type	Array	Init value	Attribute	Description
1	VAR		DelayTm	UDINT	No	0	..	Delay time (uS)
2	VAR		TimeBf	UDINT	No	0	..	Time buffer (uS)
3	VAR		TimePsd	UDINT	No	0	..	Time passed (uS)
4	VAR_INPUT	1	MinOffTime	UDINT	No	0	..	Minimum off time (mS)
5	VAR_INPUT	2	MaxOffTime	UDINT	No	0	..	Maximum off time (mS)
6	VAR_INPUT	3	MinOnTime	UDINT	No	0	..	Minimum on time (mS)
7	VAR_INPUT	4	MaxOnTime	UDINT	No	0	..	Maximum on time (mS)
8	VAR_OUTPUT	0	Out	BOOL	No	FALSE	..	Output status
9	VAR_OUTPUT	1	Delay	UDINT	No	0	..	Current delay time (mS)
10	VAR_INPUT	0	Enable	BOOL	No	FALSE	..	FB enable

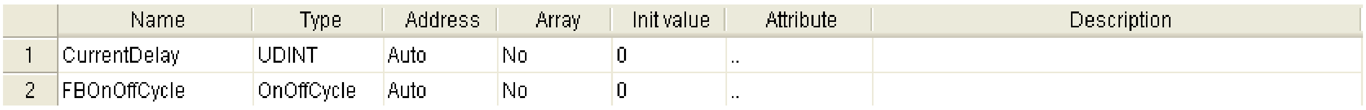
Codice sorgente blocco funzione in ST

```
(* --------------------------------------------------------------------------- *)
(* GESTIONE ABILITAZIONE                                                       *)
(* --------------------------------------------------------------------------- *)
(* Eseguo gestione abilitazione blocco funzione. *)

    IF (NOT(Enable)) THEN
        Out:=FALSE; (* Output status *)
        TimeBf:=SysGetSysTime(TRUE); (* Time buffer (uS) *)
        Delay:=MinOffTime; (* Current delay time (mS) *)
        DelayTm:=Delay*1000; (* Delay time (uS) *)
        RETURN;
    END_IF;

(* --------------------------------------------------------------------------- *)
(* GESTIONE TEMPORIZZAZIONE ON/OFF                                             *)
(* --------------------------------------------------------------------------- *)
(* Eseguo controllo se variazione stato uscita ed eseguo salvataggio tempo e *)
(* calcolo del relativo tempo di attesa. *)

    TimePsd:=SysGetSysTime(TRUE)-TimeBf; (* Time passed (uS) *)
    TimeBf:=SysGetSysTime(FALSE); (* Time buffer (uS) *)

    IF (DelayTm > TimePsd) THEN
        DelayTm:=DelayTm-TimePsd; (* Delay time (uS) *)
    ELSE
        (* Eseguo inversione uscita e calcolo il relativo tempo di ritardo. *)

        Out:=Out XOR TRUE; (* Output status *)
        IF (NOT(Out)) THEN
            (* Calcolo tempo di off, viene utilizzata la formula: *)
            (* TOff=MinOffTime+((MaxOffTime-MinOffTime)*Numero Random) *)

            DelayTm:=(MinOffTime*1000)+((MaxOffTime-MinOffTime)*TO_UDINT(SysGetRandom(TRUE)*1000)); *)
        ELSE
            (* Calcolo tempo di on, viene utilizzata la formula: *)
            (* TOn=MinOnTime+((MaxOnTime-MinOnTime)*Numero Random) *)

            DelayTm:=(MinOnTime*1000)+((MaxOnTime-MinOnTime)*TO_UDINT(SysGetRandom(TRUE)*1000));
        END_IF;

        (* Eseguo calcolo valore tempo attuale in temporizzazione. *)

        Delay:=DelayTm/1000; (* Current delay time (mS) *)
    END_IF;

(* [End of file] *)
```

10.4.1 Utilizzo FB ciclo On/Off con tempi random

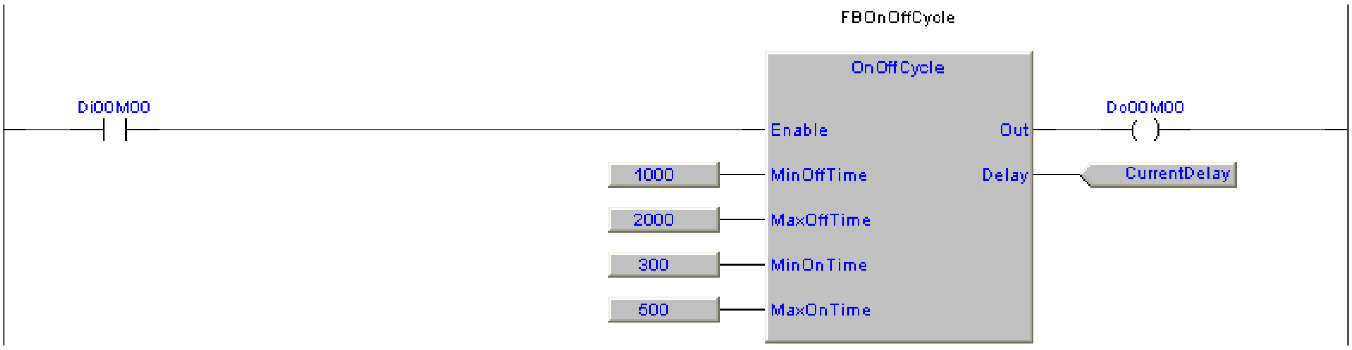
Per utilizzare il blocco funzione è possibile realizzare un semplice programma in LD che lo richiama. Nell'esempio che riporto avremo il lampeggio della uscita ***Do00M00*** con tempi di ***Off*** variabile tra 1 e 2 secondi, mentre il tempo di ***On*** è variabile tra 300 e 500 mS.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	CurrentDelay	UDINT	Auto	No	0	..	
2	FBOnOffCycle	OnOffCycle	Auto	No	0	..	

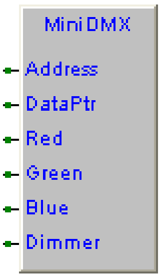
Esempio LD



10.5 Blocco funzione MiniDMX

Ecco un esempio su come realizzare un blocco funzione per la gestione di un mini dimmer a 3 canali RGB utilizzando il linguaggio ST. Il prodotto in questione utilizza 4 indirizzi DMX:

1) Preset uscita comando colore rosso.
2) Preset uscita comando colore verde.
3) Preset uscita comando colore blù.
4) Preset valore dimmer su tutte le uscite.

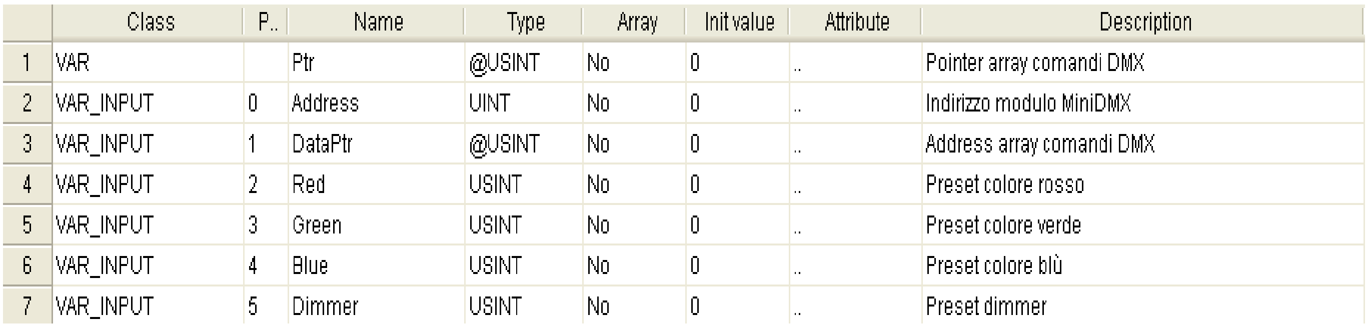


Il blocco funzione viene chiamato ***MiniDMX***, sulla destra è possibile vedere come verrà visualizzato il blocco funzione nel proprio programma LD. Il programma in codice sorgente del blocco funzione e del programma di esempio si trova nel ***Ptp117*000***.

Sull'ingresso ***Address*** occorre definire l'indirizzo del dimmer, cioè l'indirizzo DMX a cui corrisponde il preset del colore rosso, gli altri valori saranno mappati sui 3 indirizzi successivi. Sull'ingresso ***DataPtr*** occorre trasferire l'indirizzo dell'array dati DMX.

Red, definisce il valore dell'uscita di colore rosso. ***Green***, definisce il valore dell'uscita di colore verde. ***Blue***, definisce il valore dell'uscita di colore blù. ***Dimmer*** definisce il valore di dimmering delle uscite.

Definizione variabili



	Class	P..	Name	Type	Array	Init value	Attribute	Description
1	VAR		Ptr	@USINT	No	0	..	Pointer array comandi DMX
2	VAR_INPUT	0	Address	UINT	No	0	..	Indirizzo modulo MiniDMX
3	VAR_INPUT	1	DataPtr	@USINT	No	0	..	Address array comandi DMX
4	VAR_INPUT	2	Red	USINT	No	0	..	Preset colore rosso
5	VAR_INPUT	3	Green	USINT	No	0	..	Preset colore verde
6	VAR_INPUT	4	Blue	USINT	No	0	..	Preset colore blù
7	VAR_INPUT	5	Dimmer	USINT	No	0	..	Preset dimmer

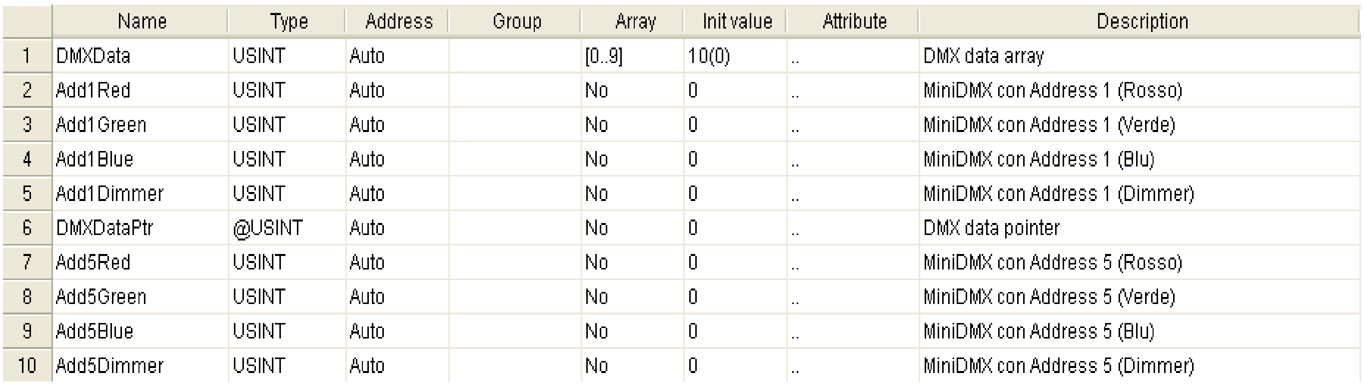
Codice sorgente ST *(Ptp117a100)*

```
(* *************************************************************************** *)
(* FB GESTIONE DIMMER DMX (MiniDMX)                                            *)
(* *************************************************************************** *)
(* Il driver MiniDMX gestisce 3 uscite RGB. Il driver utilizza 4 canali DMX,   *)
(*                                                                             *)
(* 1: Comando segnale rosso                                                    *)
(* 2: Comando segnale verde                                                    *)
(* 3: Comando segnale blu                                                      *)
(* 4: Comando dimmer su tutti i segnali                                        *)
(* --------------------------------------------------------------------------- *)
(* Preset pointer su array comandi DMX. *)

    Ptr:=TO_UDINT(DataPtr)+Address-1; (* Pointer array comandi DMX *)
    @Ptr:=Red; (* Preset colore rosso *)

    Ptr:=Ptr+1; (* Pointer array comandi DMX *)
    @Ptr:=Green;(* Preset colore verde *)

    Ptr:=Ptr+1; (* Pointer array comandi DMX *)
    @Ptr:=Blue; (* Preset colore blù *)

    Ptr:=Ptr+1; (* Pointer array comandi DMX *)
    @Ptr:=Dimmer; (* Preset dimmer *)

(* [End of file] *)
```

10.5.1 Programma DMXUse

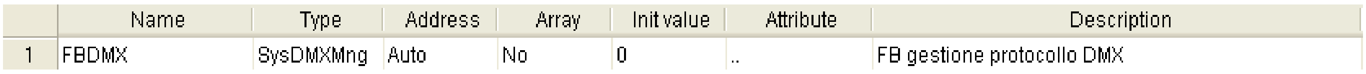
Questo programma istanzia e gestisce il blocco funzione ***SysDMXMng***. Viene valorizzata la variabile globale ***DMXDataPtr*** che contiene l'indirizzo dell'array dati DMX che dovrà essere passato al blocco funzione di gestione ***MiniDMX***.

Definizione variabili globali



	Name	Type	Address	Group	Array	Init value	Attribute	Description
1	DMXData	USINT	Auto		[0..9]	10(0)	..	DMX data array
2	Add1Red	USINT	Auto		No	0	..	MiniDMX con Address 1 (Rosso)
3	Add1Green	USINT	Auto		No	0	..	MiniDMX con Address 1 (Verde)
4	Add1Blue	USINT	Auto		No	0	..	MiniDMX con Address 1 (Blu)
5	Add1Dimmer	USINT	Auto		No	0	..	MiniDMX con Address 1 (Dimmer)
6	DMXDataPtr	@USINT	Auto		No	0	..	DMX data pointer
7	Add5Red	USINT	Auto		No	0	..	MiniDMX con Address 5 (Rosso)
8	Add5Green	USINT	Auto		No	0	..	MiniDMX con Address 5 (Verde)
9	Add5Blue	USINT	Auto		No	0	..	MiniDMX con Address 5 (Blu)
10	Add5Dimmer	USINT	Auto		No	0	..	MiniDMX con Address 5 (Dimmer)

Definizione variabili



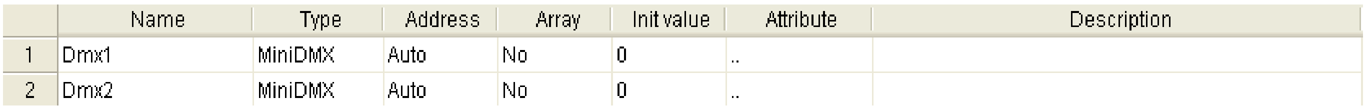
	Name	Type	Address	Array	Init value	Attribute	Description
1	FBDMX	SysDMXMng	Auto	No	0	..	FB gestione protocollo DMX

Codice sorgente ST *(Ptp117a100)*

```
(* -------------------------------------------------------------------------- *)
(* ESEGUO APERTURA PORTA SERIALE                                              *)
(* -------------------------------------------------------------------------- *)
(* Here the COM1 port is opened in read/write. *)


    IF (FBDMX.File = NULL) THEN
        FBDMX.File:=Sysfopen('COM1', 'rw'); (* Port COM1 file pointer *)
    END_IF;

(* Valorizzo pointer dati DMX per passarlo alle FB gestione DMX. *)

    DMXDataPtr:=ADR(DMXData); (* DMX data pointer *)

(* -------------------------------------------------------------------------- *)
(* ESEGUO GESTIONE PROTOCOLLO DMX                                             *)
(* -------------------------------------------------------------------------- *)
(* Gestione protocollo DMX. *)

    FBDMX.Start:=TRUE; (* Start *)
    FBDMX.Status:=0; (* Status byte *)
    FBDMX.Devices:=10; (* Number of devices *)
    FBDMX.Delay:=100; (* Interframe delay (mSec) *)
    FBDMX.DataPtr:=DMXDataPtr; (* Data array pointer *)
    FBDMX(); (* FB gestione protocollo DMX *)

(* [End of file] *)
```

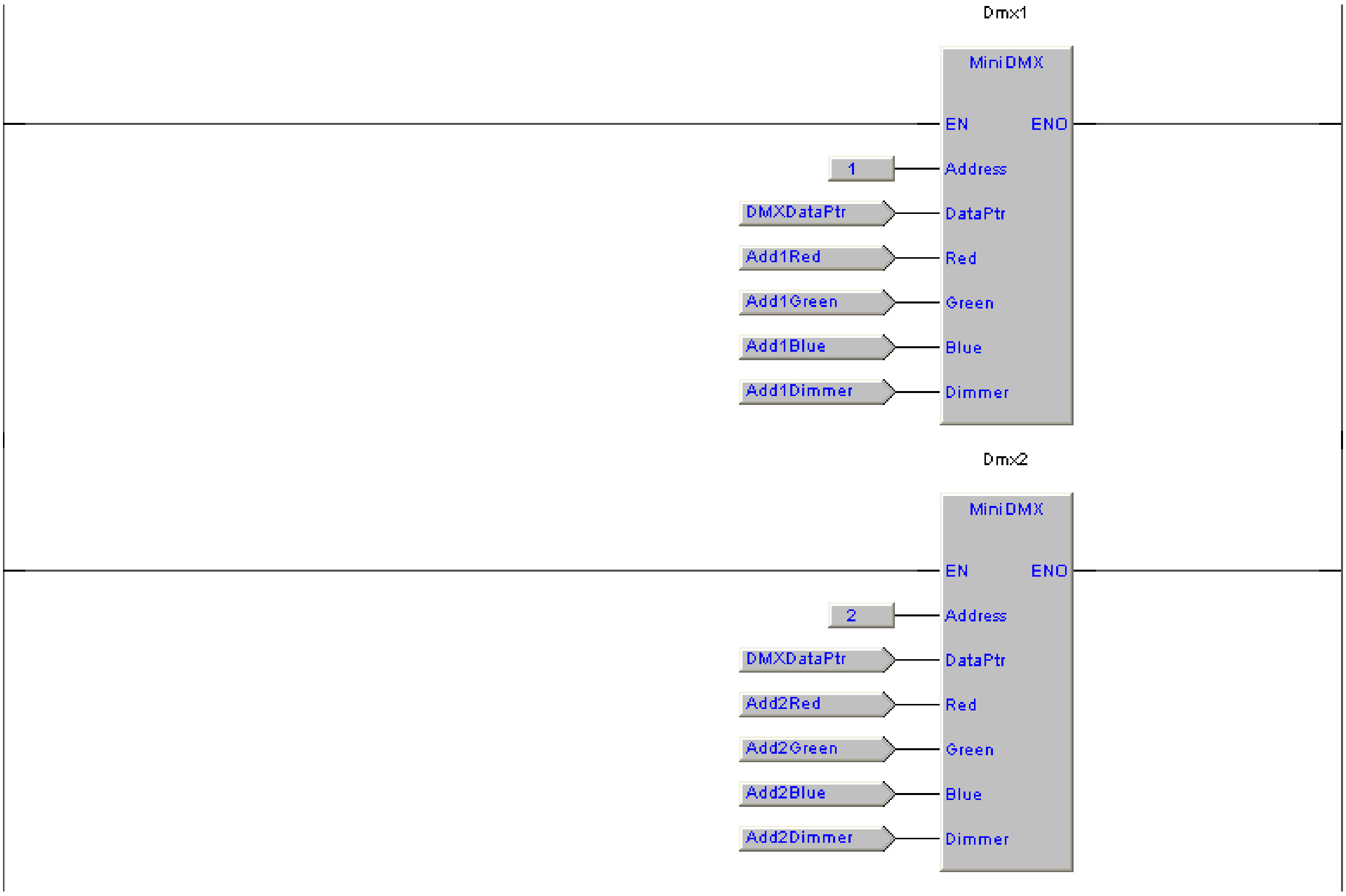
Questo programma utilizza due blocchi funzione ***MiniDMX*** a cui viene passata la variabile globale ***DMXDataPtr*** che contiene l'indirizzo dell'array dati DMX. Impostando i valori desiderati nelle variabili globali di preset essi verranno trasferiti nei relativi apparecchi MiniDMX con l'indirizzo definito.

Definizione variabili



	Name	Type	Address	Array	Init value	Attribute	Description
1	Dmx1	MiniDMX	Auto	No	0	..	
2	Dmx2	MiniDMX	Auto	No	0	..	

Codice sorgente LD *(Ptp117a100)*



Panorama de la Oferta

Arrancadores Suaves
Protección de Motores
Control y Medida

ELION

La Solución en Automatismos

AUTOMATIZACIÓN INDUSTRIAL



Fundada en 1977, Solcon Industries Ltd. es una empresa dinámica de alta tecnología electrónica. Durante unos 30 años ha estado a la vanguardia del diseño, desarrollo y fabricación de sistemas electrónicos industriales, principalmente destinados a la instalación para baja y media tensión.
Solcon utiliza tecnología avanzada basada en la contínua investigación en campo, pruebas y evolución. Aplica criterios de diseño para ofrecer la mayor fiabilidad a largo plazo, de este modo, proporciona las soluciones innovadoras que el cliente necesita. Estas ventajas contribuyen a mantener su posición de liderazgo en los mercados de arrancadores suaves industriales y para la industria naval.


Solcon cuenta con una red de distribución a nivel mundial. Esta red contribuye a la introducción global de sus soluciones innovadoras. Esto facilita a los usuarios una vasta experiencia derivada de una diversidad de más de 50.000 instalaciones y aplicaciones en la industria, marina, offshore, petróleo y gas.


SOLCON

Solstart

Arrancador Suave Miniatura 8-58A, con bypass interno.

KW 400V	Freno tipo (A)	Dimensiones (mm) Ancho	 Alto	 Prof.	Peso (Kg)
4	Solstart 8	45	75	110	0.4
7.5	Solstart 17	90	75	105	0.6
11	Solstart 22	90	75	105	0.6
15	Solstart 31	65	190	114	1.3
22	Solstart 44	65	190	114	1.3
30	Solstart 58	65	190	114	1.3

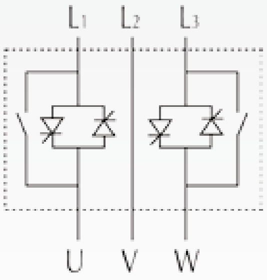
El Solstart provee de arranque y paro suaves e incorpora relés de by-pass internos.
Compacto, para montaje en carril DIN.

Características generales

- Arranque y Paro Suave.
- Bypass interno.
- Arranque/Paro por contacto libre de tensión.
- Relé fin de aceleración, un contacto N.A. (sólo 31-58A).
- Compacto, de dimensiones reducidas.
- Caja en material plástico 8-17A, en Aluminio 31-58A.
- Montaje en raíl DIN (Estándar 8-22A, opción 31-58A).

Valores nominales

- Tensiones: 230, 400, 440, 460 y 600V.
- Frecuencias: 50 y 60 Hz.



RVS-AX

Arrancador Suave Analógico 8-170A, con bypass interno.

KW 400V	Freno tipo (A)	Dimensiones (mm) Ancho	 Alto	 Prof.	Peso (Kg)
4	RVS-AX 8	120	232	105	2.6
7.5	RVS-AX 17	120	232	105	2.6
15	RVS-AX 31	120	232	105	2.6
22	RVS-AX 44	120	232	105	2.6
30	RVS-AX 58	129	275	185	5.0
37	RVS-AX 72	129	275	185	5.0
45	RVS-AX 85	129	380	185	8.4
55	RVS-AX 105	129	380	185	8.4
75	RVS-AX 145	172	380	195	11.8
90	RVS-AX 170	172	380	195	11.8

Incorpora Límite de Corriente y protecciones a motor, instalación simple y fácil operación, el RVS-AX es una óptima solución para motores de pequeña y mediana potencia.

Características generales

- Arranque y Paro Suaves.
- Límite de corriente.
- Protecciones de motor incorporadas.
- Bypass interno (sólo para 31-170A).
- Arranque/Paro por contacto libre de tensión.
- Compacto, dimensiones reducidas.
- Caja de Aluminio.

Valores nominales

- Tensiones: 230, 400, 440, 460 y 600V.
- Frecuencias: 50 y 60 Hz.

RVS-DX

Arrancador Suave Digital 8-1100A,
con bypass interno.

KW	Freno tipo	Dimensiones (mm)			Peso
400V	(A)	Ancho	Alto	Prof.	(Kg)
4	RVS-DX 8	120	232	122	3.1
7.5	RVS-DX 17	120	232	122	3.1
15	RVS-DX 31	120	232	122	3.1
22	RVS-DX 44	120	232	122	3.1
30	RVS-DX 58	129	275	182	5.2
37	RVS-DX 72	129	275	182	5.2
45	RVS-DX 85	129	380	182	8.5
55	RVS-DX 105	129	380	182	8.5
75	RVS-DX 145	172	380	192	11.7
90	RVS-DX 170	172	380	192	11.7
110	RVS-DX 210	310	521	300	30.2
160	RVS-DX 310	310	521	300	30.2
200	RVS-DX 390	310	521	300	55
250	RVS-DX 460	455	683	328	65
315	RVS-DX 580	455	683	328	75
400	RVS-DX 650	455	683	328	80
450	RVS-DX 820	455	683	328	90
550	RVS-DX 950	515	833	341	100
630	RVS-DX 1100	515	833	341	100

El RVS-DX incorpora características de arranque y paro mejoradas proporcionando la mejor solución para la mayoría de las aplicaciones. El completo paquete de protecciones al motor, garantiza fiabilidad a largo plazo, mientras que el by-pass interno asegura excelente comportamiento.

Características generales

- Compacto, dimensiones reducidas, caja de Aluminio.
- Diseño circuitos con microprocesador de tercera generación.
- Diseño con prestaciones totales incluido bypass interno.
- Características de arranque y paro inmejorables.
- Extenso paquete de protecciones de motor.
- Comunicación RS 485 Modbus.
- Auto reglaje de frecuencia 45-65Hz.

Valores nominales

- Tensiones: 230, 400, 440, 460 y 600V.

RVS-DN

Arrancador Suave Digital 8-3000A,
para servicio duro, con prestaciones totales.

KW	Freno tipo	Dimensiones (mm)						Peso	
400V	(A)	Ancho		Alto		Prof.		(Kg)	
4	RVS-DN 8	153		310		170		4.5	
7.5	RVS-DN 17	153		310		170		4.5	
15	RVS-DN 31	153		310		170		6.0	
22	RVS-DN 44	153		310		217		7.4	
30	RVS-DN 58	153		310		217		7.4	
37	RVS-DN 72	153		310		217		7.4	
45	RVS-DN 85	274		385		238		15	
55	RVS-DN 105	274		385		238		15	
75	RVS-DN 145	274		385		238		15	
90	RVS-DN 170	274	[1]	385	[1]	238	[1]	15	[1]
110	RVS-DN 210	380	590	455	500	292	290	31	44.8
160	RVS-DN 310	380	590	455	500	292	290	31	44.8
200	RVS-DN 390	380	590	455	500	292	290	31	44.8
250	RVS-DN 460	380	623	555	660 [2]	292	290	55	65
315	RVS-DN 580	470	623	655	660 [2]	302	290	55	65
400	RVS-DN 650	470		715		302		65	
450	RVS-DN 820	470	623	715	660 [2]	302	290	65	65
550	RVS-DN 950	623		660 [2]		290		83.3	
630	RVS-DN 1100	723		1100		370		155	
800	RVS-DN 1400	723		1100		370		155	
950	RVS-DN 1800	723		1100		370		155	
1250	RVS-DN 2150	750		1100		392		240	
1400	RVS-DN 2400	900		1300		472		314	
1550	RVS-DN 2700	900		1300		472		314	

[1] Versión anterior.

[2] Con contactor bypass añada 160mm a la altura.

Arrancador suave digital, fuerte, resistente, con prestaciones totales, incorpora características inmejorables de arranque y paro que proporcionan soluciones para las aplicaciones más exigentes. El completo paquete de protecciones al motor garantiza fiabilidad a largo plazo, mientras que su robusto diseño asegura un excelente comportamiento en ambientes severos. Incorpora características únicas como Programa para Control de Bombas, Baja Velocidad con Inversión Electrónica, visualización por LCD y LED's.

Características generales

- Gama completa 8-3500A, 220-1000V
- Servicio duro, diseño con prestaciones totales.
- Construcción robusta y uso sencillo.
- Características de arranque y paro inmejorables.
- Extenso paquete de protecciones de motor.
- Temperatura ambiente máxima hasta 50°C
- Opciones únicas, que incluyen:
    - Test de aislamiento del motor.
    - Comunicación RS 485, ModBUS/Profibus/TCP-IP
    - Entrada de termistor / Salida analógica.

Arranque y Paro

- Arranque y Paro Suaves.
- Límite de corriente.
- Programa para el control de bombas.
- Funciones de control de Par y Corriente para optimizar los procesos de arranque y paro.
- Doble ajuste - Dos características de arranque y paro.
- Pulso de arranque.
- Baja velocidad con inversión electrónica.
- Aceleración lineal (realimentación por taco).
- Ahorro de energía para la mejora del factor de potencia.

Protecciones al Motor y del Arrancador

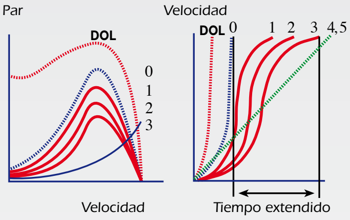
- Demasiados arranques.
- Tiempo de arranque largo (bloqueo)
- "Shear-pin" (Fusible electrónico arranque, marcha, obstrucción...).
- Sobrecarga electrónica con curvas seleccionables.
- Baja corriente con retardo ajustable.
- Pérdida de fase y Secuencia de fases.
- Baja, Sobre y Sin tensión.
- Pérdida de carga (motor no conectado).
- Cortocircuito SCR.
- Sobretemperatura del arrancador.

Indicaciones LCD y LEDs

- LCD - Dos filas de 16 caracteres.
- Múltiples idiomas - Inglés, Alemán, Francés y Castellano.
- Dos modos indicación para aplicaciones básicas y avanzadas.
- Manejo sencillo con parámetros por defecto.
- Ocho LEDs - de estado de operación.
- Datos estadísticos incluyendo:
    - Tiempo total de marcha.
    - Número total de arranques.
    - Tiempo del último arranque.
    - Corriente del último arranque.
    - Último fallo.
    - Número total fallos.
    - Corriente de fallo.

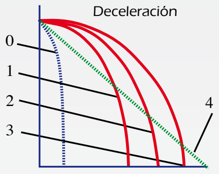
Control de Bombas (común para RVS-DN y RVS-DX)

Curvas de Arranque



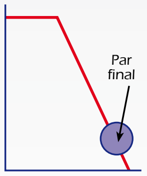
Los RVS-DN (DX) incorporan un Programa inteligente para el control de bombas, que permite la selección entre tres curvas dinámicas de incremento de tensión y curvas de Par o Corriente, las cuales reducen el pico de par, así como prolongan el tiempo de aceleración.

Curvas de Paro



Cuando se bombea a grandes alturas y el motor es parado suavemente, el par motor puede caer rápidamente por debajo de par de carga, causando una pérdida de sustentación brusca, en vez de reducir suavemente la velocidad hasta cero. Esto crea un golpe de ariete y en consecuencia fuertes ruidos y daños en la tubería. El control de bombas permite la selección entre tres curvas dinámicas de reducción de tensión o de Par, para prevenir una pérdida de sustentación y eliminar el golpe de ariete.

Par Final



Antes de finalizar el proceso de deceleración, el par motor alcanza un nivel donde el par de carga es superior al par motor y la válvula de retención cierra. El motor continua girando contra una válvula cerrada (sin carga) hasta parar. La función Par Final permite seleccionar un punto donde el motor pare cuando la válvula cierra.

RVS-DN 1000V

El Arrancador Suave Digital de 1000V controlado por microprocesador más pequeño del mundo.

Las mismas prestaciones y características que el RVS-DN.

RVS-DN 1000V para minas

Arrancador Suave Digital de 1000V construido en acero inoxidable y cobre para instalación en ambientes severos bajo tierra (mineria).

RVS-EX

Arrancador Suave Digital con bypass interno para arranque de motores Ex.
De 8-1100A y 220-600V.

Para arranque de motores: Ex-E, Ex-N, Ex-D, Ex-P

HRVS-DN

Arrancador Suave Digital para Media Tensión
Servicio duro continuo, con prestaciones totales.

Basado en tecnología de circuitos por microprocesador y conexiones al control por fibra óptica, el HRVS-DN es la solución ideal para el arranque suave de motores asíncronos trifásicos de media tensión, así como motores síncronos. El sofisticado control asegura características de aceleración y deceleración inmejorables, eliminando así, el pico de corriente y el choque mecánico.

El arrancador puede suministrarse como kit IP00 o en celda (IP31-67, NEMA 1-4X) con contactores de vacío para línea y bypass o interruptores de máxima, seccionadores, fusibles de protección, relés de protección a motor, etc.

HRVS-DN-EX
50-2700A, 1500-15000V

Arrancador Suave Media Tensión en ambientes exp

El corazón del equipo de arranq
lador basado en un microproce
un amigable interfase hombre m
nes excepcionales.

Estandars:

- Supera GB3836.1-4-2000 Requ
  Electrical apparatus for explosi
- Certificado de seguridad del a
  productos en minas de carbón
- ISO9001:2000 Certificación Sis
  cional de Calidad.
- Protección Clase IP54 (TBD).

Tipo	Tensión nominal	Corriente nominal	Potencia kW	Dimensiones (mm) Ancho	Alto	Prof.
QJGR-75/6		75A	600			
QJGR-150/6		150A	1210			
QJGR-250/6	6 kV	250A	2170	1940	1570	1050
QJGR-300/6		300A	2610			
QJGR-400/6		400A	3480			

SOLCON

losivos.

ue es un contro-
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stema Interna-

Simbolo

Exd (id) I

Versión Marina y Offshore incorpora contactores de vacío de línea y bypass. 6600 V, 30-1200A.

Versión Marina y Offshore en construcción estándar para media tensión de 10-15 kV, 30-2500A. Contactores o interruptores para línea y bypass, instalados individualmente en compartimentos segregados.

Arrancador Suave para 2300-6600V, 30-1200A con celda de alimentación con seccionador y fusibles.

Construcción estándar para media tensión de 10-15 kV, 30-2500 A. Contactores o interruptores para línea y bypass, instalados individualmente en compartimentos segregados.

"Todo en uno" Celda de arrancador con seccionador, bases fusibles, fusibles, contactor de línea y contactor de bypass.

El kit para OEM (IP00) incluye el módulo de potencia, el módulo de control, emisor y receptor del EPT y transformador de control. Disponible para todos OEM's formados en nuestros seminarios de media tensión.

RVS-TX

Arrancador Digital para Transformadores. De 8-3500A y de 220-1000V.

Elimina el pico de corriente de magnetización en los transformadores. El RVS-TX incorpora operación automática con comunicación RS 485 Modbus.
También para media tensión.

TPS

Controlador de Temperatura. De 8-1500A y de 220-1000V.

Sistema controlador de tensión/calor por tiristores totalmente digital. El TPS controla la tensión aplicada a cargas de elementos calefactores, unidades de potencia de una, dos o tres fases. El TPS permite un control automático y contínuo de temperatura, eliminando el contactor de conmutación y la sobre/baja temperatura. Sus características estándar son: control de fase, paso por cero, entrada PID, control por potenciómetro local, comunicación RS 485 y mas.

Solbrake

Frenos de Inyección DC 10-390A.

KW 400V	Freno tipo (A)	Dimensiones (mm) Ancho	 Alto	 Prof.	Peso (Kg)
5.0*	Solbrake 10*	90	75	105	0.5
7.5	Solbrake 17	65	190	114	1.3
15	Solbrake 31	65	190	114	1.3
30	Solbrake 58	65	190	114	1.3
55	Solbrake 105	154	280	168	5.0
90	Solbrake 170	154	280	168	5.0
110	Solbrake 210	154	280	168	5.4
160	Solbrake 310	224	384	222	12
200	Solbrake 390	224	384	222	12

* 5.5KW a 415V

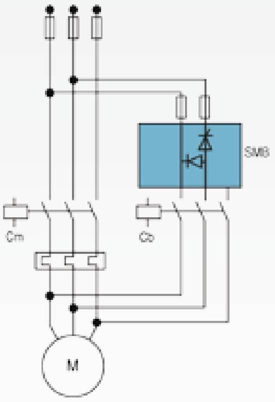
Características generales

El Freno electrónico de Motor SMB proporciona una parada rápida, suave y sin fricción a los motores trifásicos de inducción, mediante la inyección controlada de corriente continua a los devanados del motor, después que el contactor principal haya abierto.

- Previene el desgaste mecánico.
- Reduce el tiempo de parada de cargas de alta inercia.
- Tiempo de frenado ajustable.
- Auto stop - La inyección DC finaliza cuando el motor para.
- Montaje raíl DIN (Estándar 10A, opcional 17-58A).
- Instalación simple y fácil utilización.

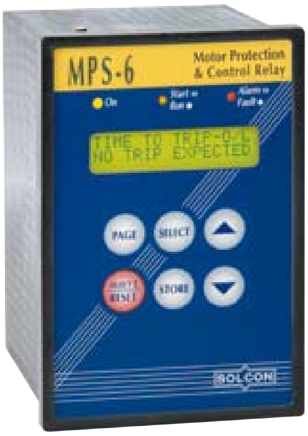
Valores nominales

- Tensiones:
  230, 400, 460 y 600V
  (105-580A disponibles
  hasta 690V).



MPS-6

Relé para Protección y Control de Motor.



El MPS-6 está basado en la última tecnología de microprocesador. Su avanzada circuitería permite la Protección, el Control y la Supervisión de motores.

Características generales

- Control de las tres fases de corriente, tensión y tres entradas de temperatura.
- Completo paquete de protecciones y control.
- Medida de Potencia.
- Indicación de Energía (kWH) y salida de pulsos.
- Salida analógica programable.
- Reloj de tiempo real.
- Datos estadísticos de los últimos 10 disparos (con fecha y hora).
- Múltiples curvas de Sobrecarga Térmica.
- Desequilibrio de corriente:
  - Secuencia negativa y positiva.
  - Tiempo mínimo, previene respuesta rápida.
  - Bias para la Sobrecarga Térmica.
  - RTD Bias para la Sobrecarga Térmica.
- Software único para aprendizaje y simulación de fallo.
- Pre-alarma de Demasiados Arranque.
- I>>0 Energíza relé de salida B en un Disparo.
- Grupos de fallo configurables, para relés A, B y C.
- Sin Proceso de Arranque, permite la marcha si I>=10%
- Indicación de mín. y máx. media RMS de A, V y Hz.
- Ajuste de G/F durante el arranque.
- Función de Rearranque de Emergencia.
- Rearranque después de fallo de la tensión principal o de control.
- Alimentación Auxiliar y de Control separadas.
- Comunicación Modbus.
- Seis entradas discretas programables.
- Seis relés de salida programables.
- Gran visualizador LCD.
- Entrada de control AC o DC (85V a 230V).
- Dimensiones DIN estándar.
- Instalación y operación sencillas.

MIP-6

Relé para Protección de Aislamiento de Motor.

El MIP-6 controla el nivel de deterioramiento del aislamiento del motor, en baja y media tensión. Mide la resistencia de aislamiento entre el motor y tierra e indica los valores real y medios mayores y menores en un periodo de tiempo predefinido.

El rango de medida es de 0,1-20 MΩ y existen versiones para baja y media tensión. Cuatro relés programables proveen de señales de salida digitales y la comunicación RS 485 proporciona información a tiempo real. Una salida analógica de 4-20 mA está disponible opcionalmente.

Características generales

- Controla el deterioro del aislamiento en motores de baja y media tensión.
- Indica el valor de resistencia de aislamiento presente y medio en el LCD.
- Controla mientras el motor esté des-energizado.
- Operación automática con parámetros por defecto.
- Parámetros programables.
- Tecnología basada en microprocesador.
- Selección del nivel de Alarma y Disparo en el rango de 0,1 a 20 20 MΩ.
- Utiliza hasta 48 VDC de tensión para prueba para mejora de la seguridad personal.
- Visualizador LCD iluminado 2 líneas de 16 caracteres.
- Seis teclas para una fácil programación.
- Tres LED's para indicación simple del estado.
- Seguimiento del deterioro por datos históricos con fecha y hora.
- Autorización para modificación de parámetros.
- Cuatro relés programables.
- Salida analógica opcional 0/4-20 mA.
- Comunicación Modbus opcional.
- Tensión de control 120 V ±20%, 50/60 Hz.
- Temperatura de operación de 0° hasta 50° C (estándar) opcional -10° a +60° C.

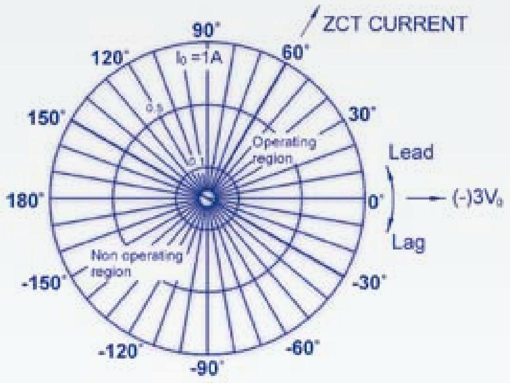
MPR-6-DGF

Relé de Protección con Fallo a Tierra Direccional.

El MPR-6-DGF controla las tres fases de corriente, corriente a tierra direccional, temperatura del motor (tres RTD's / Termistores) y crea un "Modelo Térmico" exacto del motor para protegerlo de condiciones anormales debidas a fallos de la alimentación, del cableado, del propio motor, así como, con el fallo a tierra direccional protege de fugas a tierra en barcos y hospitales, donde la tierra convencional es complicada.

Características generales

- Circuitos basados en microprocesador.
- Medida de verdadero valor RMS con tiempo de muestreo de 0,5 ms.
- Indicación de los datos de operación del motor, fallos y datos estadísticos.
- Indicación de "Tiempo al Disparo".
- Entradas y Salidas programables.
- Comunicación RS 485 para programación remota, control y supervisión.
- Diseño compacto e instalación simple.



MPS-3000

Relé para Protección y Control de Motor.

El MPS 3000 es la protección ideal para motores de alta tensión y grandes motores de baja tensión en aplicaciones donde se requiera extensa protección con advertencias avanzadas, especialmente en procesos químicos, marinos y «offshore».
Controlando las tres fase de corriente, tensiones y hasta 10 entradas de temperatura, provee del paquete de protección de motor más completo. Los métodos de cálculo de la Capacidad Térmica y Sobrecarga están incorporados así como entrada de desviación de la curva de sobrecarga a partir del desequilibrio de corriente (secuencia positiva/ negativa) y de los sensores de temperatura, asegurando un preciso modelo de la condición del motor.

Protecciones

- Tiempo Máximo de Arranque.
- Pre-alarma Demasiados Arranques.
- Demasiados Arranques.
- Baja corriente Nivel 1 y Nivel 2.
- Incremento de Carga - Alarma.
- Sobre-corriente Nivel 1 - Bloqueo.
- Sobre-corriente Nivel 2 - Corto.
- Sobre-carga Térmica Nivel 1 y Nivel 2.
- Desequilibrio de Corriente Nivel 1 y Nivel 2. (Secuencia Positiva / Negativa)
- Baja Tensión.
- Sobre-tensión Nivel 1 y Nivel 2.
- Pérdida de Fase y Secuencia de Fases.
- Nivel Fallo a Tierra en el arranque.
- Fallo a Tierra Nivel 1 y Nivel 2.
- Fallo de Comunicación y Fallo Interno.
- Fallo Externo 1 - 2 - 3 - bloqueo.
- Alta Temperatura Nivel 1 y Nivel 2, sensores 1-10.
- Baja Potencia Nivel 1 y Nivel 2.
- Factor de Potencia Bajo.
- Relé Auxiliar cierra al detectar contactor soldado (programable).

Nivel 1 y 2 pueden usarse para Alarma y Disparo o los para Disparo, cada uno con retardo individual.

TPR-6

Relé Digital para Protección de Temperatura.

El TPR-6 controla de 6 a 14 entradas de temperatura RTD / Termistor. Mide el incremento exacto de temperatura, para proteger a los devanados y rodamientos del motor/ transformador de daños debidos al calor.
El auto-test interno protege contra sensor desconectado y fallos del operador.

- Circuitos basados en microprocesador.
- Indicación Datos RTD o Termistor, Fallos y Estadísticas.
- Entradas y Salidas programables.
- Comunicación RS 485, con protocolo Modbus, para selección remota y supervisión.
- Dos niveles de protección Alarma y Disparo.
- Selección entre Disparo y Disparo «fail safe».
- Salida Analógica relativa a cualquier entrada o combinación de ellas.
- Selección de RTD / Termistor vía Dip.
- Protección de sensor desconectado.

Característica de Protección

- Selección de RTD / Termistor (independiente para cada entrada).
- Selección de Termistor PTC / NTC (independiente para cada entrada).
- Alarma de sobre-temperatura Entrada número 1..14.
- Disparo de sobre-temperatura Entrada número 1..14.
- Señal analógica de salida continua.
- Fallo Externo 1 y 2 (contacto N.A./N.C.).

Funciones de Protección

Cada protección puede asignarse a cualquiera de las siguientes funciones:

- Sólo Alarma – Relé A.
- Sólo Disparo – Relé B.
- Inhibida.
- Habilitar Auto Rearme.
- Alarma y Disparo.
- Relés C y D programables.

Aplicaciones Típicas

- Motores Media y Baja tensión (devanados y rodamientos).
- Motores accionados por convertidor de frecuencia.
- Transformadores.
- Multi RTD y dispositivos con rodamientos, (turbinas).

SOLCON

DPM-10

Medidor Digital de Potencia.

El DPM-10 es un avanzado medidor e indicador de potencia con electrónica basada en microprocesador, que combina lecturas de gran exactitud con fiabilidad, para un seguimiento y supervisión de la energía eléctrica completos.
Reemplazando varios dispositivos analógicos y selectores, el DPM-10 es una alternativa de coste efectivo proveyendo flexibilidad realzada, requerida por los modernos sistemas de potencia. Fácilmente integrable en cualquier gestión de línea de energía, el DPM-10 incluye comunicación RS 485 con protocolo MODBUS.

Ventajas a simple vista

- Medida valor verdadero RMS (tiempo muestreo 0,5 ms).
- Cálculo exacto de la onda no-senoidal.
- Medida de Potencia y Energía.
- Precisión clase 0,5 con larga estabilidad.
- LEDs de siete segmentos, visibilidad a larga distancia.
- Configuración programable en campo.
- Programación simple vía panel frontal o comunicación.
- Salida de pulsos de relé (KWH) programable.
- Comunicación versátil RS 485 & 232 Modbus.
- Apropiado para sistemas de 3 ó 4 hilos, 2 ó 3 C/Ts y P/Ts.
- Entradas aisladas.
- Compatibilidad Electro magnética.
- Dimensiones compactas: 144 x 144 x 95 mm.

Medidas Instantáneas

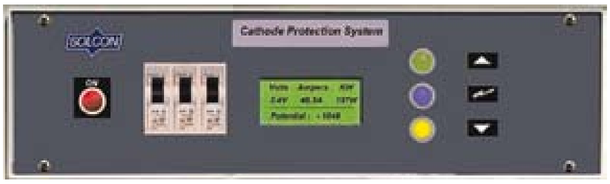
- Tensión - 3 fases a neutro (V, KV).
- Corriente - 3 fases (A, KA).
- Máxima demanda (A, KA).
- Potencia Activa (KW, MW).
- Potencia Reactiva (KVAR, MVAR).
- Energía Activa (KWH, MWH).
- Energía Reactiva (KVARH, MVARH).
- Factor de Potencia (Retrasado o adelantado).
- Frecuencia (Hz).

Aplicaciones Típicas

- Paneles de control, cuadros de conmutación, MCCs.
- Generadores Diesel (cálculo en 4 cuadrantes).
- Sistemas UPS.

CorPro Protección Catódica

Sistema por Aplicación de Corriente.



Solcon Industries ofrece una avanzada Protección Catódica por Impresión de Corriente con control digital.
El CorPro incluye un amplio rango de protección y elementos de medida, proporcionando así, la última solución para supervisión y operación contínuas.
CorPro ha sido diseñado y construido según los rigurosos estándars tales como NACE, EC y DNV.

Características Principales

- Modo de operación: Tensión constante pre-ajustada, Corriente constante, Potencia constante (Entrada de célula de potencia externa), PI mejorado.
- Alimentación monofásica y trifásica.
- Contactor y fusibles ultra-rápidos de entrada.
- Rendimiento mínimo del sistema 85%.
- Rango de corriente de 8, 24, 50 Amperios DC.
- Rango de conmutación:
  estado ON – 0,1 a 8 s en pasos de 0,1 s.
  estado OFF – 0,1 a 2 s en pasos de 0,1 s
- Comunicaciones por GPS, Satélite, Internet, Modbus, GSM y otras.
- Registro de datos (para histórico y análisis).
- Start/Stop para sistema computerizado (contacto seco).

Aplicación

- Tuberías (aguas límpias, aguas residuales, petróleo crudo, gas, etc).
- Cascos de buques.
- Tanques de almacenaje.
- Muelles y estructuras en puertos.
- Láminas de acero, columnas y cimientos.
- Plataformas Offshore, estructuras flotantes y sumergidas.
- Tanques de almacenaje y de lastre en buques.

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DISTRIBUIDO POR:

AI1176B08 (2000 - 02/08)

RVS-DN

Digital Soft Starter
8-3500A, 220-1000V

Instruction Manual

Ver. 12/10/2003

Table of Contents

Safety

- Read this manual carefully before operating the equipment and follow its instructions
- Installation, operation and maintenance should be in strict accordance with this manual, national codes and good practice. Installation or operation not performed in strict accordance with these instructions will void manufacturer's warranty.
- Disconnect all power inputs before servicing the soft-starter and/or the motor.
- After installation, check and verify that no parts (bolts, washers, etc) have fallen into the power Section (IP00 for sizes B-G).

Attention

- This product was designed for compliance with IEC 947-4-2 for class A equipment.
- RVS-DN 8 - 820 are UL approved. RVS-DN 950 - 3500 are designed to meet UL requirements.
- RVS-DN 8 - 1400 are LR approved. RVS-DN 1800 - 3500 are designed to meet LR requirements.
- Use of the product in domestic environments may cause radio interference, in which case, the user may be required to employ additional mitigation methods.
- Utilization category is AC-53a or AC53b. Form1. For further information, see Technical Specifications for further details.

Warnings

- Internal components and P.C.B's are at main potential when the RVS-DN is connected to main. This voltage is extremely dangerous and will cause death or severe injury if contacted.
- When RVS-DN is connected to main, even if control voltage is disconnected and motors is stopped, full voltage may appear on starter's output and motor's terminals.
- Unit must be grounded to ensure correct operation, safety and to prevent damage.
- Check that Power Factor capacitors are not connected to the output side of the soft starter.

Starter Selection

The RVS-DN is a highly sophisticated and reliable starter designed for use with standard three-phase, three-wire, squirrel cage induction motors. It provides the best method of reducing current and torque during motor starting.

The RVS-DN starts the motor by supplying a slowly increasing voltage to the motor, providing soft start and smooth acceleration, while drawing the minimum current necessary to start the motor.

The second generation, microprocessor based digital circuitry provides unique features like pump control, slow speed, electronic reversing and accurate motor protection, with optional Insulation Protection, Thermistor input, etc.

The optional RS 485 Communication with MODBUS protocol enables full control (Start, Stop, Dual Adjust, command, etc.) and supervision. Up to 32 starters can be connected on a shield twisted pair to a host computer.

RVS-DN Ratings and Frame sizes

Max Motor FLA (Amp)	Starter Type (FLC)	Frame Size
8	RVS-DN 8	A
17	RVS-DN 17	
31	RVS-DN 31	
44	RVS-DN 44	
58	RVS-DN 58	
72	RVS-DN 72	
85	RVS-DN 85	B
105	RVS-DN 105	
145	RVS-DN 145	
170	RVS-DN 170	
210	RVS-DN 210	C
310	RVS-DN 310	
390	RVS-DN 390	
460	RVS-DN 460	D
580	RVS-DN 580	
820	RVS-DN 820	
950	RVS-DN 950	
1100*	RVS-DN 1100	E
1400*	RVS-DN 1400	
1800*	RVS-DN 1800	
2150*	RVS-DN 2150	F
2400*	RVS-DN 2400	G
2700*	RVS-DN 2700	
3000*	RVS-DN 3000	
3500*	RVS-DN 3500	

* Fully rated when used with a by-pass contactor

Dimensions (mm)

For exact dimensions, see Dimension Sheets.

Size	Width	Height	Depth	Weight (Kg)
A	153	310	170*	4.5, 6.0, 7.5
B std.	274	370	222	15
B new	274	385	238	15
C	590**	500	290	45
D	623	660***	290	65
E	723	1100	370	170
F	750	1300	392	240
G	900	1300	410	314

* 217mm – for 44, 58 & 72A

** 536mm – By special order, without side covers

*** Add 160mm for bypass bus-bars extension

The starter should be selected in accordance with the following criteria (see Ordering Information data).

Motor Current & Starting Conditions
Select the starter according to motor's Full Load Ampere (FLA) – as indicated on its nameplate (even if the motor is not fully loaded).

The RVS-DN is designed to operate under the following conditions:

Max. ambient temp:	50ºC
Max. starting current:	400% motor's FLA
Max. starting time:	30 sec. (at 400% FLA)
Max. starts per hour:	4 starts per hour at max conditions. Up to 60 starts per hour at light load applications.

Note: For very frequent starts (inching applications), the inching current should be considered as the Full Load Ampere (FLA).

Main Voltage (line to line)

Deleted: ¶

Thyristor's PIV rating, internal circuitry and insulation defines four voltage levels: 220-440V, 575-600V
460-500V, 660-690V
Each starter is suitable for one of the above levels & for 50/60 Hz.

Control Voltage
The Control Voltage operates the electronic circuitry and fans. Two voltage levels are available:

220-240V + 10%-15%, 50/60 Hz (standard)
110-120V + 10%-15%, 50/60 Hz
110 Vdc for Frame size B-G (by special order).

Control Inputs
Control Input voltage (start, stop, etc.) can be the same as Control Supply above (standard), or 24-240V AC / DC (by special order).

Options (see Ordering Information Data)

• Communication Card	(option # 3)
• Insulation Tester Card	(option # 4)
• Analogue card-Thermistor in/Analogue out	(option # 5)
• Special treatment – Consult factory	(option # 8)
• Preparation for by-pass contactor	(option # 9)
• Special width for size C-536 mm	(option #A)
• Line/load bus-bars at the bottom, size C&D	(option #B)
• Door install MMI instead of the original	(option #D)
• Door install MMI w/op.#L&1.5m cable	(option #DK)
• Back-lit LCD	(option # L)
• Lloyds Register ENV-1, ENV-2 approval	(option #M)
• Tachometer feedback	(option # T)
• UL & cUL approvals	(option # U)

Prior to Installation

Check that Motor's Full Load Ampere (FLA) is lower than or equal to the starters Full Load Current (FLC) and that Main and Control voltages are as indicated on the front panel.

Mounting

- The starter must be mounted vertically, allow sufficient space above and below the starter for suitable airflow.
- It is recommended to mount the starter directly on the rear metal plate for better heat dissipation.
- Do not mount the starter near heat sources.
- Protect the starter from dust and corrosive atmospheres.

Note: For harsh environments, it is recommended to order the starter with Option # 8 – Special Treatment (printed circuit board coating).

Temp. Range and Heat Dissipation

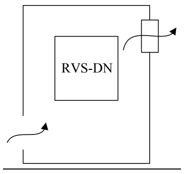
The starter is rated to operate over a temperature range of -10ºC (14ºF) to + 50ºC (122ºF). Relative non-condensed humidity inside the enclosure should not exceed 95%.

Starter's heat dissipation is approx. 3 x In (three times the current in watts).

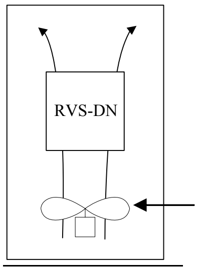
Example: For a 100A motor, heat dissipation is approx. 300 watts.
Internal enclosure heating can be reduced through the use of:

a. Additional ventilation
b. Employing a by-pass contactor.

Additional Ventilation



General purpose enclosure
Fan on air outlet



Non-ventilated enclosure
Fan, creating air circulation

Calculating the enclosure size, for non-ventilated metallic enclosure:

$$\text{Area } (m^2) \quad \frac{0.12 \text{ x Total heat dissipation (Watts)*}}{60 - \text{External ambient temp. (ºC)}}$$

Where Area (m^2) - Surface area that can dissipate heat (front, sides, top).

* Total heat dissipation of the starter and other control devices in the enclosure.

Note: If the starter is installed in a non-metallic enclosure, a by-pass contactor must be used.

Short Circuit Protection

Protect the starter against a short circuit by Thyristor Protection Fuses (see appendix page 44 for I_2t and fuses).

Transient Protection

Line transient voltages can cause a malfunction of the starter and damage to the thyristors. Starters frame sizes B-E incorporate Metal Oxide Varistors (MOV to protect from normal line voltage spikes.

For size A, or when higher transients are expected, additional external protection should be used (consult factory).

ATTENTION

When Start signal is initiated and a motor is not connected to load terminals, the Wrong Connection protection will be activated.

WARNING

1. When main voltage is connected to the RVS-DN, even if control voltage is disconnected, full voltage may appear on the starter load terminals. Therefore, for isolation purposes, it is necessary to connect an isolating device before the starter.
2. Power factor correction capacitors must not be installed on the starters load side. When required, install capacitors on starter's line side.

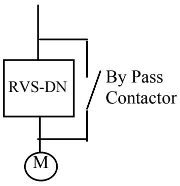
WARNING

RVS-DN current transformers, although may be installed outside of the soft-starter with extended wires, can not be grounded or connected to any other load except for the RVS-DN itself. Any such connection may cause damage to the load which was connected to it or to the RVS-DN itself!

By-pass Contactor

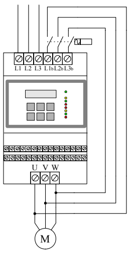
Under normal operating conditions, the heat dissipated by an electronic soft starter causes heating of the enclosure and energy losses. The heating and losses can be eliminated by the use of a by-pass contactor, which by passes the RVS-DN after completion of start-up, so motor current will flow through the by-pass contactor.

In this case the starter protection will be maintained except for the current protection, as the current will not flow through the internal current transformers after the by-pass closes.

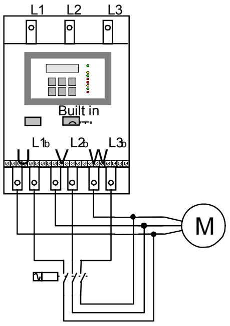


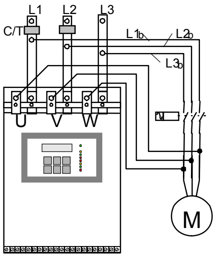
Preparation for By-pass Contactor (option)
In order to maintain current protection after the by-pass contactor closes, Preparations for By-pass Contactor can be ordered.

Frame Size A (8 – 72A)
Must be factory supplied, three additional terminals are added, marked L_{1b}, L_{2b}, L_{3b}.These terminals are connected after the internal C/Ts, intended for connection to the by-pass.

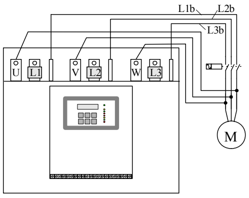


Frame Sizes B (Standard and New 85-170A)
Old – Additional set of bus-bars can be field mounted on the line side, after the C/Ts, marked L_{1b}, L_{2b}, L_{3b}.
New – Additional set of bus bars is built-in, where the line side is on top and motor side is at the bottom with the by-pass
L_{1b}, L_{2b}, L_{3b} terminals are located. By-pass contactor cables should be connected to these terminals.

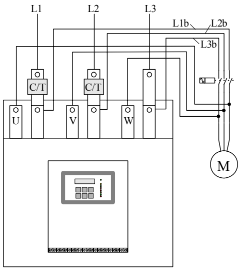




Frame Size C
(210 - 390A)
Additional set of bus bars can be field mounted on line side, after the C/T's marked L_{1b}, L_{2b}, L_{3b}. Bypass cables should be connected to these terminals.



Frame Size D
(460 - 820A)
Additional set of bus bars can be field mounted on line side, downstream to the C/T's marked L_{1b}, L_{2b}, L_{3b}. Bypass cables should be connected to these bus-bars.



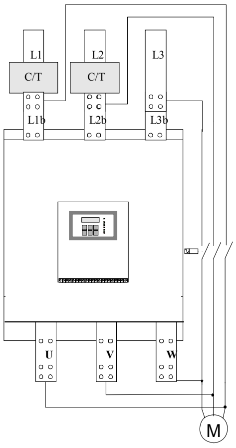
Note: Starter frame sizes C and D can be field modified to have Line and Load Bus-bars at the bottom (consult factory for further information).

Frame Size E
(1100 – 1800A)

Frame Size F
(2150A)

Frame Size G
(2400 – 3500A)

Additional set of bus-bars can be field mounted on line side, down stream to the C/Ts, marked L_{1b}, L_{2b}, L_{3b}. By-pass cables should be connected to the bus-bars down stream to the C/T's



Note: Connect as follows

- **Line to L1, L2, L3**
- **By-pass**
  Input to L_{1b}, L_{2b}, L_{3b}
  Output to U, V, W
- **Motor (Load)** to U,V,& W

Do not interchange line and load connections.

Control Terminals

Control Supply **Terminals 1-3**
110-120VAC or 220-240VAC, 50/60Hz as indicated on the front panel, required to power the electronic circuitry and fans when incorporated. This voltage can be from a grounded or ungrounded main system.

110VDC can be supplied by special order for starter sizes B-G (not field interchangeable).

Note: It is recommended that terminals 1-3 be always connected to the Control Supply.

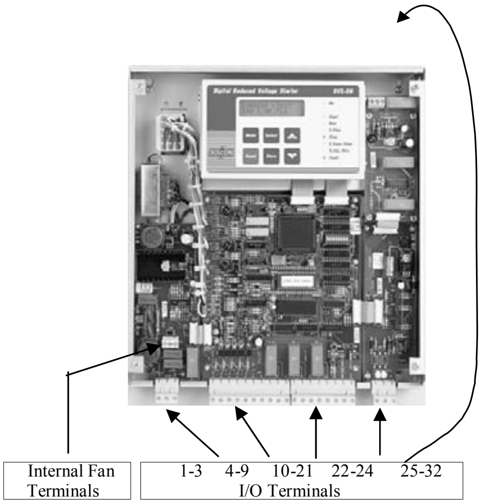
Fan's Supply Voltage **Terminal 2**
An internal jumper, connected between fan and terminal 2 enables three modes of operation (see Fan Control – page 16). For fan power consumption, see technical specification.

<u>Continuous mode</u> (factory default) – Fan operates as long as Control Supply is connected to terminals 1-3. Leave internal jumper connected to left lug of JI terminal (A).

<u>External control mode</u> – Fan operates when Control Supply is connected to terminal 2. Connect internal jumper to the center lug of JI terminal (B). For use without by-pass, connect fans before "start" and disconnect at least 5 minutes after "Stop/Soft-stop".

<u>Automatic mode</u> – Fan begins operation when start signal is initiated and stops approximately five minutes after start signal. When stop signal is initiated, the fan begins operation and stops after five minutes. Connect internal jumper right lug of JI terminal (C).

WARNING
Automatic mode may be used only if by-pass contactor is directly controlled by the RVS-DN "End-of-Acceleration" contact.



<u>Control Inputs</u>
Incorporating opto-couplers to isolate the micro-processor circuitry.
The starter is supplied standard for 220-240V, 50/60Hz Control Supply and Control Inputs voltage.

By special order, Control Inputs may be supplied for voltage levels of 24-240 VAC/DC. (for more information, see Ordering Information data – Appendix page 48).

Stop **Terminal 4**
Input from a N.C contact. To stop the motor, disconnect control voltage from Terminal 4 for at least 250mSec.

Soft stop **Terminal 5**
Input from a N.C contact. To soft stop the motor, disconnect control voltage from Terminal 5 for at least 250mSecs.

Note: If Soft Stop is not required, connect a jumper between terminals 4 and 5.

Start **Terminal 6**
Input from a N.O contact. To start the motor, connect control voltage to Terminal 6 for at least 250mSecs.

Notes:
1. Motor will start only if Stop (4) and Soft Stop (5) terminals are connected to control voltage.
2. Reset after a fault is not possible for as long as Start command is present.

Energy Save / Slow Speed / Reset **Terminal 7**
Input from a N.O contact. Selection between above functions is made from the keypad or through the communication (see I/O Programm.)

- When <u>Energy Save</u> function is selected –connect terminal 7 to control voltage by a jumper for automatic operation, upon load decrease.
  When connected through a N.O contact, closing the contact operates Energy Save.
- When <u>Slow Speed</u> function is selected – connect control voltage to terminal 7 **before** starting, to run the motor at 1/6 nominal speed. Closing terminal 7 while motor is running will not have any effect.
- When Reset function is selected, connect terminal 7 to control voltage (use a N.O <u>momentary</u> contact) to reset the starter.

Dual Adjust Reverse / Reset **Terminal 8**

Input from a N.O contact. Selection between above functions is made from the keypad or through the communication (see I/O Programming).

a. When Dual Adjustment function is selected – connect terminal 8 to control voltage to operate starter with the Dual adjustment characteristic.
Switching between primary and Dual Adjustment settings can be done before and during starting. If a push-button arrangement is used, keep control voltage connected at least RUN LED is lit.

Note: When starting from Diesel Generator or weak power supply set dip. Switch # 3 "On" – connect terminal 8 to control voltage to operate starter with Generator Parameter settings.

b. When Slow Speed reverse function is selected (Slow Speed function must be selected for terminal 7 and Control Input voltage connected to it). Connect control voltage to terminal 8 to reverse direction. Reverse command can be given before motor is started, or during operation at Slow Speed.
Connecting Control Voltage to terminal 8 before motor is started, starts the motor in Reverse Direction.
Connecting control voltage while motor is running at Slow Speed, stops the motor for 0.6 – 2 sec (according to motor size) before reversing its direction.

c. When "Reset" function is selected, connect terminal 8 to control voltage (use a N.O momentary contact) to reset the starter.

Common **Terminal 9**

Common for terminals 4, 5, 6, 7, 8.

Note: When Control Supply and Control Input voltage are from the same source, connect a jumper between terminals 3 and 9.

Immediate/Shear-pin Relay **Terminals 10-11-12**

Terminals: 10- N.O. 11-N.C. 12 – common.
Voltage free 8A, 250VAC, 2000VA max.
Selection between functions is made from the keypad or through the communication, (see I/O Programming).

Programmable functions:

1. **Immediate** (after start signal).
When immediate is selected, the contact changes its position upon Start signal. The contact returns to its original position on Stop signal, in case of a fault or upon control supply outage.

When Soft Stop is operated, the contact returns to the original position at the end of the Soft Stop process.

The contact incorporates On & Off delays 0-60 sec. each.
The Immediate Contact can be used:
- To release the brake of a brake motor.
- For interlocking with other systems.
- For signaling.
- Used with delay for opening an upstream contactor at the end of soft stop thus, allowing current decrease to zero before opening the contactor.
- To switch to / from Dual Adjustment settings with a time delay from Start signal (see Special Starting).

2. **O/C Shear-pin detection**
When O/C Shear-pin is selected, the contact changes position upon Shear-pin detection (Starter's trip can be delayed 0-5 sec).

The O/C Shear-Pin contact can be used:
- For interlocking with other systems.
- For signaling.
- Used with delay for operating a reversing combination of upstream contactors when Shear-Pin is detected, thus, allowing clearing a Jam condition.

Fault Contact **Terminals 13-14-15**
Terminals: 13-N.O. 14-N.C. 15 – Common.

Voltage free 8A, 250VAC, 2000VA max. changes its position on fault. The contact is programmable to function as Trip or Trip – fail safe relay.

a. When Trip function is selected, the relay is energized upon fault. The contact returns to its original position after fault has been removed and starter was reset, or upon disconnection of Control Supply.

b. When Trip-fail safe function is selected, the relay is energized immediately when Control Supply is connected and de-energizes upon fault or Control Supply disconnection.

End of Acceleration Contact **Terminals 16-17-18**
Terminals: 16-N.O. 17-N.C. 18 – Common.

Voltage free 8A, 250VAC, 2000VA max. changes its position at the end of acceleration, after an adjustable time delay (Contact Delay), 0 – 120 sec.

The contact returns to its original position, when Energy Saver is operated, on Soft Stop or Stop signals, on fault condition, or upon voltage outage.

The End of Acceleration contact can be used for:
- Closing a by-pass contactor.
- Activating a valve after compressor has reached full speed.
- Loading a conveyor after motor reached full speed.

External Fault **Terminal 19**
Input from a N.O contact, connected between terminals 19 and 21. The starter will trip 2 sec. after contact closes.

WARNING
- Only potential free contacts may be connected to terminal 19.
- Do not connect any voltage to terminal 19. Any connection of voltage to this terminal may disrupt soft-starter operation, and cause starter or motor damage.

Notes:
- Wires connecting the External Fault contact to terminal 19 should not exceed 1 meter in length.
- External Fault can be used only when terminal 21 is connected to Neutral or Ground.
- Do not use External Fault while using Insulation Alarm option.

Tacho Feedback – Optional **Terminal 20**
Provides linear acceleration and deceleration.
Requires high quality Tacho generator on motor shaft, output voltage 0-10VDC, linear speed/voltage ratio.
Consult factory before using Tacho feedback feature for further information.

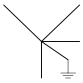
Neutral **Terminal 21**
When Neutral wire is available, connect Terminal 21 to Neutral (see pages 6, 8 & 10). Terminal 21 serves only as voltage reference.

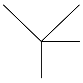
Note: Starter's power section incorporates and internal artificial neutral, which should only be used, when the system is not grounded and neutral connection is not available.

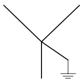
WARNING
- Only potential free contacts may be connected to terminal 21.
- Do not connect any voltage to terminal 21.Any connection of voltage to this terminal may disrupt soft-starter operation, and cause starter or motor damage.

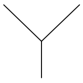
Notes:
- Wires connecting between terminal 21 and terminal 19 should not exceed 1 meter in length.
- Do not use External Fault when terminal 21 is not connected to Neutral or Ground.

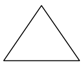
Terminal 21- Connections with various mains.

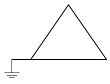

3P+N+GR Connect terminal 21 to neutral


3P+N Connect terminal 21 to neutral


3P+GR Connect terminal 21 to ground


3P Leave terminal 21 unconnected


3P Leave terminal 21 unconnected


3P+GR Leave terminal 21 unconnected

Control Terminals – Option Boards

Option # 3

RS-485 Communication **Terminals 23-24**
Terminals: 23 (-), 24 (+)

Standard RS485, Half Duplex with MODBUS Protocol, baud rate 1200, 2400, 4800, 9600 BPS. Twisted shielded pair should be used, connect shield to ground a PLC/Computer side. Terminals 4 & 5 must be wired to control supply for operation in communication mode (see Wiring Diagram – page 14 and Communication Instruction Manual).

Option # 4

Insulation Alarm **Terminals 25-26-27**
Terminals: 25- Common 26- N.O. 27 – N.C.

Voltage free 8A, 250VAC, 2000VA max. changes its position when motor insulation level decreases below Insulation Alarm level. The contact returns to its original position, after fault has been removed and starter reset, or upon Control Supply disconnection, or when insulation level increase above Alarm set-point for more than 60 sec.

Notes:

1. Do not use External Fault while using Insulation Alarm option.

2. Insulation test can be performed only when main voltage is not connected to the RVS-DN, namely an upstream isolation device must be opened.
   For correct operation of Insulation test, it is important that the RVS-DN is properly grounded and that the control module is properly fastened to the power section.

3. Option # 4 and option # 5 may not be applied together.

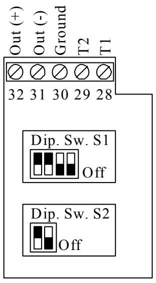
Option # 5

Analogue I/O (option # 5) **Terminals 28-32**

The Analogue card output incorporates two functions:

- Thermistor input
- Analogue output

Analogue P.C.B. layout:



Thermistor input **Terminals 28-29**
Programmable as PTC or NTC type thermistor. Trip value is adjustable between 1-10K, preset delay of 2 Sec.

Ground Terminal **Terminal 30**
Connect thermistor and / or Analogue output shield to this ground terminal.

Analogue Output **Terminals 31, 32**
Terminal: 31 (-), 32(+)
Dip switches allow selection between: 0-10VDC
0-20mA
4-20mA

Analogue value is related to motor current and can be programmed to normal or inverted output. (Default = Normal) Maximum value (20mA or 10Vdc) is related to twice the RVS-DN rated current (2xFLC).

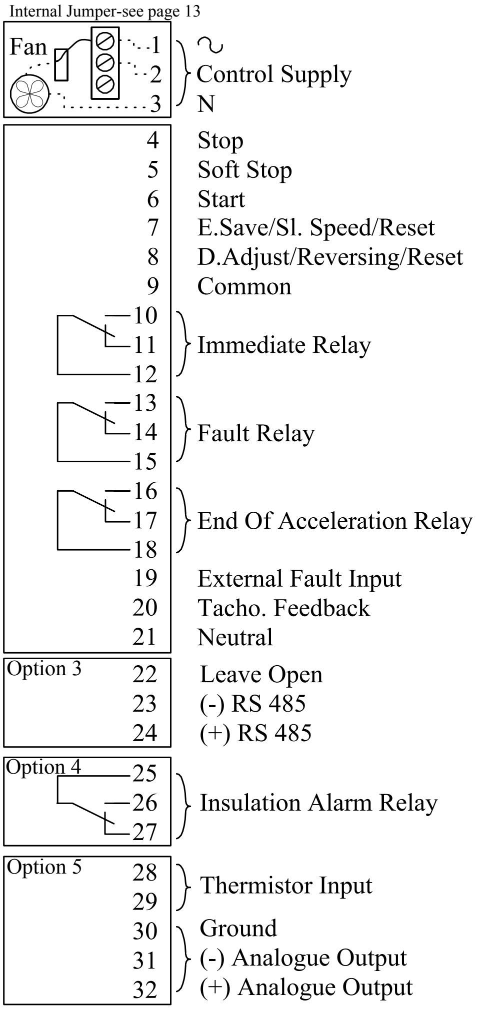
Dip No.	4-20 mA*	0-20 mA	0-10VDC
Dip-Sw. S1 # 1	On	On	Off
Dip-Sw. S1 # 2	On	On	Off
Dip-Sw. S1 # 3	Off	Off	On
Dip-Sw. S1 # 4	Off	Off	On
Dip-Sw. S2 # 1	On	Off	Off
Dip-Sw. S2 # 2	No use	No use	No use

* Default

Notes:

1. It is important that the RVS-DN is properly grounded, and control module is tightly fastened to the power section.
2. Option # 5 and option # 4 may not be applied together.
3. Use twisted shielded cable for thermistor connection.

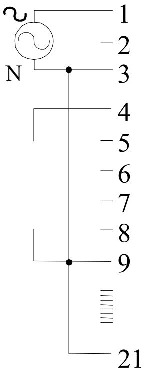
Control Wiring



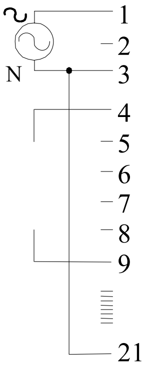
WARNING

Incorrect connection of terminal 19 and 21 may disrupt soft-starter operation and cause starter or motor damage.

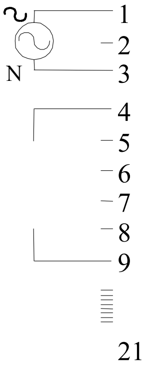
Fusing – Control Supply must be protected by a 6A fuse. It is recommended to use a separate fuse for the auxiliary circuits.



Control Supply and Control Inputs from the same source, Neutral connected to Terminal 21.



Separate sources for Control Supply and Control Inputs, Neutral connected to Terminal 21.



Separate sources for Control Supply and Control Inputs.

For grounded Y systems with neutral, connect 21 to neutral.

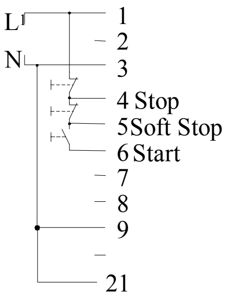
For grounded Y systems without neutral, connect 21 to ground.

For other systems, leave 21 open.

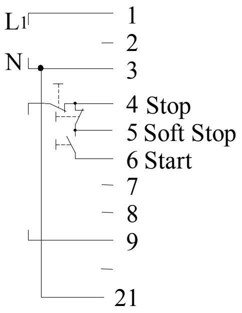
When terminal 21 is not connected to neutral, do not use External Fault – terminal 19.

Wiring Diagrams

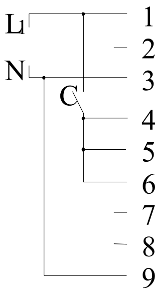
1. Start, soft stop and stop buttons, single supply source for Control Supply and Control Inputs. If Soft Stop is not used, connect a jumper between terminals 4-5 connect emergency stop and /or soft stop between terminals 1-4.



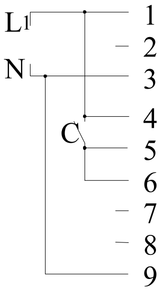
2. Start-Stop push buttons, Separate sources for Control Supply and Control Inputs. If Soft Stop is not used, connect a jumper between terminals 4-5.



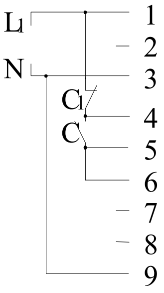
3. Motor will soft start when C closes and stops immediately when C opens.



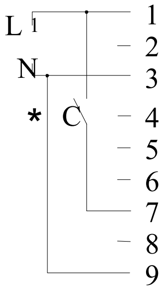
4. Motors will soft start when C closes and soft stop when C opens



5. Motors will soft start and soft stop with C. C1 act as emergency stop.

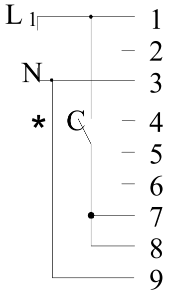


6. Close C to operate Energy Save, Slow speed or Reset – as selected.



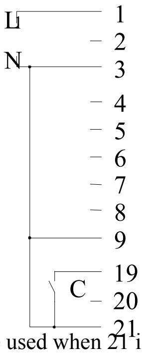
C must be of momentary type when used as Reset

7. Close C to operate Dual Adjust. Slow Speed Reversing or Reset – as selected.



For Slow speed reversing terminal 7 must be connected to Control Supply

8. External Fault contact. The starter will trip 2 sec after C closes.

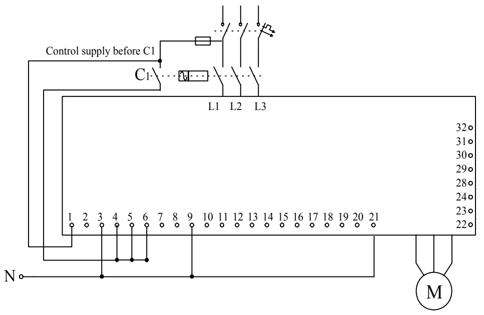


Must Not be used when 21 is not connected to neutral/ground or when Insulation Test is used

Notes: 1. Terminal 21 may be connected to terminal 3 only if terminal 3 is at neutral or at ground potential.
2. Resetting is possible only after start signal is removed

Wiring Diagrams

Series contactor



This system is mainly used when the RVS-DN is retrofitted into an existing system, to reduce modifications in existing installations.

Main power and Start signal are switched on upon closure of the series contactor. The starter will operate as long as the series contactor is closed.

Control supply obtained from main voltage must match starter's Control Supply voltage.

Notes:

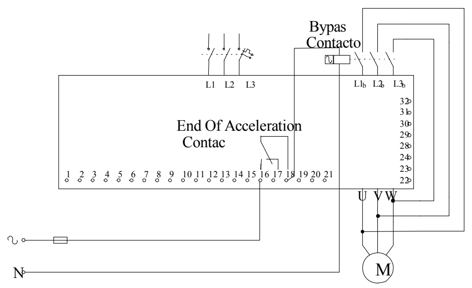
1. It is recommended that terminals 1-3 be always connected to Control Supply.

2. In some applications, it is required to open the upstream contactor after soft stopping. The upstream contactor can be operated by the Immediate Contact that changes its position only at the end of soft stop.

   It is therefore recommended to delay the opening of the upstream contactor for a few seconds after the completion of Soft stop process, when current reached zero, see Immediate/Shear-pin Contact delay – page 7.

- Ensure that auxiliary contact C_1 closes after the main contactor "the soft-starter provides a 500 mSec. delay for the start signal. If it closes before, Under Voltage, fault will occur. It is recommended to use a time delay timer to prevent possible faults.

By-pass contactor



End of Acceleration contact is activated after an adjustable time delays "Run Contact Delay" – see page 29 at the end of start-up period, closing the by-pass contactor.

The contact will return to its original position when:

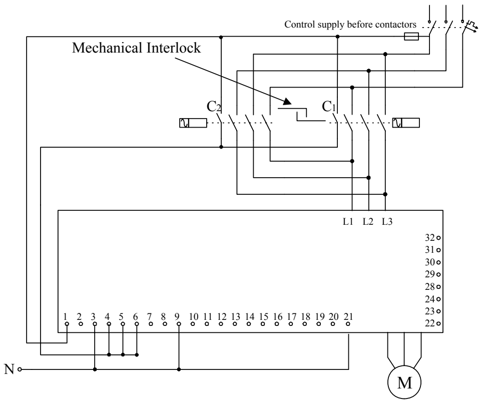
- Soft Stop or Stop signals are initiated
- Energy Saver signal is initiated
- Slow-Speed signal is initiated
- Fault condition occurs.

When the by-pass contactor closes, current to the motor will flow through the by-pass.

Note: When a by-pass contactor is used, it is recommended to order the starter with preparation for by-pass contactor, so that the RVS-DN current protections are operative also after the by-pass contactor closes.

When a Soft Stop signal is given, the End of Acceleration contact returns to its original position opening the by-pass contactor. Thereafter, the voltage will gradually ramp down to zero, soft stopping the motor.

Reversing with 2 series contactors



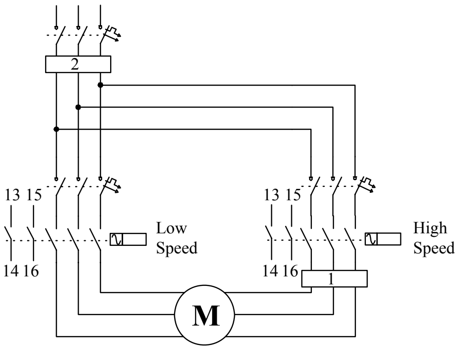
The start-stop control is by a N.O auxiliary contact in each of the two series contactors C_1 & C_2. Closure of either contactor will supply main power and a start signal to the RVS-DN.

Control voltage, obtained from main, must match the starter's Control Supply voltage.

Note:

1. It is recommended to employ a mechanical interlock between the Forward and Reverse Contactors.
2. It is required to delay the transfer between opening of one contactor and closing of second contactor.
3. Phase Sequence fault must be disabled to operate Reversing Contactors at the Line Input of the soft-starter.

Two Speed Motor



Used for Two Speed Motors:

* When soft start is required during transfer from low to high speed, the RVS-DN should be installed downstream to the high speed contactor (marked 1) and operated by its auxiliary contact (13-14).

* When soft start is required for both low and high speeds, the RVS-DN should be mounted before both contactors (marked 2) and operated by each of the downstream contactors (13-14 of each contactor).

Note: The RVS-DN should be sized for appropriate motor rating of either the low or the high speed.

If two different motor ratings and/or starting characteristics are required, for example, higher Initial Voltage and Current Limit for high speed, use the Dual Adjustment feature (see Dual Adjustment – page 21) which allows two different settings of:

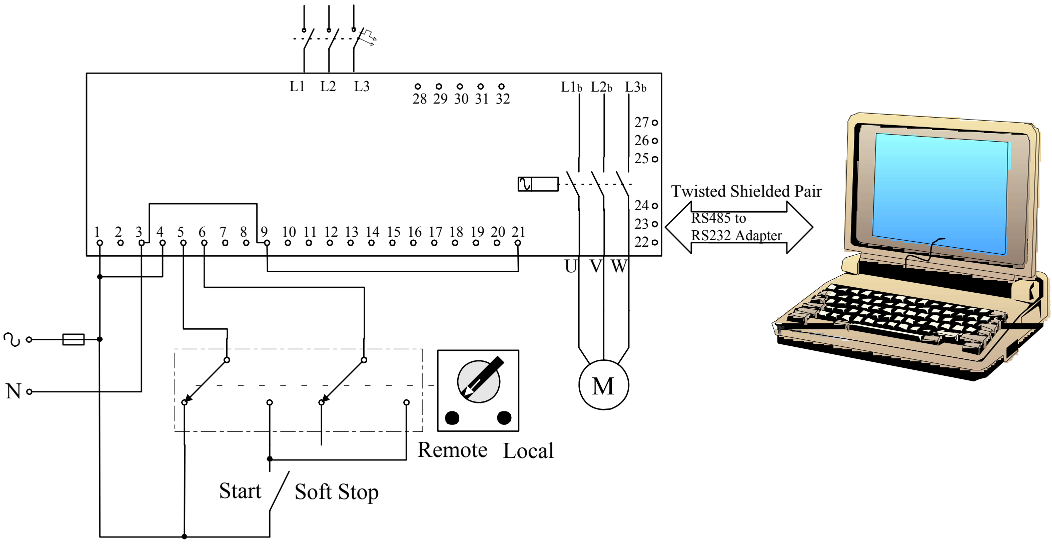
* Initial Voltage
* Current Limit
* Acceleration Time
* Deceleration Time
* Motor FLA.

An additional N.O. contact (15-16) on the high-speed contactor should act as the Dual Adjustment Switch. It should close simultaneously with 13-14 of the same contactor to start the RVS-DN and to switch to the Dual Adjustment settings.

Wiring Diagrams - Communication

Operation via communication link with Local / Remote selector switch

*** Remote: via Communication link**
*** Local: Soft-start, soft stop by maintained contact**



The communication enables remote parameter settings and reading. For start, stop, soft-stop, dual adjusts, etc terminals 4 and 5 must be wired as shown.

Soft-start and soft-stop

- Program the “Serial Link Number” in the communication page to a number between 1-247.
- Disconnect control supply, so the new information will be loaded on the next time you turn it on.
- Connect a communication line (twisted shielded pair) with its (+) to RVS-DN terminal 24 and (-) to terminal 23, connect the other end to your computer containing RS-485 communication port with MODBUS protocol.
- Connect other RVS-DN terminals as follows:
  1. Terminal 1, 3 and Control Supply.
  2. Terminal 4 to Control Supply phase.
  3. Terminal 9 to Neutral (or the Common for terminals 4,5,6).
  4. During operation via communication link, terminal 5 is connected through the “Local-Remote” selector switch to Control Supply and Start-Stop commands are controlled through the communication port.

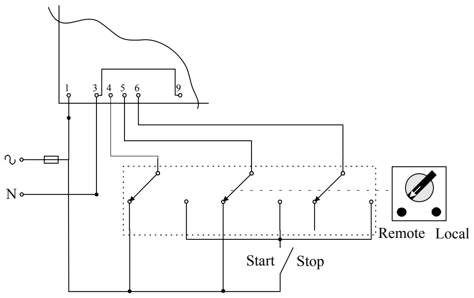
     During operation in Local mode, terminals 5 and 6 are connected to Control Supply through the Start/Stop toggle switch.
  5. Terminal 21 should be at ground potential.

WARNING

The host computer must be grounded when communicating with RVS-DN (unless using a Lap-Top Computer).

Operation via communication link with Local/Remote (selector switch)

- **Remote: via Communication link**
- **Local: Soft-start, immediate-stop by maintaining contact.**



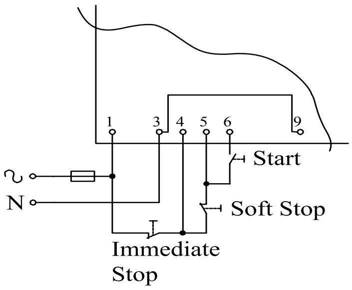
Soft-start and immediate stop

Same as the explanation for **Soft-start** and **soft stop**, except for # 4:

4. During operation via communication link, terminals 4 and 5 are connected through the Local / Remote selector switch to Control Supply and Start-Stop commands are controlled through the communication port.

   During operation in Local mode, terminals 4, 5 and 6 are connected to Control Supply through the Start-Stop toggle switch.

Operation via communication link with Momentary contact (Push-Buttons) Soft-start, immediate stop, soft-stop.



Soft-start, Soft-stop and immediate stop

Same as the explanation for **Soft-start** and **soft-stop**, except for # 2 and # 4:

2. Connect terminal 4 as described below.
4. During operation via communication link, terminals 4 and 5 are connected through the push buttons to Control Supply and Start-Stop commands are controlled through the communication port.

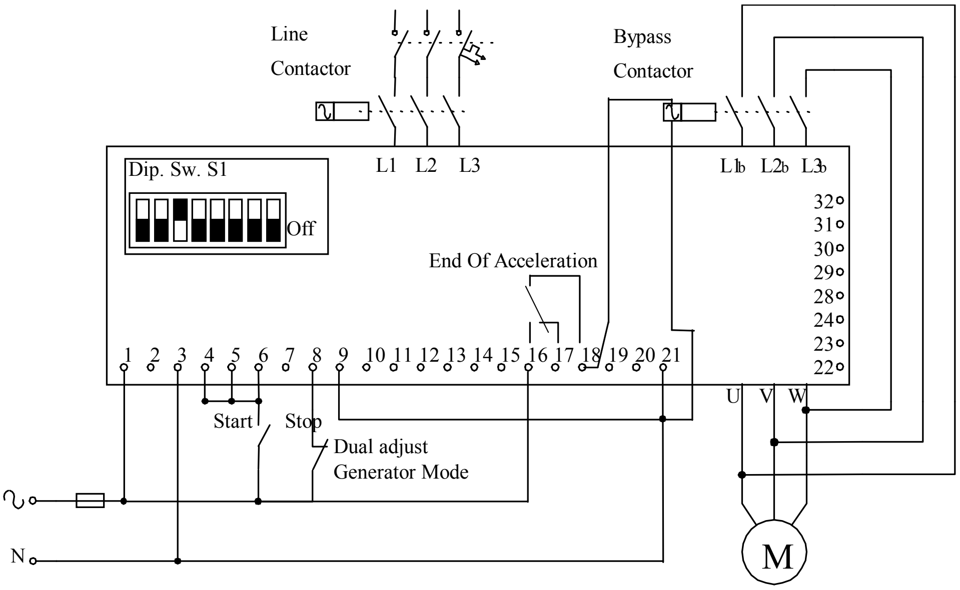
   During normal operation mode, terminals 4 and 5 are connected to Control Supply through the Immediate-stop and soft-stop push buttons, soft-start command may be initiated by pressing the start push-button.

Notes: The communication (data retrieval and statistics) is active at all times!

When control signals (start, stop, etc.) are required, terminals 4 and 5 have to be wired in accordance with the appropriate wiring diagram:

1. Maintained soft-start and stop
2. Maintained soft-start with immediate stop.
3. Soft-start/stop with immediate stop via push-button control.

Starting from Diesel-Generator



1. When starting from a Diesel-Gen., its voltage regulator (especially older type regulators) may be affected during the starting process, causing rapid voltage fluctuations (~350V to ~500V in 400V systems). In these rare cases, the voltage regulator must be upgraded – consult your Diesel-Gen. Supplier.
2. In most other cases where voltage, current or frequency is unstable – a special routine may be applied to overcome the starting difficulty. Use the procedure below:-
   a. Set Dip. Switch # 3 to "On" (as shown above).
   b. Insert a contact (or jumper) between Control Supply and terminal 8 (Dual Adjust. Terminal) and close contact to operate the Generator Mode. Dual Adjust LED will light when operating in Generator Mode.
   c. Set Dual Adjust parameters to the values necessary for the application (e.g. faster acceleration, lower current limit, etc.).
3. When operating from Main and alternatively from Diesel Gen. Set normal starting characteristics for Main and suitable parameters for the Diesel Gen. in the Dual Adjustment setting. When starting from Main, the primary settings (suitable for main starting) will be operative. Upon starting from Generator, close contact between Control Supply and Terminal 8 to operate on Generator Mode.

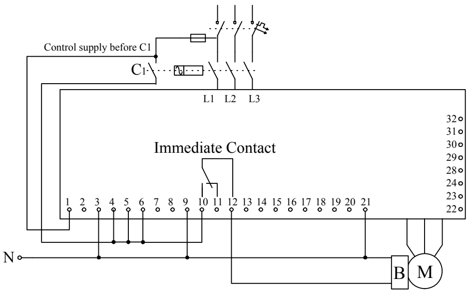
Note: Ensure that Diesel Gen. size is suitable (Diesel Gen. KVA should be at least is 1.35 motor KVA, consult factory for all other cases).

WARNING

1. Motor can not run idle and must be loaded when operating in Generator Mode, otherwise vibration may occur during starting and stopping.
2. When using extended range, use maximum precaution to avoid motor or starter burnout.
3. Disconnect all other loads before starting for the first time to prevent damages due to voltage fluctuations.
4. Disconnect Power Factor Capacitors when operating with Diesel Gen.
5. Connect terminal 21 to terminals 3 and/or 9 only if these terminals are connected to neutral or at ground potential.
6. Only potential free contacts may be connected to terminal 21. Do not connect any voltage to terminal 21. Any connection of voltage to this terminal may disrupt soft-starter operation, and cause starter or motor damage.

Wiring Diagrams – Brake Motor & Insulation Test

Brake Motor



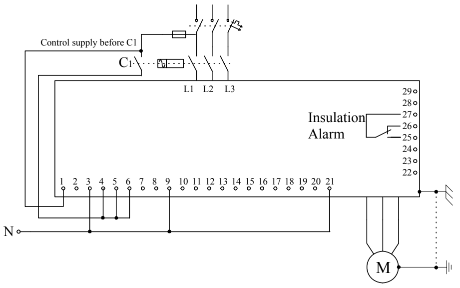
Upon starting, the "Immediate" contact is activated releasing the brake and allowing the voltage to ramp up (this contact will operate without a delay as long as "Immediate Relay ON delay" is set to 0 – see page 27). Upon stopping, the contact returns to its original position and the brake will close.

Note: Use an interposing relay when:

a. Brake voltage is different from starter's Control Input voltage.
b. Brake current is greater than relay's maximum Current (8A).

Caution: It is not recommended to use soft-starters in Vertical hoists applications.

Insulation Test Wiring

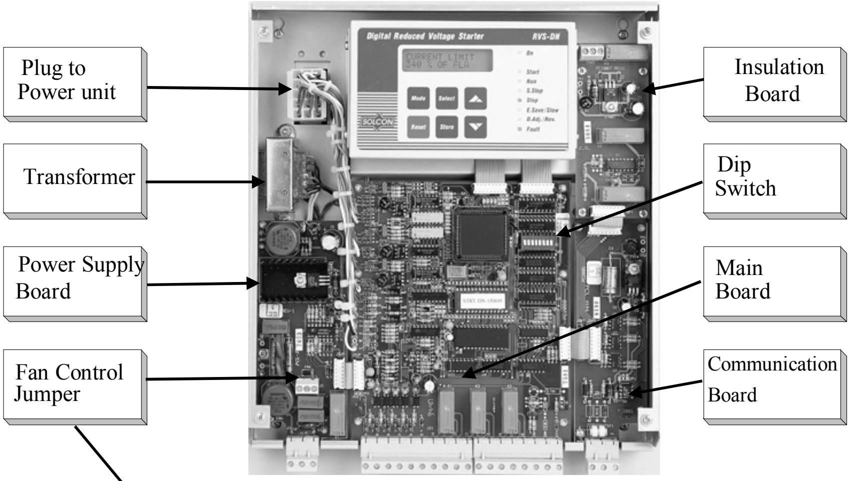


Few conditions must exist for the Insulation circuitry to operate, hence:

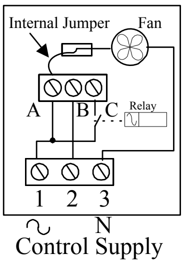
1. "On" and "Stop" LED's must be ON.
2. The series contactor has to be "Open".
3. Motor and starter must be properly grounded.
4. "External Fault" (terminal 19) can not be used.

Note: The Insulation circuitry begins operation after 120 seconds.

Internal Settings



Fan Control
Starter's fan(s) can be controlled by in internal jumper. It is recommended to use continuous operation as default.



- Continuous operation (default connection) – The internal jumper is connected to terminal A. Fan(s) will operate continuously as long as Control Supply is connected.

- External Control - Connect the jumper to terminal B. Connect terminal 2 to Control Supply through an external contact. Fan(s) will operate when the external contact closes and stop when it opens.

- Automatic operation – Connect the jumper to terminal C. Fan(s) will operate automatically for a few minutes after start. The fan(s) will stop automatically a few minutes after stop signal.

> **WARNING**
>
> 1. The starter is supplied with the internal jumper connected to terminal A, for continuous operation. If changed, it is the Customer's responsibility to operate the Fan(s).
> 2. Use only when by-pass contactor is utilized.

Built-in memory systems
The RVS-DN incorporates 3 memory systems:

EPROM A read-only, non-volatile memory, containing factory set parameters (default) that cannot be changed.

EEPROM A read/write, non-volatile memory, where field adjusted parameters, statistical and fault data are saved and stored.

RAM A read/write memory containing parameters loaded from the EEPROM which can be changed from the keypad. These parameters are stored only as long as Control Supply is connected.

Memory system operation

1. When Control Supply is switched on, the RAM is automatically loaded from the EEPROM and parameters are displayed on the LCD.
2. Parameters can now be modified from the keypad (if starter is in one of the operating modes and software lock is open – Dip Sw. 8 open).
3. Start Parameters can be modified during starting process and will immediately affect the operation. For example, if Current Limit is set too low and motor does not accelerate to full speed, increasing Current Limit setting will immediately affect starting process. This enables selection of the optimal starting characteristics. After completion of the adjustments, parameters should be stored in the EEPROM. Storing new parameters is possible at the end of each Mode Page by pressing Store key after "Store Enable" is displayed on the LCD.

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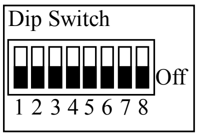
Internal Settings

Inside Delta Motor Connection Mode

Allows connection of the RVS-DN inside the Delta. Current is reduced by 1.73 (√3), namely for an 800A motor the standard selection will be an 820A soft-starter. "In the Delta", the calculation will be 800 / 1.73 = 460A, hence, for a 800A motor, a 460A "Inside Delta" starter is selected. Programming via first window in "Main Parameters". Selectable options are: either "Line" or "Inside Delta". See Appendix for "Inside Delta" details and motor connection diagram.

Dip Switch settings

The Dip Switch, containing eight separate switches, is located under the front cover of Control Module (in sizes B-F) and under the Display unit (in size A).



When necessary, carefully open the front panel and set the switches as required.

Note: All switches are factory set in OFF position.

No	Switch Function	Switch Off	Switch On
1	Display Format	Minimized	Maximized
2	Tacho feedback	Disabled	Enabled
3	Main / Generator	Main	Generator
4	Must be Off		
5-6	LCD-language selection	See table	
7	Special settings - keep in Off position	Disabled	Enabled
8	Software lock	Open	Locked

Switch # 1 – Display Modes

For operation convenience, there are two display modes,

Maximized – Display of all possible parameters.

Minimized – Display of pre-selected parameters.

Setting Dip Sw. # 1 to Off will minimize the LCD displays.

Maximized mode	**Minimized mode**
Switch 1 – On	Switch 1 – Off
Display only	Display only
Main parameters	Main parameters
Start parameters	Start parameters
Stop parameters	Stop parameters
Dual adjustment	Statistical data
Energy save parameters	
Slow speed parameters	
Fault parameters	
I/O programming	
Communication parameters	
Statistical data	

Switch # 2 – Tacho feedback (0-10VDC)

Set Dip Sw. # 2 to On, when using Tacho feedback.

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Note: To operate tacho feedback – consult factory for specific settings for each application.

Switch # 3 – Main / Generator control

When starting from a diesel – generator supply, starting process can sometimes terminate due to instability of the supply system.

Set Dip Sw. # 3 to On, special starting characteristics, suitable for Diesel Generator supply – with unstable voltage & frequency, becomes operative.

Closure of Dual Adjustment contact (terminal 8) operates the special starting characteristics.

When operating from mains and alternatively from diesel generator, set normal starting characteristics for mains and suitable parameters for the Diesel Generator (for example faster acceleration, lower current limiting, etc.) on Dual Adjustment setting.

> **WARNING**
> When operating in Generator Mode, motor must be loaded, otherwise, vibration may occur during starting and stopping.

Switches # 5, 6 – Language Selection

Language	Switch 5	Switch 6
English	Off	Off
French	Off	On
German	On	Off
Spanish	On	On

Switch # 7 – Special settings – consult factory

> **WARNING**
> When using extended Soft-Starter range, apply maximum precautions to avoid motor or starter damage.

Switch # 8 – Software Lock

The software lock prevents undesired parameter modification.

When locked, upon pressing Store, ▼ or ▲ keys, the LCD displays "Unauthorized Access".

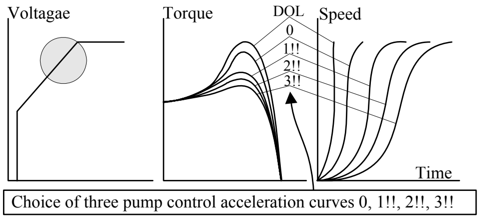
Pump Control – Start Curves

Induction motors produce peak torque of up to 3 times the rated torque towards the end of starting process. In some pump applications, this peak may cause high pressure in the pipes.

The RVS-DN incorporates 4 different starting curves:

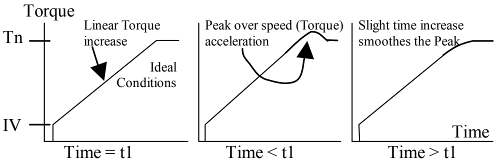
Start Curve 0 – Standard curve (Default). The most stable and suitable curve for the motor, preventing prolonged starting and motor overheating.

Start Curves 1, 2, 3 – During acceleration, before reaching peak torque, the Pump Control Program automatically controls the voltage ramp-up, reducing peak torque.



Choice of three pump control acceleration curves 0, 1!!, 2!!, 3!!

Start Curve 4 (Torque) – Torque Controlled acceleration, provides a smooth time controlled torque ramp for the motor and the pump.

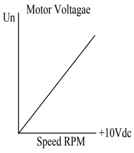


Note: Always starts with Start Curve 0. If towards end of acceleration, peak torque is too high (pressure is too high), proceed to Curve 1, 2, 3 or 4 if necessary.

Tacho Feedback, 0-10VDC (Optional)

Provides linear acceleration and deceleration curves according to rpm feedback. 12 tacho gain levels can be selected for closed loop control starting and stopping.

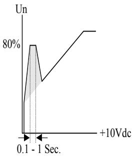
Note: Consult factory for additional information.



Pulse Start

Intended to start high friction loads, requiring high starting torque for a short time.

A pulse of approx. 80% Un without Current Limit is initiated to break the load frees. Pulse duration is adjustable, 0.1 – 1 sec.



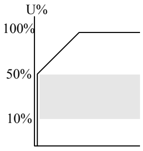
After this pulse, the voltage is ramped down to Initial Voltage setting, before ramping up again to full voltage according to Start Parameters settings.

Initial Voltage

Determines motor's initial starting torque (the torque is directly proportional to the square of the voltage).

Range: 10-50% Un (consult factory for extended range). This adjustment also determines the inrush current and mechanical shock. A setting that is too high may cause high initial mechanical shock and high inrush current (even if Current Limit is set low, as the **Initial Voltage setting overrides Current Limit setting).**

A setting that is too low may result in prolonged time until motor begins to turn. In general, this setting should ensure that the motor begins turning <u>immediately</u> after start signal.



Current Ramp (Initial Current)

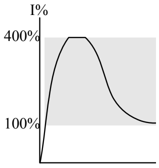
Determines initial Ramp-Up starting Current. When desired, increase Initial Voltage to Max. (50% or 80% respectively). The LCD displays "Initial Current" and the starter will linearly Ramp Up the current following the desired acceleration time. Range: 100-400%

Current limit

Determines motor's highest current during starting. Range 100-400% of FLA setting (consult factory for extended range). A too high setting will cause greater current drawn from main and faster acceleration.

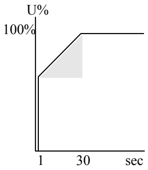
A setting that is too low may prevent motor from completing acceleration process and reaching full speed. In general, this setting should be set to a high enough value in order to prevent stalling.

Note: Current limit is not operating during Run and Soft stop.



Acceleration Time

Determines motor's voltage ramp-up time, from initial to full voltage. Range 1-30 sec. (consult factory for extended range). It is recommended to set Acceleration Time to the minimum acceptable value (approx. 5 sec).



Notes:

1. Since Current Limit overrides Acceleration Time, when Current Limit is set low, starting time will be longer than the preset acceleration time.
2. When motor reaches full speed before voltage reaches nominal, Acceleration Time setting is overridden, causing voltage to quickly ramp-up to nominal.
3. Using starting curves 1, 2, 3 prevents quick ramp up.

Maximum Start Time
The maximum allowable starts time, from start signal to end of acceleration. If voltage does not reach full voltage during this time (for example, because of low Current Limit setting), the starter will trip the motor.
LCD displays "Long Start Time" message.
Range: 1-30 sec (consult factory for extended range).

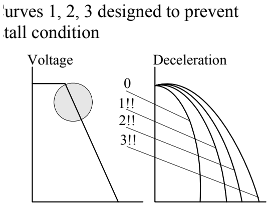
Contact Delay
Time delay for End of Acceleration Contact, after completion of starting process. Range: 0-120 sec.

Pump Control – Stop curve
Intended to prevent Water Hammer during stopping. In pump applications, load torque decreases in square relation to the speed, thus, reducing the voltage will reduce torque and motor will smoothly decelerate to a stop.

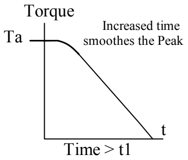
The following **Stop curves** can be selected:

Stop curves 0 – Standard Default curve – voltage is linearly reduced from nominal to zero.

Stop curves 1, 2, 3 – In some pump applications, when pumping to a higher level, a considerable part of the torque is constant and does not decrease with speed. It may happen that during Soft Stop, when voltage is decreasing, motor torque quickly falls below load torque and motor will abruptly stall instead of smoothly decreasing speed to zero.

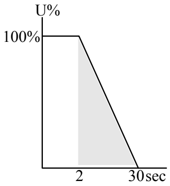


Stop Curve 4 (Torque) – Provides Linear Controlled torque deceleration ramp, from Ta (Actual Torque), thus, eliminating stall conditions.



Note: Always use Stop Curve 0. If motor stalls quickly instead of slowly decreasing its speed, select Stop Curve 1, 2, 3 or 4 if necessary.

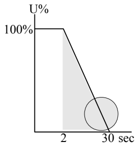
Deceleration Time – Soft Stop



Used for controlled deceleration of high friction loads. Determines motor's voltage ramp down time.
Range: 1-30 sec. (consult factory for extended range).

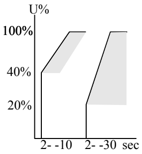
Note: When the starter operates with a by-pass contactor, Soft Stop initiation opens the End Of Acceleration contact, tripping open the by-pass contactor. Load will then be transferred to the RVS-DN and voltage begins ramping down.

Final Torque
Determines torque towards end of Soft Stop. If current is still flowing after speed is softly reduced to zero, increase Final Torque setting.



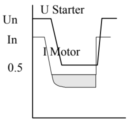
Dual Adjustment
A secondary set of parameters, used for varying loads, two speed motors, etc. Connecting Control Supply to Terminal 8 makes transfer to Dual Adjustment settings.

IV - Initial Voltage 10-50% of Un.
CL - Current Limit 100-400% of motor's FLA
AT - Acceleration Time 1-30 sec.
DT - Deceleration Time 1-30 sec.
FLA- Motor Full Load Ampere.



Note: Consult factory for extended range.

Energy Save
Activated when motor is lightly loaded for extended periods of time. Supply voltage the motor decreases (lowering the rotating magnetic field intensity), thus, reducing the reactive current and copper/iron losses.



Note: When using Energy Save system, harmonics should be taken into consideration. At maximum Energy Save settings, the 5th harmonic may exceed 30% of the RMS current value.

ATTENTION
To meet CE standards while in Energy Save mode, the user may be required to employ additional mitigation methods.

Slow Speed Torque
Determines the torque while motor is operating at 1/6 of nominal speed. Range: 1-10.

Maximum Slow Speed Time
Determines the maximum allowable operation time at slow speed. Range: 1-30 sec. (consult factory for extended range).

WARNING
Operating current while motor is running at 1/6 speed is much higher than nominal current and motor ventilation is much weaker. Special precaution must be taken to prevent overheating when running the motor at slow speed for long periods of time.

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Motor Insulation (option)
Operational when motor is not running (the motor must be galvanically isolated). Two distinct level can be set for Alarm and Trip functions.

- Alarm level, Range: 0.2 – 5 MΩ
- Trip level, Range : 0.2 – 5 MΩ

When insulation decreases below Alarm Level set point for more than 120 sec., the LCD displays ALARM:
INSULATION LEVEL and shows the value in MΩ.
The Fault LED flashes and the Insulation Alarm Relay is activated.
Alarm signal will disappear automatically 60 seconds after insulation level returns to normal. Trip does not reset automatically.

When insulation decreases below Trip Level set point, the LCD displays TRIP: INSULATION LEVEL and shows the value in Mohm. The fault LED illuminates and Fault Relay is activated.

Motor Thermistor (option – Analogue Card)
Measures motor's thermistor resistance and trips the starter when level decreases below set level. Only one of the optional cards can be fitted in one starter, Analogue card or Insulation card.
Thermistor Type: Selectable PTC or NTC.
Trip Level, range: 1 – 10 KΩ
Delay: Factory preset time delay of 2 sec.

Too Many Starts
Combines three parameters:

- **Number of Starts**
  Determines maximum allowable number of starts.
  Range: Off, 1-10 starts.

- **Start Period**
  Time period during which Number of Starts is being counted. Range: 1-60 min.

- **Start inhibit**
  Determines time period during which starting is disabled after "Too many starts" trip.
  Range: 1-60 min

Note: Motor can not be started before "Start Inhibit Time" has elapsed. Trying to start the motor during this time delay will result in LCD displaying "Wait Before Rst: ___ MIN.

Long Start Time – (Stall Protection)
Trips the starter if motor does not reach full speed during "Maximum Start Time".
Range: 1-30 sec. (consult factory for extended range).

Over Current Shear-pin
Becomes operational when starter is energized and has two Trip functions:

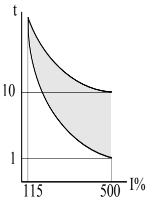
- Trips the starter when current exceeds 850% of starter's FLC setting in 1 cycle or less.

- During run (after RUN LED is lit) – Trips the starter when current exceeds set level and time delay.

Range: 200 - 850% of motor FLA setting
Delay: 0 – 5 sec. (0=up to 200 mSec)

Note: The O/C Shear-Pin is not intended to replace the fast acting fuses, required to protect the thyristors (see fuse table in the appendix).

Overload (O/L)
Inverse time electronic overload becomes operational when RUN LED is lit.
The O/L circuitry incorporates a Thermal Memory Register calculating heating minus dissipation of the motor. The starter trips when the register fills up. The thermal register resets itself 15 minutes after motor stops.



Adjustable between 75-150% of motor's FLA and factory set at 115%.
Tripping time at 500% FLA is adjustable between 1-10 sec. Allowing trip curve selection.

ATTENTION
Overload protection is not operative during soft-start or soft stop.

Under Current
Operational when motor is running. Trips the starter when motor current drops below set Under Current Trip (UCT) for a time longer than Under Current Delay (UCD).
Under Current Trip, Range: 0=Off, 20-90% of FLA
Under Current Delay. Range: 1-40 sec.

Under Voltage
Becomes operational only after start signal. Trips the starter when main voltage drops below the set Under Voltage Trip (UVT) for a time longer than Under Voltage Delay (UVD).
Under Voltage Trip, Range: 120-600V (phase to phase)
Under Voltage delay, range 1-10 sec.

Note:
When voltage drops to zero (full voltage outage) the starter will trip immediately, overriding the delay.

Over Voltage
Becomes operational only after start signal. Trips the starter when main voltage increases above the set Over Voltage Trip (OVT) Level for an adjustable period of time longer than Over Voltage Delay (OVD).
Range: 150 – 750V (phase to phase)
Over Voltage Delay, Range: 1-10 sec.

Phase loss (and Under / Over Frequency)
Becomes operational when starter is energized and protects motor from single phasing. Trips the starter when 1 or 2 phases are missing for more than 1 sec.

Starter will also trip when frequency is less than 40 or greater than 65Hz.

Note: Phase loss might not be detected in lightly loaded motors.

Phase Sequence
Becomes operational when starter is energized, provided this protection has been activated (Fault Enable – Phase Sequence Protection, see Fault Parameters). Trips the starter when phase sequence is wrong.

Long Slow-Speed Time
Trips the starter if motor operates at slow speed for a time longer than "Maximum Slow Speed Time"
Range: 1-30 sec. (consult factory for extended range).

Note: Operate motor at slow speed for the minimum possible time to prevent overheating. When motor operates at slow speed, it draws higher than nominal current (depending on Slow-Speed Torque adjustment) thus, motor and starter may overheat.

Wrong Connections
Become operational after start signal. Trips if motor is not properly connected to starter's Load terminals, or when:
Internal disconnection in the motor winding is detected.

Shorted SCR

Trips the starter in case one or more SCRs have been shorted.

Heatsink Over Temperature
Thermal sensors are mounted on the heatsink and trip the starter when temperature rises above 85ºC.

WARNING
The over temperature protection is designed to operate under normal conditions e.g. in the event of extended low overload, insufficient ventilation – fan stoppage or air flow blockage.
Incorrect starter selection or operation frequents starting at max. conditions, or repeated starting under fault conditions can cause SCRs to overheat and fail before the heatsink reaches 85°C to trip the thermal sensors.

External Fault
Becomes operational when starter is energized, trips the starter when an External Contact closes for more than 2 sec.

WARNING
Do not use External Fault when terminal 21 is not connected to ground.

Fault and Reset
When any of the above protection (except Insulation Alarm) operates, the starter locks in a fault condition, disabling thyristors firing. Fault LED lights up, fault description is displayed on the LCD and Fault Relay operates.

- For local resetting, after fault has been removed, press Reset key.
- Remote resetting can be done through terminals 7 or 8 (see I/O Programming).

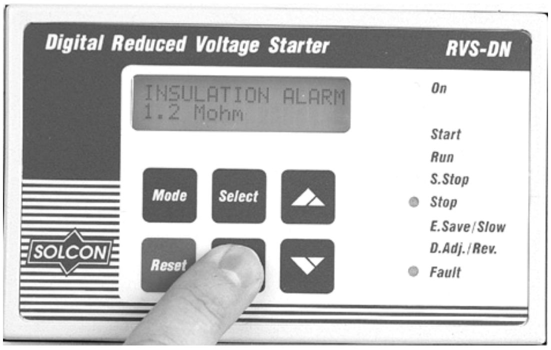
When Fault occurs, followed by a voltage outage, fault condition is latched and reappears upon voltage restoration.

Note:
Resetting is not possible as long as Start signal exists.

Auto Reset
Under-voltage and Phase-loss, faults can be set to Auto-Reset (see Fault Parameters). The starter will reset itself 60 sec. after voltage was fully restored provided no start signal exists.

Note:
Auto- Resetting is not possible as long as Start signal exists.

Front Panel



LED's Arrangement

On
Lights up when Control Supply voltage is connected to the starter.

Start
Lights up during start process, indicating that motor supply voltage is ramping up.

Run
Lights up after completion of starting process, indicating that motor is receiving full voltage.
Flashes during slow speed operation.

S. Stop
Lights up during Soft Stop process, indicating that motor supply voltage is ramping down.

Stop
Lights up when motor is stopped.

E. Save / Slow
Lights up when "Energy Save" is in operation.
Flashes when motor is running at Slow Speed.

D. Adj. / Rev
Lights up when Dual Adjustment is in operation.
Flashes when motor is running in the Reverse direction at slow speed.

Fault
Lights up upon operation of any of the built-in protection.
Flashes when Insulation Alarm (optional) relay is activated

Keypad Provides selection of the following modes:
(When Dip Switch 1 is in "On", gray zone shows list of maximized parameters).

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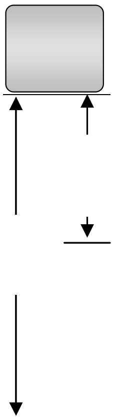

- Display Only
- Main Parameters
- Start Parameters
- Stop Parameters
- Statistical Data

- Dual-Adjustment Parameters
- Energy Saver and Slow Speed Parameters
- Fault Parameters
- I/O Programming Parameters
- Communication Parameters

Select	To select function within each mode.
▲	To increase adjusted parameters. Press momentarily or continuously.
▼	To decrease adjusted parameters.
Store	To save modified parameters.
Reset	To reset the starter after fault has been removed, canceling the displayed fault and allows restarting.

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Note: Pressing Mode or Select continuously increases parameters changing speed.

Front Panel

LCD Arrangement

Two lines of 16 alphanumeric characters, displaying: System Parameters, Starter Settings, Motor Current, Insulation and Fault Identification.
Four selectable languages – English, French, German and Spanish (see Dip Switch setting – page 19).

CURRENT LIMIT
390%

- Upper line displays functions.
- Lower line displays setting and measured values.

Parameter Review and modifiation

1. Press mode key several times until you reach the required **Mode** page.
2. Press **Select** to review parameters of this Mode.
3. When reaching the required parameter, modifying its values with ▲ or ▼ keys.
4. To store the new parameters, press **Select** until "Store Enable" appears and then press **Store** key

Note: Pressing **Mode** or **Select** keys continuously increase parameter change speed.

Mode pages

Upon initiation of the starter, the LCD displays motor's operating current.

% OF MOTOR FLA
98 %

When Dip Sw.#1 is set to On (see Display Options – page 19), by pressing the Mode key all **Mode** pages can be reviewed.
When Dip Sw. # 1 is set to Off, the following Mode pages marked ** will not appear.

MAIN PARAMETERS

START PARAMETERS

STOP PARAMETERS

** **DUAL ADJUSTMENT**
PARAMETERS

** **EN. SAVE & SL. SPD**
PARAMETERS

FAULT
PARAMETERS

** **I/O PROGRAMMING**
PARAMETERS

** **COMM.**
PARAMETERS

STATISTICAL DATA

Display Mode

In this mode, parameters cannot be adjusted

% OF MOTOR
FLA

Displays operating current as a percentage of motor FLA.

Note: Starter's Default Display, after pressing Mode or Select, a time delay is initiated. Following the delay, the LCD defaults back to display "% OF MOTOR FLA".

Press Select – When Insulation card is incorporated

MOTOR INSULATION
52.8 Mohm

Displays motors winding insulation level

Press Select – When Analogue card is incorporated

THERMISTOR
RES.
3.1 Kohm

Displays motor thermistor's resistance

When option cards are not incorporated, the LCD displays

OPTION CARD
Not installed

Press Select

ANALOGUE
OUTPUT
Normal

Normal- Analogue output increases when current increases.
Inverted- Analogue output decreases when current increases.
Range: Normal, Inverted.

This concludes the DISPLAY Mode.
Pressing **Select** key at this point returns to the first display.

Obtaining "Default Parameters"

- Press **Mode** and ▼ys simultaneously, the LCD will display "Store Enable Default Parameters".
- Press **Store** + **Mode** keys simultaneously.

CAUTION
Obtaining Default Parameters erases all previously modified settings and requires the operator to program FLC and FLA values again.

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Parameter Settings

Press Mode
To advance to:

MAIN PARAMETERS

Press Select

Press ▲ ▼ keys to set Starter's connection type.
(see Appendix for: Inside Delta description).

CONNECTION TYPE
LINE / INSIDE DELTA

Press Select

Press ▲ ▼ keys to set Starter's FLC.
(see RVS-DN ratings – Page 3).

STARTER FLC
105 AMP

Press Select

Press ▲ ▼ keys to set motor's FLA
Range: 50-100% of "STARTER FLC"

MOTOR FLA
105 AMP

Press Select

Press ▲ ▼ keys to set Under Current Trip.
Range: 0 = OFF, 20-90% of FLA

UNDERCURR. TRIP
0% OF FLA

Press Select

Press ▲ ▼ keys to set under Current Trip Delay.
Range: 1-40 sec.

UNDERCURR. DELAY
10 SEC.

Press Select

Press ▲ ▼ keys to set Over Current Shear-pin.
Range: 200 – 850% of FLA

O/C – SHEAR PIN
850% OF FLA

Press Select

Press ▲ ▼ keys to set O/C Shear-pin Delay.
Range: 0.5-5 sec.

O/C DELAY
1.5 SEC.

Press Select

Press ▲ ▼ keys to set Overload Trip Current.
Range: 75-150% of FLA

OVERLOAD TRIP
115% OF FLA

Press Select

Press ▲ ▼ keys to set Overload Delay at 500% of motor FLA
Range: 1-10 sec.

OVERLOAD DELAY
4 SEC – AT 5 FLA

Press Select

Press ▲ ▼ keys to set Under Voltage Trip.
Range: 120-600V

UNDERVOLT. TRIP
300 VOLT

Press Select

Press ▲ ▼ keys to set Under Voltage Trip Delay
Range: 1-10 sec.

UNDERVOLT. DELAY
5 SEC.

Press Select

Press ▲ ▼ keys to set Over Voltage Trip.
Range: 150-750V (can not be set below Under Voltage).

OVERVOLT. TRIP
480 VOLT.

Press Select

Press ▲ ▼ keys to set Over Voltage Trip Delay.
Range: 1 – 10 sec.

OVERVOLT. DELAY
2 SEC.

Press Select
To store selected parameters, press **Store** key.

STORE ENABLE
MAIN PARAMETERS

Note: Storing selected parameters is possible only when Stop or Run LED are lit. Storing cannot be done when Start, Soft Stop, Slow Speed, Energy Save, or Fault LED are lit.

When parameters have been correctly stored, the LCD will read:

DATA SAVED OK

This concludes MAIN PARAMETER settings.
Pressing **Select** key after "Data Saved OK" returns to the first display in this mode.

Note: In case of a failure in parameter storing, the LCD displays:

STORAGE ERROR

Press **Select** button again until "Store Enable Main Parameters" returns. Then press **Store** key until "Data Saved OK" appears.

Press Mode
To Advance to:

START PARAMETERS

Press Select

SOFT START CURVE
0 (STANDARD)

Then press ▲ ▼ keys to set Soft Start Curve:
0 (Standard) = Standard Curve
1!! = Pump Control Curve # 1
2!! = Pump Control Curve # 2
3!! = Pump Control Curve # 3
4 (Torque) = Torque Control Pump Curve # 4

When setting Dip sw. # 2 On for Tacho Mode

Press ▲, following Curve #4 message changes to:

START TACHO. GAIN
0 (MIN. GAIN)

Then press ▲ ▼ keys to set Tacho gain:
0 = Minimum gain tacho, control
1!! = Second level tacho gain
2!! = Third level tacho gain
3!! = Fourth level tacho gain
4!! = Fifth level tacho gain
5!! = Sixth level tacho gain

Note: Tacho Feedback is operational in its basic form. Additional curves except for the basic linear curve are optional. Consult factory for correct tacho selection and mechanical installation.

Press Select,

Press ▲ ▼ keys to set Pulse Start Time.
Range: 0-1 sec. (Pulse level at 80% Un)

PULSE TIME
0 SEC.

Press Select,

Press ▲ ▼ keys to set Initial Voltage.
Range: 10-50% of Un.

INITIAL VOLTAGE
30%

When Up Arrow key is pressed at 50% Initial Voltage, the display will change to the current curve and show:

INITIAL CURRENT
100%

At this point, the choice of current will determine the Initial Current at the beginning of the starting curve.
Range: 100-400% of Motor FLA

Press Select,

Press ▲ ▼ keys to set Current Limit
Range: 100-400% of motor FLA.

CURRENT LIMIT
400% OF FLA

Press Select

Press ▲ ▼ keys to set Acceleration Time
Range: 1-30 sec.

ACC. TIME
10 SEC.

Press Select

Press ▲ ▼ keys to set Maximum Start Time
Range: 1-30 sec.

MAX. START TIME
30 SEC.

Press Select

Press ▲ ▼ keys to set Number of Starts permitted (During STARTS PERIOD below). Range: 1-10, Off.

NUMBER OF STARTS
10

Press Select

Press ▲ ▼ keys to set Number of Starts Time Period
Range: 1-60 min.

STARTS PERIOD
30 MIN.

Press Select

Press ▲ ▼ keys to set Start Inhibit Period
Range: 1-60 min.

STARTS INHIBIT
15 MIN.

Press Select

Press ▲ ▼ keys to set Time Delay for End of Acceleration Contact.
Range: 0-120 sec.

RUN CONTACT DEL.
5 SEC.

Press Select
To store selected parameters, press **Store** key

STORE ENABLE
START PARAMETERS

When parameters have been correctly stored, the LCD reads:

DATA SAVED O.K.

This concludes START PARAMETERS setting.

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Column Break

Press Mode
To advance to

STOP PARAMATERS

Press Select

Then press ▲ ▼ keys to set Soft Stop Curve
0 = Standard Curve
1!! = Pump Control Curve # 1
2!! = Pump Control Curve # 2
3!! = Pump Control Curve # 3
4 = Pump Control Curve 4 (Torque Control)

SOFT STOP CURVE
0 (STANDARD)

When setting Dip sw # 2 On for Tacho Mode,

Press ▲ curve message changes to:

STOP TACHO GAIN
0 (MIN. GAIN)

Then press ▲ ▼ keys to set Tacho gain:
0 = Minimum gain tacho, control
1!! = Second level tacho gain
2!! = Third level tacho gain
3!! = Fourth level tacho gain
4!! = Firth level tacho gain
5!! = Sixth level tacho gain

Note: Tacho Feedback is operational in its basic form. Additional curves except for the basic linear curve are optional. Consult factory for correct tacho selection and mechanical installation.

Press Select

Then press ▲ ▼ keys to set Deceleration Time.
Range: 1-30 sec.

DEC. TIME
10 SEC.

Press Select

Then press ▲ ▼ keys to set Final Torque during Soft Stop.
Range: 0 – 10 (0 = min., 10 = max.)

FINAL TORQUE
0 (MIN)

Press Select
To store selected parameters, press **Store** key

STORE ENABLE
STOP PARAMETERS

When parameters have been correctly stored the LCD displays:

DATA SAVED OK

This concludes STOP PARAMETERS setting.

Press Mode
To advance to (only when Dip Sw. # 1 is set to ON):

DUAL ADJUSTMENT
PARAMETERS

When selecting "Generator Mode" (Dip sw # 3 is On) the following display appears instead of the above.

D. ADJ: GENERATOR
PARAMETERS

Press Select

Then press ▲ ▼ keys to set DA: Initial Voltage.
Range: 10-50% of Un.

DA: INIT. VOLT.
30%

Press Select

Then press ▲ ▼ keys to set DA: Current Limit.
Range: 100-400% of motor's FLA.

DA: CUR. LIMIT
400% OF FLA

Press Select

Then press ▲ ▼ keys to set DA: Acceleration Time.
Range: 1-30 sec.

DA: ACC. TIME
10 SEC.

Press Select

Then press ▲ ▼ keys to set DA: Deceleration Time.
Range: 1-30 sec.

DA: DEC. TIME
10 SEC.

Press Select

Then press ▲ ▼ keys to set DA: Motor FLA
Range: 50-100% of "STARTER FLC"

DA: MOTOR FLA
105 AMP.

Press Select
To store selected parameters, press **Store** key

STORE ENABLE
D.ADJ. PARAMETERS

When parameters have been correctly stored, the LCD displays:

DATA SAVED OK

This concluded DUAL ADJUSTMENT PARAMETERS setting.

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Press Mode
Set Dip. Sw. # 1 ON, to advance to:
Energy Save and Slow Speed Modes

```
EN. SAVE & SL. SPD
PARAMETERS
```

Press Select
Then press ▲ ▼ keys to set Energy Saving Level.
Range: 0-10 (0 = min., 10 = max.)

```
SAVING ADJUST.
0 (MIN.)
```

Press Select
Then press ▲ ▼ keys to set Slow Speed Torque.
Range: 1-10 (1 = min., 10 = max.)

```
SLOW SPEED TORQ.
8
```

Press Select
Then press ▲ ▼ keys to set Maximum Slow Speed Time.
Range: 1-30 sec.

```
MAX SLOW SP TIME
30 SEC.
```

Press Select
To store selected parameters, press **Store** key

```
STORE ENABLE
EN. SAVE & SL. SPD
```

When parameters have been correctly stored, the LCD displays:

```
DATA SAVED OK
```

This concludes ENERGY SAVING / SLOW SPEED PARAMETERS setting.

Press Mode
Set Dip. Sw. # 1 ON, to advance to:

```
FAULT PARAMETERS
```

Press Select
Then press ▲ ▼ keys to set Phase Sequence trip.
Range: Yes / No

```
PHASE SEQ. Y/N
NO
```

Press Select
Then press ▲ ▼ keys to set Insulation Alarm.
Range: Off, 0.2 – 5 MΩ

```
INSULATION ALARM
OFF
```

Press Select
Then press ▲ ▼ keys to set Insulation Trip.
Range: Off, 0.2 – 5 MΩ

```
INSULATION TRIP
OFF
```

Press Select
Then press ▲ ▼ keys to set Auto.Reset (for Under-voltage and Phase-loss faults).
Range: Yes / No.

```
AUTO RESET
NO
```

Press Select
Then press ▲ ▼ keys to set Thermistor Type.
Range: PTC, NTC.

```
THERMISTOR TYPE
PTC
```

Press Select
Then press ▲ ▼ keys to set Thermistor Trip Level.
Range: Off, 0.1 – 10 KΩ, step: 0.1Kohn.

```
THERMISTOR TRIP
OFF
```

Press Select
Then press ▲ ▼ keys to set UNDER CUR. RESET (for temporary Under-currents, in remote installations.)
Range: 10-120Min./OFF.

```
UNDER CUR. RESET
OFF
```

Press Select
To store selected parameters, press **Store** key

```
STORE ENABLE
FAULT PARAMETERS
```

When parameters have been correctly stored,
the LCD displays:

```
DATA SAVED OK
```

This concludes FAULT PARAMETERS setting.

Press Mode
Set Dip Sw. # 1 ON, to Advance to:

I/O PROGRAMMING
PARAMETERS

Press Select
Then press ▲▼keys to set Terminal # 7 function
Range: Energy Saver, Slow Speed, Reset

PROG. INPUT # 7
ENERGY SAVER

Press Select
Then press ▲▼keys to set Terminal # 8 function
Range: Dual Adjustments, Slow Speed Reverse, Reset

PROG. INPUT # 8
DUAL ADJUSTMENT

Press Select
Then press ▲▼keys to set Fault Relay function
Range: Fault, Fault - Fail Safe (Fail-Safe Logic - page 23)

FAULT RELAY TYPE
FAULT

Press Select
Then press ▲▼keys to set Immediate Relay function
Range: Immediate, Shear-Pin

IMM / S.PIN RELAY
IMMEDIATE

Press Select
Then press ▲▼keys to set Imm / S. Pin Relay On Delay
Range: Immediate 0-60 sec. / Shear-Pin 0-5 sec.

RELAY ON DELAY
0 SEC.

Press Select
Then press ▲▼keys to set Imm / S. Pin Relay Off Delay
Range: Immediate 0-60 sec. / Shear-Pin 0-5 sec.

RELAY OFF DELAY
0 SEC.

Press Select
Then press ▲▼keys to set Normal or Inverted output
Range: Normal, Inverted

ANALOG OUTPUT
NORMAL

Press Select
To store selected parameters, press **Store** key

STORE ENABLE
I / O PROG. PARAM.

When parameters are correctly stored, the LCD displays

DATA SAVED OK

This concludes I/O PARAMETER setting.

Press Mode
Set Dip Sw. # 1 ON, to Advance to:

COMM. PARAMETERS

Communication is optional and operates only when starter incorporates this feature.

Note: When using communication and local commands, the last command determines the function.

Press Select
Then press ▲▼keys to specify Communication Protocol.

COMM. PROTOCOL
MODBUS

Range: Modbus, Profibus, Modbus-TCP

Press Select
Then press ▲▼keys to set Communication Baud Rate.
Range: 1200-9600 bps

BAUD RATE
9600

Press Select
Then press ▲▼keys to set Communication Parity Check. Range: Even / Odd

PARITY CHECK
EVEN

Press Select
Then press ▲▼keys to set Communication Serial Link Number.
Range: 1-248 (for up to 32 starters on one twisted pair)

SERIAL LINK NO.
248 (OFF)

Note: If communication is not used, serial link number must be set to 248 (Off)

Press Select
To store selected parameters press **Store** key

STORE ENABLE
COMM. PARAMETERS

When parameters have been correctly stored, the LCD displays:

DATA SAVED OK

This concludes COMMUNICATION PARAMETERS setting.

Press Mode
To Advance to

STATISTICAL DATA
- **-**

Press Select
To store selected parameters, press **Store** key

LAST STRT PERIOD
NO DATA

Displays last starting time in seconds.
(Time duration until motor's current reached nominal)

Press Select

LAST START MAX I
NO DATA

Displays the maximum current at last start.

Press Select

TOTAL RUN TIME
0 HOURS

Displays motor's hour counter since commencement or since "Statistical Data" was last reset.

Press Select

TOTAL # OF START
0

Displays the total numbers of starts since commissioning or since "Statistical Data" was last reset.

Press Select

LAST TRIP
NO DATA

Describes last fault.

Press Select

TRIP CURRENT
0% OF FLA

Displays the current at the last fault.

Press Select

TOTAL # OF TRIPS
0

Displays the total numbers of trips since commencement or since "statistical Data" was last reset.

Press Select

PREVIOUS TRIPS – 1…9
PHASE LOSS

Displays historical event of the last 1-9 faults, by scrolling with the "▲" or "▼" arrows through the trips stored since commencement or since "Statistical Data" was last reset.

Press Mode to return to Display Only Mode

% OF MOTOR FLA

Service Mode

Press **Mode** and ▼ keys simultaneously, the LCD displays:

STORE ENABLE
DEFAULT PARAMET.

Press Store and **Mode** simultaneously to store factory Default Parameters. <u>All previously stored parameters will be erased.</u> This also returns to "Display Only" Mode.

Or, to Reset Statistical Data:
Press Select

RESET STATISTICS

Press Reset and **Store** simultaneously to reset all your statistical data. This also returns automatically to Statistical Data Mode.

Press Select to see the software program version
Displays program version

PROGRAM VERSION
STRT.DN-020797

Or, for Factory Calibration:
Press Select
Read phase to phase mains voltage.

VOLTAGE ADJUST.
XXX % VOLT

Press Select
Reads current for factory calibration use only.

CURRENT ADJUST.
XX% OF RVS FLC

Press Select
Display goes back to Store Enable Default Parameters

STORE ENABLE
DEFAULT PARAMET.

To exit "Service Mode" press **Mode** + ▼ simultaneously.

NOTES:

- Entering "Service Mode" is possible only when Stop LED is On.
- A Start signal while in "Service Mode" exits from this mode.

Note: It is necessary to connect a **motor** to load terminals otherwise "Wrong Connection" Protection is activated. Other loads such as light bulbs, resistors, etc. may also cause "Wrong Connection" (Fault).

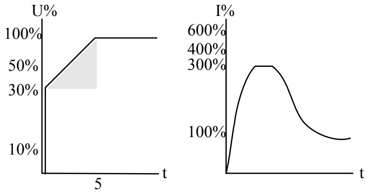
Start-up procedure with start-stop buttons

1. Connect Control Supply. **On** and **Stop** LEDs will lit.
2. Review all parameters with **Mode** and **Select** keys Set parameters as required.
3. If necessary, return to Default Parameters (see "Service Mode" page 33).
4. Connect mains voltage to starter's line terminals.
5. Set LCD to show "MOTOR FLA" (% of motor FLA).
6. Press Start. If motor starts to turn shortly after Start signal, proceed to Para 7. If not, increase "Initial Voltage" setting and start again. When, upon starting, initial inrush current and mechanical shock are too high decrease "Initial Voltage" settings and proceed to Para 7.
7. Motor begins to turn. If speed accelerates smoothly to nominal, proceed to Para 8. If current during acceleration is too high, decrease "Current Limit" setting and proceed to Para 8. If motor speed does not accelerate to nominal, increase Current Limit setting.
8. Press Stop and wait until motor stops.
9. Slightly increase Initial Voltage and Current Limit settings to allow for load changes.
10. Press Start and see that motor is Acceleration Time to full speed is as required.
11. If acceleration time is too short, increase "Acceleration Time" setting.
12. Check total starting time and set Max. Start Time to approx. 5 sec. Longer than the maximum time required to complete the starting process.

Examples of starting curves

Light Loads-Pumps, Fans, etc.

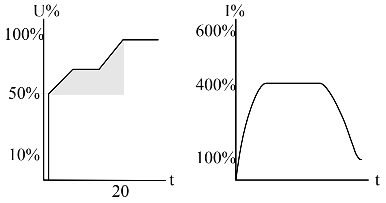
Initial Voltage (IV) – set to 30% (Factory Default)
Current Limit (CL) – set 300%
Acceleration Time (AT) – set 5 sec.



Voltage quickly increases to the Initial Voltage value and then gradually ramps-up to nominal. Current simultaneously and smoothly increases to reach Current Limit setting or less, before smoothly decreasing to the operating current. Motor speed will accelerate to full speed quickly and smoothly.

High Inertia Loads – Fans, Centrifuges, etc

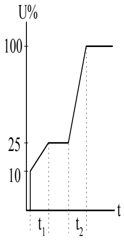
Initial Voltage – set 50%
Current limit – set 400%
Acceleration time– set 20 sec



Voltage and current increase until current reaches "Current Limit value". The voltage is held at this value until motor is close to nominal speed, then current will begin to decrease. The RVS-DN continues to ramp-up the voltage until reaching nominal. Motor speed smoothly accelerates to full speed.

Special starting – Using Dual Adjustment

Using two starting characteristics, the starter will accelerate to DA-IV reaching 100% current limit. After Tx (Imm. Relay delay) voltage to terminal 8 is switched off, using the standard characteristic to complete acceleration. Useful to prevent initial high acceleration. (Applications: Submersible pumps, Drum fans with resonating frequency, etc).

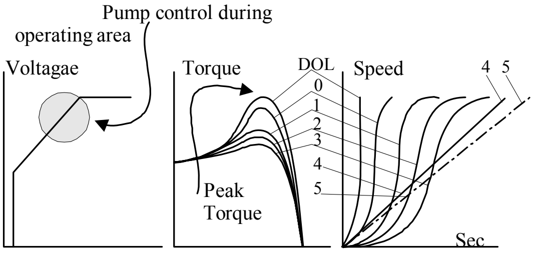


	Dual Adj. Par.	Standard Par.
Initial Voltage	10%	25%
Acceleration Time	tl = 2-30 sec	t2 = 2-30 sec
Current Limit	200%	300-400%
Imm.Rel. ON delay	Tx = 1-60 sec.	-----

Choosing a suitable **Pump Curve** (centrifugal Pumps)

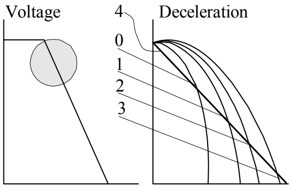
Starting Curve

1. Adjust main parameters as necessary (FLA, FLC, etc..)
2. Set Starting Curve, Acceleration Time, Current Limit, and Initial Voltage to their default values (curve 0, 10 sec., 400% and 30% respectively).
3. Start the pump while watching the pressure gauge as the pump starts and look for overshooting ("Pressure Surge") of the gauge needle above the target pressure. In case of over pressure, choose a peak torque reduction curve (Pump Control curve 1!).
4. Set Start Curve 1!, increase Acceleration Time to 15 sec. and reduce Current Limit to 350%. Start the pump and watch the pressure gauge while the pump starts.
5. In most cases, overshooting is reduced, if the overshoot persists, increase Acceleration time to 25 sec. (confirm with motor manufacturer) and try again.
6. If the overpressure persists, increase Starting Curve setting to 2!, 3!, 4 (Torque) or 5 (Current Ramp) if necessary. Each increase in Starting Curve setting will reduce the Peak Torque, thus, reducing the overpressure and preventing the "Pressure Surge" during start.
7. To increase starting time above these maximums, employ "Special Starting" (page 32) with these techniques or incorporate Torque and Current characteristics.



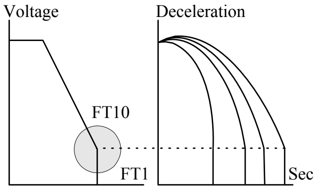
Stopping Curve

1. Adjust main parameters as necessary (FLA, FLC, etc..)
2. Set Stop Curve and Deceleration Time, to their default values (curve 0, 10 sec., respectively).
3. Stop the pump, watching the pressure gauge and the check valve as the pump stops. Look for undershooting/overshooting ("Water Hammer") of the gauge (which may abruptly stops the pump and the motor).
4. Select Stop Curve 1, increase Deceleration time to 15 seconds. Stop the pump and watch the pressure gauge and the rate of closing of the check valve as the pump stops. Abrupt stopping of the pump and motor will cause a loud audible noise emitted from the check valve.
5. In most cases, "Water Hammer" is reduced. If the "Water Hammer" persists, increase the time to 25 seconds (confirm with motor manufacturer) and try again.
6. If the "Water Hammer" persists, increase Stop Curve setting to 2!, or 3!. Each increase in stop curve will reduce the abrupt stop of the pump, thus, preventing the "Water Hammer" phenomenon.
7. If the extent of the water hammer was not reduced, increase to stop curve # 4 to employ Torque Controlled deceleration.

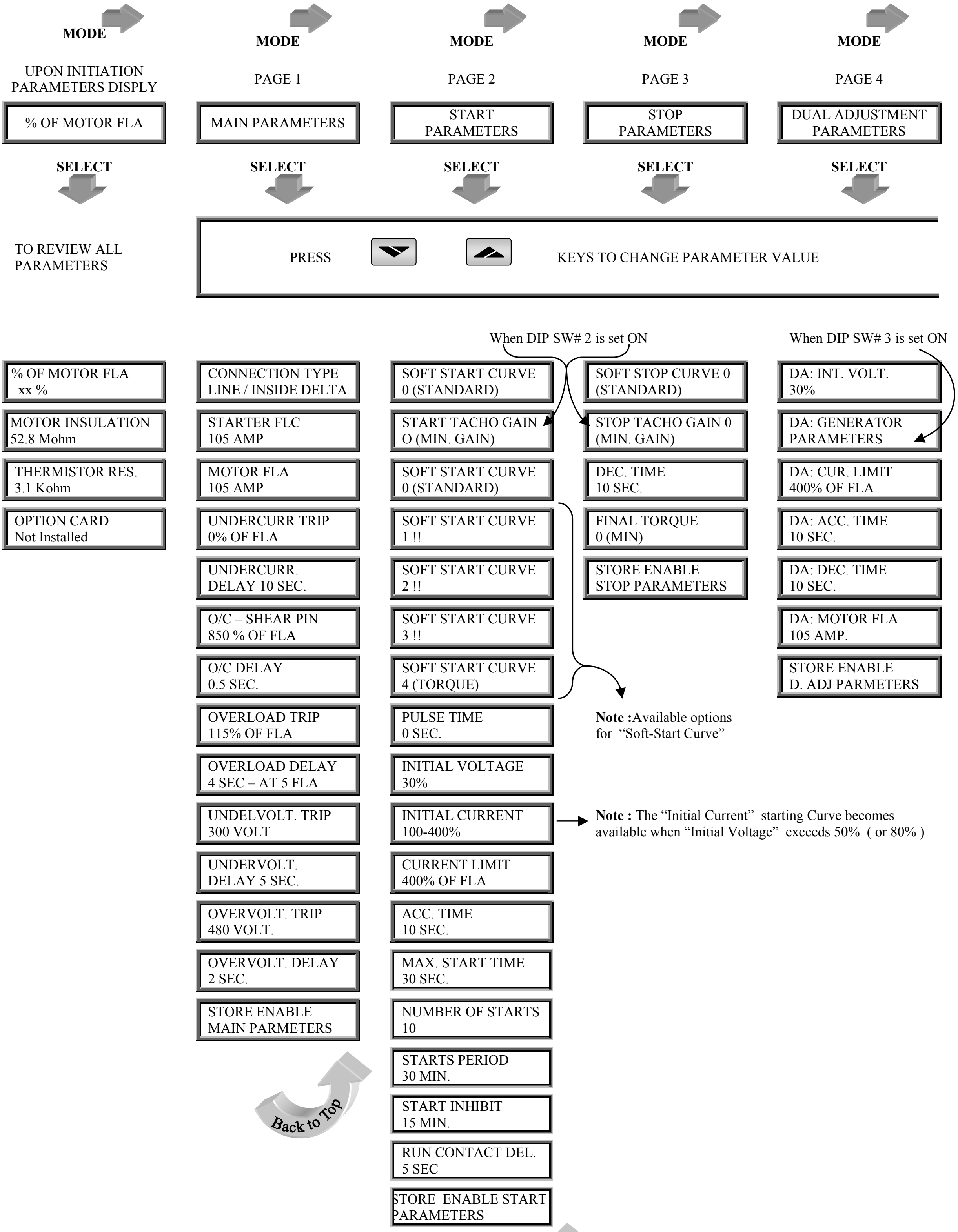


Final torque during soft-stopping a pump motor

1. While decelerating, the check valve may close before Deceleration Time has elapsed, thus, allowing current to flow through stator winding causing unnecessary heat. Select Final Torque sensitivity to 1, and stop the pump, confirm that current stopped flowing through the motor shortly after the check valve closed.
2. If current still flows more than 3-5 seconds after check valve closure, increase Final Torque up to 10 if necessary, to stop current flow earlier.



Menu Description



Note : Available options for "Soft-Start Curve"

Note : The "Initial Current" starting Curve becomes available when "Initial Voltage" exceeds 50% (or 80%)

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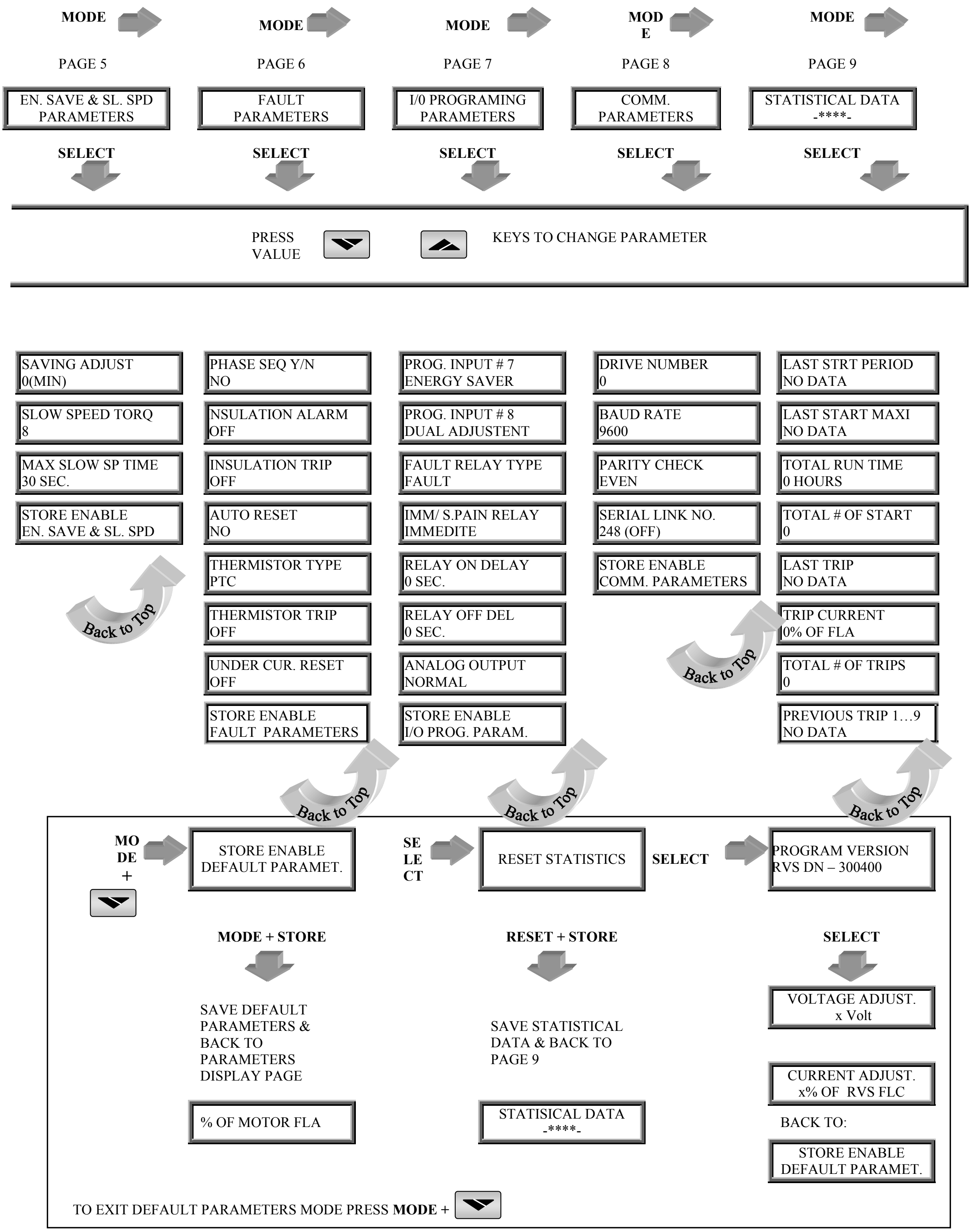
Back to Top

Menu Description



Trouble Shooting

Upon fault – motor stops, Fault LED lights and Fault Relay operates. The LCD shows TRIP: and fault description.
Upon Alarm – motor continues running, Alarm Relay operates and Fault LED flashes. The LCD shows ALARM: and fault description
(for example: **ALARM: MOTOR INSULATION).**

INSULATION ALARM	(Optional) Alarms when motor insulation level decreases below set level. Alarm ceases automatically 60 sec. after resistance able set level. Check motor and cable insulation.
INSULATION TRIP	(Optional) Trips the starter when motor's insulation level decreases below trip value. Check motor and cable insulation level.
THERMISTOR TRIP	(Optional) Trips the starter when motor's thermistor resistance decreases below trip value. Check thermistor and cable's resistance, check motor temperature near thermistor location.
TOO MANY STARTS	Trips the starter if number of starts, during "Start Period" exceeds the preset number. Wait until motor and starter cool down – according to "Start Inhibit" setting.
LONG START TIME	Trips the starter if output voltage does not reach nominal at the preset max. Start time. Check FLA, FLC, and Max Start Time settings. Increase Initial Voltage, Current Limit & Max. start time or decrease Acceleration Time as necessary.
O/C – SHEAR PIN	Trips the starter when: 1. Instantaneously when current exceeds 8.5 x Starter FLC. 2. During starting when current exceed 8.5 x Motor FLA. 3. During running when current exceeds 200-850%. O/C Shear-Pin has a programmable delay of 0-5 seconds where the starter detects the fault and does not trip before time delay has elapsed (delay is override when current reaches 8.5 x Starter FLC). Check that motor is not installed or Jammed. Check FLA, FLC settings. Check motor and cable connections. Perform a "Megger" test to verify motor and cable's condition
OVERLOAD	Trips the starter when current exceed the Overload Trip level and thermal register has filled up. Check FLA, FLC and Overload settings, check motor current, wait 15 minutes to let motor and starter cool down before restarting.
UNDER CURRENT	Trips the starter when line current drops below the preset level for the preset time. Check "Under Current Trip" and "Time Delay" settings, check line currents through L_1, L_2, L_3.

CAUTION

- Check that "Megger" maximum voltage is no more than 500V!.
- Disconnect terminal 21 before performing a "Megger" test.

Trouble Shooting

UNDER VOLTAGE	Trips the starter when line voltage drops below the preset level for the preset time. Check "Under Voltage Trip " and "Time Delay" settings, check line voltages on L_1, L_2, L_3. When voltage drops to zero, the starter trips immediately with no delay.
OVER VOLTAGE	Trips the starter when line voltage increases above a preset level for a preset time. Check "Over Voltage Trip" and "Time Delay" settings, check line voltage on L1, L_2, L_3.
PHASE LOSS	Trips the starter if 1 or 2 phases are missing. Check line voltages related to terminal 21 is connected correctly (see page 8). Check that frequency variations are between 40-65Hz.
PHASE SEQUENCE	Trips the starter if line phase sequence is wrong. Check line phase sequence, and if wrong, swap two wires on <u>line</u> side. If motor now rotates in the wrong direction, swap two wires on <u>load</u> side.
MAX SLOW SP TIME	Trips the starter when operating at slow speed for extended period of time. Check that operation time at Slow Speed is shorter than "Max Slow Speed Time" setting. **Note:** Motor and starter may be overheated when operating at slow speed for an extended period.
WRONG CONNECTION	Trips the starter when one or more motor phases is not properly connected to starter's load terminals or in case of internal disconnection in motor winding. If required, may be eliminated by using Dip Sw # 3 and wiring the soft-starter in generator mode (programming D.A. parameters accordingly*).
SHORTED SCR	Trips the starter and prevents starting if any SCR is short-circuited or when motor windings are shorted. Check with an ohmmeter between L_1-U, L_2-V, L_3-W; resistance > 20 KΩ. Check for no voltage on terminals U, V, W (from parallel system or an independent by-pass). SCRs may fail due to: * High short current not protected by proper fuses * High voltage spikes not protected by proper external Varistors. * Frequent starting at maximum conditions or fault conditions.
OVER TEMPERATURE	Heat-sink over-temperature. Trips the starter when heat-sink temp. rises above 85˚C. Improve cooling or use a by-pass contactor. Check that motor starting is not too frequent.
EXTERNAL FAULT	Trips the starter when a N.O contact between terminals 19-21 closes for over two seconds. Check contact position and cause of closure.
WRONG PARAMETERS	Parameters not transferred from RAM to EEPROM or vice versa. After replacing the EPROM with a new software version or after power up, press **Reset**, than **Mode** and ▼ simultaneously and save the default parameters by pressing Store and Mode simultaneously. (If Fault LED is on, press **Reset** after strong parameters).
*** NOTE:**	When operating in generator mode, Shorted SCR and Wrong Connection faults are not active.

Technical Specification

General Information:

Supply Voltage	Line to Line 220-690V (to be specified) + 10%-15%
Frequency	45 – 65 Hz (Fixed or variable frequency source)
Control Supply	110-230V (to be specified) +10% - 15%
Control inputs & Outputs	Either same as Control Supply or by special order 24-230V AC/DC (to be specified)
Load	Three phases, three wires, squirrel cage induction motor.
Connection type	Standard 3 wire U, V, W connection, or 6 wire "Inside Delta" (Programmable)

Start-Stop Parameters:

Starter FLC	Starter's Full Load Current, according to Selector Guide
Motor FLA	Motor Full Load Ampere 50-100% of Starter FLC
Starting Curve 0 (Standard)	2 Standard Starting and stopping curves.
Pump Control Curves (1!, 2!, 3!)	6 field selectable curves preventing Over-pressure during start and Water Hammer during stop.
Torque Control Curve (4)	2 Selectable curves preventing Over-pressure during start and Water Hammer during stop. In addition, these curves may be used for Torque control starting of constant torque applications.
Pulse Start Duration	A pulse of 80% Un, for an adj. time 0.1-1 Sec, for starting high friction loads
Initial Voltage	10-50% Un (*10-80%), 5% - by special order
Initial Current	100-400% In (1 Current Control starting Curve, appears when Initial Voltage is displayed , "Up" arrow is pressed, and IV% has reached its Max.)
Current Limit	100-400% of Motor FLA (*100-500%)
Acceleration Time	1-30 Sec (*1-90 sec)
Deceleration Time	1-30 Sec (*1-90 sec, not in Dual Adjust)
Dual Adjustments	Secondary start stop characteristic for: Motor FLA, Initial Voltage, Current Limit, Acceleration Time and Deceleration Time.
Energy Saving	Energy save for lightly loaded motors
Slow Speed Torque	Torque while motor is at 1/6 nominal speed
Tacho and Linear Acceleration	12 field selectable curves – defining gain control, improving Tacho Feedback.

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* Consult Factory

Motor Protection:

Too many starts	Maximum number of starts, range: Off or 1-10, during a time period 1-60 min.
Starts inhibit	Time period 1-60 min, when starting is prevented, after Too Many Starts fault
Long start time (Stall protection)	Maximum allowable starting time 1-30 sec. (*1-250 Sec).
Over current (Shear-pin)	Two operation functions: during starting trips the starter at 850% and during running at 200-850% In, both within 1 Cycle.
Electronic overload (I^2t)	Adjustable 75-150% of motor FLA, adjustable Trip time at 500% In of 1-10 sec.
Under current	Trips when current drops below 20-90% In, time delay 1-40 sec.
Under voltage**	Trips when main voltage drops below 120-600V, time delay 1-10 Sec
Over voltage	Trips when main voltage increase above 150-750V, time delay 1-10 sec.
Phase loss, Under/over Frequency**	Trips when one or two phases are missing or frequency is < 40Hz or > 65Hz.
Phase sequence	Trips when phase sequence is wrong
Long slow speed time	Trips if operating at slow speed for more than 1-30 sec (*1-250 sec)
Wrong connection	Prevents starting, trips if motor is notconnected / incorrectly connected to the starter.
Shorted SCR	Trips in case one or more SCRs have been shorted
Heat Sink over temperature	Trips when heat-sink temperature rises above 85˚C.
External fault	Trips when an External Contact closes for 2 sec.
Motor Insulation (optional	Alarm level setting 0.2 – 5MΩ, trips when insulation decreases below 0.2-5MΩ
Motor Thermistor (optional)	Trip level setting 1-10KΩ, trips when resistance decreases below the set level.

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* Special settings – Consult Factory

** With optional Auto Reset.

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Technical Specification

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Control:

Displays	LCD in 4 – Field selectable languages and 8 LEDs.
Keypad	6 keys for easy setting
Aux Contact – Immediate	1 C/O, 8A, 250VAC, 2000VA
Aux Contact – End Of Acceleration	1 C/O, 8A, 250VAC, 2000VA
Fault Contact	1 C/O, 8A, 250VAC, 2000VA
Insulation Alarm Contact (option)	1 C/O, 8A, 250VAC, 2000VA
Communication	RS 485 with MODBUS protocol for full control and supervision.
	Consult factory for other communication protocol.

Temperatures

Operating	-10° to 50°C
Storage	-20° to 70°C

Standards:

Dielectric Test		2500VAC	
Degree of Protection		IP 20 for frame size A IP 00 for frame sizes B, C, D, E, F, G	
Pollution Degree		3	
EMC	Emissions	EN 55011	CISPR 11 Class A
	Immunity	EN 55082-2	ESD 8KV air, IEC 801-2 Electric RF field 10 V/m, 20-1000Mhz, IEC 801-3 Fast transients 2KV, IEC 801-4
	Safety	EN 600947-1 UL508C	Related to safety requirements.

Normal Service Conditions:

Altitude	Up to 1000m. For equipment to be used at higher altitudes consult Factory.
Humidity	95% at 50˚C or 98% at 45˚C.

Fan and Starter Consumption Ratings:

Size A (8-31A)	No fan	Total starter Consumption	150VA
Size A (44-72A)	Fan 35 VA	Total starter Consumption	185VA
Size B	Fan 60 VA	Total starter Consumption	210VA
Size C	Fans 105 VA (35VA x 3)	Total starter Consumption	255VA
Size D, E, F, G	Fans 150 VA (50VA x 3)	Total starter Consumption	300VA

Appendix Table of Contents

UL, cUL Installation Instructions

1. Input power and output motor field wiring shall be copper conductors, rated 75ºC.
2. Use UL listed closed-loop connectors sized for the selected wire gauge. Install connectors using the correct crimp tool recommended by the connector manufacturer. Applies only to units bus bars.
3. Table showing corresponding wire size, terminal screw, closed-loop connector size. Torque ratings for attachment of connector to bus bar (see table).
4. Branch circuit protection, shall be provided per the NEC.

For units with UL cUL, see ordering information.

Cables, Terminal screws and Torque recommendations

No.	Max. Mot. FLA	Min. dimensions for copper cables (mm^2)	Term Screw	Mech. Torq. Kg.cm
1	8	3 x 1.5 + 1.5		
2	17	3 x 2.5 + 2.5		
3	31	3 x 6 + 6		
4	44	3 x 6 + 6		
5	58	3 x 10 + 10		
6	72	3 x 16 + 16		
7	105	3 x 50 + 50	M8	180
8	145	3 x 70 + 35	M8	180
9	170	3 x 95 + 50	M8	180
10	210	3 x 150 + 70	M10	220
11	310	2 x (3 x 120+ 70)	M10	220
12	390	2 x (3 x 185+ 95)	M10	220
13	460	2 x (3 x 240+120)	M10	220
14	580	3 x (3 x 185+ 95)	M10	220
15	820	3 x (3 x 240+120)	M10	220
16	1100			
17	1400			
18	1800			
19	2500	TBD	TBD	TBD

LR Recommendation

LR recommendations for marine, offshore or industrial use.

System design needs to take into account the power supply source and the motor drive together with the electronic soft starter. Particular features to be considered are torque production, harmonic production and their consequential effects and EMC. These points are relevant for marine, off-shore or industrial use.

Fuse Selection (Recommended Values For Main Supply Of 400V)

RVS-DN Fuse Value	Max. thyristor I^2t Allowed (A^2Sec)	BUSSMAN	Schneider	GEC ALSTOM Ultra Fast Fuse	JEAN MULLER Semicon Fuse	FERRAZ -	
RVS – DN 8	400	T.B.D.	T.B.D.	GSGB30	500V - 40A	6,9 Grb 17.	
RVS – DN 17	5,000	T.B.D.	T.B.D.	GSGB55	500V - 50A	6,9 Grb 17.	
RVS – DN 31	10,000	T.B.D.	T.B.D.	GSGB110	500V - 80A	6,6 URB 00	
RVS – DN 44	12,000	T.B.D.	T.B.D.	GSGB125	500V - 125A	6,6 URB 00	
RVS – DN 58	15,000	T.B.D.	T.B.D.	GSGB150	500V - 200A	6,6 URB 00	
RVS – DN 72	18,000	T.B.D.	T.B.D.	GSGB170	500V - 250A	6,6 URC 00	
RVS – DN 105	60,000	T.B.D.	T.B.D.	GSGB225	500V - 315A	6,6 URD 00	
RVS – DN 145	100,000	T.B.D.	T.B.D.	GSGB350	500V - 350A	6,6 URD 2	
RVS – DN 170	140,000	T.B.D.	T.B.D.	GSGB400	500V - 400A	6,6 URD 2x	
RVS – DN 210	200,000	T.B.D.	T.B.D.	GSGB450	500V - 450A	6,6 URC 2x	
RVS – DN 310	600,000	T.B.D.	T.B.D.	GSGB580	500V - 710A	6,6 URD 31	
RVS – DN 390	700,000	T.B.D.	T.B.D.	GSGB710	500V - 800A	6,6 URD 31	
RVS – DN 460	800,000	T.B.D.	T.B.D.	GSGB800	500V - 1000A	6,6 URD 32	
RVS – DN 580	1,200,000	T.B.D.	T.B.D.	GSGB900	500V - 1250A	6,6 URD 32	
RVS – DN 820	2,000,000	T.B.D.	T.B.D.	GSMJ1200	N.A.	6,6 URD 33	
RVS – DN 1100	N.A	T.B.D.	T.B.D.	N.A	N.A	A065URD3 AO60R160	
RVS – DN 1400	N.A	T.B.D.	T.B.D.	N.A	N.A	A060URD3 A060R200	
RVS – DN 1800	N.A	T.B.D.	T.B.D.	N.A	N.A	T.B.D.	
RVS – DN 2150	N.A	T.B.D.	T.B.D.	N.A	N.A	T.B.D.	
RVS – DN 2400	N.A	T.B.D.	T.B.D.	N.A	N.A	T.B.D.	
RVS – DN 2700	N.A	T.B.D.	T.B.D.	N.A	N.A	T.B.D.	
RVS – DN 3000	N.A	T.B.D.	T.B.D.	N.A	N.A	T.B.D.	
RVS – DN 3500	N.A	T.B.D.	T.B.D.	N.A	N.A	T.B.D.	

Notes: 1. The above table is for maximum starting current of 500% of FLC, maximum starting time of 30 sec and rated voltage of 400
2. Rating may change with different external conditions such as ambient temperature, forced cooling etc. Refer to fuse manufac
3. Ferraz ratings are simulated for 4In, 4 times per hour with a 10sec. starting time for each start.

Motor and Starter Protection Occurance Table

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Timing And Occurrence	Active During			
	Start	**Run**	**Stop**	**Soft Stop**
Too many starts with Start Inhibit period	√			
Electronic Overload with Curve selection		√		
Shear Pin (Jam) * Default setting				
Starter Protection – trip function at 850% FLC	√	√		√
Motor Protection – trip function				
During Start – factory set at 850% FLA in less than 1 cycle.	√			√
During Run – adjust. 200 – 850% FLA within 1 cycle		√		
Programmable setting (Dip switch # 2 On)				
Starter Protection – trip function at 850% FLC	√	√		√
Motor Protection – Alarm & Trip functions On fault "Immediate Relay" acts as Alarm w/adj. delay – If fault is cleared within the time delay, trip will not occur				
During Start – preset at 850% FLA, adjust. delay (Imm. Relay)	√			√
During Run – adjust. 200-850% FLA adjust. delay (Imm. Relay)		√		
Under current adjustable time delay		√		
Phase Loss	√	√		√
Phase sequence	√	√		√
Under voltage with adjustable time delay. Time delay is overriden in case of "No-Volt".	√	√		√
Over voltage with adjustable time delay	√	√		√
Long start time (Stall protection)	√			
Shorted SCR	√			√
Wrong connection (Load Loss)	√			
External fault – input from a N.O. contact	√	√	√	√
SCR protection by Metal Oxide Varistors (MOV)	√	√	√	√
Starter over-temperature	√	√	√	√
Starter internal test, when "On" LED is lit.	√	√	√	√
Motor Insulation test (option) – two levels for Alarm & Trip when installed, operates upon no main voltage			√	
Motor Thermistor (option) – programmable PTC/NTC, With adjustable Trip level.	√	√	√	√

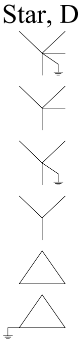
* Available from software version 5/11/97

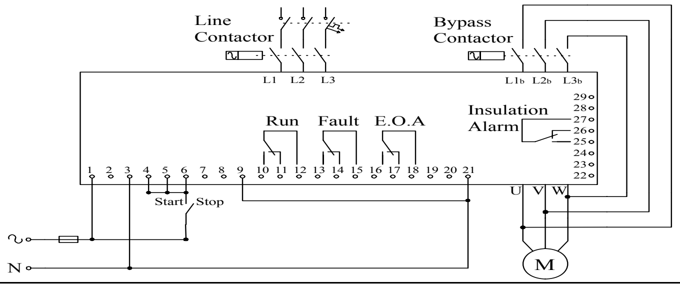
Warranty Report and Problem Inquiry – Complete the form and fax for inquiry

Representative Name:	Country:	Fax Number:
Model Number And Built Options:	Example: 390 – 400 – 230 – 230 – 3 + 4 + 9 + L + A + B – S RVS-DN _ _ _ _ - _ _ _ - _ _ _ - _ _ _ - _ + _ + _ + _ + _ - _	
Serial Number:		
Purchasing Date:		
Sale / Installation Date:		
Failure Date:		
Program Version: STRT.DN- _ _ _ _ _ _	Press MODE + ∇, press SELECT twice, the LCD displays the program version (e.g. STRT.DN-011197)	

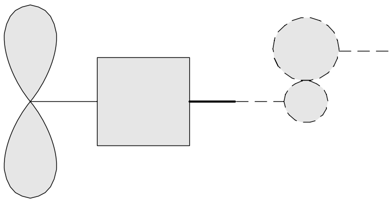
Connection Diagram & Supply Network Type. Circle the correct main supply and add or erase parts in the drawing:

Star, Delta, with/without neutral or ground





Application Description:



Details of Fault / Fault Message:

Define time of fault occurrance: (during start, after start, during soft stop, end of soft stop, when closing B.P. contactor, when performing…)	

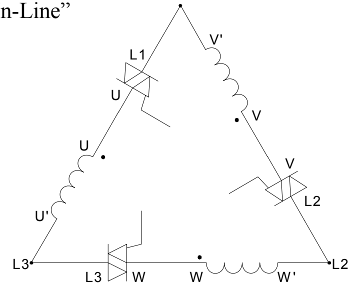
Statistical Information		Starter Operative Information	
Last Start Period:		Starter FLC:	
Last Start Max. I		Motor FLC:	
Total Run Time:		Initial Voltage:	
Total Number Of Starts:		Acceleration Time:	
Last Trip:		Current Limit:	
Trip Current:			
Total Number Of Trips:			
Trip History :			

“Inside Delta” mode - Description

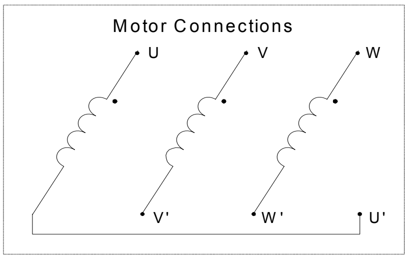
General information

- Mains current is reduced by 1.73 (√3), namely for an 800A motor, an 820A starter will be selected, to operate “In-Line”. For “Inside Delta” starter, we calculate (800 / 1.73 =) and select a 460A starter.
- Less heat dissipates in the cabinet vs. the standard “In-Line” connection.

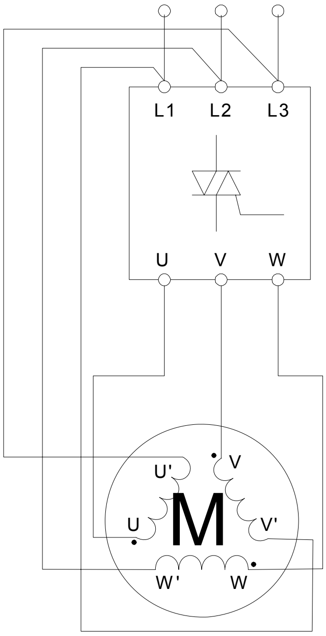
The attached drawings are for reference purposes only.



Standard Motor Connection Box



Standard Inside Delta Connection



Important Notes:

- **Wrong motor connection will cause serious damage to the motor windings.**
- The sinusoidal shape of the current is imperfect (since each phase is separately fired and not influenced by other phase firing). As a result, higher harmonic content is incurred (THD), which can be as high as twice the THD value as in the standard “In-Line”.
- Higher motor heating is expected for the same motor size (due to the higher THD).
- Phase sequence must be correct; otherwise, “Phase Sequence fault” will trip the starter immediately (without any damage).
- Higher torques can not be obtained
- “Inside Delta” requires 6-wire to the motor.
- Factory preset - features and functions when “Inside Delta” mode is configured:
  - No Pulse Start.
  - No curve selection (Curve 0 !!).
  - No Energy Save
  - No Slow Speed
  - No Phase sequence “Off” mode

Note :
For a high starting torque process, we recommend to use the starter in the “standard” connection (in-line).

WARNING
Beware
Wrong connection of the starter or the Motor, will seriously damage the motor.

Motor Ratings for In-Line and Inside Delta, at 400V

Starter Type In Line	Soft-Starter Current (A)	Motor KW @400V “In- Line”	Motor KW @ 400V “Inside Delta”
RVS-DN 8	8	4	6
RVS-DN 17	17	7.5	12
RVS-DN 31	31	15	25
RVS-DN 44	44	22	38
RVS-DN 58	58	30	50
RVS-DN 72	72	37	64
RVS-DN 85	85	45	75
RVS-DN 105	105	55	95
RVS-DN 145	145	75	120
RVS-DN 170	170	90	155
RVS-DN 210	210	110	190
RVS-DN 310	310	160	275
RVS-DN 390	390	220	380
RVS-DN 460	460	250	430
RVS-DN 580	580	315	540
RVS-DN 820	820	450	770
RVS-DN 1100	1100	600	1000
RVS-DN 1400	1400	750	1300

The starter must always be selected according to motor’s nominal current and starting conditions.
For “Inside Delta” connection, the “In Line” KW ratings were multiplied by 1.73.

Overload Trip Time Calculation

Note: In overload procedure, current is limited to 5 x Motor FLA to prevent saturation in calculation, so trip time at 5 or 8 times motor FLA will be identical.

The approximate trip time is given in the following equation:

$$\text{O/L Trip Time} = \frac{1{,}375{,}000}{I_{\%}{}^2 - OLT^2} \times \frac{OLD}{6} \quad \text{(In Seconds)}$$

$$\text{Where} \quad : \quad I_{\%} = \text{Actual Current} \times \frac{100}{\text{Motor FLA}}$$

OLT = Overload Trip setting (default 115%)

OLD = Overload Delay setting – trip delay at 5 x Motor FLA, (default 4 sec).

Example 1: Motor FLA = 80A, actual current = 120A,
$I_{\%}$ = 120 x 100 / 80 = 150%
If settings are as in default then

$$\text{O/L Trip Time} = \frac{1{,}375{,}000}{150^2 - 115^2} \times \frac{4}{6} = 99 \text{ sec.}$$

Example 2: Same motor and setting, but current is 400A,
$I_{\%}$ = 400 x 100 / 80 = 500%
If settings are as in default then

$$\text{O/L Trip Time} = \frac{1{,}375{,}000}{500^2 - 115^2} \times \frac{4}{6} = 4 \text{ sec.}$$

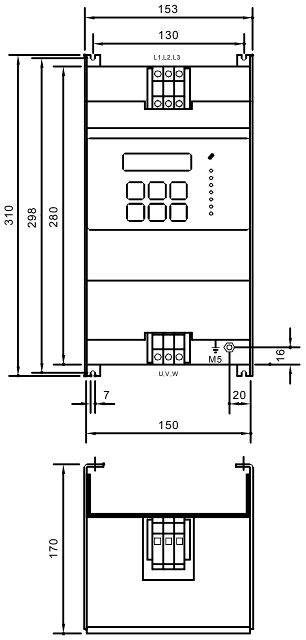
Example 3: Motor FLA = 80A, actual current = 200A, Overload Delay (OLD) = 10
$I_{\%}$ = 200 x 100 / 80 = 250%

$$\text{O/L Trip Time} = \frac{1{,}375{,}000}{250^2 - 115^2} \times \frac{10}{6} = 47 \text{ sec.}$$

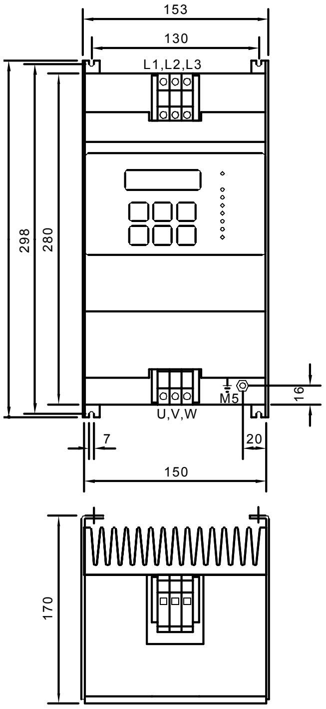
Dimensions (mm)

FRAME SIZE - A

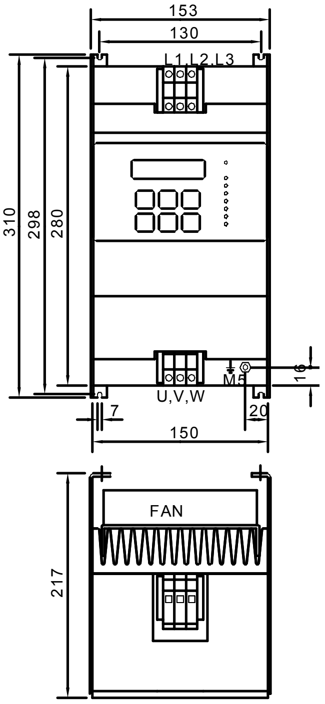
8,17A



31A



44, 58, 72A



Note: Main voltage terminals size: 8A – 58A - 16mm^2
72A - 25mm^2

Dimensions (mm)

FRAME SIZE – B (Standard)

105, 145, 170A

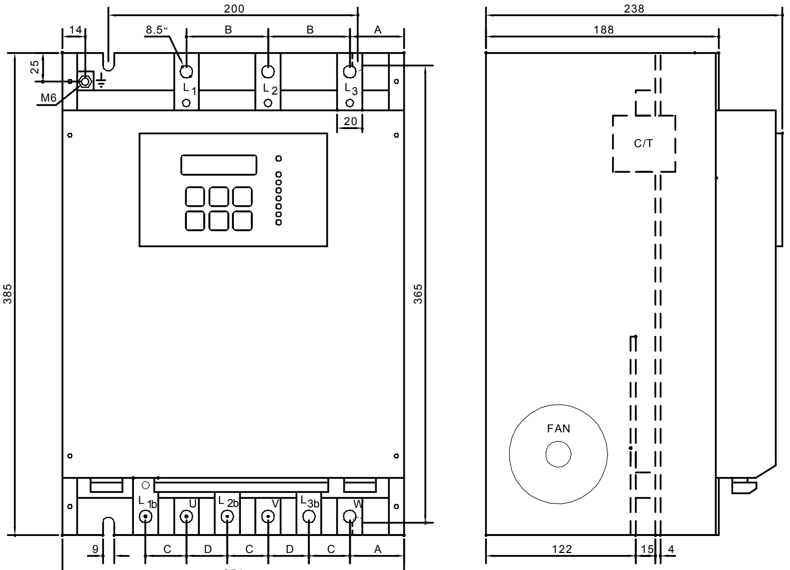
Drawing will be delivered upon request

With preparation for by-pass contactor

Drawing will be delivered upon request

FRAME SIZE – B (New – New type includes preparation for bypass as standard)

85, 105, 145, 170A (Deep Type)



RVS	A	B	C	D
105	48.5	60	29	31
145,170	43.5	65.4	32.7	32.7

With preparation for by-pass contactor

Notes:

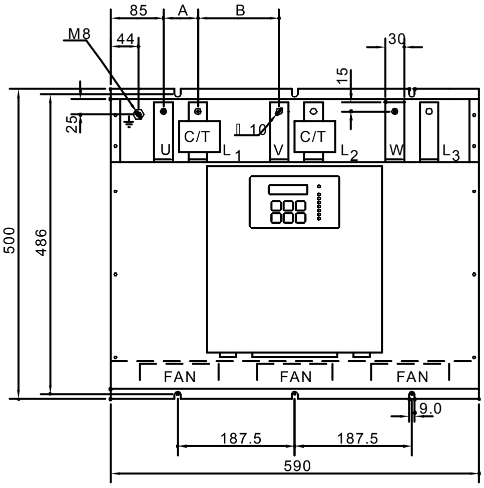
Frame size B (New type, shallow and deep) includes:

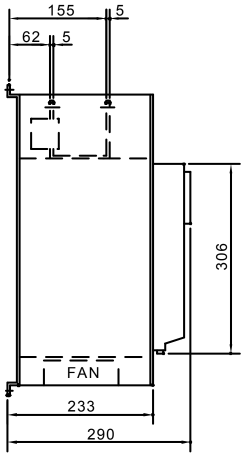
1. Preparation for by-pass as standard
2. Line bus bars at the top, Load and By-pass outputs at the bottom.

Dimensions (mm)

FRAME SIZE - C

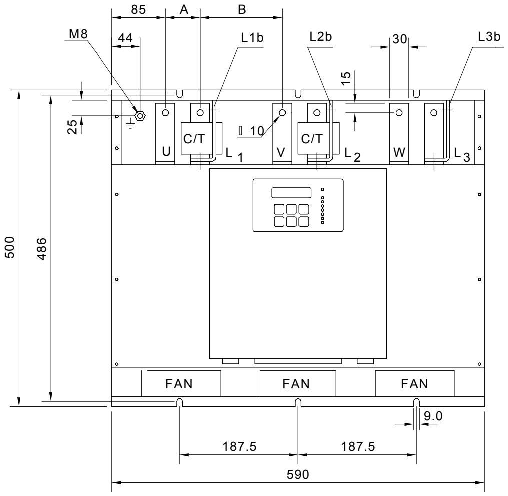
210, 310, 390A

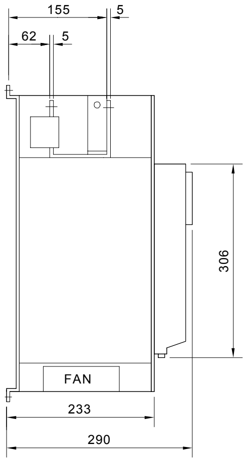




RVS-DN	210	310	390
A	45	45	55
B	140	135	130

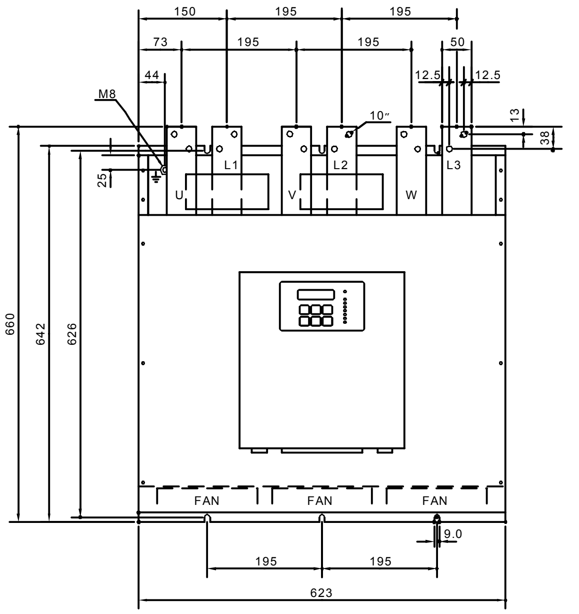
- The starter can be supplied with line & load bus-bars at the bottom
- The starter can be supplied without side covers, with max width of 536 mm (instead 590)

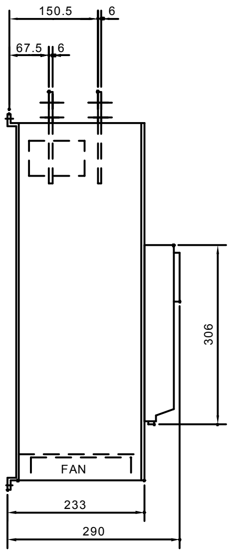




Dimensions (mm)

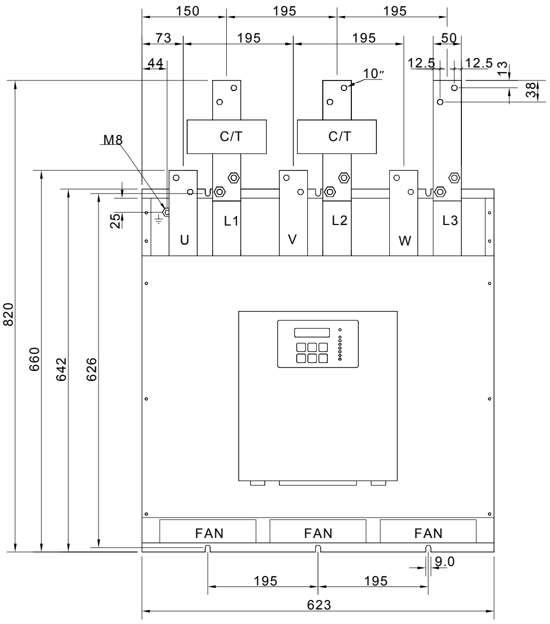
FRAME SIZE - D
460, 580, 820A

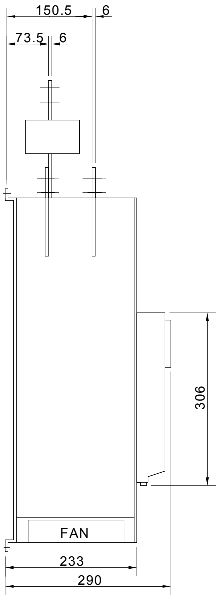




- The starter can be supplied with line & load bus-bars at the bottom

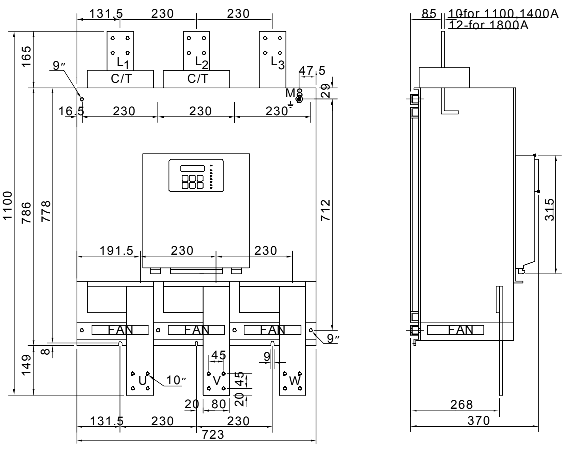
Preparation for by-pass contactor



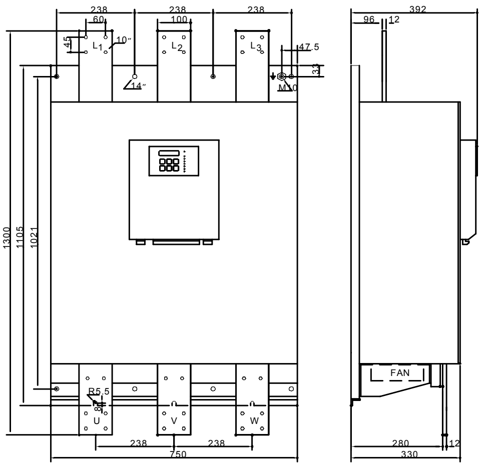


Dimensions (mm)

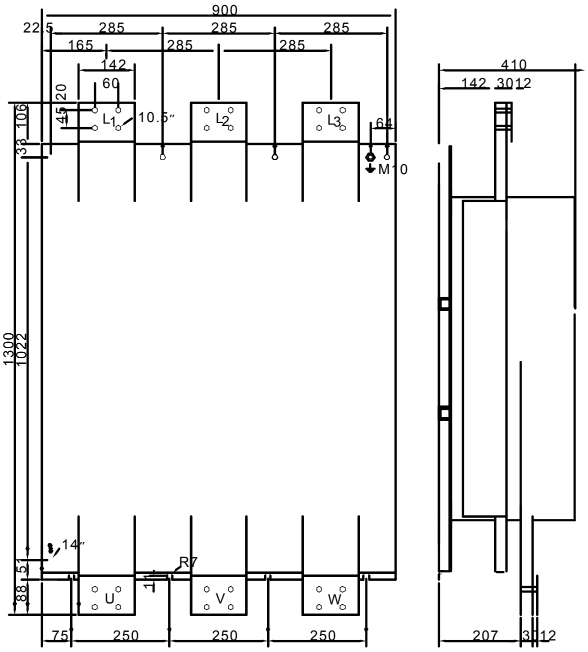
FRAME SIZE – E 1100, 1400, 1800A



FRAME SIZE – F 2150A



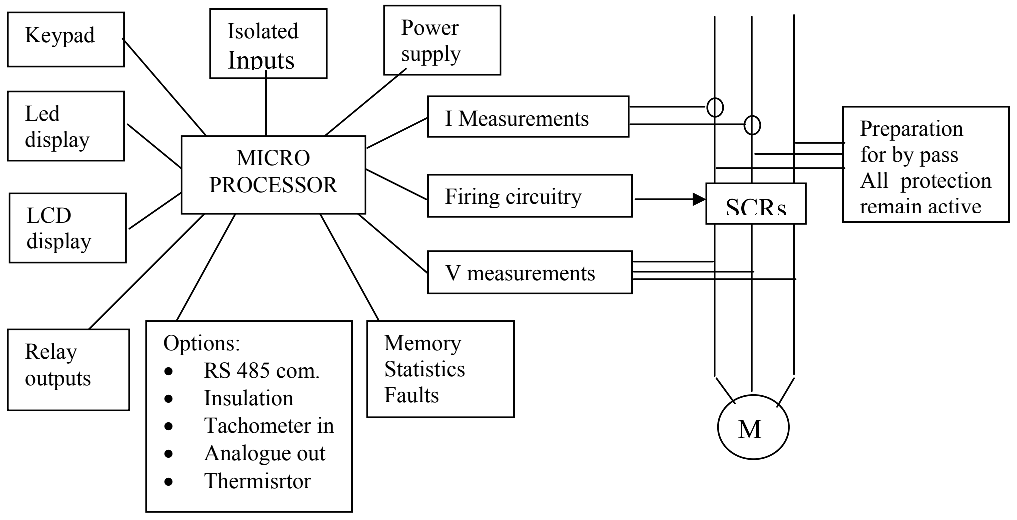
FRAME SIZE – G 2400A, 2700A, 3000A, 3500A



Starter Type	Current FLC (Amp)	Frame Size	Width	Height	Depth	Weight (Kg.)
RVS-DN	8, 17	A	150	310	170	4.5
	31	A	150	310	170	6
	44, 58, 72	A	150	310	217	7.4
	105, 145, 170	B	274	370	222	15.1
	210, 310, 390	C	590	500	290	44.8
	460, 580, 820	D	623	660	290	65
	1100, 1400, 1800	E	723	1100	361	170
	2150	F	750	1300	392	235
	2400, 2700, 3000, 3500	G	900	1300	360	350

RVS-DN Block Diagram

Block Diagram for the RVS-DN control, power and firing module, inputs and option boards.

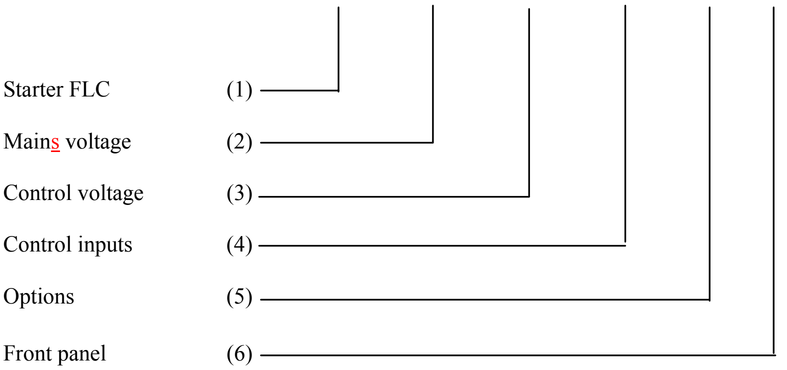


Notes:

Ordering Information

Example: RVS-DN 210 - 400 - 230 - 230 - 9 - S

RVS-DN xxxx - xxx - xxx - xxx - x - x



(1) Starter FLC: 8, 17, 31, 44, 58, 72, 85, 105, 145, 170, 210, 310, 390, 460, 580, 820, 1100, 1400, 1800, 2150, 2700, 3000, 3500 Amp

	Specify	For
(2) Mains voltage 50/60Hz	230	220- 240 Vac + 10%-15%
	400	380- 440 Vac + 10%-15%
	480	460- 500 Vac + 10%-15%
	600	575- 600 Vac + 10%-15%
	690	660- 690 Vac + 10%-15%
	1000	850-1100 Vac + 10%-15% (Special – Please Consult Factory)

	Specify	For
(3) Control Supply Voltage (terminals 1-3) 50/60Hz	115	110-120 Vac + 10%-15%
	230	220-240 Vac + 10%-15%
	DC	90-250 Vdc + 10%-15%

	Specify	For
(4) Control Input Voltage (terminals 4-9) 50/60HZ or DC	115	110-120 Vac + 10%-15%
	230	220-240 Vac + 10%-15%
	24	24- 48 Vdc

	Specify	For
(5) Required Options For more than one option indicate, for example, 3+4 (Comm. + Insulation)	0	No options
	3	Comm. RS-485 (MODBUS, PROFIBUS, MODBUS-TCP) (c)
	4	Insulation tester (b)
	5	Analogue card – Thermistor in + Analogue out .(b)
	8	Harsh environment treatment (must be factory supplied)
	9	Preparation for by-pass contactor
	A	536mm special width (for size C only)
	B	Line & Load Bus Bars at the bottom (sizes C & D)
	D	Remote Panel Mounting replacing the original (with 1.5m cable).
	DK	Remote Panel Mounting kit with MMI, option #L and 1.5m cable.
	L	Illuminated LCD
	M	Lloyd's ENV-1, ENV-2 approval, GL as well (consult factory)
	T	Tachometer for special drive systems (consult factory) (b)
	U	UL & cUL Approval (8-820A)

	Specify	For
(6) Front Panel	S	Standard

Notes: (a) RVS-DN ratings 1100-3500 have to be used with a by-pass.
(b) RVS-DN size A (8-72A), options should be factory supplied.
(b) Only one option, either #4, # 5 or # T may be installed in one starter.
(c) Consult factory for any communication protocol other than MODBUS.

Instrucciones de servicio

VEGAPULS 67

4 … 20 mA/HART - de dos hilos

Document ID:
32938

Radar

Índice

1 Acerca del presente documento

2 Para su seguridad

3 Descripción del producto

4 Montaje

5 Conectar a la alimentación de tensión

6 Puesta en funcionamiento con el módulo de visualización y configuración PLICSCOM

7 Poner en marcha con PACTware y otros programas de configuración

Documentación complementaria

Información:
En dependencia de la versión solicitada se incluye una documentación complementaria dentro del alcance de suministros. Esta está en el capítulo "*Descripción del producto*".

Instrucciones para accesorios y piezas de repuesto

Consejos:
Para el empleo seguro de su VEGAPULS 67 ofertamos accesorios y piezas de repuesto. Las documentaciones correspondientes son:

- 27835 - Empleo del modulo de visualización y configuración PLICSCOM
- 32628 - Adaptador de interface VEGACONNECT
- 27720 - Indicación externa VEGADIS 61
- 34296 - Tapa protectora contra agentes meteorológicos
- 30176 - Pieza electrónica recambiable VEGAPULS Serie 60

1 Acerca del presente documento

1.1 Función

La presente instrucción de servicio le brinda las informaciones necesarias para montaje, conexión y puesta en marcha, así como instrucciones importantes de mantenimiento y eliminación de interrupciones. Por eso léala antes de la puesta en marcha, conservándola todo el tiempo al alcance de la mano en las cercanías del equipo como parte integrante del producto.

1.2 Grupo de destinatarios

La presente instrucción de servicio está dirigida a los especialistas capacitados. Hay que facilitar el acceso de los especialistas al contenido de la presente instrucción y aplicarlo.

1.3 Simbología empleada

ℹ **Información, consejos, indicaciones**
Este símbolo caracteriza informaciones adicionales de gran utilidad.

⚠ **Cuidado:** La falta de atención de esas indicaciones de advertencia puede tener como consecuencia un interrupciones o fallos de funcionamiento.
Advertencia: La falta de atención de esas indicaciones de advertencia puede tener como consecuencia daños personales y/o un daño grave del equipo.
Peligro: La falta de atención de esas indicaciones de advertencia puede traer como consecuencia una lesión grave de personas y/o una destrucción del equipo.

⬡ **Aplicaciones Ex**
Este símbolo caracteriza indicaciones especiales para aplicaciones Ex.

● **Lista**
El punto antepuesto caracteriza una lista sin secuencia obligatoria.

→ **Paso de procedimiento**
Esa flecha caracteriza un paso de procedimiento individual.

1 **Secuencia de procedimiento**
Los números antepuestos caracterizan pasos consecutivos de procedimiento.

2 Para su seguridad

2.1 Personal autorizado

Todas las manipulaciones descritas en esta instrucción de servicio pueden ser realizadas solamente por especialistas capacitados, autorizados por el operador del equipo.

Durante los trabajos en y con el equipo siempre es necesario el uso del equipo de protección necesario.

2.2 Empleo acorde con las prescripciones

El VEGAPULS 67 es un sensor para la medición continua de nivel.

Informaciones detalladas sobre el campo de aplicación están en el capítulo "*Descripción del producto*".

La confiabilidad funcional del equipo está garantizada solo en caso de empleo acorde con las prescripciones según las indicaciones en la instrucción de servicio del equipo así como las instrucciones de servicio suplementarias.

Por motivos de seguridad y de garantía las operaciones en el equipo que excedan las manipulaciones necesarias descritas en la instrucción de servicio deben ser realizadas exclusivamente por personal autorizado por el fabricante. Se prohiben terminantemente las modificaciones o ampliaciones arbitrarias.

2.3 Advertencia contra uso erróneo

En caso de empleo inadecuado o contrario a las prescripciones se pueden producir riesgos de aplicación específicos de este equipo, por ejemplo, un sobrellenado de depósito o daños en las partes del equipo a causa de montaje o ajuste erróneo.

2.4 Instrucciones generales de seguridad

El equipo corresponde con el estado tecnológico, considerando las prescripciones y recomendaciones normales. El usuario tiene que respetar las instrucciones de seguridad de esta instrucción de servicio, las normas de instalación específicas del país y las normas validas de seguridad y de prevención de accidentes.

Las frecuencias de transmisión de todos los sensores de radar están en la gama de banda C o K en dependencia de la versión del equipo. Las potencias reducidas de transmisión son muy inferiores a los valores límites homologados internacionalmente. No se espera ningún tipo de perjuicio de la salud en caso de empleo acorde con las prescripciones. El equipo se también puede emplearse sin restricciones fuera de envases metálicos cerrados.

El equipo solamente puede emplearse en estado técnico perfecto y con seguridad funcional. El operador es responsable por el funcionamiento sin interrupciones del equipo.

Además, el operador está en la obligación de determinar durante el tiempo completo de empleo la conformidad de las medidas de seguridad del trabajo necesarias con el estado actual de las regulaciones validas en cada caso y las nuevas prescripciones.

2.5 indicaciones de seguridad en el equipo

Hay que atender a los símbolos e indicaciones de seguridad puestos en el equipo.

2.6 Conformidad CE

Este equipo cumple los requisitos legales de la norma CE correspondiente. Con la colocación del símbolo CE VEGA confirma la comprobación exitosa. La declaración ce conformidad se encuentra en el área de descarga en www.vega.com.

2.7 Cumplimiento de las recomendaciones NAMUR

Respecto a la compatibilidad se cumple la recomendación NAMUR NE 53. Eso también es válido para los componentes de visualización y configuración correspondientes. Generalmente los equipos VEGA son compatibles hacia arriba y hacia abajo:

- Software del sensor para el DTM-VEGAPULS 67
- DTM-VEGAPULS 67 para el software de configuración PACTware
- Módulo de visualización y configuración para el software del sensor

El ajuste de parámetros de las funciones básicas del sensor es posible independientemente de la versión de software. La capacidad de funcionamiento se rige por la versión de software correspondiente de los componentes individuales.

2.8 Conformidad FCC/IC (solo para USA/Canadá)

VEGAPULS 67 solamente se puede emplear en depósitos cerrados de metal, hormigón o plástico reforzado con fibra de vidrio.

Indicación sobre esta instrucción de servicio

Esta instrucción de servicio está prevista para uso internacional. Las figuras representan aplicaciones parciales del VEGAPULS 67 en depósitos abiertos a la atmósfera. Esas aplicaciones no están acordes con las certificaciones FCC-/IC del equipo.

VEGAPULS 67 está aprobado por FCC/IC con todas las formas de antenas descritas en esta instrucción de servicio.

Modificaciones o cambio en el equipo sin la aprobación expresa de VEGA, provocan la cancelación del permiso de operación.

El equipo concuerda con la parte 15 de las determinaciones FCC. La operación solo se permite con cumplimiento de las dos condiciones siguientes:

1. El equipo no puede emitir ninguna radiación de interferencia y

2. El equipo tiene que trabajar sin afectación por radiación de interferencia, incluso con aquellas, que provocan estados de operación indeseados.

El equipo fue comprobado, determinándose el cumplimiento de los valores límites para un equipo digital clase A, acorde con la parte 15 de las determinaciones FCC. Esos valores límites están determinados, para asegurar una protección adecuada contra radiaciones parásitas durante la operación en ambiente industrial. El equipo genera, emplea y puede emitir ondas electromagnéticas. En caso de no ser instalado y operado, considerando las especificaciones de esta instrucción de servicio, el mismo puede emitir radiaciones de interferencia para equipos de telecomunicación. La operación en zona residencial produce radiaciones de interferencia, cuya eliminación es responsabilidad y corre a cargo del operador.

2.9 Instrucciones de seguridad para zonas Ex

En caso de aplicaciones Ex hay que atender las Instrucciones específicas de seguridad. Las presentes instrucciones de seguridad forman parte de las instrucciones de servicio y se encuentran anexas en cada equipo con homologación Ex.

2.10 Indicaciones acerca del medio ambiente

La protección de la base natural de vida es una de las tareas más urgentes. Por eso hemos introducido un sistema de gestión del medio ambiente, con el objetivo de mejorar continuamente el medio ambiente empresarial. El sistema de gestión del medio ambiente está certificado por la norma DIN EN ISO 14001.

Ayúdenos a satisfacer esos requisitos, prestando atención a las indicaciones del medio ambiente de la presente instrucción de servicio:

- Capitulo "*Embalaje, transporte y almacenaje*"
- Capitulo "*Eliminación*"

3 Descripción del producto

3.1 Construcción

Alcance de suministros

El alcance de suministros se compone de:

- Sensor de radar VEGAPULS 67
- Estribo de montaje (opcional)
- Brida suelta o adaptadora (opcional)
- Documentación
  - Esta instrucción de servicio
  - Instrucción de servicio - 27835 "*Módulo de visualización y configuración PLICSCOM*" (opcional)
  - instrucción adicional 31708 "*Calefacción para el modulo de visualización y configuración*" (opcional)
  - Instrucción adicional " *Conexión roscada de enchufe para sensores de medición continua*" (opcional)
  - "*Indicaciones de seguridad*" especifica EX (en caso de versiones Ex)
  - otras certificaciones en caso necesario

Componentes

VEGAPULS 67 tiene los componentes siguientes:

- Conexión al proceso con sistema de antenas encapsulado
- Caja con sistema electrónico, opcional con conexión de enchufe, opcional con cable de conexión
- Tapa de carcasa, opcional con módulo de visualización y configuración PLICSCOM

Los componentes se encuentran disponibles en diferentes variantes.

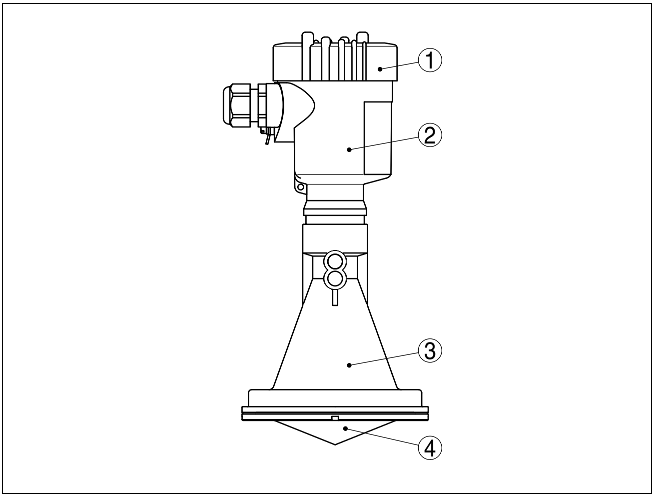


Fig. 1: VEGAPULS 67 - Versión con carcasa plástica

1 Tapa de carcasa con PLICSCOM situado debajo (opcional)
2 Carcasa con electrónica
3 Conexión a proceso con antena de trompeta plástica
4 Cubierta de la antena

Placa de tipos

La placa de tipos contiene datos más importantes para la identificación y empleo del equipo.

- Tipo de equipo
- Artículo y número de serie aparato
- Número de artículo y documentación
- Datos técnicos: Certificaciones, tipo de antena, conexión a proceso, junta de proceso/ temperatura, salida de señal, alimentación de tensión, tipo de protección, clase de protección
- Certificación SIL (para calificación SIL de fábrica

El número de serie le posibilita, mostrar los datos de suministro del equipo a través de www.vega.com, "*VEGA Tools*" y "*serial number search*". Adicionalmente a la placa de tipos situada en el exterior del equipo hay también un número de serie en el interior del equipo.

3.2 Modo de trabajo

Campo de empleo

VEGAPULS 67 es especialmente adecuado para la medición de sólidos en silos de hasta 15 m de altura.

Principio de funcionamiento

Desde la antena del sensor de radar se emiten impulsos cortos de radar con una duración aproximada de 1 ns. Dichos impulsos son reflejados por el producto almacenado y captados en forma de ecos por la antena. El tiempo de duración de los impulsos de radar desde la transmisión hasta la recepción es proporcional a la distancia y de esta forma a la altura de llenado. La altura de llenado determinada de esta forma se transforma en una señal de salida correspondiente y emitida como valor de medición.

Alimentación de tensión

Electrónica bifilar de 4 … 20 mA/HART para la alimentación de tensión y transmisión del valor de medición por la misma línea.

La gama de alimentación de tensión puede diferenciarse en dependencia de la ejecución del equipo.

Los datos para la alimentación de tensión se encuentran en el capítulo *Datos técnicos*.

La luz de fondo del modulo de visualización y configuración es alimentada por el sensor. Condición para ello es un nivel determinado de tensión de alimentación. Favor de tomar las especificaciones exactas de tensión de los *Datos técnicos*"

La calefacción opcional necesita una tensión de trabajo propia. Detalles se encuentran en la instrucción adicional "*Calefacción para el modulo de visualización y configuración*". Generalmente esa función no está disponible para equipos homologados.

3.3 Configuración

VEGAPULS 67 ofrece diferentes técnicas de configuración:

- con módulo de visualización y configuración
- Con el DTM-VEGA adecuado combinado con un software de configuración según la norma FDT/DTM, p.Ej. PACTware y PC
- Con el programa de configuración específico del fabricante AMS™ o PDM
- Con un comunicador HART

3.4 Embalaje, transporte y almacenaje

Embalaje

Su equipo está protegido por un embalaje durante el transporte hasta el lugar de empleo. Aquí las solicitaciones normales a causa del transporte se encuentran aseguradas mediante un control según la norma DIN EN 24180.

En caso de equipos estándar el embalaje es de cartón, compatible con el medio ambiente y reciclable. En el caso de versiones especiales se emplea adicionalmente espuma o película de PE. Elimine los desperdicios de material de embalaje a través de empresas especializadas en reciclaje.

Transporte

Hay que realizar el transporte, considerando las instrucciones en el embalaje de transporte. La falta de atención puede tener como consecuencia daños en el equipo.

Inspección de transporte

Durante la recepción hay que comprobar inmediatamente la integridad del alcance de suministros y daños de transporte eventuales. Hay que tratar correspondientemente los daños de transporte o los vicios ocultos determinados.

Almacenaje

Hay que mantener los paquetes cerrados hasta el montaje, y almacenados bajo observación de las marcas de colocación y almacenaje puestas en el exterior.

Almacenar los paquetes solamente bajo esas condiciones, siempre y cuando no se indique otra cosa:

- No mantener a la intemperie
- Almacenar seco y libre de polvo
- No exponer a ningún medio agresivo
- Proteger de los rayos solares
- Evitar vibraciones mecánicas

Temperatura de almacenaje y transporte

- Temperatura de almacenaje y transporte ver "*Anexo - Datos técnicos - Condiciones ambientales*"
- Humedad relativa del aire 20 … 85 %

4 Montaje

4.1 Instrucciones generales

Posición de montaje

Seleccionar la posición de montaje de forma tal, que exista un acceso fácil al equipo durante el montaje así como durante el reequipamiento posterior de un modulo de visualización y configuración. Para eso la carcasa puede girarse 330° sin herramientas. Además, puede ponerse el módulo de visualización y configuración girado a pasos de 90°.

Humedad

Emplear el cable recomendado (ver capitulo "*Conexión a la alimentación de tensión*") y fije el racor atornillado para cables.

De esta forma Usted protege su equipo adicionalmente contra la entrada de humedad, llevando el cable de conexión hacia abajo antes del racor atornillado para cables. De esta forma puede gotear el agua de lluvia y de condensado. Esto resulta especialmente valido durante el montaje a la intemperie, en recintos donde hay que calcular con humedad (p. ej., por procesos de limpieza) o en depósitos refrigerados o caldeados.

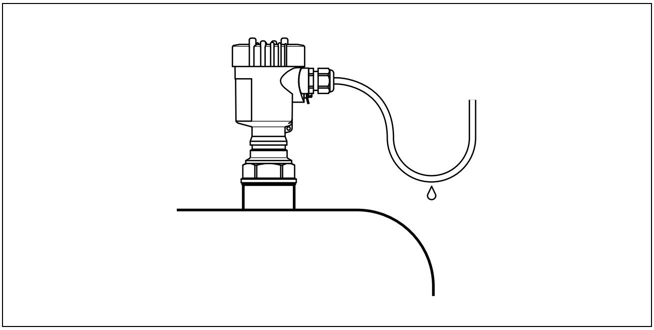


Fig. 2: Medidas contra la entrada de humedad

Rango de medición

El plano de referencia para el rango de medición de los sensores es la superficie de apoyo lateral a la línea de focalización. Para las versiones con brida de adaptación el plano de referencia es la parte inferior de la brida.

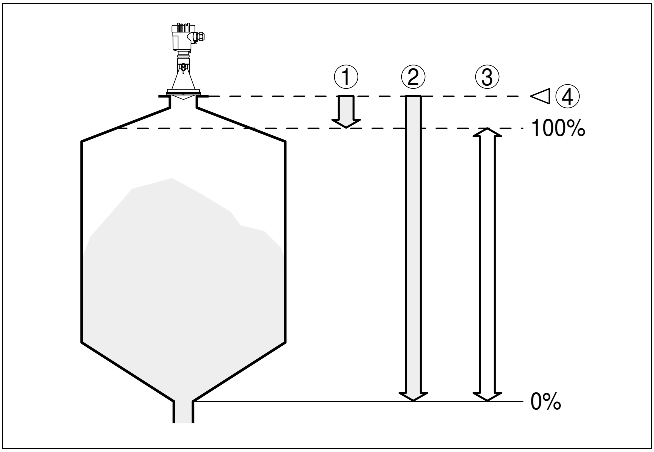


Fig. 3: Rango de medición (rango de operación) y distancia máxima de medición

1 lleno
2 vacío (distancia máxima de medición)
3 Rango de medición
4 Plano de referencia

Información:
Cuando el producto llega hasta la antena, pueden formarse incrustaciones en la antena a largo plazo, que pueden conducir a errores de medición posteriormente.

Plano de polarización

Los impulsos de radar emitidos de VEGAPULS 67 son ondas electromagnéticas. De esta forma se tiene un componente eléctrico y un componente magnético, orientados ortogonalmente entre sí. El plano de polarización está definido por la dirección del componente eléctrico. En caso de equipos de radar la polarización se puede emplear, para la reducir considerablemente el efecto de Ecos falsos, girando el equipo en la brida de conexión o tubuladura roscada. La posición del plano de polarización está identificada por marcas en el equipo.

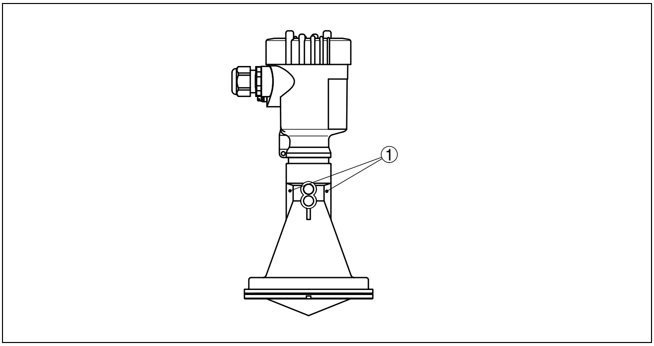


Fig. 4: Posición del plano de polarización en el VEGAPULS 67

1 Barras de marca

Idoneidad para las condiciones de proceso

Asegurar, que todas las partes del equipo que están en el proceso, especialmente los elementos sensores, sellos y las conexiones a proceso sean adecuadas para las condiciones de proceso existentes Dentro de ellas se cuentan especialmente la presión de proceso, la temperatura de proceso así como las propiedades químicas de los medios.

Las informaciones correspondientes se encuentran en el capítulo "*Datos técnicos*" o en la placa de tipos.

4.2 Preparación de montaje

El sensor de radar se puede montar de dos formas diferentes:

- con un estribo de montaje
- a través de una brida suelta o una brida de adaptación.

Estribo de montaje

El estribo de montaje posibilita la fijación sencilla a la pared del depósito o el techo del silo. El mismo sirve para el montaje en paredes, techo o salientes. Ante todo, en caso de depósitos abiertos esto representa una posibilidad muy simple y efectiva de orientar el sensor sobre la superficie del producto.

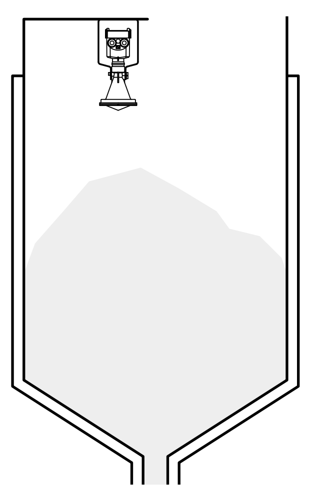


Fig. 5: Sensor de radar con estribo de montaje

El estribo se suministra suelto y hay que atornillarlo al sensor con 3 tornillos Allen M5x10 y arandelas elásticas antes de la puesta en marcha. Par máximo de apriete ver capitulo "*Datos técnicos*". Herramientas necesarias: Llave Allen Nº 4.

Para atornillar el estribo al sensor existen dos variantes. En dependencia de la variante seleccionada se puede orientar el sensor en el estribo de la forma siguiente:

- Carcasa de una cámara
  - Ángulo de inclinación 180° continuo
  - Ángulo de inclinación en tres escalones 0°, 90° y 180°
- Carcasa de dos cámaras
  - Ángulo de inclinación 90° continuo
  - Ángulo de inclinación en dos escalones 0° y 90°

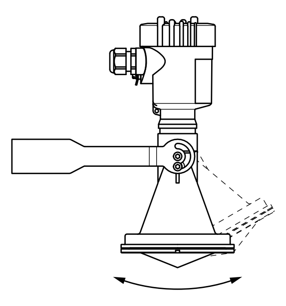


Fig. 6: Ajuste del ángulo de inclinación

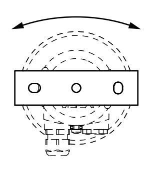


Fig. 7: Girar en caso de fijación central

Brida suelta o brida de adaptación

La brida suelta posibilita el montaje a una brida DN 80/ANSI 3", la brida de adaptación a bridas DN 100/ANSI 4" y DN 150/ANSI 6

Los planos correspondientes de esas opciones de montaje están en el capítulo "*Cotas*".

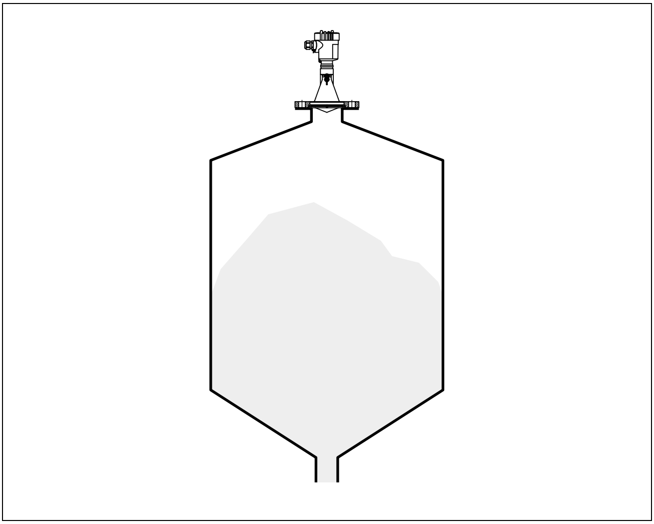


Fig. 8: Brida de montaje del sensor de radar

4.3 Instrucciones de montaje

Posición de montaje

Montar el VEGAPULS 67 en una posición, separada como mínimo 200 mm (7.874 in) de la pared del depósito.

Si no puede mantenerse dicha distancia, hay que realizar un registro de señal parásita durante la puesta en marcha. Esto resulta especialmente valido, si se esperan adherencias en la pared del deposito. En ese caso se recomienda repetir más tarde el registro de señal parásita con presencia de adherencias.

Tubuladuras

Para el montaje del VEGAPULS 67 en una tubuladura hay disponible una brida suelta correspondiente para DN 80 (ASME 3" o JIS 80) así como bridas de adaptación adecuadas.

En el caso de las variantes de carcasas plásticas, cámara única de aluminio y acero inoxidable se puede pasar la brida suelta directamente sobre la carcasa. En el caso de las variantes de carcasas de aluminio de dos cámara es imposible el montaje posterior, hay que definir el tipo de montaje durante el pedido.

Información:
Hay que mantener la tubuladura lo más corta posible y el extremo de la tubuladura debe ser redondeado. De esta forma se mantienen reducidas las reflexiones de interferencia por las tubuladuras del depósito.

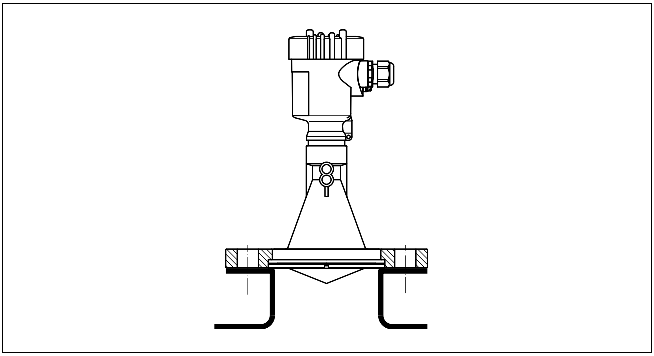
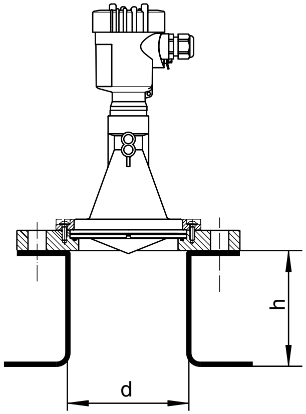


Fig. 9: Montaje recomendado en tubuladuras

En caso de buenas propiedades de reflexión del producto también puede montarse VEGAPULS 67 sobre tubuladuras más largas. Valores de referencia de las alturas de las tubuladuras están en la instrucción de servicio. Después hay que realizar un registro de señales parásitas.



Las tablas a continuación reflejan la longitud máxima de tubuladura h en dependencia del diámetro d.

Diámetro de tubuladura d	**Longitud de tubuladura h**
80 mm	300 mm
100 mm	400 mm
150 mm	500 mm

Diámetro de tubuladura d	Longitud de tubuladura h
3"	11.8 in
4"	15.8 in
6"	19.7 in

Consejos:
En el caso de instalaciones nuevas resulta conveniente inclinar las tubuladuras del depósito en dirección de la descarga. De esta forma se producen menos reflexiones de interferencia desde la pared del depósito, siendo posible una medición hasta la salida cónica.

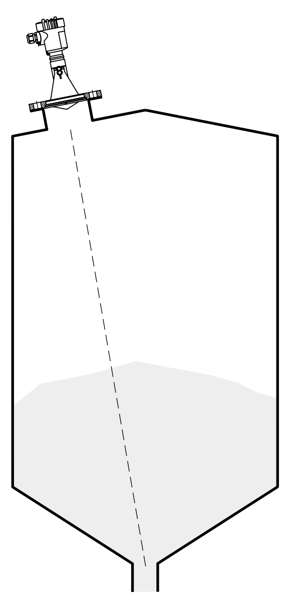


Fig. 11: Instalación en silos

Montaje en silo de varias cámaras

A menudo las paredes del silo en silos multi-cámaras están hechas de paredes acanaladas, como p. Ej. chapas trapezoidales, para garantizar la estabilidad necesaria. Si el sensor de radar está montado muy cerca de una pared de depósito fuertemente estructurada, pueden producirse reflexiones considerables. Por ello hay que montar el sensor a una distancia lo mayor posible de la pared de separación.

El montaje óptimo se realiza en la pared externa del silo con una orientación del sensor hacia el vaciado en el centro del silo.

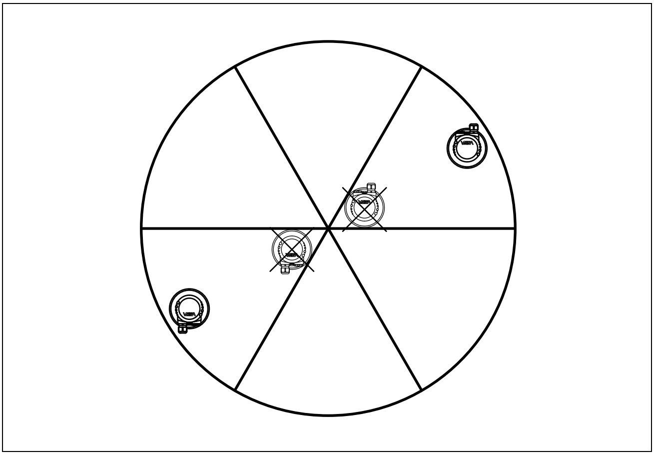


Fig. 12: Montaje e instalación en silos de varias cámaras

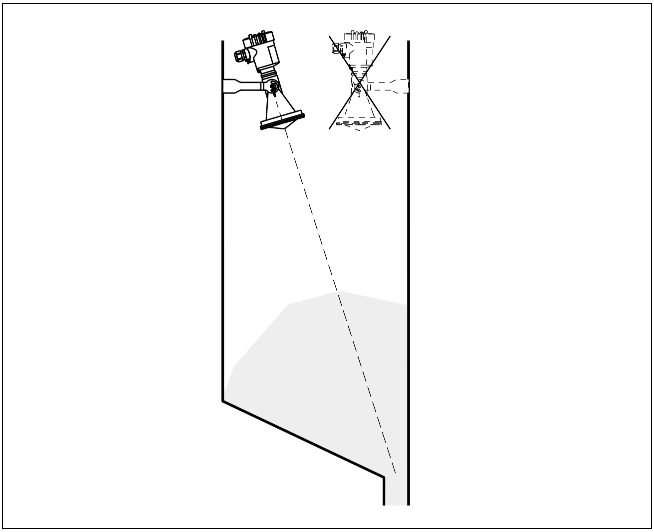


Fig. 13: Montaje e instalación en silos de varias cámaras

Estructuras internas del depósito.

Estructuras del depósito, tales como escalerillas, interruptores limitadores y también paredes de depósito estructurada pueden causar ecos perturbadores que se superponen al eco útil. La ubicación del sensor de radar debe seleccionarse de forma que ninguna de las estructuras internas se cruce con los impulsos de microondas. Por eso al planificar el punto de medición debe prestarse atención a una "vista libre" de la señal de radar hacia el producto.

En caso existencia de estructuras en el depósito hay que realizar un registro de eco durante la puesta en marcha.

En caso de que estructuras grandes del depósito tales como arriostramientos y soportes produzcan ecos falsos, se pueden debilitar los mismos mediante medidas adicionales. Pequeñas pantallas metálicas colocadas de forma inclinada sobre las estructuras "dispersan" las señales de radar, impidiendo así la reflexión directa del eco falso de una forma efectiva.

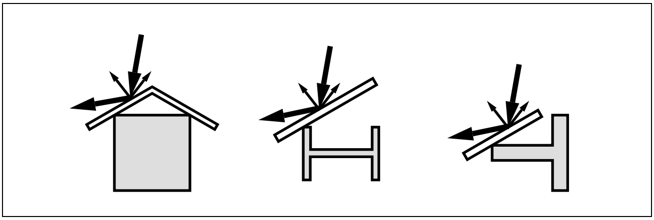


Fig. 14: Tapar los perfiles lisos con pantallas dispersoras

Purga de aire

Para evitar incrustaciones, sobre todo en caso de formación intensa de condensado, es recomendable un lavado del aire. Pero como el VEGAPULS 67 no dispone de una conexión directa de lavado de aire, hay que prever una conexión separada de lavado de aire en la tubuladura de montaje. La limpieza de la cubierta de la antena es especialmente efectiva, a través de una inclinación de dicha conexión hacia arriba.

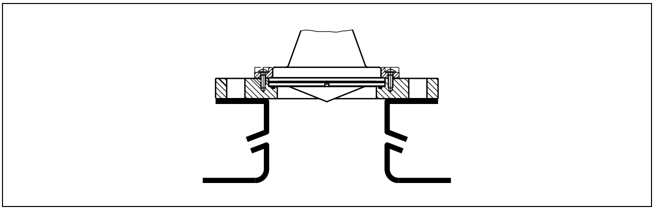


Fig. 15: Conexión de purga de aire

Vaciaderos

Los amontonamientos grandes de material pueden detectarse con varios sensores, que pueden fijarse p. ej. en las vigas de las grúas. En el caso de conos de apilado, resulta conveniente dirigir los sensores lo más perpendicularmente posible hacia la superficie del árido.

No se produce una influencia recíproca de los sensores.

Información:
En el caso de tales aplicaciones hay que tener en cuenta, que los sensores estén diseñados para variaciones de nivel relativamente lentas. Si hay que usar el sensor con un brazo móvil, entonces hay que considerar la velocidad máxima de medición (ver capítulo "*Datos técnicos*").

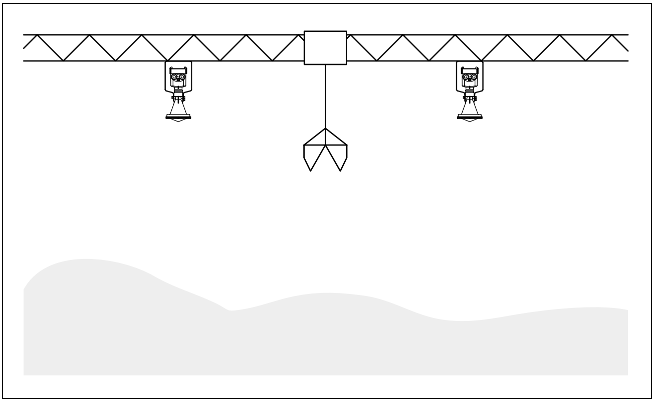


Fig. 16: Sensores de radar en la viga de una grúa

5 Conectar a la alimentación de tensión

5.1 Preparación de la conexión

Indicaciones de seguridad

Prestar atención fundamentalmente a las instrucciones de seguridad siguientes:

- Conectar solamente en estado libre de tensión
- En caso de esperarse sobrecargas de voltaje, hay que montar un equipo de protección contra sobrecarga.

Consejos:
Con ese objetivo recomendamos los equipos de protección contra sobrecarga B63-48 y ÜSB 62-36G.X.

En áreas con peligro de explosión hay que atender las prescripciones, las certificaciones de conformidad y de comprobación de modelos de construcción correspondientes de los sensores y los equipos de alimentación.

Alimentación de tensión

La alimentación de tensión y la señal de corriente tienen lugar por el mismo cable de conexión de dos hilos. La gama de alimentación de tensión puede diferenciarse en dependencia de la versión del equipo.

Los datos para la alimentación de tensión están en el capítulo *Datos técnicos*.

Preocuparse por la separación segura del circuito de alimentación del circuito de la red según DIN VDE 0106 parte 101. Las fuentes de alimentación de la empresa VEGA VEGATRENN 149A Ex, VEGASTAB 690 así como todas los VEGAMET y VEGASCAN cumplen dicha condición.

Información:
Los equipos de evaluación VEGAMET 624 y 625 así como VEGASCAN 693 tienen detección de sensor digital. En caso de conexión del VEGAPULS 67 se necesita un estado de software a partir de la versión 1.92. Para la actualización del software ir a "Software" en "*www.vega.com/downloads*".

Considerar los factores adicionales siguientes para la tensión de trabajo:

- La tensión de salida de la fuente de alimentación puede disminuir bajo carga nominal (con una corriente de sensor de 20,5 mA , o 22 mA en caso de alarma de interrupción)
- Influencia de otros equipos en el circuito de corriente (ver los valores de carga en el capítulo "*Datos técnicos*")

Cable de conexión

El equipo se conecta con cable comercial de dos hilos sin blindaje. En caso de esperarse interferencias electromagnéticas, superiores a los valores de comprobación de la norma EN 61326 para zonas industriales, hay que emplear cable blindado.

Emplear cable con sección redonda. Un diámetro exterior del cable de 5 … 9 mm (0.2 … 0.35 in) garantiza la estanqueidad del racor. Si se emplea cable de otro diámetro o sección, cambiar la junta o emplear un racor atornillado adecuado.

En modo de operación HART-Multidrop recomendamos el empleo general de cable blindado.

Entrada de cables ½ NPT

En el caso del equipo con entrada de cables ½ NPT y carcasa plástica hay un inserto roscado de ½" inyectado en la carcasa plástica.

Cuidado:
Hay que ejecutar la fijación del racor NPT o del tubo de acero en el inserto roscado sin grasa. Las grasas comunes pueden contener aditivos que atacan los puntos de conexión entre el inserto roscado y la carcasa. Eso puede afectar la resistencia de la conexión y la hermeticidad de la carcasa.

Blindaje del cable y conexión a tierra

Si es necesario cable blindado, conectar el blindaje del cable a tierra por ambos extremos. En el sensor hay que conectar el blindaje directamente al borne interno de puesta a tierra. El borne externo de puesta a tierra de la carcasa del sensor tiene que estar conectado con la conexión equipotencial.

En caso de esperarse corrientes equipotenciales, hay que realizar la conexión por el lado de evaluación a través de un condensador cerámico (p. Ej 1 nF, 1500 V). Las corrientes equipotenciales de baja frecuencia se interrumpen ahora, sin embargo se conserva el efecto protector para las señales de interferencia de alta frecuencia.

En el caso de aplicaciones Ex hay que tener en cuenta las especificaciones de montaje. Especialmente hay que asegurar, que no fluya ninguna corriente equipotencial por el blindaje del cable. En caso de puesta a tierra por ambos extremos esto se logra, mediante el empleo del condensador descrito anteriormente o mediante una conexión equipotencial individual.

5.2 Pasos de conexión

Proceder de la forma siguiente:

1 Destornillar la tapa de la carcasa
2 Extraer eventualmente un módulo de visualización y configuración existente, girando ligeramente hacia la izquierda
3 Zafar la tuerca de unión del racor pasacables

4 Pelar aproximadamente 10 cm (4 in), quitar aproximadamente 1 cm (0.4 in) del aislamiento a los extremos de los conductores

5 Empujar el cable en el sensor a través del racor atornillado para cables

6 Subir la palanca de apertura de los bornes con un destornillador (ver la Fig. siguiente)

7 Insertar los extremos de los conductores en los bornes según el esquema de conexión.

Fig. 17: Pasos de conexión 6 y 7

8 Empujar hacia abajo las palancas del borne, el resorte del borne cierra perceptiblemente

9 Comprobar el asiento correcto de los conductores en los bornes tirando ligeramente de ellos

10 Conectar el blindaje con el borne interno de puesta a tierra, y el borne externo de puesta a tierra con la conexión equipotencial.

11 Apretar la tuerca de unión del racor pasacables, el sello tiene que abrazar el cable completamente

12 Atornillar la tapa de la carcasa

Con ello queda establecida la conexión eléctrica.

5.3 Esquema de conexión para carcasa de una cámara

Las figuras siguientes son validas tanto para la versión No Ex como para la versión Ex ia.

Resumen de carcasas

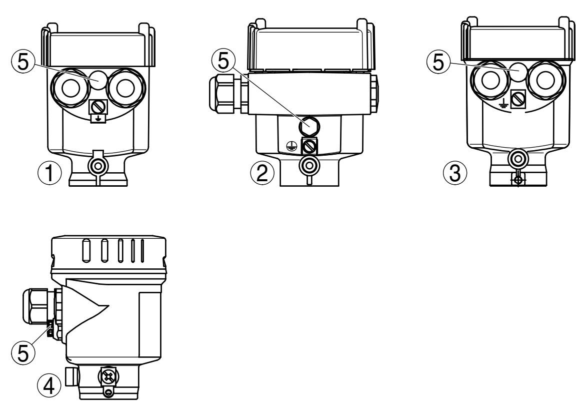


Fig. 18: Variantes de materiales de carcasa de una cámara

1 Plástico
2 Aluminio
3 Acero inoxidable, fundición de precisión
4 Acero inoxidable, electropulido
5 Elemento de filtro para la compensación de la presión de aire. Tapón ciego en caso de versión IP 66/IP 68, 1 bar para aluminio y acero inoxidable

Sistema electrónico y carcasa de conexiones

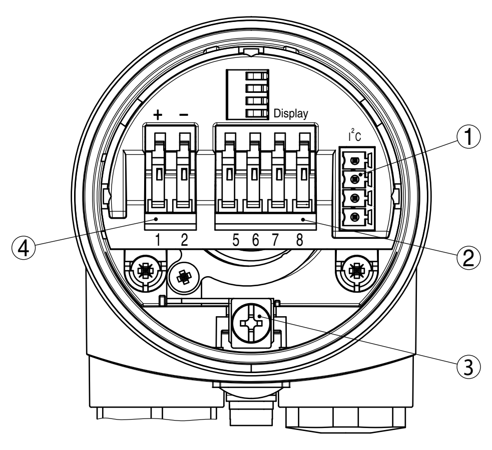


Fig. 19: Sistema electrónico y carcasa de conexión carcasa de una cámara

1 *Conectador enchufable para VEGACONNECT (Conector-I²C)*
2 *Bornes elásticos para la conexión de la unidad de visualización externa VEGADIS 61*
3 *Terminal de puesta a tierra para la conexión del blindaje del cable*
4 *Bornes elásticos para la alimentación de tensión*

Esquema de conexión

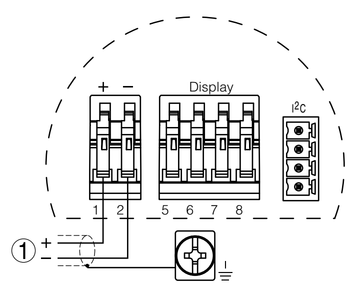


Fig. 20: Esquema de conexión para carcasa de una cámara

1 *Alimentación de tensión/salida de señal*

5.4 Esquema de conexión carcasa de dos cámaras

Las figuras siguientes resultan validas tanto para las versiones No Ex como para las versiones Ex ia. La ejecución Exd se describe en el subcapítulo siguiente.

Resumen de carcasas

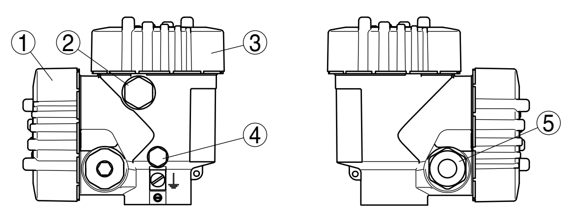


Fig. 21: Carcasa de dos cámaras

1 Tapa carcasa cámara de conexiones
2 Tapón ciego o enchufe M12 x 1 para VEGADIS 61 (opcional)
3 Tapa de la carcasa compartimiento electrónico
4 Elemento de filtro para la compensación de la presión atmosférica
5 Racor atornillado para cables

Cámara de la electrónica

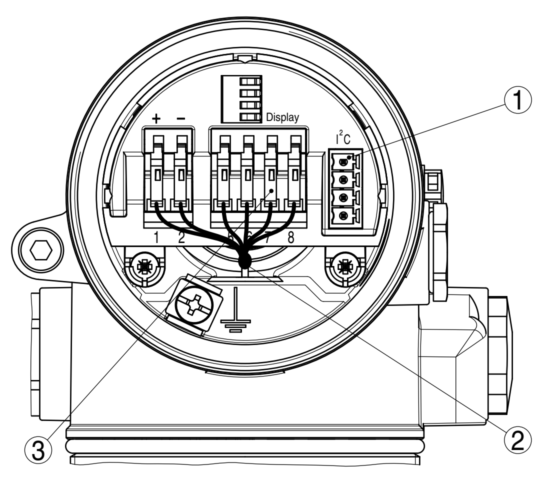


Fig. 22: Cámara de la electrónica en la carcasa de dos cámaras.

1 Conectador enchufable para VEGACONNECT (Conector-I²C)
2 Línea de conexión interna hacia el compartimiento de conexión
3 Bornes de conexión para VEGADIS 61

Cámara de conexión

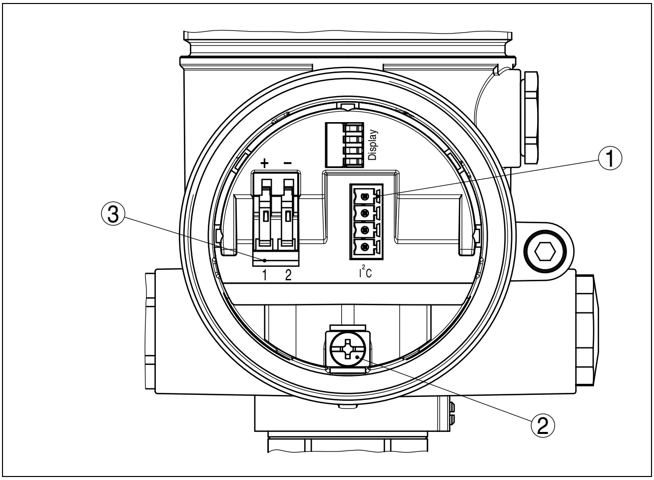


Fig. 23: Cámara de conexión carcasa de conexión de dos cámaras

1 Conectador enchufable para VEGACONNECT (Conector-I^2C)
2 Terminal de puesta a tierra para la conexión del blindaje del cable
3 Bornes elásticos para la alimentación de tensión

Esquema de conexión

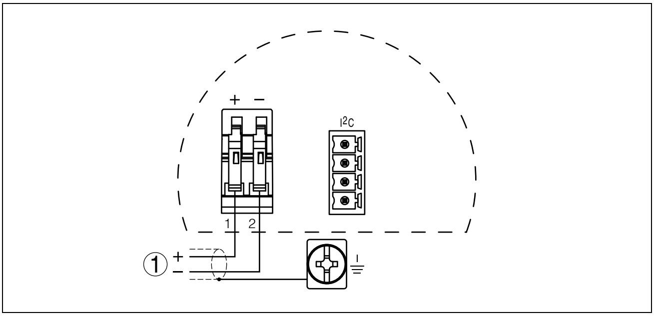


Fig. 24: Esquema de conexión carcasa de dos cámaras

1 Alimentación de tensión/salida de señal

5.5 Esquema de conexión - versión IP 66/IP 68, 1 bar

Ocupación de conductores cable de conexión

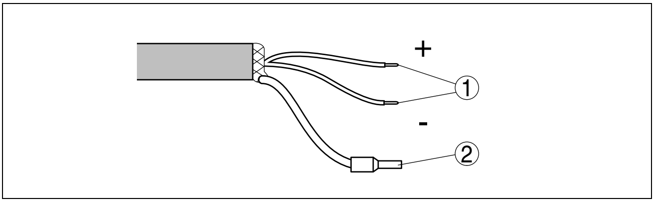


Fig. 25: Ocupación de conductores cable de conexión

1 pardo (+) y azul (-) hacia la alimentación de tensión o hacia el sistema de análisis
2 Blindaje

5.6 Fase de conexión

Fase de conexión

Después de la conexión del VEGAPULS 67 a la alimentación de tensión o después del retorno de la tensión, el equipo realiza primeramente un auto chequeo durante 30 segundos aproximadamente.

- Comprobación interna de la electrónica
- Indicación del tipo de equipo, versión de firmware así como la etiqueta (TAG) del sensor (denominación del sensor)
- La señal de salida salta momentáneamente (apróx. 10 segundos) a la corriente parásita ajustada.

Después se entrega la corriente correspondiente a la línea (el valor corresponde el nivel actual así como los ajustes realizados previamente, p. Ej., el ajuste de fábrica).

6 Puesta en funcionamiento con el módulo de visualización y configuración PLICSCOM

6.1 Descripción breve

Funcionamiento/Construcción

El modulo de visualización y configuración sirve para la indicación del valor de medición, el manejo y el diagnóstico. Se puede emplear en las siguientes variantes de carcasas y equipos:

- Todos los sensores de la familia de equipos plics®, tanto en carcasas de una como de dos cámaras (opcionalmente en la electrónica o en la caja de conexiones)
- Unidad de visualización y manejo externa VEGADIS 61

A partir de una versión de hardware…- 01 o superior del módulo de visualización y configuración o del sensor correspondiente existe la posibilidad de conexión de una luz de fondo integrada a través del menú de manejo. La versión de Hardware se encuentra en la placa de tipos del módulo de visualización y configuración o del sistema electrónico del sensor.

Indicaciones:
Una descripción de la función se encuentra en la instrucción de servicio " *Módulo de visualización y configuración*".

6.2 Poner módulo de visualización y configuración

Montar/desmontar módulo de visualización y configuración

El módulo de visualización y configuración PLICSCOM puede montarse y desmontarse del sensor en cualquier momento. Aquí no es necesario la interrupción de la alimentación de tensión.

Proceder de la forma siguiente:

1 Destornillar la tapa de la carcasa
2 Colocar el módulo de visualización y configuración en la posición deseada encima de electrónica (Se pueden seleccionar cuatro posiciones desplazadas a 90°)
3 Colocar el módulo de visualización y configuración sobre la electrónica, girándolo ligeramente hacia la derecha hasta que enclave.
4 Atornillar fijamente la tapa de la carcasa con la ventana.

El desmontaje tiene lugar análogamente en secuencia inversa.

El módulo de visualización y configuración es alimentado por el sensor, no se requiere ninguna conexión adicional.

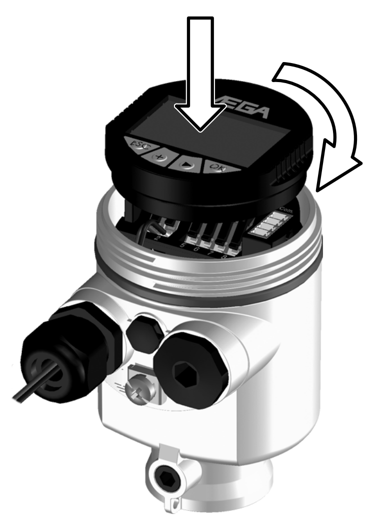


Fig. 26: Poner módulo de visualización y configuración

Indicaciones:
En caso de que se desee reequipar el equipo con un módulo de visualización y configuración para la indicación continua del valor de medición, se necesita una tapa más alta con ventana.

6.3 Sistema de configuración

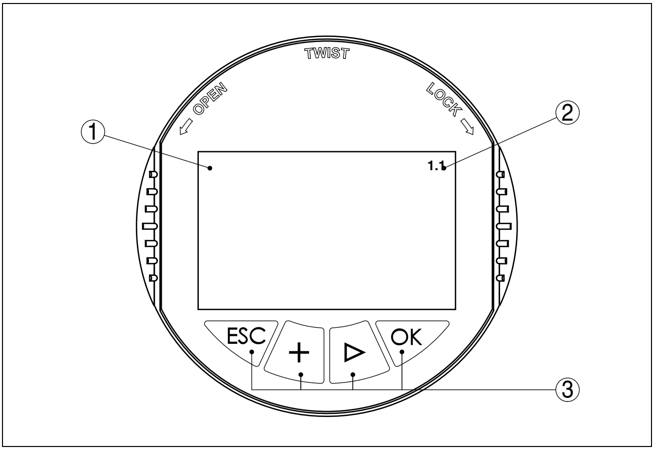


Fig. 27: Elementos de visualización y configuración

1 Display LC
2 Indicación de los números de los puntos del menú
3 Teclas de configuración

Teclas de funciones

- Tecla ***[OK]***:
  - Cambiar al esquema de menús
  - Confirmar el menú seleccionado
  - Edición de parámetros
  - Guardar valor
- ***[->]***-Tecla para la selección de:
  - Cambio de menú
  - Seleccionar registro de lista
  - Seleccionar posición de edición
- Tecla ***[+]***:
  - Modificar el valor de un parámetro
- Tecla-***[ESC]***:
  - Interrupción de la entrada
  - Retorno al menú de orden superior

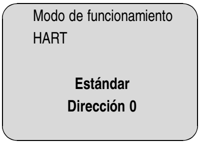
Sistema de configuración

El sensor se maneja mediante las cuatro teclas del módulo de visualización y configuración. En el display - LC aparecen los diferentes puntos del menú. La función se toma de la representación superior. Aproximadamente 10 minutos después de la última pulsación de teclas tiene lugar un retorno automático a la indicación de valor. Durante esta operación se pierden los valores que no han sido confirmados con ***[OK]***.

6.4 Pasos de puesta en marcha

Ajuste de dirección HART-Multidrop

En el caso de régimen de operación HART-Multidrop (varios sensores en una salida) hay que realizar el direccionamiento antes de continuar realizando el ajuste de parámetros. Una descripción más detallada acerca de ello se encuentra en la "*Instrucción de servicio del módulo de visualización y configuración*" o la ayuda online de PACTware o DTM.



Modo de funcionamiento
HART

Estándar
Dirección 0

Ajuste de parámetros

Debido a que el VEGAPULS 67 es un equipo de medición de distancia, se mide la distancia del sensor a la superficie del producto. Para poder indicar la altura verdadera del producto, tiene que producirse una asignación de la distancia medida respecto a la altura porcentual. Para la ejecución de ese ajuste se entra la distancia con el depósito vacío y con el depósito lleno. Si se desconocen esos valores, puede ajustarse también con las distancias de p. Ej. 10 % y 90 %. El punto de partida para esos datos de distancia es siempre la superficie de obturación de la rosca o de la brida. A través de dichas informaciones se calcula después la verdadera altura de llenado. Simultáneamente con ello se limita el rango de trabajo del sensor desde el máximo hasta el rango necesario.

El nivel actual no juega ningún tipo de papel durante ese ajuste, el ajuste Mín-/Máx. siempre se realiza sin variación del producto almacenado. De esta forma pueden realizarse esos ajustes previamente sin necesidad de montaje del equipo.

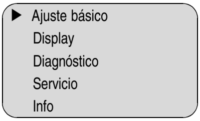
En el punto del menú principal *Ajustes básicos*" hay que seleccionar los puntos secundarios del menú secuencialmente, dotándolos de los parámetros correctos para el ajuste óptimo de la medición.

Comenzar ahora el ajuste de parámetros con los siguientes puntos de menú de ajuste básico:

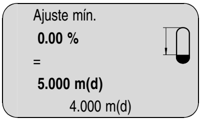
Realizar ajuste mín.

Proceder de la forma siguiente:

1 Cambio de la indicación del valor de medición al menú principal pulsando ***[OK]***.



2 Seleccionar el punto de menú *Ajuste básico* con ***[->]***, confirmando con ***[OK]***. Ahora, aparece el punto de menú *Ajuste mínimo*.



Ajuste mín.
0.00 %
=
5.000 m(d)
4.000 m(d)

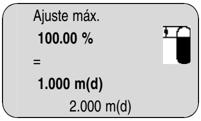
3 Preparar el valor porcentual para la edición con ***[OK]*** , poniendo el cursor con ***[->]*** sobre el punto deseado. Ajustar el valor porcentual deseado ***[+]*** , salvándolo con ***[OK]*** . Ahora el cursor salta al valor de distancia.

4 Entrar el valor de distancia correcto en metros adecuado al valor procentual para el deposito vacío (p. Ej. Distancia del sensor al fondo del deposito).

5 Almacenaje de los ajustes con ***[OK]*** y cambio con ***[->]*** a ajuste máx.

Realizar ajuste máx

Proceder de la forma siguiente:



Ajuste máx.
100.00 %
=
1.000 m(d)
2.000 m(d)

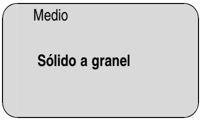
1 Preparar el valor porcentual para la edición con ***[OK]*** , poniendo el cursor con ***[->]*** sobre el punto deseado. Ajustar el valor porcentual deseado ***[+]*** , salvándolo con ***[OK]*** . Ahora el cursor salta al valor de distancia.

2 Entrar el valor correcto de distancia en metros, adecuado al valor procentual para el deposito lleno. Durante dicha operación favor de prestar atención, a que el nivel máximo tiene que estar debajo de la zona muerta.

3 Almacenaje de los ajustes con ***[OK]***, cambiando con ***[->]*** a la selección del medio.

Selección del medio

Cada producto de almacenado tiene un comportamiento de reflexión diferente. Y en el caso de los productos a granel el desarrollo de polvo, los conos de apilado y los ecos adicionales a través de la pared del depósito. A través de esa selección adicional el sensor se adapta óptimamente al producto, aumentando considerablemente la seguridad de medición, especialmente en caso de medios con malas propiedades de reflexión.



Medio
Sólido a granel

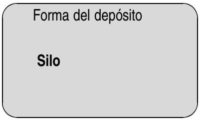
En caso de sólidos puede seleccionarse opcionalmente "*Polvo/ Polvo*", "*Granulado/Pelletes*" o "*Grava/Peladilla*".

En el caso de los líquidos se añaden las superficies agitadas del producto almacenado y la formación de espuma como factores perturbadores. Para adaptar el sensor a esas condiciones diferentes de medición, hay que realizar primeramente la selección *Árido* o *Líquido*.

Entrar los parámetros deseados a través de la tecla correspondiente, almacenar la entrada y pasar al punto de menú próximo con la tecla ***[->]***.

Forma del depósito

En combinación con el medio la forma del depósito puede influenciar también la medición. Este menú le brinda diferentes posibilidades de selección para adaptar el sensor a esas condiciones de medición, de acuerdo con la selección de líquido o sólido. Para "*Sólidos*" estos son "*Silo*" o "*Bunker*", en caso de "*Líquidos*", "*Tanque de almacenamiento*", "*Tubo vertical*", "*Depósito abierto*" o "*Depósitos con agitadores*".



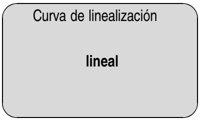
Forma del depósito

Silo

Entrar los parámetros deseados a través de la tecla correspondiente, almacenar la entrada y pasar al punto de menú próximo con la tecla ***[->]***.

Curva de linealización

Para todos los depósitos donde el volumen del depósito no aumenta linealmente con la altura de nivel - p. Ej., en el caso de un tanque acostado o esférico - y se desea la indicación o salida del volumen, resulta necesaria una linealización. Para esos depósitos se encuentran consignadas curvas de linealización adecuadas. Las mismas expresan la relación entre la altura de nivel porcentual y el volumen del depósito. Mediante la activación de la curva adecuada se indica correctamente el volumen porcentual del depósito. En caso de que el volumen no se represente en por ciento, sino en litros o kilogramos por ejemplo, puede realizarse un ajuste de escala en el punto de menú "*Display*".



Curva de linealización

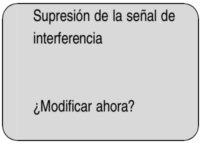
lineal

Entrar los parámetros deseados a través de la tecla correspondiente, almacenar la entrada y pasar al punto de menú próximo con la tecla ***[->]***.

Supresión de la señal de interferencia

Las reflexiones de interferencia a causa de estructuras internas del depósito pueden afectar la medición, como se indica en capítulo "*Montaje*". Un registro del eco perturbador detecta, marca y almacena dicho eco perturbador, para no considerarlo más durante la medición de nivel. Para detectar las mismas por todo el rango de medición, hay que realizar la supresión de la señal de interferencia con el depósito vacío.

Información:
Sin embargo, en caso de depósitos metálicos completamente vacíos las señales no sufren ninguna atenuación por el producto. De esta forma pueden producirse reflexiones múltiples de importancia, que traen como consecuencia un aumento del nivel de ruido. Por eso en el caso de tales depósitos se recomienda la realización de la atenuación de la señal durante el llenado parcial.



Supresión de la señal de interferencia

¿Modificar ahora?

Proceder de la forma siguiente:

1 Cambio de la indicación del valor de medición al menú principal pulsando ***[OK]***.

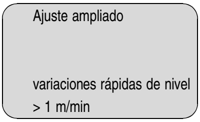
2 Seleccionar el punto de menú "*Servicio*" con ***[->]***, confirmando con ***[OK]***. Ahora aparece el punto de menú *Supresión de la señal de interferencia*.

3 Confirmar "*Modificar ahora - supresión de la señal de interferencia*" con ***[OK]*** seleccionando "*Nueva creación*" en el menú siguiente. Entrar la distancia verdadera desde el sensor hasta la superficie del producto. Todos los ecos perturbadores existentes en esa zona son captados y almacenados por el sensor después de la confirmación con ***[OK]***.

Indicaciones:
Comprobar la distancia hasta la superficie del producto almacenado, ya que en caso de una información falsa (demasiado grande) se almacena el nivel actual en calidad de señal de interferencia. Por consiguiente en esa zona no puede captarse más el nivel.

Ajuste ampliado/variación rápida de nivel

El punto de menú "*Ajuste ampliado*" brinda la posibilidad de optimizar el VEGAPULS 67 para aplicaciones con variaciones muy rápidas de nivel. Para ello seleccionar la función "*variación rápida de nivel > 1 m/ min.*".



Ajuste ampliado

variaciones rápidas de nivel
> 1 m/min

Indicaciones:
Debido a que la formación del promedio del análisis de la señal es considerablemente reducido para la función "*variación rápida de nivel > 1 m/min.*", las reflexiones de interferencia a causa de agitadores o estructuras internas del depósito pueden conducir a variaciones del valor de medición. Por eso es recomendable un almacenaje del eco perturbador.

Copiar datos del sensor

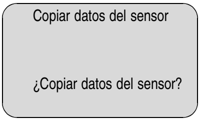
Esa función posibilita la lectura de los datos de parametrización, así como la escritura de los datos de parametrización en el sensor mediante el módulo de visualización y control. Una descripción de la función se encuentra en la instrucción de servicio " *Módulo de visualización y control*".

Con esa función se leen y se escriben los datos siguientes:

- Representación de la magnitud de medición
- Ajuste
- Medio
- Diámetro interior tubo vertical (para versiones de tubo vertical)
- Forma del depósito
- Tiempo integración
- Curva de linealización
- Etiqueta - sensor
- Valor de indicación
- Unidad de indicación
- Calibración
- Salida de corriente
- Unidad de ajuste
- Idioma

Los siguientes datos importantes de seguridad **no** no se leen o escriben:

- Modo de funcionamiento HART
- PIN
- SIL



Copiar datos del sensor

¿Copiar datos del sensor?

Reset

Ajuste básico

Cuando se realiza el "*Reset*", el sensor inicializa los valores de las funciones siguientes a los valores de reset (ver tabla):[1]

Función	Valor de reset
Ajuste máx.	0 m(d)
Ajuste mín.	15 m(d) (VEGAPULS 67) 70 m(d) (VEGAPULS 68)
Medio	Sólido a granel
Forma del depósito	desconocido
Tiempo integración	0 s
Linealización	lineal
Etiqueta - sensor	Sensor
Valor de indicación	Distancia
Ajustes ampliados	Ninguno
Salida de corriente - Curva característica	4 … 20 mA
Salida de corriente - corriente máxima	20 mA
Salida de corriente - corriente mínima	4 mA
Salida de corriente - Interrupción	< 3.6 mA
Unidad de ajuste	m(d)

Los valores de las funciones siguientes "*no*" no se inicializan a los valores de inicialización con **Reset** (ver tabla):

Función	Valor de reset
Iluminación	ningún reset
Idioma	ningún reset
SIL	ningún reset
Modo de funcionamiento HART	ningún reset

Valores iniciales

Como el ajuste básico, además se inicializan parámetros especiales a los valores por defecto.[2]

Indicador de seguimiento

Los valores de distancia mín. y máx. se inicializan al valor actual.

---

[1] Ajuste básico específico del sensor.

[2] Parámetros especiales son parámetros que se ajustan con el software de configuración PACTware a nivel de servicio de forma específica para el cliente.

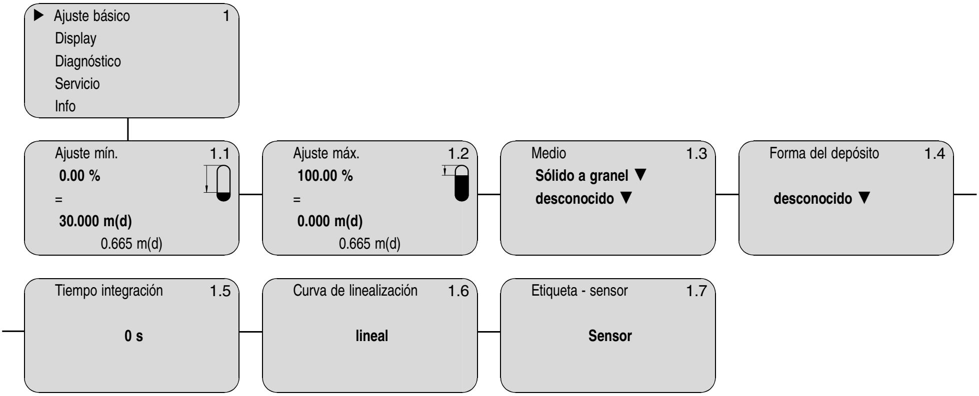
Ajustes opcionales

En el plan de menú representado a continuación se indican las posibilidades de ajuste y diagnostico adicionales, tales como ajuste de la escala de visualización, simulación o representación de curvas de tendencia. Una descripción detallada de ese punto de menú se encuentra en la instrucción de servicio " *Módulo de visualización y control*".

6.5 Plan de menú

Información:
La ventana de menú en fondo claro no están siempre disponibles en dependencia del equipamiento y la aplicación, o no brindan ninguna posibilidad de selección.

Ajuste básico



Ajuste mín. 1.1
0.00 %
=
30.000 m(d)
0.665 m(d)

Ajuste máx. 1.2
100.00 %
=
0.000 m(d)
0.665 m(d)

Medio 1.3
Sólido a granel ▼
desconocido ▼

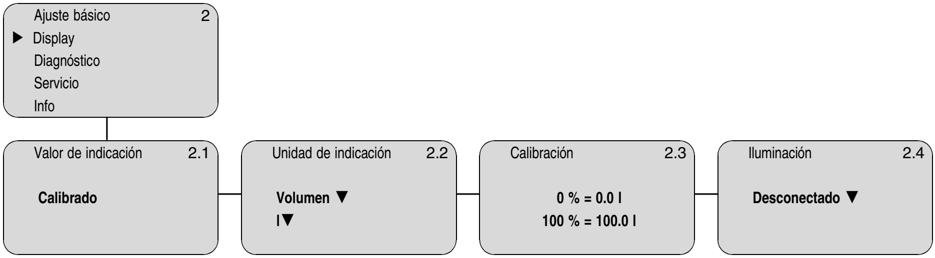
Forma del depósito 1.4
desconocido ▼

Tiempo integración 1.5
0 s

Curva de linealización 1.6
lineal

Etiqueta - sensor 1.7
Sensor

Display



Valor de indicación 2.1
Calibrado

Unidad de indicación 2.2
Volumen ▼
l ▼

Calibración 2.3
0 % = 0.0 l
100 % = 100.0 l

Iluminación 2.4
Desconectado ▼

Diagnóstico

Ajuste básico 3
Display
▶ Diagnóstico
Servicio
Info

Indicador de seguimiento 3.1

Distancia mín.: 0.234 m(d)
Distancia máx.: 5.385 m(d)

Seguridad de medición 3.2
15 dB
Estado del equipo
OK

Selección de curvas 3.3

Curva de ecos ▼

Curva de ecos 3.4

Representación de la curva de ecos

Servicio

Ajuste básico 4
Display
Diagnóstico
▶ Servicio
Info

Supresión de la señal de interferencia 4.1

¿Modificar ahora?

Ajuste ampliado 4.2

Ninguno ▼
Cambio rápido de nivel ▼

Salida de corriente 4.3
Curva característica: 4-20 mA ▼
Modo de interrupción: < 3.6 mA ▼
corriente mín: 4 mA ▼
corriente máx: 20 mA ▼

Simulación 4.4

Iniciar simulación ▼

Reset 4.6

¿Seleccionar reset?

Unidad de ajuste 4.7

m(d)▼

Idioma 4.8

Alemán ▼

SIL 4.9

No activada▼

Modo de funcionamiento HART 4.10

Estándar
Dirección 0

Copiar datos del sensor 4.11

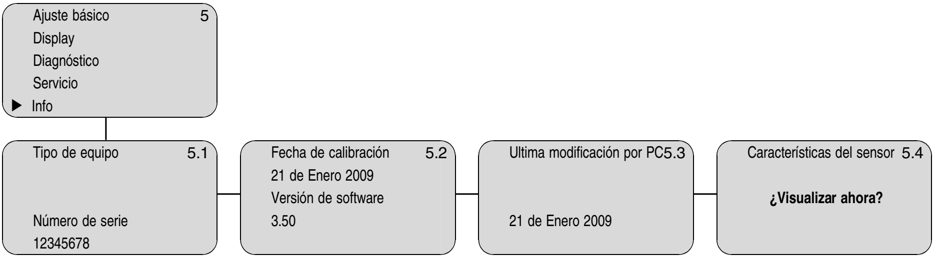
¿Copiar datos del sensor?

PIN 4.12

¿Activar ahora?

32938-ES-090817

Info



Tipo de equipo 5.1
Número de serie
12345678

Fecha de calibración 5.2
21 de Enero 2009
Versión de software
3.50

Ultima modificación por PC5.3
21 de Enero 2009

Características del sensor 5.4
¿Visualizar ahora?

6.6 Aseguramiento de los datos de parametrización

Se recomienda la anotación de los datos ajustados, p. Ej., en la presente instrucción de servicio, archivándolos a continuación. De esta forma se encuentran disponible para uso múltiple y para fines de servicio.

Si el VEGAPULS 67 está equipado con un módulo de visualización y configuración, entonces pueden leerse los datos más importantes del sensor en el módulo de visualización y configuración. El modo de procedimiento se describe en la instrucción de servicio "*Módulo de visualización y configuración* " en el punto de menú "*Copiar datos del sensor*". Los datos permanecen almacenados permanentemente allí también en caso de una interrupción de la alimentación del sensor.

Si fuera necesario un cambio del sensor, entonces se enchufa el módulo de visualización y configuración en el equipo de recambio, escribiendo también los datos en el sensor en el punto de menú "*Copiar datos del sensor*".

7 Poner en marcha con PACTware y otros programas de configuración

7.1 Conectar el PC a través de VEGACONNECT

VEGACONNECT directamente en el sensor

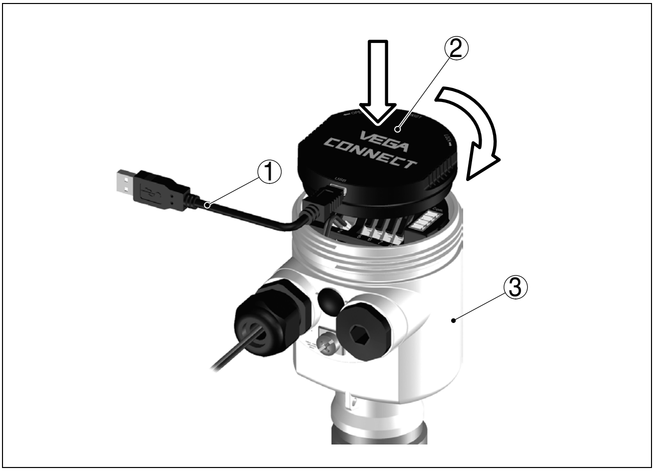


Fig. 28: Conexión del PC directamente al sensor a través de VEGACONNECT

1 Cable USB hacia el PC
2 VEGACONNECT
3 Sensor

VEGACONNECT externo

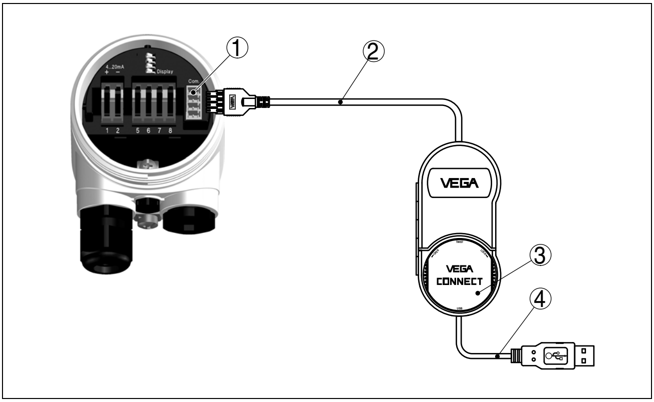


Fig. 29: Conexión vía VEGACONNECT externo

1 Bus I^2C interfaz (Com.) en el sensor
2 Cable de conexión I^2C del VEGACONNECT
3 VEGACONNECT
4 Cable USB hacia el PC

Componentes necesarios

- VEGAPULS 67
- PC con PACTware y DTM-VEGA adecuado
- VEGACONNECT
- Fuente de alimentación o equipo de evaluación

VEGACONNECT vía HART

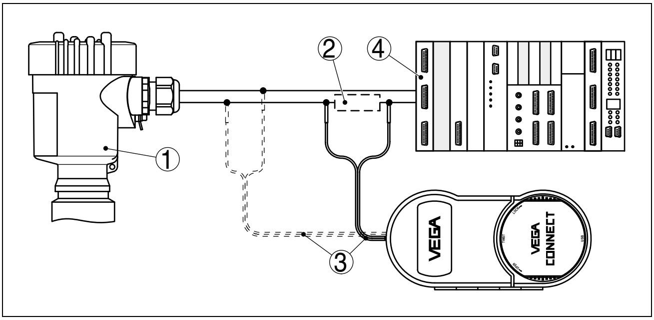


Fig. 30: Conexión del PC a la línea de señal vía HART

1 VEGAPULS 67
2 Resistencia HART 250 Ω (opcional en dependencia de la evaluación)
3 Cable de conexión con fichas monopolares de 2 mm y bornes
4 Sistema de análisis/PLC/Alimentación de tensión

Componentes necesarios

- VEGAPULS 67
- PC con PACTware y DTM-VEGA adecuado
- VEGACONNECT
- Resistencia HART apróx. 250 Ω
- Fuente de alimentación o equipo de evaluación

Indicaciones:
En el caso de fuentes de alimentación con resistencia HART integrada (Resistencia interna apróx. 250 Ω) no se requiere ninguna resistencia externa adicional. Esto resulta válido p. Ej. para los equipos VEGA VEGATRENN 149A, VEGADIS 371, VEGAMET 381. Generalmente los seccionadores de alimentación comerciales también están dotados de una resistencia de limitación de corriente suficientemente grande. En estos casos puede conectarse el VEGACONNECT 4 paralelo a la línea de 4 … 20 mA.

7.2 Parametrización con PACTware

La restante puesta en funcionamiento se describe en la instrucción de servicio "*DTM-Collection/PACTware*", contenida en cada CD y con posibilidad de descarga desde la página principal. Una descripción más amplia se encuentra en la ayuda en línea de PACTware y el VEGA-DTM .

Indicaciones:
Favor de prestar atención, a que durante la puesta en marcha del VEGAPULS 67 hay que emplear la versión actual de DTM-Collection.

Todos los VEGA-DTM disponibles actualmente están resumidos en una colección de DTM en CD y se pueden adquirir contra un derecho de protección a través de la representación competente de VEGA. En este CD está también la versión actual de PACTware

Adicionalmente esa DTM-Collection incluyendo la versión básica de PACTware puede descargarse gratis de Internet. Para ello ir a través de www.vega.com y "*Downloads*" al punto "*Software*".

7.3 Ajuste de parámetros con AMS™ y PDM

Para los sensores VEGA también existen descripciones de equipos en forma de DD o EDD para los programas de configuración AMS™ y PDM. Las descripciones de equipo ya están implementadas en las versiones actuales de AMS™ y PDM.

En caso de versiones antiguas de AMS™ y PDM estas se pueden descargar gratis a través de Internet. Para ello ir a través de www.vega.com y "*Downloads*" al punto "*Software*".

7.4 Aseguramiento de los datos de parametrización

Se recomienda la documentación y registro de los datos de parametrización. De esta forma se encuentran disponible para uso múltiple y para fines de servicio.

La colección DTM-VEGA y PACTware en la versión profesional con licencia le ofrece las herramientas adecuadas para una documentación sistemático del proyecto y almacenaje.

8 Mantenimiento y eliminación de interrupciones

8.1 Mantenimiento, limpieza

En caso de empleo acorde con las prescripciones no se requiere mantenimiento alguno durante el régimen normal de funcionamiento.

En algunas aplicaciones las incrustaciones de producto en el sistema de antenas pueden influenciar el resultado de medición. Por eso en dependencia del sensor y de la aplicación tomar precauciones para evitar una contaminación fuerte del sistema de antenas. En caso necesario hay que limpiar el sistema de antenas a intervalos determinados.

8.2 Eliminación de interrupciones

Comportamiento en caso de interrupciones

Es responsabilidad del explotador de la instalación, la toma de medidas necesarias para la eliminación de las interrupciones aparecidas.

Causas de interrupciones

Se garantiza una medida elevada de seguridad de funcionamiento. Sin embargo durante el funcionamiento pueden aparecer interrupciones. Dichas interrupciones pueden tener por ejemplo las causas siguientes:

- Sensor
- Proceso
- Alimentación de tensión
- Análisis de la señal

Eliminación de interrupciones

Las primeras medidas son el control de la señal de salida así como el análisis de las alarmas de error a través del módulo de visualización y configuración. La forma de procedimiento se describe a continuación. Otras posibilidades más amplias de diagnóstico se tienen con un ordenador con software PACTware y el DTM adecuado. En muchos casos por esta vía puede determinarse las causas y eliminar las interrupciones.

Línea directa de servicio de 24 horas

Si estas medidas no conducen a ningún resultado, llamar la línea directa de servicio VEGA en casos urgentes al Tel. **+49 1805 858550**.

La línea directa esta disponible durante las 24 horas incluso fuera de los horarios normales de trabajo 7 días a la semana. El soporte se realiza en idioma inglés porque el servicio se ofrece a escala mundial. El servicio es gratuito, solamente se carga la tarifa telefónica local.

Comprobar la señal 4 … 20 mA

Conectar un multímetro manual al rango de medición adecuado según el esquema de conexión.

? Señal 4 … 20 mA inestable

- ● Variaciones de nivel
- → Ajustar el tiempo de atenuación a través del módulo de visualización y configuración

? falta la señal 4 … 20 mA

- ● Conexión falsa
- → Comprobar la conexión según el capitulo "*Pasos de conexión*", corrigiéndola en caso necesario según el capitulo "*Esquema de conexión*"
- ● Ninguna alimentación de tensión
- → Comprobar las líneas contra interrupciones, reparándolas en caso necesario
- ● Tensión de trabajo muy baja o resistencia de carga muy alta
- → Comprobar, ajustando en caso necesario

? Señal de corriente mayor que 22 mA o menor que 3,6 mA

- ● Pieza electrónica defectuosa
- → Cambiar el equipo o enviarlo a reparación

En el caso de aplicaciones Ex, hay que tener en cuenta las reglas para la interconexión de circuitos eléctricos de seguridad intrínseca.

Avisos de error sobre el módulo de visualización y configuración

? E013

- ● No existe valor de medición
- → Sensor en fase de inicialización
- → El sensor no encuentra ningún eco, p. Ej., por montaje defectuoso o mal ajuste de parámetros

? E017

- ● Rango de ajuste demasiado pequeño
- → Realizar el ajuste nuevamente, agrandando la distancia entre los ajustes Mín-Máx. durante dicha operación

? E036

- ● Ningún software de sensor ejecutable
- → Realizar una actualización del software o enviar el equipo a reparación

? E041, E042, E043

- ● Error de hardware, defecto en la electrónica
- → Cambiar el equipo o enviarlo a reparación

Comportamiento después de la eliminación de interrupciones

En dependencia de la causa de interrupción y de las medidas tomadas hay que realizar nuevamente en caso necesario los pasos de procedimiento descritos en el capítulo "*Puesta en marcha*".

8.3 Cambiar pieza electrónica

La pieza electrónica puede ser sustituida por el usuario en caso de defecto.

En caso de aplicaciones Ex, solamente puede emplearse un equipo y una pieza electrónica con la homologación Ex correspondiente.

En caso de no existir ninguna pieza electrónica recambiable localmente, puede pedirse la misma a través de la representación VEGA correspondiente.

Número de serie del sensor

Hay que cargar la pieza electrónica recambiable nueva con los ajustes del sensor. Para eso existen las posibilidades siguientes:

- En la fábrica por VEGA
- Local por el cliente

En ambos casos es necesaria la información del número de serie del sensor. Los números de serie están en la placa de tipos dentro de la carcasa o en el comprobante de suministro del equipo.

Información:
En el caso de carga en el lugar hay que descargar los datos del Internet anteriormente (ver instrucción de servicio *Piezas electrónica recambiable*).

Asignación

Las piezas electrónicas recambiables están adaptadas al sensor correspondiente y además, se diferencian en la salida de señal y la alimentación de tensión.

8.4 Actualización del software

La versión de software del VEGAPULS 67 se puede determinar de la forma siguiente:

- en la placa de tipos de la electrónica
- Través del módulo de visualización y configuración
- a través de PACTware

En nuestra página Web www.vega.com se encuentran todas las historias de Software. Haga uso de la ventaja y regístrese para informaciones de actualización por E-Mail.

Para actualizar el software del sensor se necesitan los componentes siguientes:

- Sensor
- Alimentación de tensión

- VEGACONNECT
- PC con PACTware
- Software actual del sensor en forma de archivo

Cargar el software del sensor en el PC

En "www.vega.com/downloads" ir a "*Software*". Seleccionar en la serie de equipos correspondiente "*Equipos y sensores plics*". Cargar el archivo zip con la tecla derecha del ratón con "*Guardar destino en*" p. Ej. en el escritorio del PC. Extraer todos los archivos existentes en el archivo zip p. Ej. en el escritorio.

Preparar la actualización

Conectar el sensor a la alimentación de tensión y establecer la conexión del PC al equipo a través de VEGACONNECT. Conectar PACTware, estableciendo la conexión hacia el sensor, p. Ej. a través del asistente de proyecto de VEGA. Cerrar la ventana de parámetros del sensor, si está abierta.

Cargar el software en el sensor

En la barra de menú de PACTware ir a "*Datos del equipo*", "*Otras funciones*" y "*Actualizar software del equipo*".

PACTware comprueba ahora la versión actual de hardware y software del sensor y muestra los datos. Ese proceso dura apróx. 60 s.

Accionar el botón " ***Actualizar software***„ seleccionando el archivo hex extraído previamente. Después se puede iniciar la actualización del software. Los demás datos se instalan automáticamente. Ese proceso dura apróx. 1 h en dependencia del sensor.

8.5 Reparación del equipo

Proceder de la forma siguiente si es necesaria una reparación:

En Internet puede descargarse de nuestra página principal www.vega.com en: "*Descargas - Formularios y Certificados - Formulario de reparación*" " un formulario de retorno (23 KB).

De esta forma nos ayudan a realizar la reparación de forma rápida y sin necesidad de aclaraciones.

- Llenar y enviar un formulario para cada equipo
- Limpiar el equipo, empacándolo a prueba de rotura
- Colocar el formulario lleno y una hoja de datos de seguridad eventualmente en la parte externa del equipo
- Favor de solicitar la dirección para la devolución a su representación correspondiente. Usted encontrará su representación correspondiente en nuestra página principal www.vega.com en: "*Empresas - VEGA internacional*"

9 Desmontaje

9.1 Secuencia de desmontaje

Advertencia:
Antes del desmontaje, prestar atención a condiciones de proceso peligrosas tales como p. Ej., presión en el depósito, altas temperaturas, productos agresivos o tóxicos, etc.

Atender los capítulos "*Montaje*" y "*Conexión a la alimentación de tensión*" siguiendo los pasos descritos allí análogamente en secuencia inversa.

9.2 Eliminación

El equipo se compone de materiales recuperables por establecimiento especializados de reciclaje. Para ello, hemos diseñado la electrónica de fácil desconexión, empleando materiales recuperables.

Directiva WEEE 2002/96/CE
El presente módulo de visualización y configuración no responde a la directiva WEEE 2002/96/CE y las leyes nacionales correspondientes. Llevar el equipo directamente a una empresa especializada de reciclaje, sin emplear para esto los puntos comunales de recogida. Los mismos pueden emplearse solamente para productos de uso privado según la directiva WEEE.

Una eliminación especializada evita consecuencias negativas sobre el hombre y el medio ambiente, posibilitando la recuperación de materias primas valiosas.

Materiales: ver "*Datos técnicos*"

Si no tiene posibilidades de eliminar el equipo viejo de forma especializada, consulte con nosotros acerca de las posibilidades de eliminación o devolución.

10 Anexo

10.1 Datos técnicos

Datos generales

316L equivale a 1.4404 o 1.4435

Materiales, en contacto con el medio	
– Antena de trompeta	PBT-GF30
– Lente de enfoque	PP
– Brida adaptadora	PPH
– Junta brida adaptadora	FKM (Viton)
Materiales, sin contacto con el medio	
– Brida suelta	PPH
– Estribo de montaje, tornillo de sujeción estribo de montaje	316L
– Tornillo de sujeción brida adaptadora	304
– Carcasa	Plástico PBT (Poliéster), fundición a presión de aluminio recubierta de polvo, acero inoxidable 316L
– Sello entre la carcasa y la tapa de la carcasa	NBR (Carcasa acero inoxidable), Silicona (Carcasa de aluminio / plástico)
– Mirilla en la tapa de la carcasa para PLICSCOM	Policarbonato (UL-746-C listado)
– Borne de conexión a tierra	316Ti/316L
Par de fuerza máximo tornillos de montaje estribo de fijación en la carcasa del sensor	4 Nm (2.95 lbf ft)
Peso, en dependencia del material y la versión de la carcasa	0,7 … 3,4 kg (1.543 … 7.496 lbs)

Magnitud de salida

Señal de salida	4 … 20 mA/HART
Tiempo de ciclo	mín. 1 s (depende de la parametrización)
Resolución de la señal	1,6 µA
Señal de fallo salida de corriente (Ajustable)	Valor mA invariable 20,5 mA, 22 mA, < 3,6 mA (Ajustable)
Corriente máx. de salida	22 mA
Carga	ver el diagrama de carga en la alimentación de tensión
Tiempo de integración (63 % de la magnitud de entrada)	0 … 999 s, regulable
Recomendación NAMUR satisfecha	NE 43
Valores de salida HART	
– 1er valor HART (Primary Value)	Distancia hasta el nivel de llenado
– 2do Valor HART (Secondary Value)	Distancia hasta el nivel - calibrada (p. Ej. hl, %)

Resolución de medida digital	> 1 mm (0.039 in)

Magnitud de entrada

Valor de medición	Distancia entre la conexión al proceso y la superficie del producto almacenado
Distancia mínima a partir del extremo de la antena	50 mm (1.969 in)[3]
Rango de medición	hasta 15 m (49.21 ft)

Condiciones de referencia para la exactitud de medición (tomando como referencia la norma DIN EN 60770-1)

Condiciones de referencia según DIN EN 61298-1

– Temperatura	+18 … +30 °C (+64 … +86 °F)
– Humedad relativa del aire	45 … 75 %
– Presión del aire	860 … 1060 mbar/86 … 106 kPa (12.5 … 15.4 psig)

Otras condiciones de referencia

– Reflector	Reflector ideal. p. Ej. placa metálica de 2 x 2 m
– Reflexiones de interferencia	mayor eco perturbador 20 dB menor que el eco útil

Características de medición y datos de rendimiento

Frecuencia de medición	Banda K
Intervalo de medición	apróx. 1 s
Ángulo de emisión -3 dB[4]	10°
Respuesta gradual o tiempo de ajuste[5]	> 1 s (depende de la parametrización)
Variación máxima de nivel	Ajustable hasta 1 m/min. (en dependencia del ajuste de parámetros)

Capacidad máxima de HF (alta frecuencia) irradiada del sistema de antena

– Potencia máxima de impulso	< 10 mW
– Duración del impulso	< 2 ns
– Potencia media	< 25 µW
– Potencia media a 1 m de distancia	< 1 µW/cm^2

Exactitud de medida

Resolución de medida general	máx. 1 mm (0.039 in)
Error de medición[6]	ver diagramas

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[3] Para productos con valor de constante dieléctrica pequeño hasta 50 cm (19.69 in).

[4] Equivale al rango con 50% de la potencia emitida

[5] Tiempo hasta la salida correcta (máx. 10 % desviación) del nivel de llenado en caso de una variación repentina de nivel.

[6] Inclusive falta de linealidad, histéresis y falta de reproducibilidad.

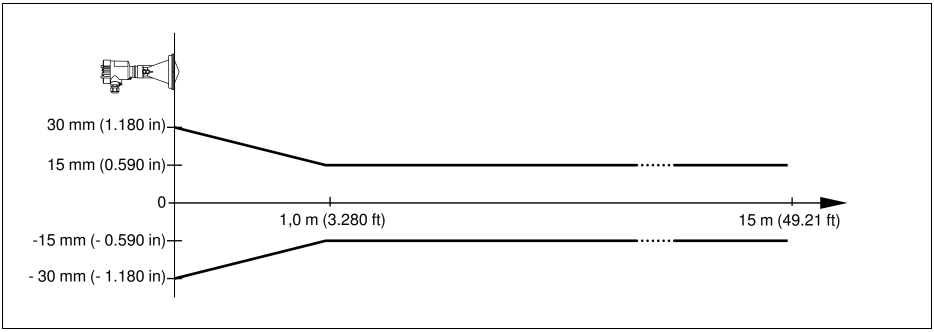

Fig. 31: Error de medición VEGAPULS 67

Influencia de la temperatura ambiente sobre la electrónica del sensor[7]

Coeficiente medio de temperatura de la señal cero (Error de temperatura)	0,03 %/10 K

Condiciones ambientales

Temperatura ambiente, de almacenaje y de transporte	-40 … +80 °C (-40 … +176 °F)

Condiciones de proceso

Presión del depósito	-100 … 200 kPa/-1 … 2 bar (-14.5 … 29.0 psig)
Temperatura de proceso (medida en la conexión al proceso)	-40 … +80 °C (-40 … +176 °F)
Resistencia a la vibración	vibraciones mecánicas con 4 g y 5 … 100 Hz[8]

Datos electromecánicos - versión IP 66/IP 67 e IP 66/IP 68; 0,2 bar

Entrada de cables/Enchufe[9]

– Carcasa de una cámara	● 1 x racor atornillado para cables M20 x 1,5 (Cable: ø 5 … 9 mm), 1 x tapón ciego M20 x 1,5 o: ● 1 x tapón roscado M20 x 1,5; 1 x tapón ciego M20 x 1,5 o:

---

[7] Con referencia a la gama nominal de medición, en el rango de temperatura -40 … +80 °C .

[8] Control según las normas del Germanischen Lloyd - Curva características GL 2.

[9] En dependencia de la versión M12 x 1, según DIN 43650, Harting, 7/8" FF.

	● 1 x Tapón roscado ½ NPT, 1 x Tapón ciego ½ NPT o: ● 1 x enchufe (en dependencia de la versión), 1 x tapón ciego M20 x 1,5
– Carcasa de dos cámaras	● 1 x racor atornillado para cables M20 x 1,5 (Cable: ø 5 … 9 mm), 1 x tapón ciego M20 x 1,5; 1 x tapón ciego M16 x 1,5 u opcional 1 x enchufe M12 x 1 para VEGADIS 61 o: ● 1 x tapón roscado ½ NPT, 1 x tapón ciego ½ NPT, 1 x tapón ciego M16 x 1,5 u opcional 1 x enchufe M12 x 1 para VEGADIS 61 o: ● 1 x enchufe (en dependencia de la versión), 1 x tapón ciego M20 x 1,5; 1 x tapón ciego M16 x 1,5 u opcional 1 x enchufe M12 x 1 para VEGADIS 61
Bornes elásticos para sección de cable	> 2,5 mm^2 (AWG 14)

Datos electromecánicos - versión IP 66/IP 68 (1 bar)

Entrada de cable	
– Carcasa de una cámara	1 x racor atornillado para cable IP 68 M20 x 1,5; 1 x tapón ciego M20 x 1,5
– Carcasa de dos cámaras	1 x racor atornillado para cable IP 68 M20 x 1,5; 1 x tapón ciego M20 x 1,5; 1 x tapón ciego M16 x 1,5
Cable de conexión	
– Sección de conductor	0,5 mm^2 (AWG Nº 20)
– Resistencia del conductor	< 0,036 Ω/m
– Resistencia a la tracción	< 1200 N (270 lbf)
– Longitud estándar	5 m (16.4 ft)
– Longitud máxima	1000 m (3280 ft)
– Radio de flexión mín.	25 mm (0.984 in) para 25 °C (77 °F)
– Diámetro aproximado	8 mm (0.315 in)
– Color - PE estándar	negro
– Color - PUR estándar	azul
– Color- Versión Ex	azul

Modulo de visualización y configuración

Alimentación de tensión y transmisión de datos	a través del sensor
Indicación	Display LC en matriz de puntos
Elementos de configuración	4 teclas

Tipo de protección

– suelto	IP 20
– montado en el sensor sin tapa	IP 40

Materiales

– Carcasa	ABS
– Ventana	Lamina de poliéster

Alimentación de tensión

Tensión de trabajo

– Equipo no Ex	15 … 36 V DC
– Equipo EEx-ia	15 … 30 V DC
– Equipo EExd-ia	20 … 36 V DC

Tensión de trabajo con módulo de visualización y configuración iluminado

– Equipo no Ex	20 … 36 V DC
– Equipo EEx-ia	20 … 30 V DC
– Equipo EExd-ia	20 … 36 V DC

Ondulación residual permisible

– < 100 Hz	U_{ss} < 1 V
– 100 Hz … 10 kHz	U_{ss} < 10 mV

Carga	ver diagrama

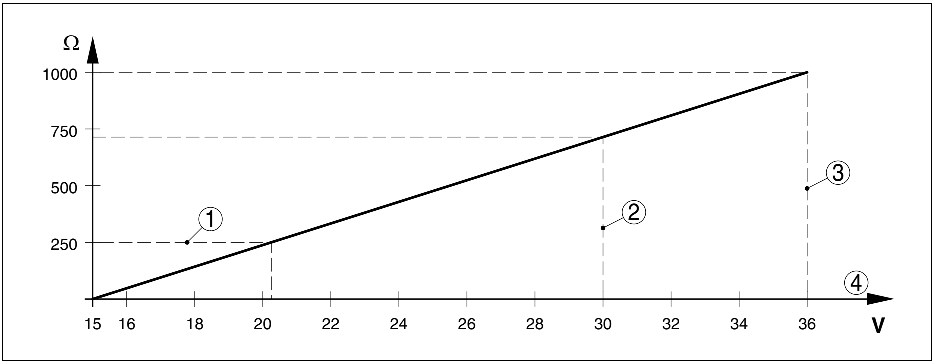

Fig. 32: Diagrama de tensión

1 *Carga HART*
2 *Límite de tensión equipo EEx-ia*
3 *Límite de tensión equipo no-Ex/Exd*
4 *Tensión de trabajo*

Medidas de protección eléctrica

Tipo de protección en dependencia de la variante de carcasa

– Carcasa plástica	IP 66/IP 67
– Carcasa de aluminio, carcasa de acero inoxidable, fundición de precisión; carcasa de acero inoxidable electropulida	IP 66/IP 68 (0,2 bares)[10]
– Carcasa de aluminio y acero inoxidable, fundición de precisión (opcional)	IP 66/IP 68 (1 bar)
Categoría de sobretensión	III
Clase de protección	II

Seguridad funcional (SIL)

En caso de equipos con calificación SIL de fábrica la seguridad funcional ya está activada. En caso de equipos sin calificación SIL de fábrica la seguridad funcional tiene que ser activada por el usuario a través del módulo de visualización y configuración o a través de PACTware para aplicaciones según SIL.

Seguridad funcional según IEC 61508-4

– Arquitectura monocanal (1oo1D)	hasta SIL2
– Arquitectura diversitaria redundante de dos canales (1oo2D)	hasta SIL3

Informaciones detalladas se encuentran en el Safety Manual de la serie de equipos suministrado o en "www.vega.com", "*Downloads*", "*Homologaciones*".

Homologaciones

Los equipos con homologación pueden tener datos técnicos diferentes en dependencia de la versión.

Para esos equipos hay que considerar los documentos de autorización correspondientes. Los mismos forman parte del alcance de suministros o se pueden descargar de www.vega.com a través de "*VEGA Tools*" y " *serial number search*" así como a través de "*Downloads*" y "*Homologaciones*".

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[10] Condición para la conservación del tipo de protección es el cable adecuado.

10.2 Medidas

Carcasa en tipo de protección IP 66/IP 68 (0,2 bar)

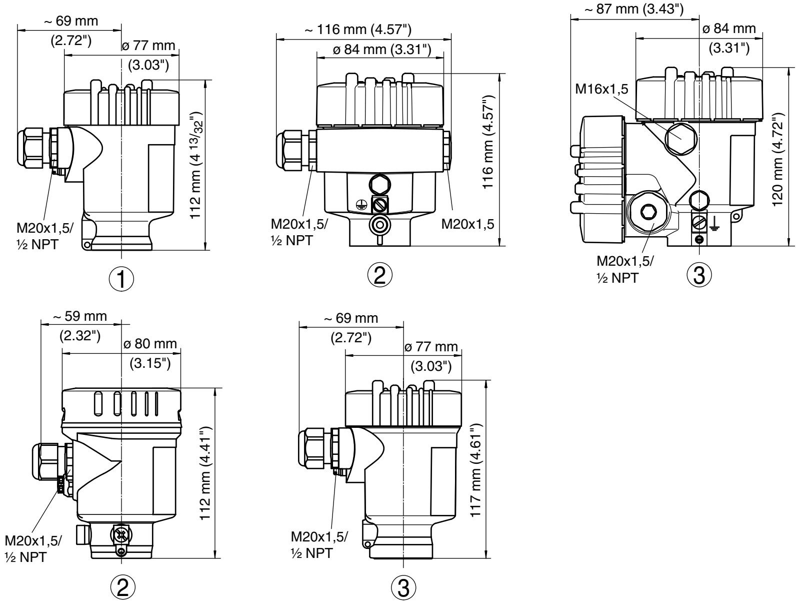


Fig. 33: Variante de carcasa en tipo de protección IP 66/IP 68; (0,2 bar) con módulo de visualización y configuración incorporado aumenta la altura de la carcasa en 9 mm/0.35 in

1 *Carcasa plástica*
2 *Carcasa de aluminio*
3 *Carcasa de aluminio de dos cámaras*
4 *Carcasa de acero inoxidable, electropulida*
5 *Carcasa de acero inoxidable - fundición de precisión*

Carcasa en tipo de protección IP 66/IP 68 (1 bar)

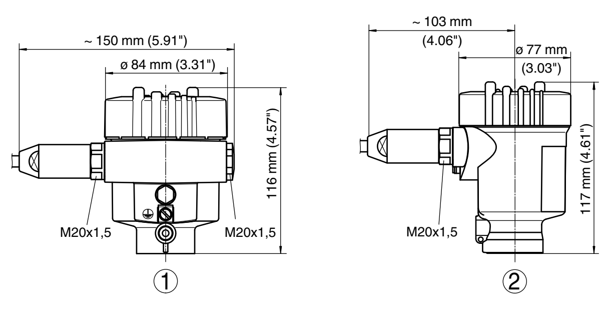


Fig. 34: Variante de carcasa en tipo de protección IP 66/IP 68; (1 bar) con módulo de visualización y configuración incorporado aumenta la altura de la carcasa en 9 mm/0.35 in

1 Carcasa de aluminio
2 Carcasa de acero inoxidable - fundición de precisión

VEGAPULS 67 - versión con estribo de montaje

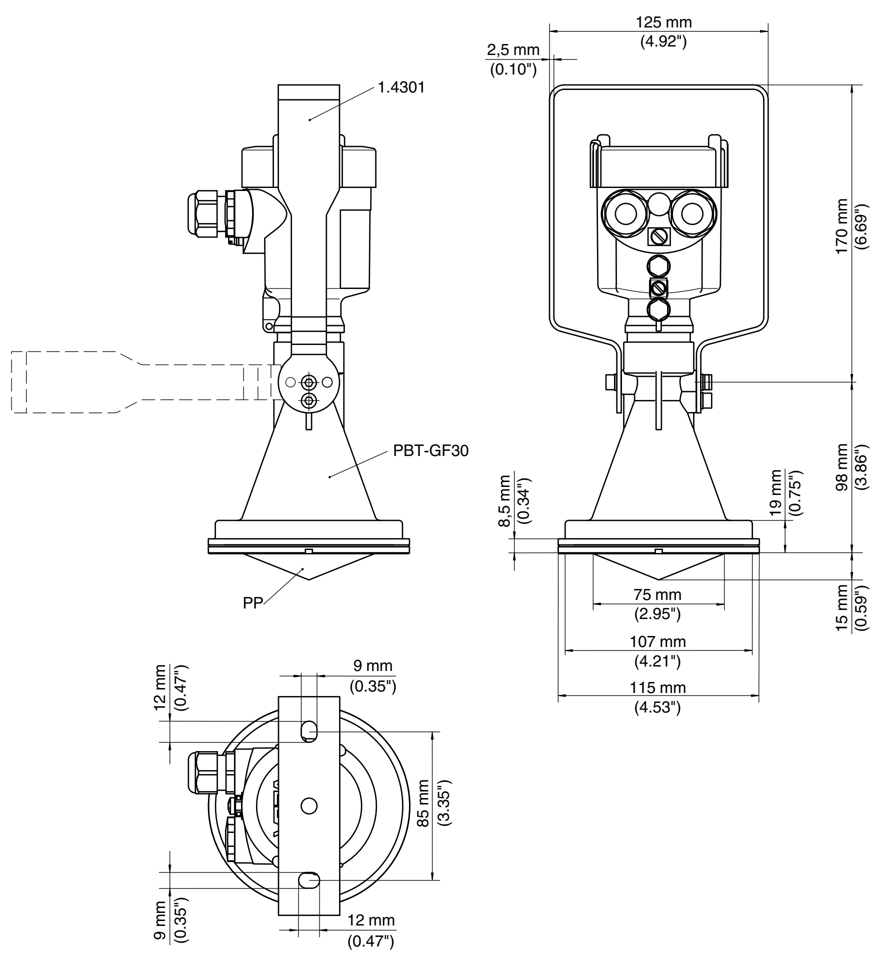


Fig. 35: VEGAPULS 67 - Versión en estribo de montaje en largos de 170 o 300 mm

VEGAPULS 67 - Versión con brida suelta

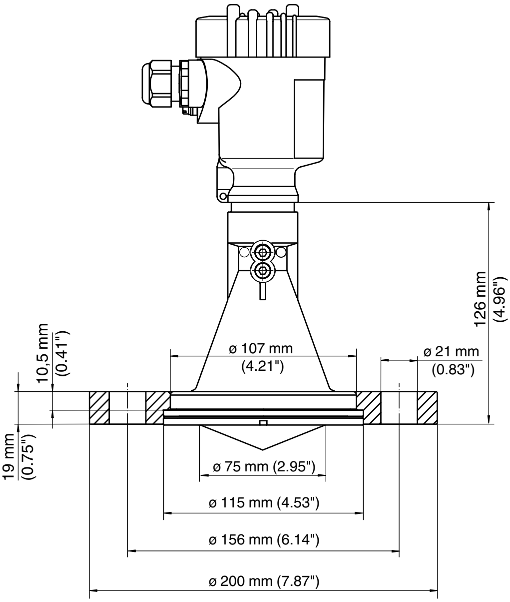
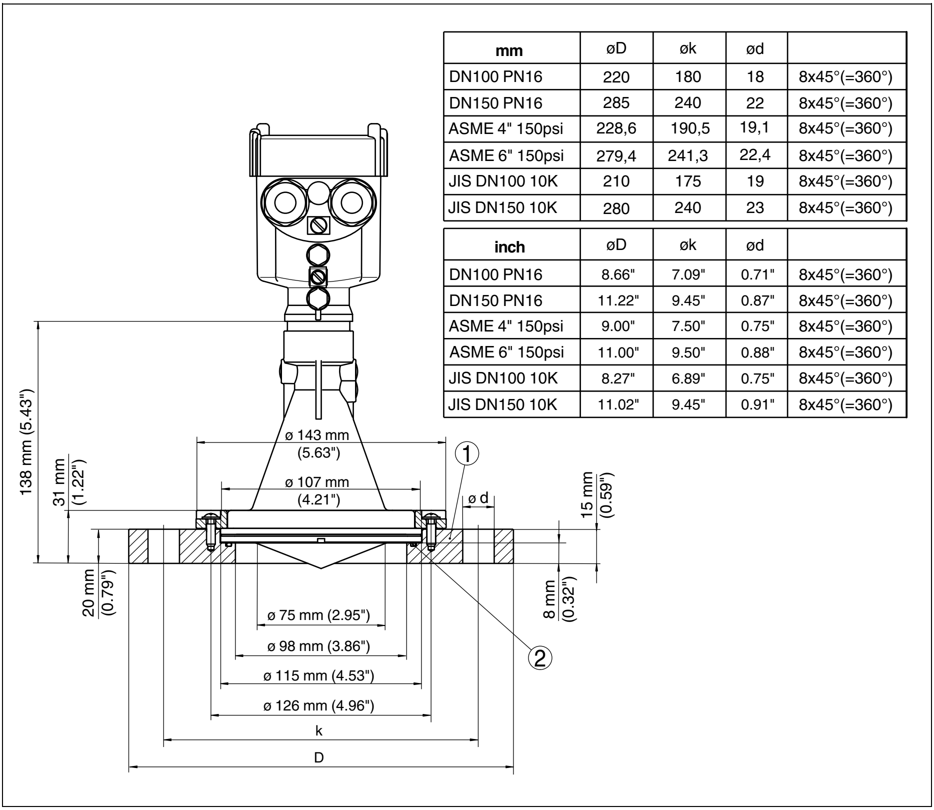


Fig. 36: VEGAPULS 67 - brida suelta DN 80/3"/JIS80

VEGAPULS 67 - versión con brida adaptadora



mm	øD	øk	ød	
DN100 PN16	220	180	18	8x45°(=360°)
DN150 PN16	285	240	22	8x45°(=360°)
ASME 4" 150psi	228,6	190,5	19,1	8x45°(=360°)
ASME 6" 150psi	279,4	241,3	22,4	8x45°(=360°)
JIS DN100 10K	210	175	19	8x45°(=360°)
JIS DN150 10K	280	240	23	8x45°(=360°)

inch	øD	øk	ød	
DN100 PN16	8.66"	7.09"	0.71"	8x45°(=360°)
DN150 PN16	11.22"	9.45"	0.87"	8x45°(=360°)
ASME 4" 150psi	9.00"	7.50"	0.75"	8x45°(=360°)
ASME 6" 150psi	11.00"	9.50"	0.88"	8x45°(=360°)
JIS DN100 10K	8.27"	6.89"	0.75"	8x45°(=360°)
JIS DN150 10K	11.02"	9.45"	0.91"	8x45°(=360°)

Fig. 37: VEGAPULS 67 - brida adaptadora DN 100/DN 150

1 *Brida adaptadora*
2 *Junta*

10.3 Derechos de protección industrial

VEGA product lines are global protected by industrial property rights. Further information see http://www.vega.com.

Only in U.S.A.: Further information see patent label at the sensor housing.

VEGA Produktfamilien sind weltweit geschützt durch gewerbliche Schutzrechte.

Nähere Informationen unter http://www.vega.com.

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VEGA系列产品在全球享有知识产权保护。

进一步信息请参见网站<http://www.vega.com>。

10.4 Marca registrada

Todas las marcas y nombres comerciales o empresariales empleados pertenecen al propietario/autor legal.

Fecha de impresión:

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Alemania
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