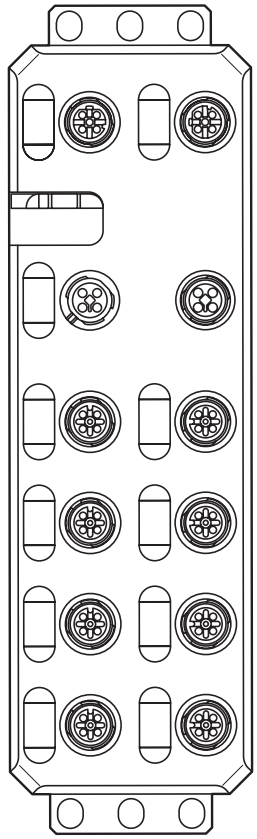
ifm electronic

UK

Device manual
IO-Link Profibus master

ecomat300

AL1010



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UK

This document is the original instructions.

1 Preliminary note

This document applies to devices of the type "IO-Link master" (art. no. AL1010).

This document is intended for specialists. These specialists are people who are qualified by their appropriate training and their experience to see risks and to avoid possible hazards that may be caused during operation or maintenance of the device. The document contains information about the correct handling of the device.

Read this document before use to familiarise yourself with operating conditions, installation and operation. Keep this document during the entire duration of use of the device.

Adhere to the safety instructions.

Symbols

► Instructions

> Reaction, result

[…] Designation of keys, buttons or indications

→ Cross-reference

Important note
Non-compliance may result in malfunction or interference.

Information
Supplementary note

Warnings used

⚠ WARNING
Warning of serious personal injury.
Death or serious irreversible injuries may result.

⚠ CAUTION
Warning of personal injury.
Slight reversible injuries may result.

NOTE
Warning of damage to property.

2 Safety instructions

These instructions contain texts and figures concerning the correct handling of the device and must be read before installation or use.

Observe the operating instructions. Non-observance of the instructions, operation which is not in accordance with use as prescribed below, wrong installation or incorrect handling can seriously affect the safety of operators and machinery.

- ► Prepare installation
- ► Disconnect the power supply of the device.
- ► Ensure that devices cannot be accidentally restarted.
- ► Verify safe isolation from the supply.
- ► Earth and short circuit.
- ► Cover or enclose adjacent units that are live.
- ► Follow the specific mounting instructions of the device.
- ► Only suitably qualified personnel in accordance with EN 50 110-1/-2 (VDC 0105 part 100) is permitted to work on this device/system.
- ► Before installation and before touching the device ensure that you are free of electrostatic charge.
- ► The functional earth (FE) must be connected to the protective earth (PE) or to the potential equalisation. The system installer is responsible for implementing this connection.
- ► Connection cables and signal lines must be installed in such a manner that inductive and capacitive interference do not impair the automation functions.
- ► Install automation equipment and related operating elements in such a way that they are protected against unintentional operation.
- ► Suitable safety hardware and software measures should be implemented for the I/O interface so that a line or wire breakage on the signal side does not result in undefined states in the automation device.
- ► Ensure a reliable electrical isolation of the low voltage for the 24 V supply. Only use power supplies compliant with IEC 60 364-4-41 or HD 384.4.41 S2 (VDE 0100 part 410).
- ► Fluctuations or deviations of the mains voltage from the rated value must not exceed the tolerance limits specified in the technical data; otherwise this may cause malfunction and dangerous operation.
- ► E-stop devices to IEC/EN 60 204-1 must be effective in all operating modes of the automation device. Unlatching the e-stop devices must not cause restart.

- ► Devices that are designed for mounting in housings or control cabinets must only be operated and controlled after they have been installed with the housing closed. Desktop or portable units must only be operated and controlled in enclosed housings.
- ► Measures should be taken to ensure the proper restart of programs interrupted after a voltage dip or failure. This should not cause dangerous operating states even for a short time. If necessary, an emergency stop must be carried out.
- ► Wherever faults in the automation system may cause personal injuries or damage to property, external measures must be implemented to ensure a safe operating state in the event of a fault or malfunction (e.g. by means of separate limit switches, mechanical interlocks etc.)
- ► The electrical installation must be carried out in accordance with the relevant regulations (e.g. with regard to cable cross-sections, fuses, PE).
- ► All work relating to transport, installation, commissioning and maintenance must only be carried out by qualified personnel. (IEC 60 364 or HD 384 or DIN VDE 0100 and national work safety regulations have to be observed).
- ► All shrouds and doors must be kept closed during operation.

3 Documentation

This documentation relates to the hardware and firmware status at the time of editing this manual. The features of the devices are continuously developed further and improved.

4 Functions and features

The devices have been designed for use in applications described in this manual and the device-specific data sheets.

Adhere to the data indicated in the data sheets and in the manual. If the handling specifications and safety instructions for configuration, installation and operation indicated in the documentation are adhered to, the devices normally do not lead to a danger for persons and objects.

The input and output devices of the IO-Link master have been designed for automation tasks in harsh environmental conditions. The devices meet the requirements of IP65/67 protection rating. They enable direct connection of sensors and actuators in an environment close to the station.

The devices are available with M12 connection technology.

The devices cannot be extended and have a directly integrated fieldbus connection and I/O level. They are used for distribution in the field when only a few digital or analogue I/O points are required.

5 Product description

5.1 DI (digital input)

The digital inputs receive the digital control signals from the process level. These signals are transferred to the higher-level automation device via the network/bus. The signal status is indicated via LEDs. The sensors are connected via M12 screw connectors. The sensors are supplied from the sensor voltage U_S.

5.2 IOL (IO-Link port)

These devices have IO-Link ports for communication-capable sensors so that the automation device can make dynamic changes to the sensor parameters directly.

The IO-Link ports can be operated in the following operating modes:

- DI (behaves like a digital input supplied via U_S)
- DO (behaves like a digital output supplied via U_S)
- IO-Link (IOL sensor supplied via U_S / IOL actuator supplied via U_S and U_A)

5.3 Connections

The bus, I/O devices and supply are connected via M12 screw connections. Each device is connected directly to the network/bus system.

5.4 Protection rating

The devices have IP65/67 protection rating. To ensure IP65 / IP67 protection, cover unused sockets with protective caps.

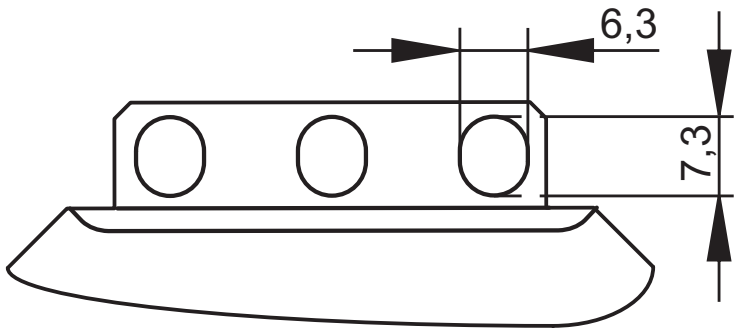
6 Features

The devices have been designed for use without a control cabinet in plant construction. The fixing clips are firmly mounted.

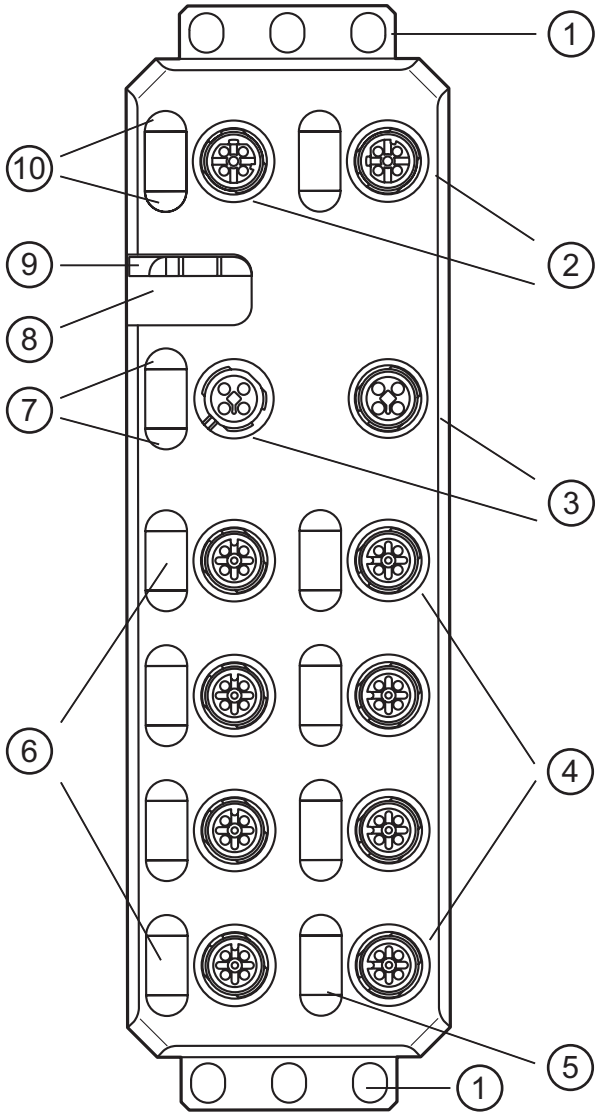
The housing dimensions of the Profibus devices differ from the housing dimensions of the Ethernet versions with regard to the depth at socket X21.

7 Scale drawings

7.1 Dimensions of the screw holes in the fixing clips



8 Structure of the device



1. Fixing clips (FE connection)
2. Network or bus connection (IN, OUT)
3. Connections for the supply voltages
4. Connections for inputs/outputs or IO-Link ports
5. Markers for labelling
6. Status indicators of the inputs/outputs or the IO-Link ports
7. Diagnostics and status indication for the supply voltages
8. Rotary coding switch (no function for ProfiNet)
9. Diagnostics and status indicators for the network / bus system
10. Diagnostics and status indicators for the network (not for Profibus)

8.1 Diagnostic and status indicators

8.1.1 Diagnostics

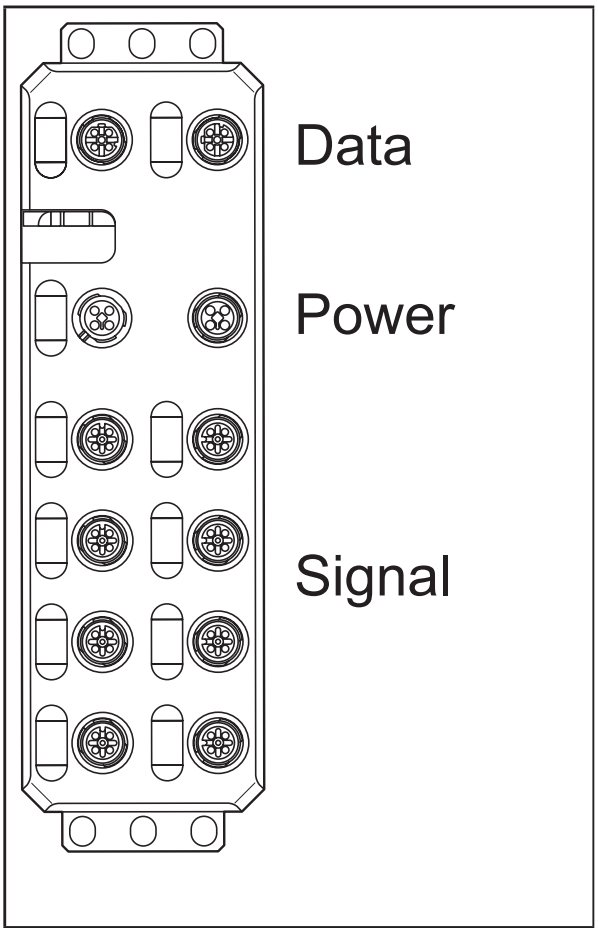
The diagnostic indicators (green/yellow/red) indicate whether an error is present or not. In case of an error, they indicate the error type and location. The device is operating correctly if all green indicators are on.

8.1.2 Status

The status indicators (yellow) indicate the signal state of the corresponding input/output or of the IO-Link port. If the yellow status indicators are on, this indicates signal state “1” of the input/output signal.

The devices have three main areas for diagnostics and status indicators.

- Indicators for the network/bus system (network/bus-specific) - Data
- Indicators for the power supplies - Power
- Indicators for the inputs and outputs and the IO-Link ports (device-specific) - Signal



9 Installation

When preparing for cable installation, the local conditions and the corresponding mounting regulations are very important. Cables can be installed, for example, in cable ducts or on cable bridges.

Data corruption and loss

A minimum distance between the cabling and possible sources of interference (e.g., machines, welding equipment, power lines) is defined in the applicable regulations and standards. During system planning and installation, these regulations and standards must be taken into account and observed.

Protect the bus cables from sources of electric/magnetic interference and mechanical strain.

Observe the following guidelines regarding “electromagnetic compatibility” (EMC) to keep mechanical risks and interference to a minimum.

9.1 Mechanical strain

- ► Choose the correct cable type for the respective application (e.g., indoor or outdoor installation, drag chains).
- ► Observe the minimum bending radius.
- ► Make sure that cables do not enter the shear area of moving machine parts.
- ► Do not install bus cables at right angles to driving routes and machine movements.
- ► Use cable ducts and cable bridges.

► Observe the specifications of the cables used.

9.2 Sources of interference

Signal cables and power supply lines should not be installed in parallel.

- ► If necessary, metal isolating segments should be placed between the power supply lines and signal cables.
- ► Only use connectors with metal housing and connect as much of the shielding as possible to the housing.
- ► For outdoor cables between buildings, make sure that grounding is carried out in accordance with “Installing network/bus cables between buildings”.
- ► During installation, all connector locking mechanisms (screws, union nuts) must be firmly tightened in order to ensure the best possible contact between shielding and ground. Before initial startup, the ground or shielding connection of cables must be checked for low-resistance continuity.

9.3 Cable routing in control cabinets

- ► Install network/bus cables in separate cable ducts or separate cable bundles.
- ► Where possible, do not install network/bus cables parallel to power supply lines.
- ► Install network/bus cables at least 10 cm away from power lines.

9.4 Cable routing in buildings

- ► Where possible, use metal cable hangers.

- ► Do not install network/bus cables together with or parallel to power supply lines.
- ► Separate network/bus cables on cable bridges or in cable ducts from power supply lines using isolating segments.
- ► Install network/bus cables as far away as possible from sources of interference, such as motors and welding equipment.
- ► For long cable connections, install an additional equipotential bonding line between the terminal points.

9.5 Cable routing outside buildings

- ► Install network/bus cables in metal pipes that are grounded on both sides or in concrete cable ducts with continuous reinforcement.
- ► For long cable connections, install an additional equipotential bonding line between the terminal points.

9.6 Installing network/bus cables between buildings

9.6.1 Causes of surge voltages

Surge voltages occur as a result of switching operations, electrostatic discharge, and lightning discharge. Surge voltages can be inductively, capacitively or galvanically coupled into electrical cables for mains supply, measured value transmission, and data transmission. In this way, surge voltages reach the power supply units and the interfaces of systems and devices.

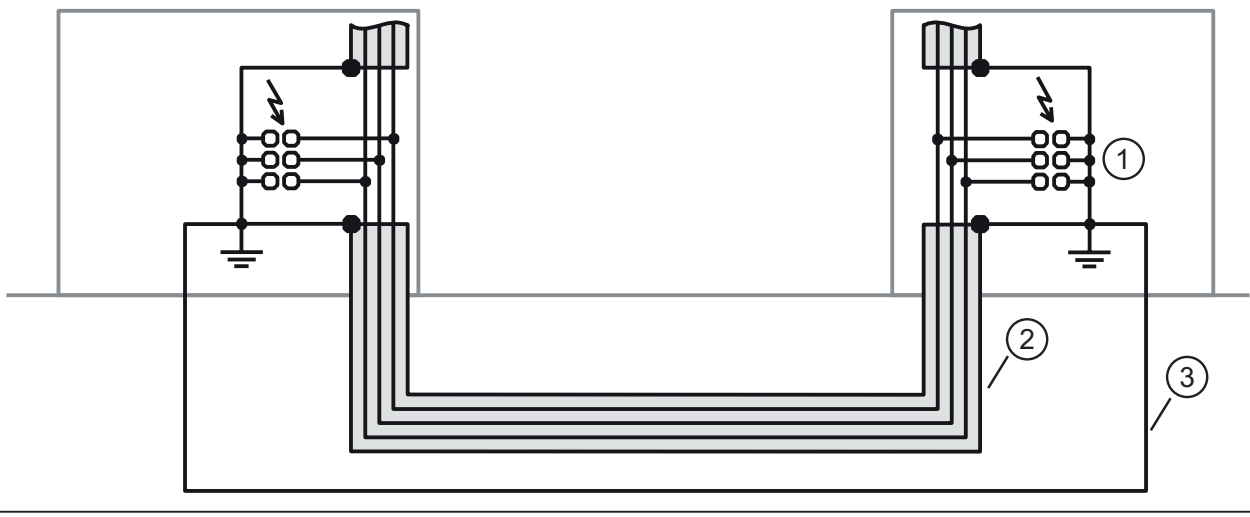
9.6.2 Equipotential bonding line

Install an additional equipotential bonding line between the grounding points of buildings, preferably in the form of

- – a metal-reinforced concrete channel,
- – an additional grounding cable or
- – a metal pipe.

9.6.3 Surge protective devices

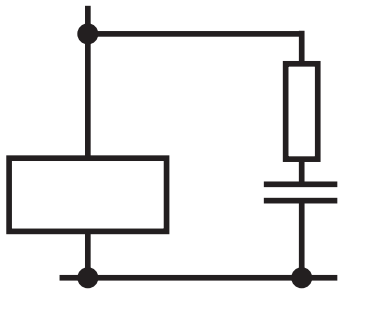
ifm recommends wiring all the wires of the cable to surge protective devices in order to protect the devices against surge voltages.
Observe all national and international regulations when installing surge protective devices.



1. Surge protective devices
2. Cable shielding
3. Equipotential bonding line

9.7 Surge protection measures

ifm recommends wiring relay coils or motor coils to an RC element in order to protect the devices against interference. Depending on the application, the delay time of the relay can be increased by approximately 1 ms.



Relay coil with RC element

For the dimensioning of the RC element, the following values are recommended:

R = 100...200 Ω /
C = 220...470 nF

9.8 Grounding concept

The devices operate in the low-level signal voltage range. In the case of low-level signal devices, interference is discharged via functional earth (FE). Functional earth (FE) is only used to discharge interference. It does not provide shock protection for people.

Functional grounding

The devices are designed to be screwed onto a flat mounting surface.

► Ground the devices by means of the mounting screws of the fixing clips.

9.9 Installation instructions

Electrostatic discharge

The device contains components that can be damaged or destroyed by electrostatic discharge. When handling the device, observe the necessary safety precautions against electrostatic discharge (ESD) according to EN 61340-5-1 and IEC 61340-5-1.

Damage to the electronics

- ► The device may only be installed and removed by qualified electricians in accordance with the ESD regulations.
- ► Implement the FE connection using mounting screws, in order to ensure immunity to interference.
- ► To ensure IP65/IP67 protection, cover unused connections with protective caps.
- ► Only supply the sensors with the voltage U_S which is provided at the terminal points.
- ► Avoid polarity reversal of supply voltages U_S and U_A.

Data corruption or loss

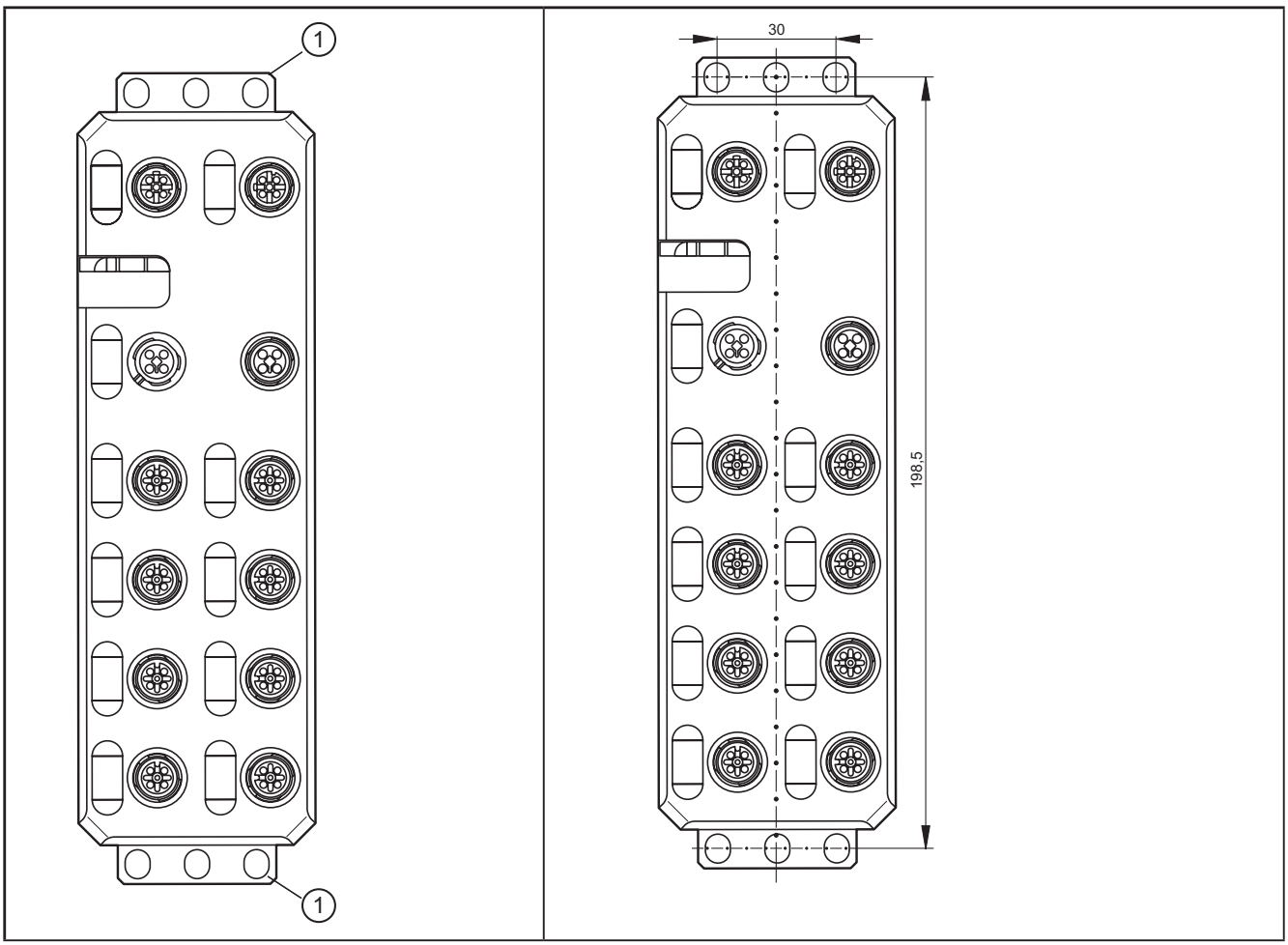
- ► Implement the FE connection using mounting screws, in order to ensure immunity to interference.

9.10 Mounting distances

No specific distances are required between devices or between a device and a cabinet door or cover. Mounting distances are determined solely by the plugs used and the bending radii of the cables.

9.11 Mounting dimensions

► Screw the device directly onto the flat mounting surface using the drill holes (1) of the fixing clips.

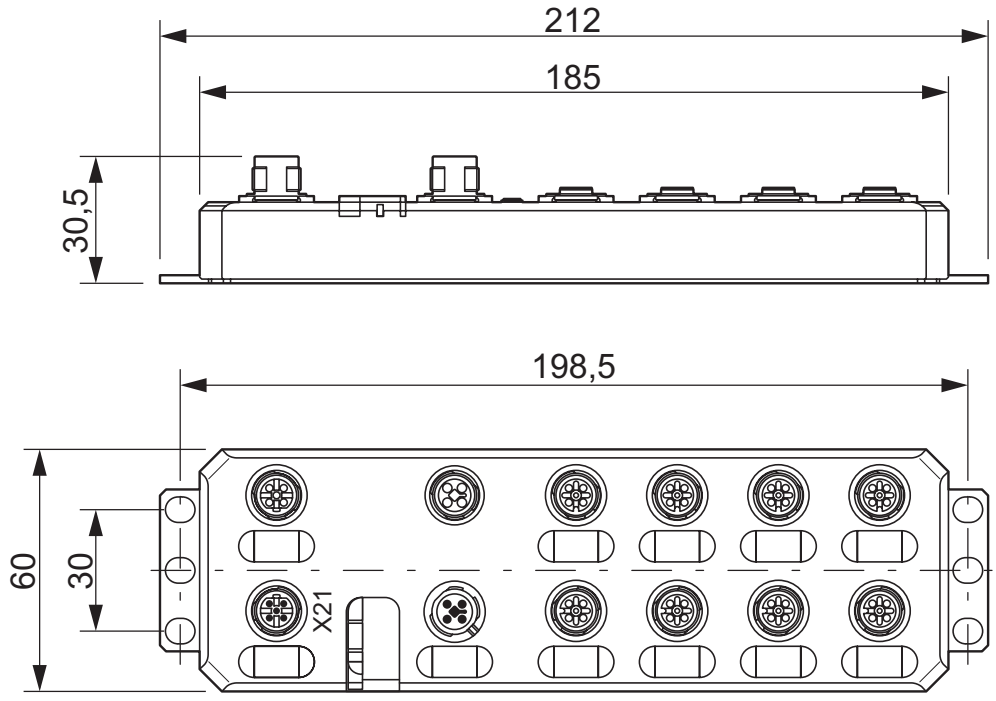


- ▶ Use standard M5 screws with toothed lock washer and self-locking nuts.
- ▶ Observe the maximum torque of the screws.

Functional grounding

- ▶ Functional grounding is crucial for interference-free operation. Ground the device by means of the mounting screws of the fixing clips.

10 Scale drawing



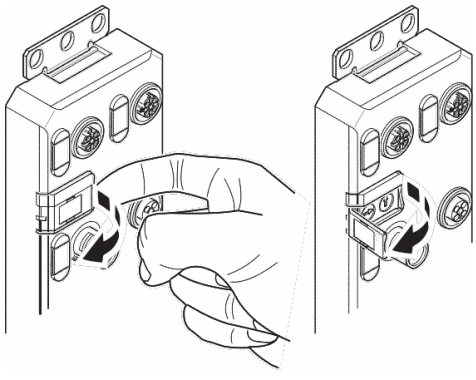
Scale drawing AL1010

11 Setting the address

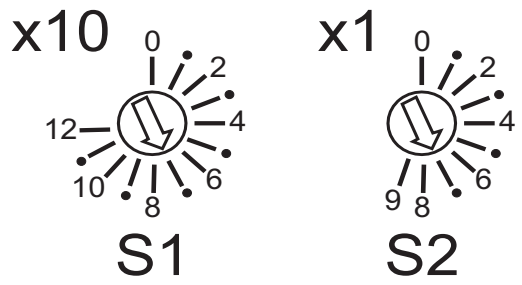
The device has rotary coding switches for setting the address and, if required, the transmission speed (see user manual for the respective network/bus system).

The rotary coding switches are located below a cover.

► Open the cover



► Rotary coding switch S1 is used to specify the tens (X10) of the device ID (module ID).
► Rotary coding switch S2 is used to specify the units (X1) of the device ID (module ID).

	Example: Profibus DP1 Setting address 77

Adjust the rotary coding switches using a suitable screwdriver (according to DIN 5264: blade width 3.0 mm or 2.5 mm). Using an unsuitable tool may damage the rotary coding switches.

12 Electrical connection

For the devices, a distinction is made between two voltages:

- U_S to supply the communications power and the sensors (always required),
- U_A for supplying the actuators, only required for devices with fixed outputs or for additional devices.

All supply voltages are connected via M12 connectors.

Damage to the electronics

► Connect both supply voltages completely (to +24 V and GND).
Do not connect several supply voltages via one GND, as this will exceed the current rating of the contacts.

12.1 Supply voltages U_S and U_A

The voltages U_S and U_A are fed in at connection X31.

Power supply U_S is required to supply the communications power of the device electronics and to supply the sensors. It must be connected to every device. If this supply voltage is disconnected, the device will not work.

► Install the power supply for the device electronics independently of the power supply for the actuators.

► Protect the power supplies independently.

> This means that the bus can continue running even if some I/O devices are switched off.

12.2 Power supply U_S

► Connect power supply Usfor the logic and sensors to socket X31.

► To supply additional devices, connect the cable for the outgoing supply voltage to socket X32.

Damage to the electronics

The current rating of the M12 connectors is 12 A per contact.
Make sure that this value is not exceeded. Please note that the connection for the outgoing supply voltage is not monitored for overload. If the permissible current rating is exceeded, this may result in damage to the connectors.

12.3 Power supply U_A

The voltage supply U_A is only required for the supply of the IO-Link actuators. IO-Link port in the operating mode DO is supplied via U_S.

Damage to the electronics

Power supplies U_S and U_A should only be supplied with SELV.

13 Features

The device is designed for use within a Profibus network. It enables the operation of up to eight IO-Link sensors/actuators and is also used to acquire digital signals.

13.1 Profibus features

- Connection to Profibus DP using M12 connectors (B-coded)
- DP/V1 for Class 1 and Class 2 masters
- Data transmission speed of 9.6 Kbits/s up to 12 Mbits/s (automatic detection)
- Rotary encoding switches for setting the PROFIBUS address
- Supported Profibus addresses 0 to 126
- Profibus features
  - Sync mode, freeze mode, I&M functions
- Device description using GSD file

13.2 IO-Link features

- Connection of eight IO-Link devices
  - 4 type A ports with an additional digital input
  - 4 type B ports with an additional voltage supply
- Connection of IO-Link ports using M12 connectors (A-coded, 5 poles)
- Parameter data storage on the master
- Parameterisable process data
- Supporting the IOL_CALL function module
- IO-Link specification v1.1

13.3 General features

- Diagnostic and status indicators

- Short-circuit and overload protection of the sensor supply
- Protection rating IP 65/67

14 Technical data

General data	
Housing material	Pocan
Weight [kg]	0.48
Ambient temperature (operation) [°C]	-25 ...60
Ambient temperature (storage/transport) [°C]	-25...85
Permissible humidity (operation) [%]	5...95
Air pressure (operation) [kPa]	70...106 kPa (up to 3000 m above sea level)
Air pressure (storage/transport) [kPa]	70...106 kPa (up to 3000 m above sea level)
Protection rating	IP 65 / IP 67
Protection class	III, IEC 61140, EN 61140, VDE 0140-1
Connection data	
Connection type	M12 connector
Profibus DP interface	
Number	2
Connection type	M12 connectors, B-coded
Designation connection point	copper cable
Number of poles	5
Transmission speed	9.6 Kbits/s...12 Mbits/s (automatic baud rate detection)
Transmission physics	Profibus DP-compliant copper cable
Profibus DP	
Equipment type	Profibus slave
Profibus protocols	DP V1
Supply of the module electronics and sensors	
Connection type	M12 connector (T-coded)
Number of poles	4
Designation	U_S
Supply voltage [V]	24 DC
Nominal supply voltage range [V]	18...31.2 V DC (including all tolerances, including ripple)
Typical current consumption [mA]	170 mA ±15 % (at 24 V DC)

Maximum current consumption [A]	12
Supply of the actuators	
Connection type	M12 connector (T-coded)
Number of poles	4
Designation	U_A
Supply voltage [V]	24 DC
Nominal supply voltage range [V]	19...31.2 V DC (including all tolerances, including ripple)
Typical current consumption [mA]	30 mA ± 15 % (at 24 V DC)
Max. current consumption [A]	12
Supply of the IO-Link ports	
Peripheral supply voltage [V]	24 DC
Nominal current for every IO-Link port [mA]	200
Nominal current for each device [A]	1.6
Overload protection	electronic
Permissible conductor length to the sensor [m]	< 20
IO-Link ports in the digital input mode (DI)	
Number of inputs	max. 8 (EN 61131-2 type 1)
Connection type	M12 connector, X01 ... X04 double occupancy
Connection technology	2, 3-wire
Nominal input voltage [V]	24 DC
Nominal input current [mA]	typ. 3
Sensor current [mA]	max. 200 for each channel from L+/L-
Total current consumption [mA]	max. 1.6 from L+/L-
Input voltage range "0" signal [V]	-3...5 DC
Input voltage range "1" signal [V]	15...30 DC
Input filter time [µs]	< 1000
Overload protection, short-circuit protection of sensor supply	electronic
IO-Link ports in the digital output mode (DO)	
Maximum number of outputs	8
Connection type	M12 connector, X01 ... X04 double occupancy
Connection method	2, 3-wire
Nominal output voltage [V]	24 DC
Output current for each channel [mA]	200
Output current for each device [A]	1.6
Nominal load, ohmic [W]	12 (48 Ω; with nominal voltage)

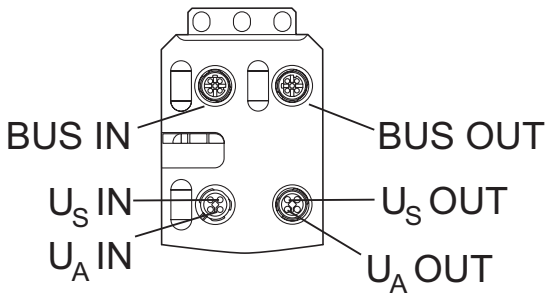
Nominal load, inductive [VA]	12 (1.2 H; 12 Ω; with nominal voltage
Signal delay [µs]	max. 150 (at power on)
Signal delay [µs]	max. 200 (at power off)
Switching frequency	max. 5500 / s (with load current)
Switching frequency	max. 1 / s (with inductive load)
Limitation of the voltage induced on circuit interruption [V]	-15 DC
Max. output voltage when switched off [V]	1
Max. output current when switched off [µA]	300
Behaviour with overload	switched off with auto restart
Overload protection, short-circuit protection of the outputs	electronic
Permissible conductor length to the sensor [m]	< 20
Digital inputs on pin 2 with type A ports	
Number of inputs	4 (EN 61131-2 Typ1)
Connection type	M12 connector, X01 ... X04 double occupancy
Connection technology	2, 3-wire
Nominal input voltage [V]	24 DC
Nominal input current [mA]	typ. 3
Sensor current [mA]	max. 200 for each channel form L+/L-
Total current consumption [mA]	max. 1.6 from L+/L-
Input voltage range "0" signal [V]	-3...5 DC
Input voltage range "1" signal [V]	15...30 DC
Input filter time [µs]	< 1000
Overload protection, short-circuit protection of the outputs	electronic
Configuration data	
ID number	0E57
Input address area	min. 2 bytes 162 bytes (depending on configuration)
Output address area	min. 2 bytes 162 bytes (depending on configuration)
Electrical isolation/isolation of the voltage areas **Test section**	**Test voltage**
24 V supply (communications power and sensor supply, IO-Link ports)/bus connection	500 AC, 50 Hz, 1 min
24 V supply (communications power and sensor supply, IO-Link ports)/FE	500 AC, 50 Hz, 1 min

Bus connection / FE	500 AC, 50 Hz, 1 min
24 V supply (actuator supply)/ 24 V supply (communications power and sensor supply, IO-Link ports)	500 AC, 50 Hz, 1 min
24 V supply (actuator supply)/bus connection	500 AC, 50 Hz, 1 min
24 V supply (actuator supply)/FE	500 AC, 50 Hz, 1 min
Mechanical tests	
Vibration resistance in accordance with EN 60068-2-6/IEC 60068-2-6 [g]	5
Shock in accordance with EN 60068-2-27/IEC 60068-2-27 [g]	30, 11 ms period, half-sine shock pulse
Continuous shock according to EN 60068-2-27/IEC 60068-2-27 [g]	10
Conformance with EMC Directive 2004/108/EC	
Noise immunity test in accordance with EN 61000-6-2	
Electrostatic discharge (ESD) EN 61000-4-2/IEC 61000-4-2	criterion B; 6 kV contact discharge; 8 kV air discharge
Electromagnetic fields EN 61000-4-3/IEC 61000-4-3	criterion A; field intensity: 10 V/m
Fast transients (burst) EN 61000-4-4/IEC 61000-4-4	criterion B, 2 kV
Transient surge voltage (surge) EN 61000-4-5/IEC 61000-4-5	criterion B; DC supply lines: ±0.5 kV / ±0.5 kV (symmetrical/ asymmetrical)
Conducted interference EN 61000-4-6/IEC 61000-4-6	criterion A; test voltage 10 V
Noise emission test as per EN 61000-6-4	
Radio interference properties EN 55022	Class A
Approvals	see www.ifm.com

UK

15 Connections

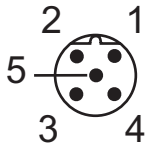
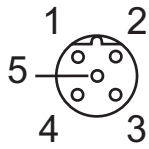
15.1 Profibus and power supply connection



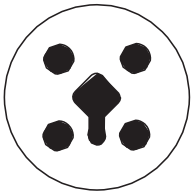
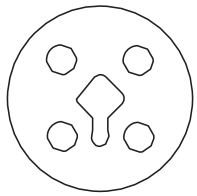
BUS IN (X21): PROFIBUS IN
BUS OUT (X22): PROFIBUS OUT
U_S IN (X31): Power supply IN (logic and sensors)
U_A IN (X31): Power supply IN (io_link actuators)
U_S OUT (X32): Power supply OUT for additional devices
U_A OUT (X32): Power supply OUT for additional devices

► Implement the FE connection using mounting screws.

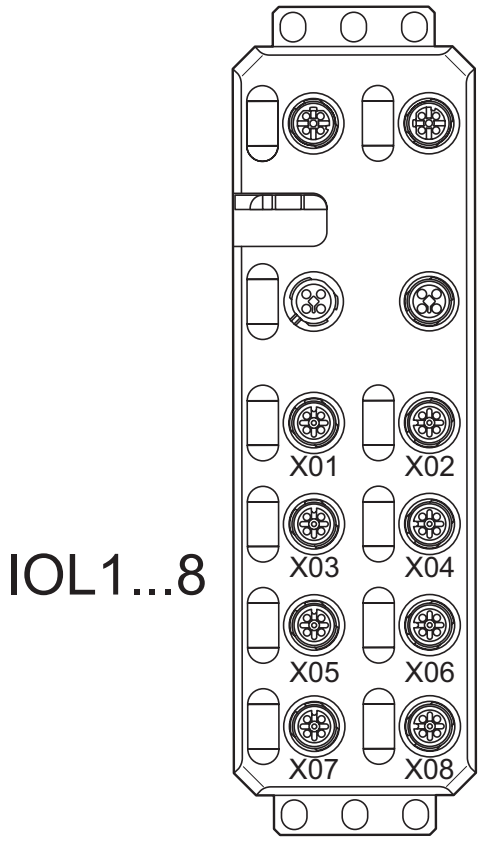
15.2 Profibus pin assignment

<table>
<tr><td colspan="2"> 
</td><td colspan="2"> 
</td></tr>
<tr><td colspan="2">M12 connector for the in-coming bus line</td><td colspan="2">M12 connector for the outgoing bus line</td></tr>
<tr><td>Pin</td><td>Signal</td><td>Specification</td><td>Description</td></tr>
<tr><td>1</td><td>VP</td><td>V</td><td>5 V termination resistor</td></tr>
<tr><td>2</td><td>RxD / TxD-N (A)</td><td>A, RS-485, PD</td><td>Inverted bus cable</td></tr>
<tr><td>3</td><td>DGND</td><td>V</td><td>0 V</td></tr>
<tr><td>4</td><td>RxD / TxD-P (B)</td><td>B, RS-485, PU</td><td>Non-inverted bus cable</td></tr>
<tr><td>5</td><td>not used</td><td>-</td><td>-</td></tr>
<tr><td colspan="4">A = A cable / B = B cable / RS-485 = RS-485 level, bidirectional / V = Voltage supply /
PU =Pullup / PD = Pulldown</td></tr>
<tr><td colspan="4">The shield is connected to FE in the device. The thread is used for additional shielding.</td></tr>
</table>

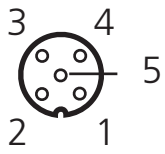
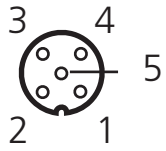
15.3 Pin connection voltage supply U_S/U_A

<table>
<tr><td>  </td><td>IN X31
1: + 24 V DC (U_S) brown
2: GND (U_A) white
3: GND (U_S) blue
4: + 24 V DC (U_A) black</td><td>  </td><td>OUT X32
1: + 24 V DC (U_S) brown
2: GND (U_A) white
3: GND (U_S) blue
4: + 24 V DC (U_A) black</td></tr>
<tr><td colspan="4">Pin assignment of the power supply, T-coded</td></tr>
</table>

15.4 Connecting IO-Link ports and inputs



IO-Link 1...8 (X01...X08): IO-Link ports 1...8
DI1...DI4 (X01...X04): Inputs 1...4

	IO-Link A ports (X01...X04) 1: 24 V DC (L+) 2: DI 3: GND (L-) 4: C/Q IO-Link data transfer channel 5: not used		IO-Link B ports (X05...X08) 1: 24 V DC (L+) 2: 24 V DC (U_A) 3: GND (L-) 4: C/Q IO-Link data transfer channel 5: GND (U_A)

Port class A (type A)

The IO-Link port according to type A is assigned an additional hardwired DI (digital in- put) at pin 2.

Port class B (type B)

The IO-Link port according to type B has an additional supply voltage via pins 2 and 5. This port is suitable for connecting devices that have a higher current consumption.

Operating modes

The C/Q cable (pin 4) can be configured independently of the other pins. The IO-Link ports can be operated in the following operating modes:

– DI (behaves like a digital input supplied via U_S)
– DO (behaves like a digital output supplied via U_S)
– IO-Link (IOL sensor supplied via US / IOL actuator supplied via U_S and U_A)

15.5 Connection notes

Implement the FE connection using mounting screws, in order to ensure immunity to interference.

To ensure IP 65/IP 67 protection, cover unused sockets with protective caps.

Only supply the IO-Link master and the IO-Link devices with the voltage U_S und U_A provided at the terminal points.

Observe the correct polarity of the supply voltages US and UA in order to prevent damage to the device.

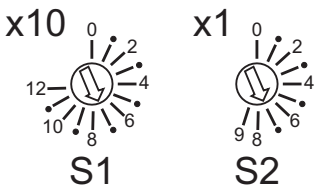
When connecting the sensors and actuators, observe the assignment of the connections.

Secure the device to a level surface or to a profile. Do not use this device to bridge gaps, in order to prevent forces being transmitted via the device.

Use standard M5 screws with toothed lock washer and self-locking nuts. Observe the maximum torque of the screws.

16 Configuration via rotary encoding switch

You can configure the address assignment and other functions using rotary encoding switches.



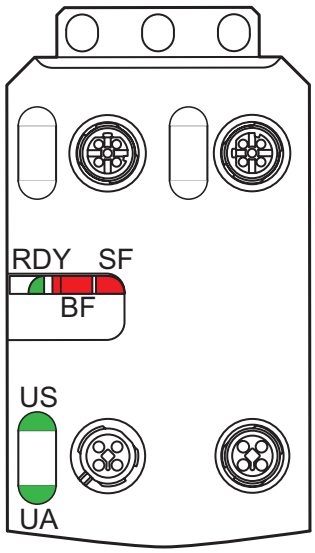
S1 (x10)	S2 (x1)

▶ After modifying the switch position, restart the device. A modification to the switch position does not take effect during operation.

S1	S2	Code	Function
0	0	00	Reserved
0 ... 12	1 ... 5	01 ... 125	Manual address assignment
12	6	126	Setting the slave address (set slave address command)
12	7	127	Reserved
12	8	128	Reserved
12	9	129	Reserved

17 Local status and diagnostic indicators

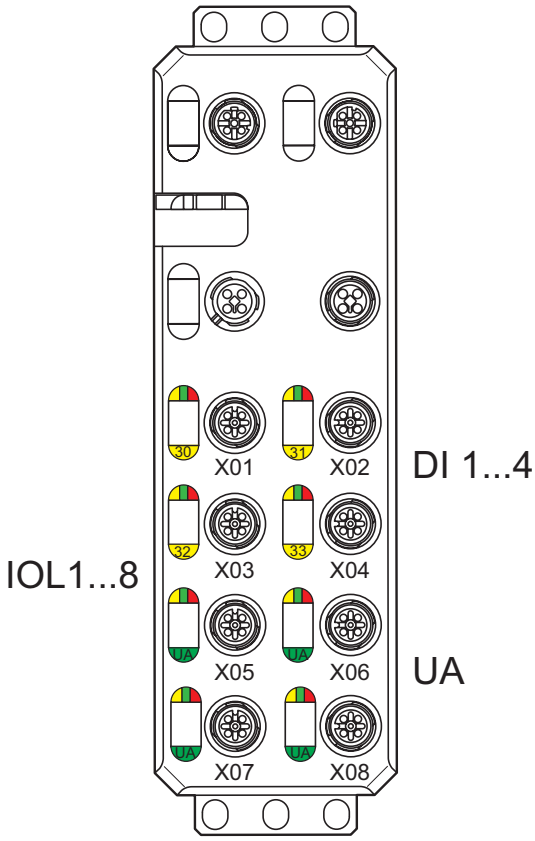
17.1 Indicators for bus and power supply



Designation	Colour	Meaning	State	Description
RDY	Green / yellow / red	Ready	Green ON	Device ready to operate
			Yellow flashing	Firmware update is being performed
			Green / yellow flashing	Overvoltage or undervoltage at U_S Temperature of the device is in the critical area. Failure of the actuator supply U_A and red U_S LED: sensor supply overload
			Red ON	Rotary encoding switches are set to an invalid/reserved position
			Red OUT	Device is not ready for operation
BF	Red	Bus fault	Red ON	No communication on Profibus Device is starting up No baud rate detected by device
			Red flashing	Device has not been configured by the master Device configuration does not match Invalid parameter data received from the master Invalid bus address The device is in the clear or stop state
			Red OUT	No error

Designation	Colour	Meaning	State	Description
SF	Red	Group error	Red ON	Device-specific diagnostics present, e.g., short circuit at the periphery. Hardware is faulty Device data or parameter data do not match
			Red OUT	No error
US	Green / red	$U_{sensors}$	Green ON	Communications power/sensor voltage sufficient
			Green OFF	Communications power/sensor voltage not present or too low
			Red ON	Sensor voltage overload
UA	Green	$U_{Actuators}$	Green ON	Actuator voltage present
			Green OFF	Actuator voltage not present

17.2 Displaying the IO-Link port and inputs



Designation	Colour	Meaning	State	Description
IO-Link LED	Green / yellow / red	Status of the IO-Link ports (X01 ... X08)	Green ON	In IO-Link mode IO-Link communication present
			Green flashing	In IO-Link mode no IO-Link communication
			Yellow ON	In the DI or DO operating mode: the digital input or output is set
			Red ON	In IO-Link mode IO-Link communication error
			Red ON	In IO-Link mode overload of the L+/L- cable
			Red ON	In DI or DO mode overload of the L+/L- cable
			Red ON	Overload of the C/Q cable
			Red OUT	In the DI or DO operating mode: the digital input or output is not set
30 ... 33	Yellow	Status of the digital inputs	Yellow ON	Input is set
			Yellow OFF	Input is not set.
U_A	Green / red	Actuator supply for X05 ... X08	Green ON	Actuator voltage present
			Green OFF	Actuator voltage not present
			Red ON	Short circuit between pin 2 and pin 5

The numbering of the LEDs is as follows:
the first number specifies the byte, the second number specifies the bit.

18 Profibus data model

The unit has a modular design. The "Status/control module" is always located in slot 1, with 4 bytes of IN and OUT process data respectively. In slots 2 to 9, the operating mode as well as the process data length can be configured for the respective IO-Link port.

18.1 Status/control module

IN process data

Byte	Byte 0	Byte 1	Byte 2	Byte 3	
Bit	0...7	8...15	16...23	24...27	28...31
Function	Port status (COM Status)	PD VALID state	DI state on pin 4 (C/Q)	DI state on pin 2	Reserved
Connection	X01...X08	X01...X08	X01...X08	X01...X04	-
Pin	4	4	4	2	-
Port	1...8	1...8	1...8	1...4	-

The port state indicates whether the corresponding port has established communication with the IO-Link device.

The PD valid state indicates whether the IO-Link process data of the corresponding port is valid.

The DI state on pin 4 indicates the state of the corresponding IO-Link port in the DI operating mode.

The DI state on pin 2 indicates the state of the hardwired digital inputs on pin 2.

OUT process data

Byte	Byte 0	Byte 1	Byte 2	Byte 3
Bit	0...7	8...15	16...23	24...31
Function	Port status (COM Status)	Reserved	DO state on pin 4 (C/Q)	Reserved
Connection	X01...X08	-	X01...X08	-
Pin	4	-	4	-
Port	1...8	-	1...8	-

Byte 0 (COM control) can be used to temporarily (as long as the corresponding COM control bit is set) switch one or more IO-Link ports that were previously configured in digital input mode (DI) to IO-Link mode. Cyclic and acyclic communication can therefore be established with the connected IO-Link device.

DO state on pin 4 (C/Q)
The digital output on the corresponding port can be controlled via the process data. The I/O-Link port must be set beforehand to function in the DO operating mode.

Start-up parameters

The status/control module in slot 1 contains the following startup parameters, which refer to the runtime behaviour of the entire device.

Parameter	Possible values	Description
Port synchronisation		
Port synchronisation	0 = free (def)	Synchronisation of the port running in the IO-Link mode
Diagnostic settings		
Channel-related diagnostics	0 = deactivated 1 = activated (def)	The channel-related diagnostics can be deactivated/activated.
Status messages	0 = deactivated 1 = activated (def)	The status feedback can be deactivated.
IO-Link master status diagnostics	0 = deactivated 1 = activated (def)	The diagnostics of the IO-Link master can be deactivated / activated
Diagnostics IOLD port 1 ... Diagnostics IOLD port 8	0 = deactivated 1 = activated (def)	For each IO-Link port, the IO-Link diagnostics can be separately deactivated/activated. If activated, then the IO-Link events of the IO- Link device can be acknowledged on the respective port and can be mapped to the Profibus diagnostics. If deactivated, then the events are only acknowledged.
Substitute values		
Failsafe behaviour DO (pin 4)	0 = clear all (def) 1 = set all 2 = hold last value 3 = switch replacement value	Substitute value behaviour for the IO-Link ports in DO mode (pin 4)'.
Failsafe pattern DO (pin 4)	0 = zero (def) Possible values: 0 … 255_{dec}	Specification of a replacement value sample for the IO-Link ports in the DO operating mode (pin 4). In order to use this parameter, the value "Replacement values" must be set beforehand in the "Behavior in the event of error for state/ control module" parameter.
Failsafe behaviour port 1 ... Failsafe behaviour port 8	0 = clear all 1 = set all 2 = hold last value 4 = IO-Link master command (def)	Substitute behaviour for the OUT process data of the IO-Link port in the IO-Link operating mode. The "IO-Link master command" option enables the use of IO-Link-specific mechanisms for valid/ invalid OUT process data.

(def = default)

18.2 Flexible module configuration

Up to 8 further modules can be flexibly configured in slots 2 to 9, whereby each of these represents a physical IO-Link port. The basic operating mode of the IO-Link port, as well as the process data length, is determined when selecting the module.

Operating mode and process data of the IO-Link port

The possible submodules are shown below.

Submodule	Process data length in bytes		Description/start-up parameters
	Input	Output	
Deactivated	0	0	Port mode (operating mode): deactivated In this operating mode the sensor supply voltage is switched off
Digital input	0*	0	Port mode (operating mode): digital input * The process data is located in the status/ control module
Digital output	0	0*	Port mode (operating mode): digital output * The process data is located in the status/ control module
Digital input with IO-Link	0*	0	Port mode (operating mode): Digital input with IO-Link Identification level (device check) – Vendor ID (2 bytes) – Device ID (3 bytes) – Data storage 0 = Disabled 1 = Download only 2 = Upload only 3 = Download and upload 4 = Disabled and cleared * The process data is located in the status/control module.

Submodule	Process data length in bytes		Description/start-up parameters
	Input	Output	
IOL_I_nByte (+DevPrm*) ... IOL_O_nByte (+DevPrm*) … IOL_I/O_n/nByte (+DevPrm*) Key: I = Input O = Output n = Number of bytes *+DevPrm = Device parameter	1...32	1...32	Port mode (operating mode): IO-Link Identification level (device check): – Vendor ID (2 bytes) – Device ID (3 bytes) Data storage: 0 = Disabled 1 = Download only 2 = Upload only 3 = Download and upload 4 = Disabled and cleared *Device parameter (DPP2): If such a submodule is selected, then the device parameter - DPP2 (byte 10_{hex} ... $1F_{hex}$) can be parameterised for the port during startup. If the IO-Link process data length of the device is not available in the submodules, then select the next largest constellation.

Start-up parameters

There is the option of carrying out start-up parameterization for the IO-Link submodules. The following parameters can be set:

Parameter	Possible values	Description
Operating mode		
Port mode	Deactivated	In this operating mode the sensor supply voltage is switched off.
	Digital input	In this operating mode the IO-Link port functions as a standard digital input.
	Digital output	In this operating mode the IO-Link port functions as a standard digital output.
	Digital input with IO-Link	The operating mode can be used if an IO-Link device is to be acquired as quickly as possible. The device can be parameterised via IO-Link (C/Q state is IO-Link). After parameterisation, the IO-Link master switches the C/Q cable to the DI mode (C/Q state is DI). The switching state of the device is now acquired as a digital signal rather than via IO-Link communication.
	IO-Link	Use this operating mode to communicate with IO-Link sensors and actuators.
Device check (identification level)		
Vendor ID	0000_{hex} ... $FFFF_{hex}$	Vendor ID, identification level 1 The vendor ID of the connected IO-Link device for the respective port can be parameterised via this. The vendor ID can be found in the data sheet of the IO-Link device.
Device ID	000000_{hex} ... $FFFFFF_{hex}$	Device ID, identification level 2 The device ID of the connected IO-Link device for the respective port can be parameterised via this. The device ID can be found in the data sheet of the IO-Link device. To check the device ID, a vendor ID check must be carried out beforehand.

As soon as the content of the vendor ID and/or device ID is not equal to "0", the IO-Link "Type Compatible" inspection level is activated. It is only if the vendor ID parameterised as well as the device ID correspond to the information read out (in the device) that communication to the device is established (COM state bit of the corresponding port = 1). Otherwise this is rejected (IO-Link LED is red).

Data storage		
Data storage	Deactivated	The data storage mechanism is deactivated.
	Download only	The parameter data is sent to the device from the IO-Link master. In the event of an inconsistency between the parameter data of the IO-Link device and the master, the data from the IO-Link master is taken as the default. As such it is possible to exchange the IO-Link device.
	Upload only	The parameter data is sent from the IO-Link device to the master. In the event of an inconsistency between the parameter data of the IO-Link device and the master, the data from the device is taken as the default. That means that it is possible to exchange the IO-Link master.
	Download and upload	The parameter data is saved in both the IO-Link master as well as the device. In the event of an inconsistency between the parameter data of the IO-Link de-vice or the master, the data from both is used as the default. That means that it is possible to exchange the IO-Link device or the IO-Link master.
	Disabled and cleared	The data storage mechanism is deactivated and the master deletes all stored parameters for the respective port.
The data storage mechanism is only supported by the IO-Link specification v1.1. Both the IO-Link master and device must support at least IO-Link v1.1.		
Device parameters		
Device parameters	$00_{hex}...FF_{hex}$	The device parameter page 2 describes the area between the IO-Link objects $10_{hex}…1F_{hex}$. This relates to the manufacturer-specific area of the IO-Link device data. This is optionally made available by IO-Link devices and can be read as well as written by the master.

18.3 Parameter telegram

This section provides a detailed description of the format of the device parameters. This may be useful when setting parameters using acyclic services or if there is no user interface for the simple selection of parameters.

Byte	Meaning
1 … 7	DP standard
8 … 10	DP/V1 standard
11 ... 28	Module parameter of the status/control module
29 … 237	Module parameters of the IO-Link ports The set-up depends on the type and sequence of the submodules inserted.

Module parameter

Module parameter "status/control"			
Byte	**Meaning**	**Contents**	
11	Port synchronisation	Bit 0	Free (ongoing) 0 = deactivated; 1 = activated
		Other	Reserved
12	General diagnostic settings	Bit 0	Channel-related diagnostics 0 = deactivated 1 = activated
		Bit 1	Status messages 0 = deactivated 1 = activated
		Bit 2	IO-Link master status diagnostics 0 = deactivated 1 = activated
		Other	Reserved
13	Port specific diagnostic settings	Bit 0	IO-Link device diagnostics port 1 0 = deactivated 1 = activated
		...	...
		Bit 7	IO-Link device diagnostics port 8 0 = deactivated 1 = activated
14	Reserved		
15	Substitute value behaviour for the IO-Link ports in DO mode (pin 4)	00_{hex}	Clear all
		01_{hex}	Set all
		02_{hex}	Hold last value
		03_{hex}	Switch replacement value
16...17	Reserved		
18	Specification of a replacement value sample for the IO-Link ports in the DO operating mode (pin 4)	00_{hex}...FF_{hex}	In order to use this parameter, the value "Replacement values" must be set beforehand in the "Behavior in the event of error for status/control module" parameter.

Module parameter "status/control"			
19	Reserved		
20	IO-Link port 1 Substitute value behaviour for the IO-Link port in the IO-Link operating mode.	00_{hex}	Clear all
		01_{hex}	Set all
		02_{hex}	Hold last value
		03_{hex}	Reserved
		04_{hex}	IO-Link master command
21...27	IO-Link port 2 ... 8	Structure as per byte 20	
28	Reserved		
Module parameter port 1 (example: generic I/O modules + DevParameter" = 23 Prm bytes)			
Byte	**Meaning**	**Contents**	
29	Port 1: operating mode (port mode)	00_{hex}	Deactivated
		01_{hex}	Digital IN
		02_{hex}	Digital OUT
		03_{hex}	DI with IO-Link
		04_{hex}	IO-Link
30	IO-Link port 1: Vendor ID	$00_{hex}...FF_{hex}$	Vendor ID (most significant bit)
31	IO-Link port 1: Vendor ID	$00_{hex}...FF_{hex}$	Vendor ID (least significant bit)
32	IO-Link port 1: Device ID	$00_{hex}...FF_{hex}$	Device ID (most significant bit)
33	IO-Link port 1: Device ID	$00_{hex}...FF_{hex}$	Device ID
34	IO-Link port 1: Device ID	$00_{hex}...FF_{hex}$	Device ID (least significant bit)
35	Port 1: Data storage	00_{hex}	Deactivated
		01_{hex}	Download only
		02_{hex}	Upload only
		03_{hex}	Download and upload
		04_{hex}	Disabled and cleared
36 ... 49	IOLD parameter (direct parameter)	$00_{hex}...FF_{hex}$	Device-specific
Module parameter port 2 (example: DI with IO-Link = 1 PrmByte			
Byte	**Meaning**	**Contents**	
50	Port 2: operating mode (port mode)	00_{hex}	Deactivated
		01_{hex}	Digital IN
		02_{hex}	Digital OUT
		03_{hex}	DI with IO-Link
		04_{hex}	IO-Link

Module parameter port 3 (example: AXL E IOL AI1 I M12 R = 9 PrmByte			
Byte	**Meaning**	**Contents**	
51	Port 3: operating mode (port mode)	00_{hex}	Deactivated
		01_{hex}	Digital IN
		02_{hex}	Digital OUT
		03_{hex}	DI with IO-Link
		04_{hex}	IO-Link
52	IO-Link port 3: Vendor ID	00_{hex}	Vendor ID (most significant bit)
53	IO-Link port 3: Vendor ID	$b0_{hex}$	Vendor ID (least significant bit)
54	IO-Link port 3: Device ID	01_{hex}	Device ID (most significant bit)
55	IO-Link port 3: Device ID	00_{hex}	Device ID
56	IO-Link port 3: Device ID	0x14	Device ID (least significant bit)
57	Port 3: Data storage	00_{hex}	Deactivated
		01_{hex}	Download only
		02_{hex}	Upload only
		03_{hex}	Download and upload
		04_{hex}	Disabled and cleared
58...59	Converter parameter	$00_{hex}...FF_{hex}$	Converter-specific
Module parameter port 3 ... port 8			
Byte	**Meaning**	**Contents**	
60... 237	The rest of the structure depends on the type and sequence of the other submodules inserted.		

The precise meaning of the individual parameters can be found in the sections "Status/control module ⟶ startup parameters" and "Flexible module configuration ⟶ startup parameters".

19 I&M functions

The Profibus device supports Identification- & Maintenance functions (I&M). Reading out the I&M data is possible via DP V1 Class 1 and Class 2.

The general Identification & Maintenance functions 0 to 4 can be read out via slot 0. The IO-Link-specific Identification & Maintenance functions 0, 16 ... 23 and 99 can be read out via slot 1.

Slot 0 and slot 1 have their own respective I&M function (I&M 0).

I&M 0 (slot 0)

I&M data	Access / data type	Default settings
MANUFACTURER_ID	Read / 2 bytes	$B0_{hex}$
ORDER_ID	Read / 20 bytes	2701503
SERIAL_Number	Read / 16 bytes	Defined in the product process
HARDWARE_Revision	Read / 2 bytes	Corresponds to the hardware version of the device
SOFTWARE_Revision	Read / 4 bytes	Corresponds to the firmware version of the device
REVISION_Counter	Read / 2 bytes	0000_{hex} (reserved)
PROFILE_ID	Read / 2 bytes	$F600_{hex}$ (generic device)
PROFILE_SPECIFIC_TYPE	Read / 2 bytes	0003_{hex} (I/O modules)
IM_VERSION	Read / 2 bytes	0101_{hex} (version 1.1)
IM_SUPPORTED	Read / 2 bytes	$001E_{hex}$ (I&M 1...4)

I&M 1 (slot 0)

I&M data	Access / data type	Default settings
TAG_FUNCTION	Read/write / 32 bytes	"20_{hex}" (empty)
TAG_LOCATION	Read/write / 22 bytes	"20_{hex}" (empty)

I&M 2 (slot 0)

I&M data	Access / data type	Default settings
INSTALLATION_DATE	Read/write / 16 bytes	"20_{hex}" (empty)
RESERVED	Read/write / 38 bytes	00_{hex}

I&M 3 (slot 0)

I&M data	Access / data type	Default settings
DESCRIPTOR	Read/write / 54 bytes	"20_{hex}" (empty)

I&M 4 (slot 0)

I&M data	Access / data type	Default settings
SIGNATURE	Read/write / 54 bytes	"20_{hex}" (empty)

I&M 0 (slot 1): IO-Link-specific

The I&M functions (I&M 0) of the IO-Link can be read out via slot 1. They are different from the I&M functions (I&M 0) of Slot 0 in PROFILE_ID / PROFILE_ SPECIFIC_TYPE and IM_SUPPORTED.

I&M data	Access / data type	Default settings
MANUFACTURER_ID	Read / 2 bytes	$B0_{hex}$
ORDER_ID	Read / 20 bytes	2701503
SERIAL_Number	Read / 16 bytes	Defined in the product process
HARDWARE_Revision	Read / 2 bytes	Corresponds to the hardware version of the device
SOFTWARE_Revision	Read / 4 bytes	Corresponds to the firmware version of the device
REVISION_Counter	Read / 2 bytes	0000_{hex} (reserved)
PROFILE_ID	Read / 2 bytes	$4E00_{hex}$ (IO-Link)
PROFILE_SPECIFIC_TYPE	Read / 2 bytes	0000_{hex}
IM_VERSION	Read / 2 bytes	0101_{hex} (version 1.1)
IM_SUPPORTED	Read / 2 bytes	0001_{hex} (profile-specific)

I&M 16 ... 23 (slot 1, subslot 1): IO-Link device directory

For each IO-Link, an individual Identification & Maintenance function is available in the area of I&M 16 (index $B000_{hex}$) bis I&M 23 (index $B007_{hex}$).

I&M data	Access / data type	Default settings
VENDOR_ID	Read / 2 bytes	Vendor ID from the connected IO-Link device. If no device is available, then 0000_{hex}.
DEVICE_ID	Read / 4 bytes	Device ID from the connected IO-Link device. The high-order byte is always equal to zero. If no device is available, then 000000_{hex}.
FUNCTION_ID	Read / 2 bytes	Function ID from the connected IO-Link device. If no device is available, then 0000_{hex}.
RESERVED	Read/10 bytes	Reserved

Access is only with read permission and exclusively via slot 1 (status/control module).

I&M 99 (slot 1): IO-Link master directory

In I&M 99 (index $B063_{hex}$), other relevant IO-Link master data is available.

I&M data	Access / data type	Default settings
IO-Link version	Read /1 byte	11hex (IO-Link revision, e.g. 11_{hex} for v1.1)
IO-Link profile version	Read /1 byte	10_{hex} (IO-Link profile version, e.g. 10_{hex} for v1.0)
IO-Link feature support	Read / 4 bytes	00000000_{hex}
Number of ports	Read /1 byte	08_{hex} (number of supported ports)
REF_ Port_Config	Read /1 byte	00_{hex} (not supported)
REF_ IO_Mapping	Read /1 byte	00_{hex} (not supported)
REF_ iPar_Directory	Read /1 byte	00_{hex} (not supported)
REF_IOL_M	Read /1 byte	00_{hex} (not supported)
Number of CAPs	Read /1 byte	01_{hex} (number of Client Access Points)
Index CAP1	Read / 2 bytes	255_{hex} (Client Access Point for IOL_CALL's)

20 Sync/freeze mode

The device supports sync and freeze mode.

The functions must be activated by the Profibus master in the parameter data. Input and output data is written or read at defined times with the sync and freeze commands.

If the device receives a sync command from the PROFIBUS master at any given time, the current OUT process data is transferred and frozen until the next sync command.

Similarly, the states of the inputs are transferred on the respective freeze command and are frozen until the next freeze command.

21 Diagnostic alarms

Profibus enables the device to store diagnostic information together with the error location and error type. In the default upon delivery the alarms are enabled, however, they can be disabled with parameters on startup.

An incoming alarm informs the Profibus device that diagnostic information has been entered. When the diagnostic information has been removed, an outgoing alarm is sent to the device.

If at least one piece of diagnostic information is stored, the SF LED is on. If no diagnostic information is present, the SF LED is off.

The following Profibus diagnostic messages are indicated by the Profibus device:

- Overtemperature of the device
- Overvoltage of U_S
- Overload of U_S
- Overvoltage of U_A
- Undervoltage of U_A
- Short circuit of U_A
- Short circuit of an output or output overload
- Cable break at IO-Link port n

22 IO-Link master

IO-Link is an internationally standardised I/O technology (IEC 61131-9) for communicating with sensors and actuators. An IO-Link master is integrated in the Profibus device. The IO-Link master establishes the connection between the IO-Link devices and the automation system.

The device supports the IO-Link specification v1.1 monitoring.
A process data watchdog is integrated into the device to avoid uncontrolled setting/resetting of outputs in the event of an error. If device outputs are set, the controlling process must be able to access the device.
In the event of an error, e.g., bus cable interrupted or function error in the controlling process, the device can respond appropriately via the process data watchdog.

When activating the process data watchdog, it is started by the first write process and the next write process is expected within the timeout period. During error-free operation, the write process is performed during the timeout period and the watchdog is restarted (triggered).

Reading calls do not trigger the process data watchdog.

If there is no triggering during the timeout period, an error occurred. Two responses follow:

– All outputs are set to the configured substitute value.
– The BF LED indicates the corresponding state.

23 Substitute value behaviour

If Profibus communication fails or if no valid process data is received from the Profibus master, all device outputs are set to the parameterized substitute values.

Please refer to the chapters → Status/control module → Startup parameters and Flexible module configuration → Startup parameters sections for the precise parameterisation of substitute values.

24 Setup as per STEP 7

24.1 Description of the setup of the device on a SIMATIC® S7 controller.

This document describes specific features associated with the setup of AL1010 on an S7 controller.

This document is intended for S7 specialists. It does not cover a complete project, just specific features associated with the use of the device.

It is assumed the user has knowledge of and experience in the operation of PCs and Windows operating systems, and knowledge of the Siemens SIMATIC software and Ethernet basics.

25 System requirements

25.1 Software

You are working with the software STEP 7 version 5.5, service pack 3 (version K5.5.3.0).

25.2 Hardware

Hardware requirements for the Siemens SIMATIC software:

Please refer to the S7 documentation for the hardware requirements.

26 Integrate ifm Profibus device in the S7 controller (STEP 7)

To integrate the device into the network, proceed as described in the manufacturer's documentation for your controller. This section only explains fundamental steps that are relevant for the connection with the device.

26.1 Creating/opening a project

► In the Siemens SIMATIC Manager, create a new project or open an existing project.

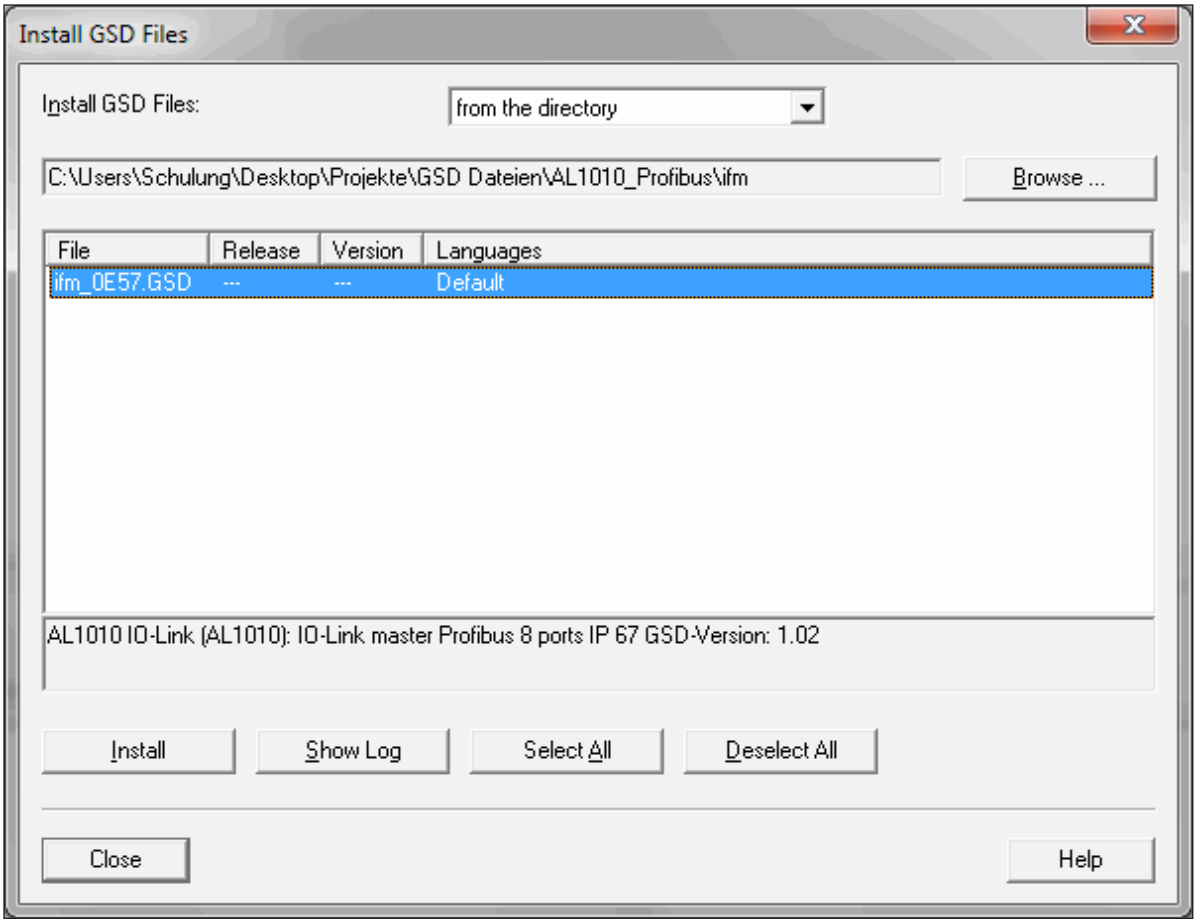
26.2 Install GSD Files

Make sure you use the latest GSD file. It is available on the internet at www.ifm.com.

Make sure that the name of the downloaded GSD file is the same as the name displayed in the Download area. If the file name differs after the download (e.g., after downloading with Mozilla Firefox), rename the file. Otherwise the file will not be recognised by STEP 7.

For the devices that appear in the STEP 7 device catalogue, the device description files (GSD) must be imported into STEP 7 first. The name of the GSD file for the relevant device can be found in the table.

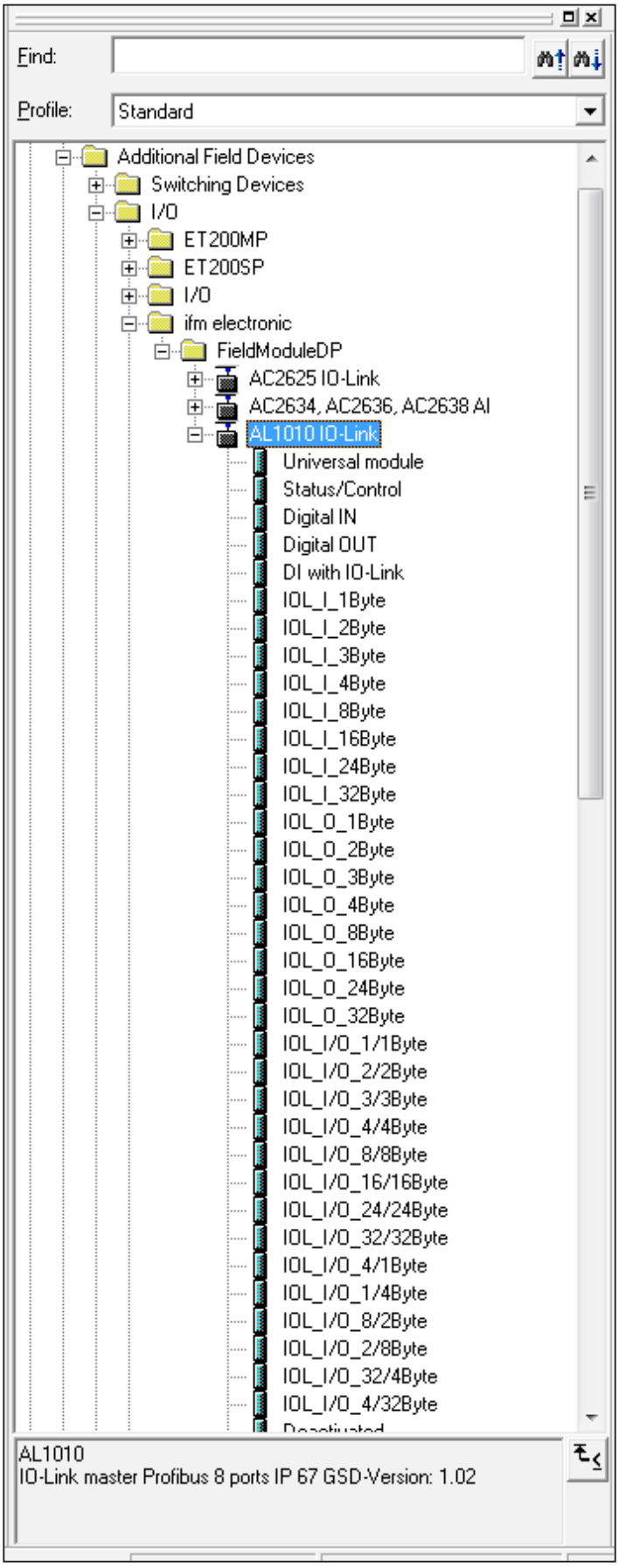
Open the [Install GSD Files] menu in [HW Config Options]. The following dialogue box appears:



- ► Under [Install GSD Files], select [from the directory].
- ► Change to the folder where the GSD file is located.
- ► Select the required GSD file.
- ► Select the file and click [Install].
- ► Click [Yes] to acknowledge the [Confirm GSD File] dialogue box.
- ► Click [Close] to exit the [Install GSD Files] dialogue box.

The device now appears in the hardware catalogue under

PROFINET IO → [Additional Field Devices] → [I/O] → [ifm electronic] → [FieldModule DP].



26.3 Inserting I/O devices in the hardware configurator

► Select the Profinet device in the hardware catalogue and move it to the Profbus network using drag & drop.

26.4 IO-Link devices

The IO-Link devices have a module in slot 1 in which nine slots are configured. Subslot 1 contains the status/control module which has 4 bytes of input data and 4 bytes of output data. These are shown in the IOLM_Status table (input) and IOLM_Control table (output).

IOLM_Status

Byte	Byte 0								Byte 1							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Port	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
Meaning	COM states								PD valid states							
Byte	Byte 2								Byte 3							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Port	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
Meaning	Digital input states of C/Q								UA states (pin 2)				Digital input states of DI (pin 2)			

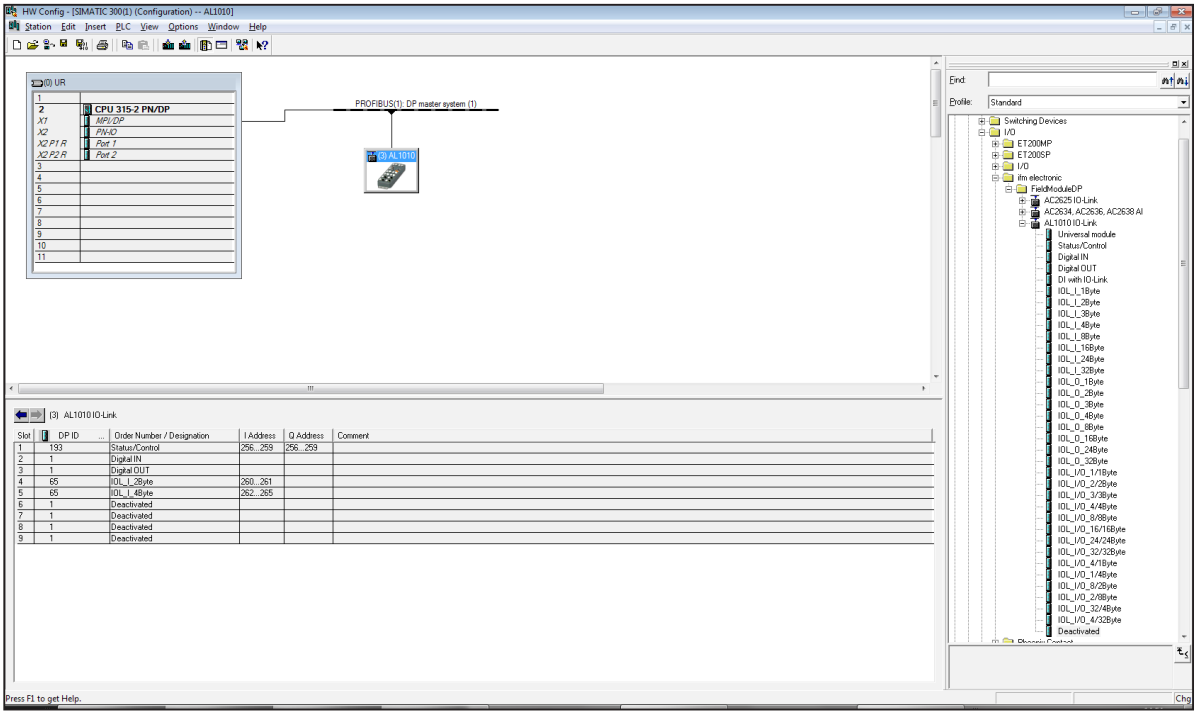
IOLM_Control

Byte	Byte 0								Byte 1							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Port	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
Meaning	COM Cntrl								Reserved							
Byte	Byte 2								Byte 3							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Port	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
Meaning	Digital output control of C/Q								Reserved							

The corresponding submodules (analogue converters, digital inputs/outputs, IO-Link sensors) can be configured in subslots 2 to 9 using drag and drop.

The other slots are configured as [Digital Input] by default. They must be removed if anything else needs to be configured.

The figure below shows an example configuration for the AL1010 device



26.5 Addressing

Profibus uses a station address in the range 0 to 126 to address the devices. It is set using the rotary switches on the module.

Values 0 to 125 directly assign the station address. Value 126 is reserved for the Set_Slave_Adr service. If no address has been set, the device responds with station address 126, otherwise it responds with the address set last (retentive).

The following steps must be carried out to set the station address:

► Click [Target System, PROFIBUS, Assign PROFIBUS Address] in [HW Config.].

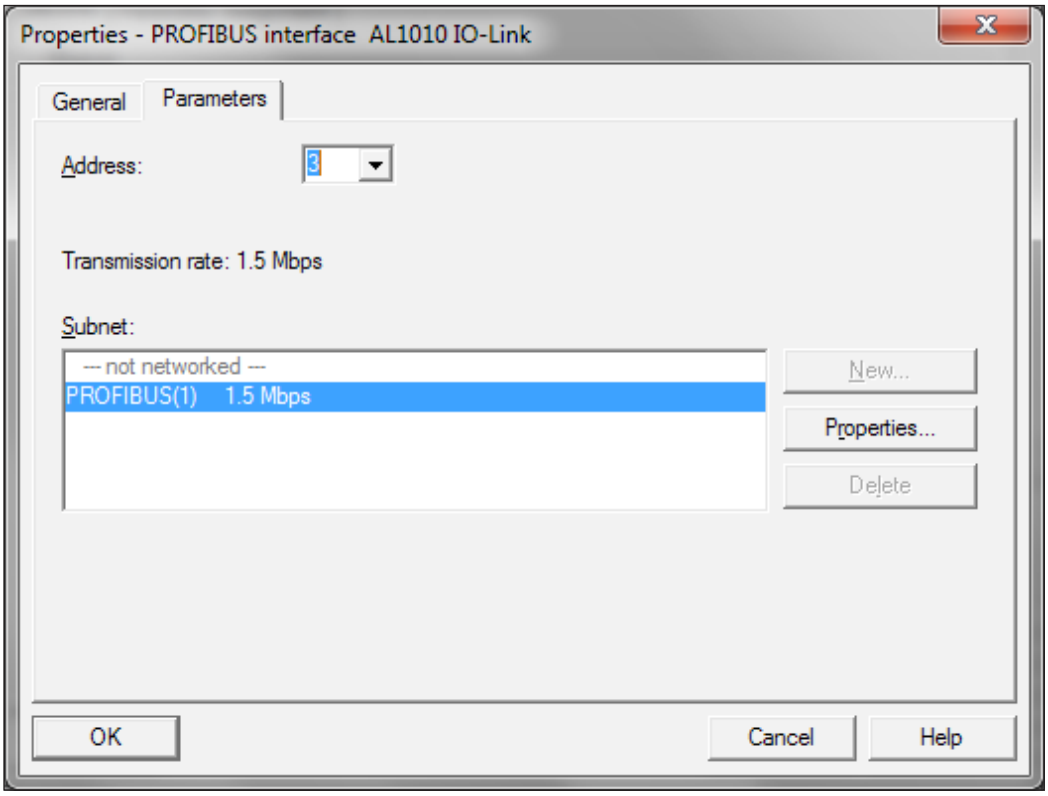
> The [Assign PROFIBUS Address] dialogue box opens.

► If no Profibus address has been assigned yet, set bus address 126 under [Current PROFIBUS Address].

► Set the desired bus address under [New PROFIBUS Address].

► Click [Apply] to assign the address.

► Exit the dialogue box by clicking [OK].



Access with the programming device (PG) to Profibus must be ensured for this. Otherwise the following error occurs:

Right now you have not made any Profibus interface parameter setting to the access point [S7 ONLINE].

► Call up [Set PG/PC Interface] to assign the Profibus interface parameter setting.

26.6 Identification and maintenance

The identification and maintenance (I&M) data records are split over several STEP 7 dialogue boxes. An online connection to the device is required to display the I&M data records.

The following steps must be carried out:
Switch the hardware manager to online view.

► Right-click on the module, then select [Module Information].

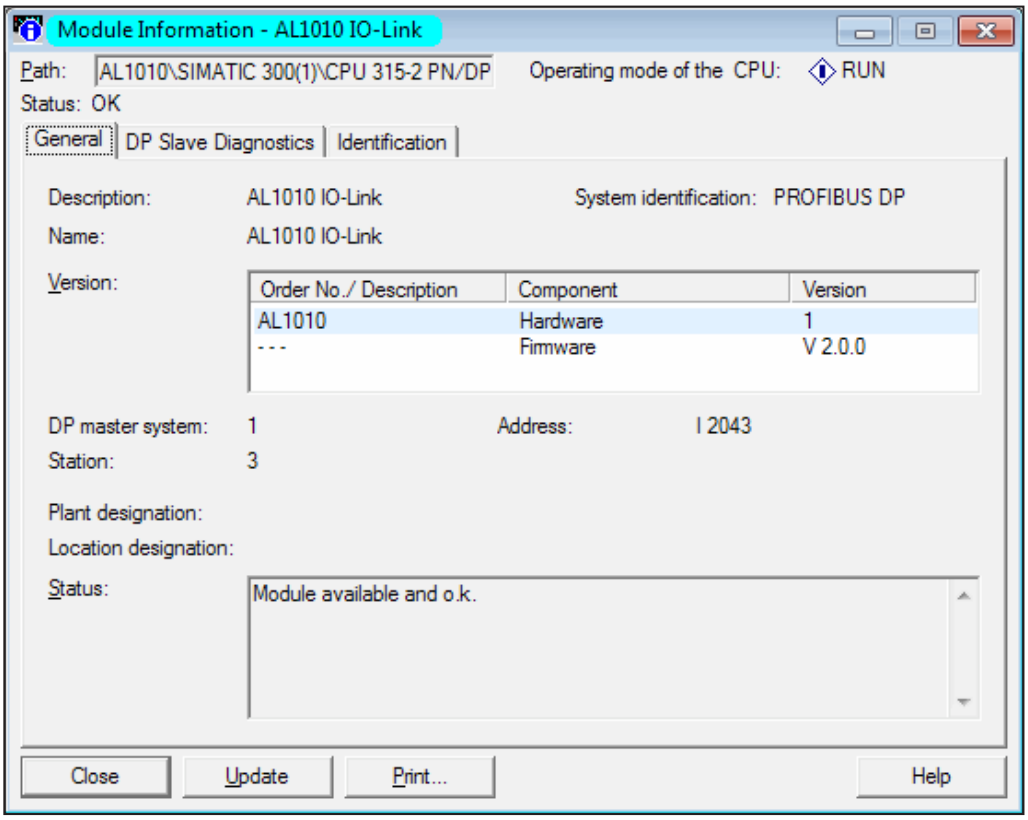
► In the [General] tab, the order number / description, hardware version and firmware version are listed in the [Version] area.

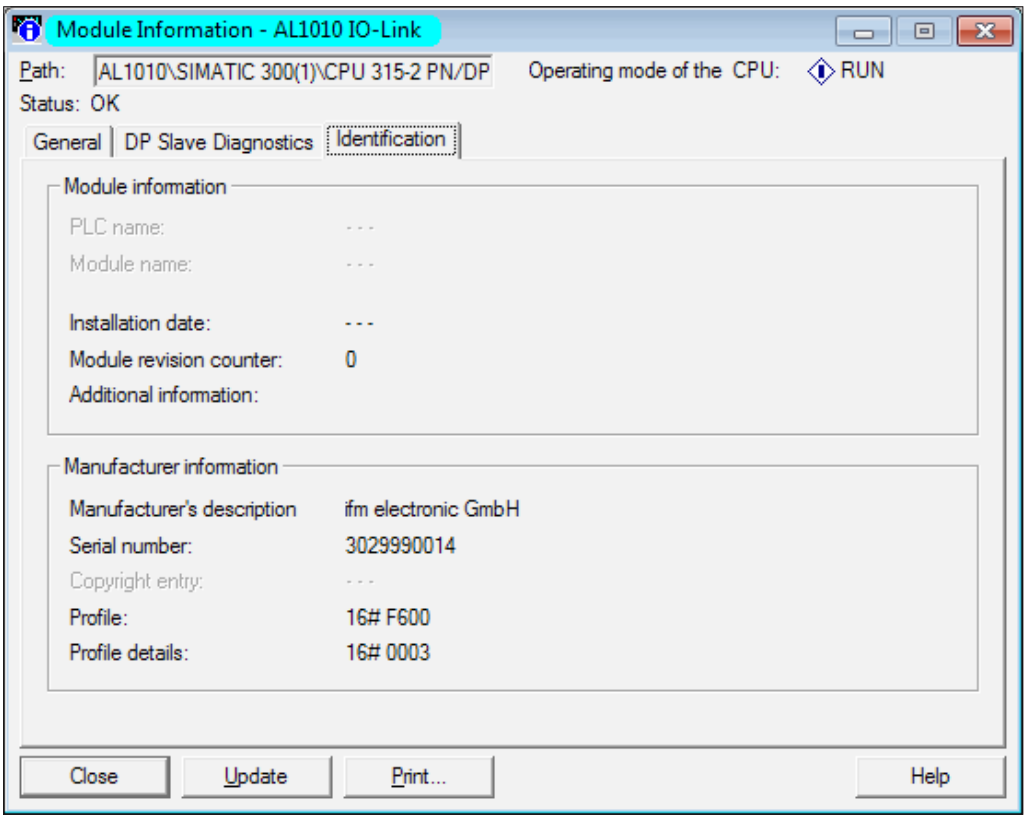
In the [Identification] tab, the module revision counter is listed in the [Module information] area and the vendor ID (manufacture's description), serial number, profile, and profile details are listed in the [Manufacturer information] area.

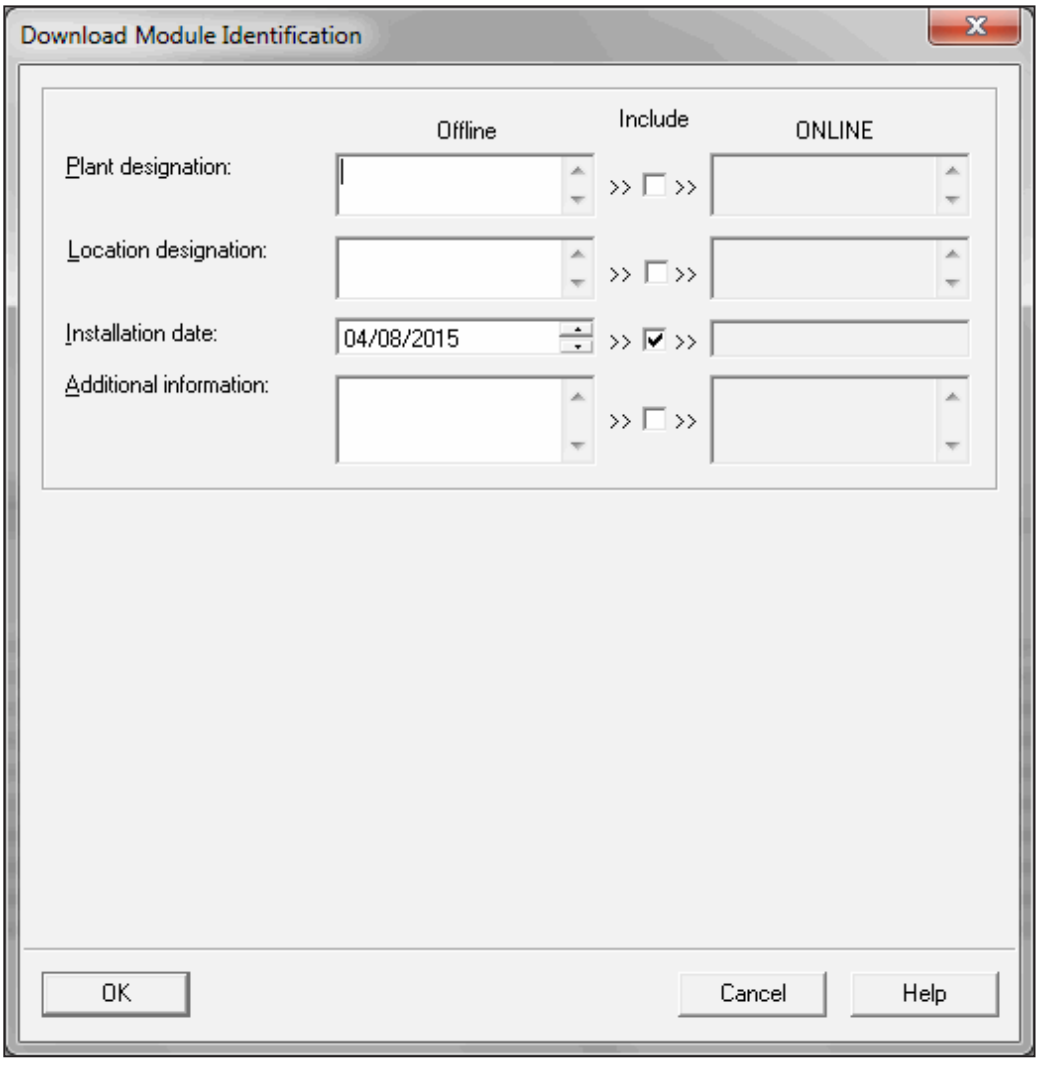
I&M data records 1 - 3 can be read and written using the [Download/Upload Module Identification] dialogue boxes.

The following steps must be carried out (offline view):

- ► Select the device.
- ► Select [Target system, Download Module Identification].
- ► In the dialogue box you can now adapt the I&M data records (1 - 3) and write them to the device with [OK].




Module Information - AL1010 IO-Link
Path: AL1010\SIMATIC 300(1)\CPU 315-2 PN/DP
Operating mode of the CPU: RUN
Status: OK
General
DP Slave Diagnostics
Identification
Module information
PLC name: - - -
Module name: - - -
Installation date: - - -
Module revision counter: 0
Additional information:
Manufacturer information
Manufacturer's description ifm electronic GmbH
Serial number: 3029990014
Copyright entry: - - -
Profile: 16# F600
Profile details: 16# 0003
Close
Update
Print...
Help


Download Module Identification
Offline
Include
ONLINE
Plant designation:
Location designation:
Installation date:
04/08/2015
Additional information:
OK
Cancel
Help

26.7 Diagnostic alarms

The devices support the following diagnostic alarms

Alarm code	Module	Alarm text	Meaning
0x0002	0	Undervoltage	Undervoltage U_S
0x0003	0	Overvoltage	Overvoltage U_S
0x0004	0	Overload	Overload U_S
0x0005	0	Overtemperature	Overtemperature
0x0100	0	Actuator overvoltage	Undervoltage U_A
0x0101	0	Actuator overvoltage	Overvoltage U_A
0x0102	2	Shortcut bits 0...3	Short circuit X1/X2
0x0103	2	Shortcut bits 4...7	Short circuit X3/X4
0x0104	2	Shortcut bits 8...11	Short circuit X5/6
0x0105	2	Shortcut bits 12...15	Short circuit X7/8

These can be viewed in the [Module Information] dialogue box in STEP 7 in online view.

The following steps must be carried out:
Switch the hardware manager to online view.

- ► Right-click on the module, then select [Module Information].
- ► In the [Module status] dialogue box, select the [DP Slave Diagnostics] tab to view the detailed text.