

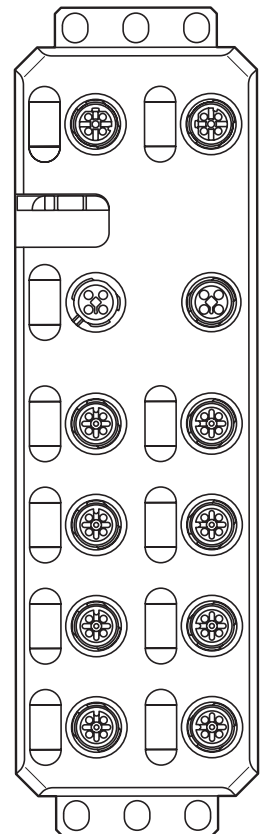


Device manual
IO-Link master ProfiNet

UK

ecomat300[®]

AL1000



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1 Preliminary note



This document applies to devices of the type "IO-Link master" (art. no. AL1000).

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.

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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.

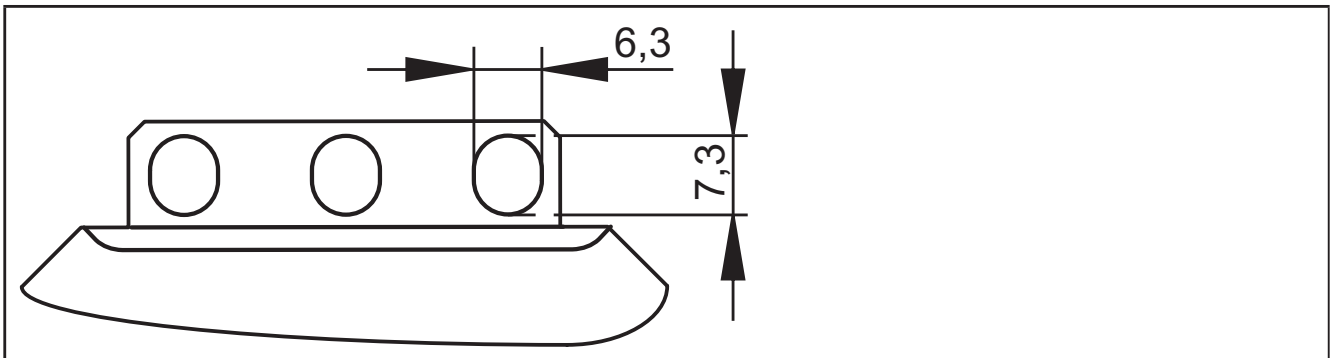
6 Features

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.

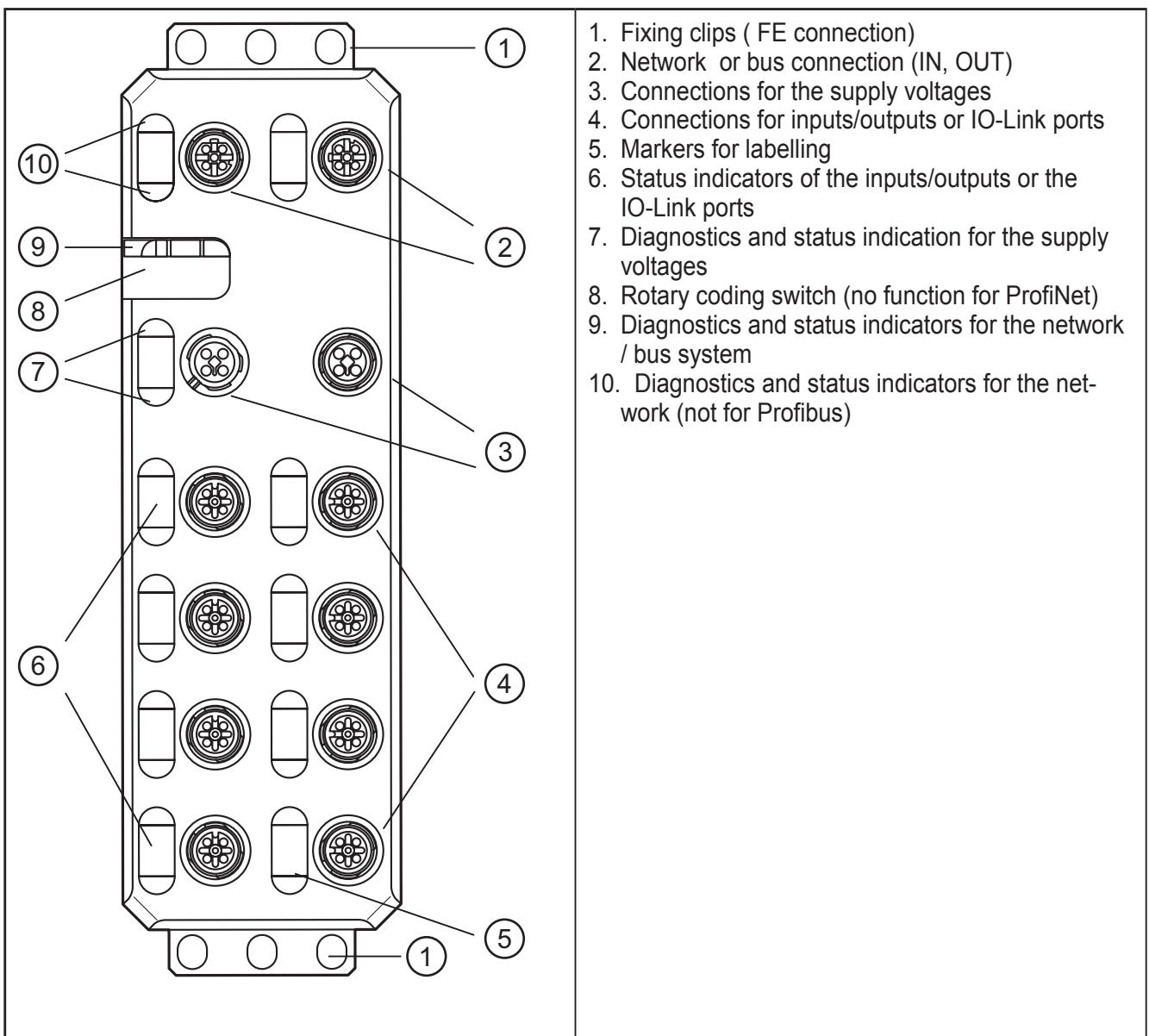
7 Scale drawings

7.1 Dimensions of the screw holes in the fixing clips



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8 Structure of the device



8.1 Diagnostic and status indicators

8.1.1 Diagnostics

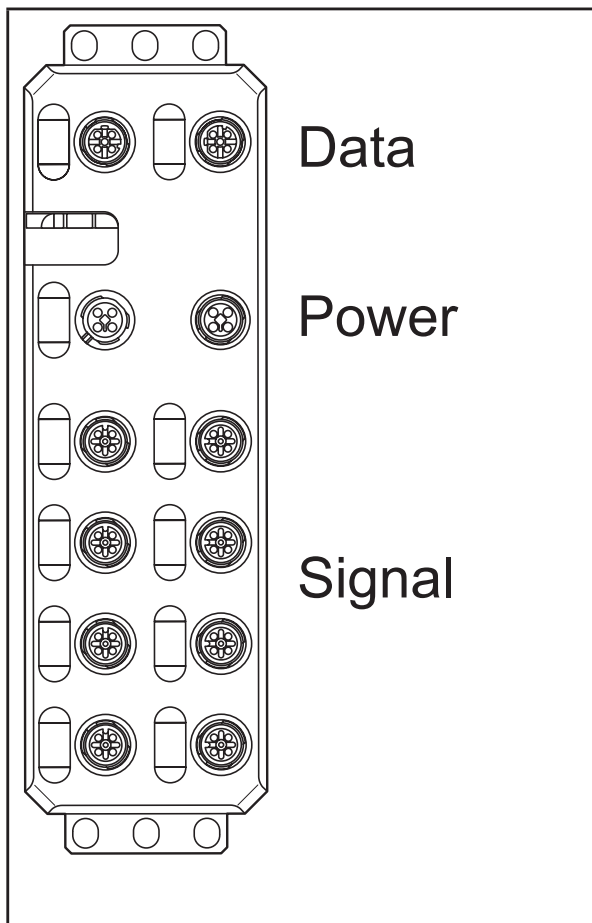
The diagnostic indicators (green/yellow/red) indicate whether an error is present or not. In case of an error, they indicate the error type and location. The device is operating correctly if all green indicators are on.

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

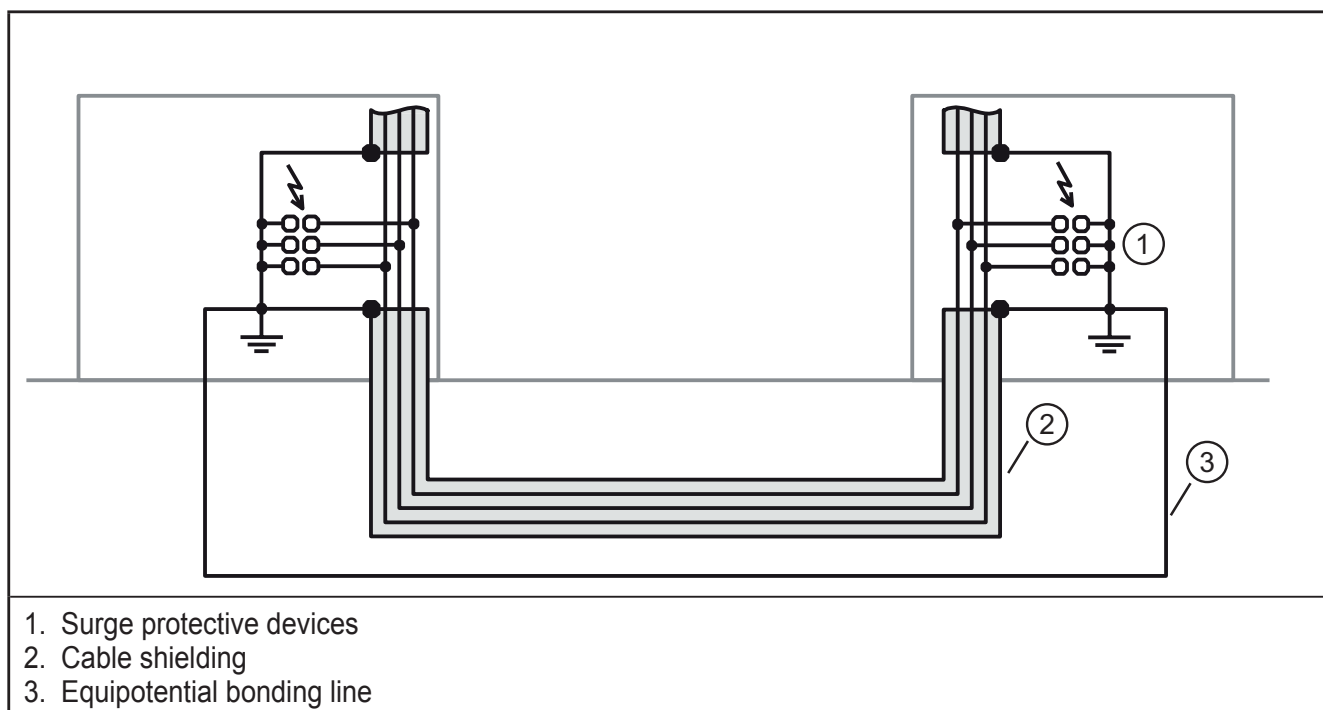
- a metal-reinforced concrete channel,
- an additional grounding cable or
- a metal pipe.

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.

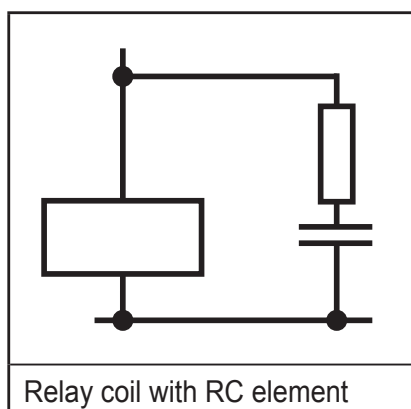


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9.7 Surge protection measures



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.



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

$$R = 100 \dots 200 \, \Omega /$$

$$C = 220 \dots 470 \, \text{nF}$$

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

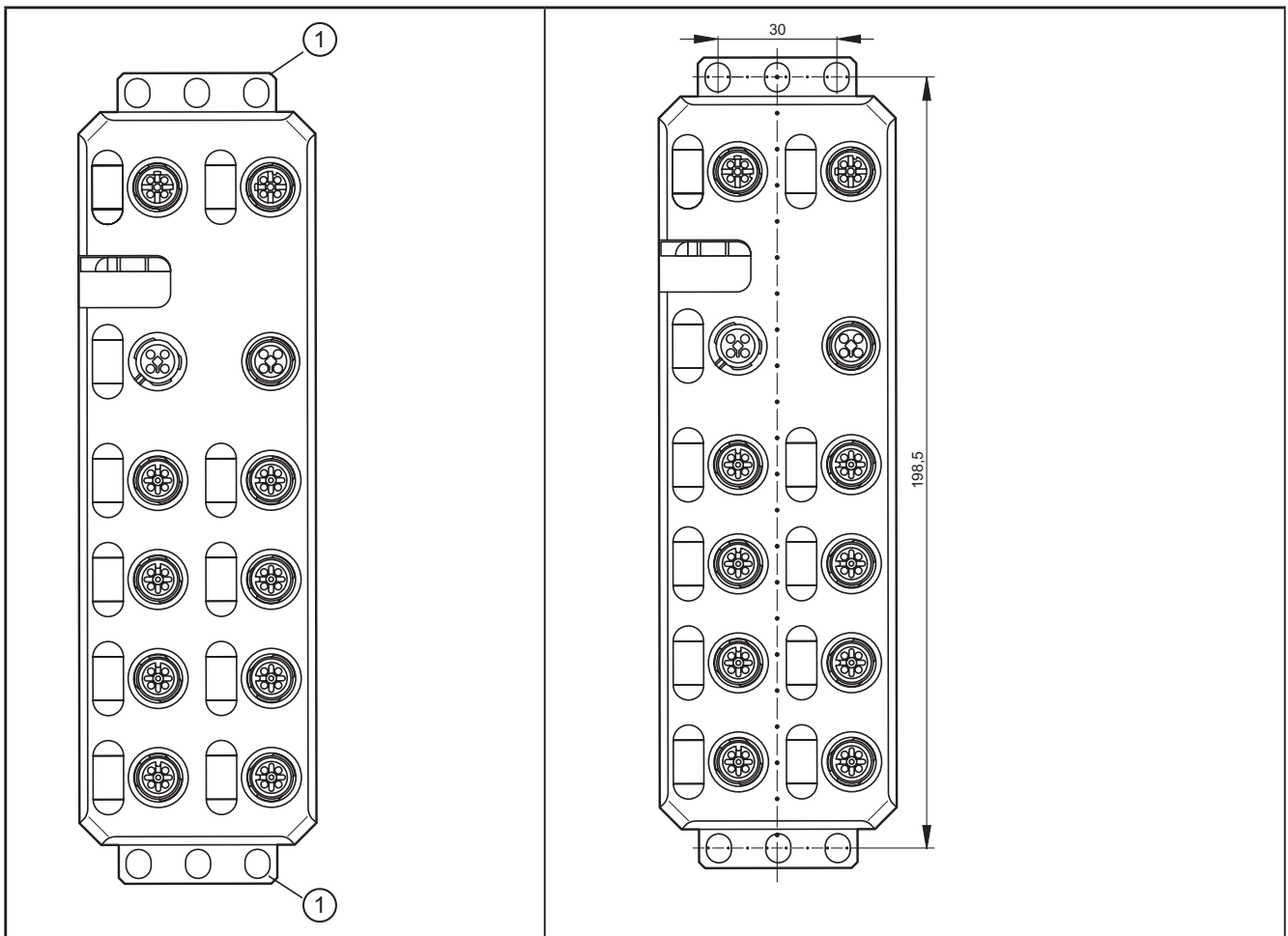
- ▶ Implement the FE connection using mounting screws, in order to ensure immunity to interference.

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.



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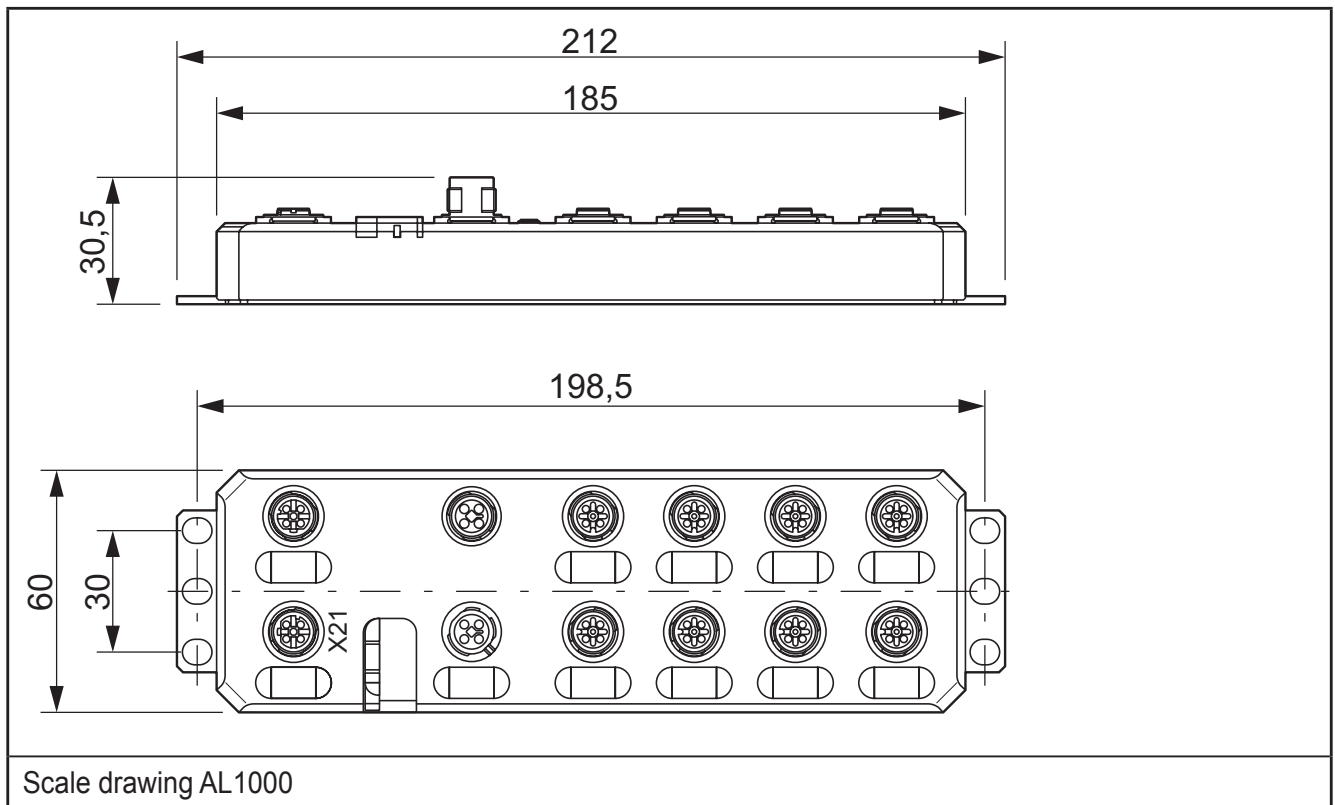
- ▶ Use standard M5 screws with toothed lock washer and self-locking nuts.
- ▶ Observe the maximum torque of the screws.



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



11 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.

11.1 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.

11.2 Power supply U_S

- ▶ Connect power supply U_S for 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.

11.3 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.

12 Features

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

12.1 ProfiNet features

- Connection to the ProfiNet network using M12 connectors (D-coded)
- Transmission speed 100 Mbps
- Two Ethernet ports (with integrated switch)
- ProfiNet RT
- Supported protocols: SNMP, LLDP, MRP, DCP
- ProfiNet features:
 - FSU, Shared Device, I&M functions
- Device description using GSDML file
- Firmware can be updated
- Integrated web server for web-based management

12.2 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 width
- Supporting the IOL_CALL function module
- IO-Link specification v1.1

12.3 General features

- Diagnostic and status indicators
- Short-circuit and overload protection of the sensor supply
- IP65/67 protection rating

13 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 (up to 3000 m above sea level)
Air pressure (storage/transport) [kPa]	70...106 (up to 3000 m above sea level)
Protection rating	IP65 / IP67
Protection class	III, IEC 61140, EN 61140, VDE 0140-1
Connection data	
Connection method	M12 connector
Interface ProfiNet	
Number	2
Connection method	M12 connector, D-coded
Designation connection point	copper cable
Number of poles	4
Transmission speed [Mbps]	100 (with auto-negotiation)
ProfiNet	
Equipment type	ProfiNet Device

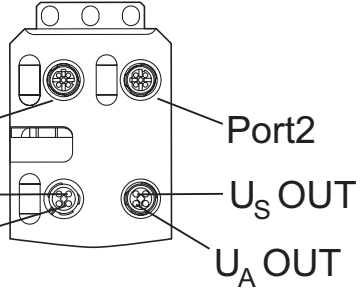
Conformance class	B
Update rate [ms]	1
Number of supported application relationships (AR)	2
Additional protocols	SNMP v1, HTTP, TFTP, FTP
ProfiNet protocols	LLDP, MRP client, DCP, DCE-RPC
Supply of the module electronics and sensors	
Connection method	M12 connector (T-coded)
Number of poles	4
Designation	U _s
Supply voltage [V]	24 DC
Nominal supply voltage range [V]	18...31.2 DC (including all tolerances, including ripple)
Typical current consumption [mA]	180 ± 15 % at 24 V DC
Maximum current consumption [A]	12
Supply of the actuators	
Connection method	M12 connector (T-coded)
Number of poles	4
Designation	U _A
Supply voltage [V]	24 DC
Nominal supply voltage range [V]	19...31.2 DC (including all tolerances, including ripple)
Typical current consumption [mA]	28 ± 15 % at 24 V DC
Max. current consumption [A]	12
Supply of the IO-Link ports	
I/O supply voltage [V]	24 DC
Nominal current for each IO-Link port [mA]	200
Nominal current for each device [A]	1.6
Overload protection	electronic
Permissible cable length to the sensor [m]	< 20
IO-Link ports in the mode digital input (DI)	
Number of inputs	max. 8 (EN 61131-2 type 1)
Connection method	M12 connector, X01 ... X04 with two configurations
Connection method	2, 3 wires
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 [μ s]	< 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 method	M12 connector, X01 ... X04 with two configurations
Connection method	2, 3 wires
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 [μ s]	max. 150 (at power on)
Signal delay [μ s]	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 [μ A]	300
Behaviour with overload	switched off with auto restart
Overload protection, short-circuit protection of the outputs	electronic
Permissible cable length to the sensor [m]	< 20
Digital inputs on pin 2 for type A ports	
Number of inputs	4 (EN 61131-2 type 1)
Connection method	M12 connector, X01 ... X04 with two configurations
Connection method	2, 3 wires
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

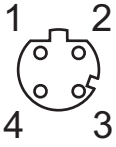
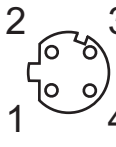
Input voltage range "1" signal [V]	15...30 DC
Input filter time [μ s]	< 1000
Overload protection, short-circuit protection of the outputs	electronic
Electrical isolation / isolation of the voltage areas	Test voltage
Test section	
24 V supply (communications power and sensor supply, IO-Link ports) / bus connection (Ethernet 1) [V]	500 AC, 50 Hz, 1 min
24 V supply (communications power and sensor supply, IO-Link ports) / bus connection (Ethernet 2) [V]	500 AC, 50 Hz, 1 min
24 V supply (communications power and sensor supply, IO-Link ports) / FE [V]	500 AC, 50 Hz, 1 min
Bus connection (Ethernet 1) / FE [V]	500 AC, 50 Hz, 1 min
Bus connection (Ethernet 2) / FE [V]	500 AC, 50 Hz, 1 min
Bus connection (Ethernet 1) / bus connection (Ethernet 2) [V]	500 AC, 50 Hz, 1 min
24 V supply (actuator supply) / 24 V supply (communications power and sensor supply, IO-Link ports) [V]	500 AC, 50 Hz, 1 min
24 V supply (actuator supply) / bus connection (Ethernet 1) [V]	500 AC, 50 Hz, 1 min
24 V supply (actuator supply) / bus connection (Ethernet 2) [V]	500 AC, 50 Hz, 1 min
24 V supply (actuator supply) / FE [V]	500 AC, 50 Hz, 1 min
Mechanical tests	
Vibration resistance to EN 60068-2-6/IEC 60068-2-6 [g]	5
Shock to EN 60068-2-27/IEC 60068-2-27 [g]	30, 11 ms period, half-sine shock pulse
Continuous shock to EN 60068-2-27/IEC 60068-2-27 [g]	10
Conformance with EMC Directive 2004/108/EC	
Noise immunity test to 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 to EN 61000-6-4	
Radio interference properties EN 55022	class A
Approvals	see www.ifm.com

14 Connection options

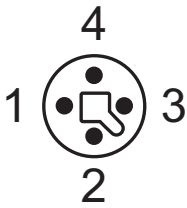
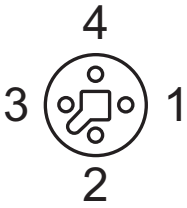
14.1 ProfiNet and voltage supply connection

 <p>Port 1 U_S IN U_A IN</p> <p>Port 2 U_S OUT U_A OUT</p>	<p>Port 1 (X21): Ethernet port 1 Port 2 (X22): Ethernet port 2 U_S IN (X31): voltage supply IN (logic and sensors) U_A IN (X31): voltage supply IN (IO-Link actuators) U_S OUT (X32): voltage supply OUT for additional devices U_A OUT (X32): voltage supply OUT for additional devices</p>
<p>► Ground the device using the screws</p>	

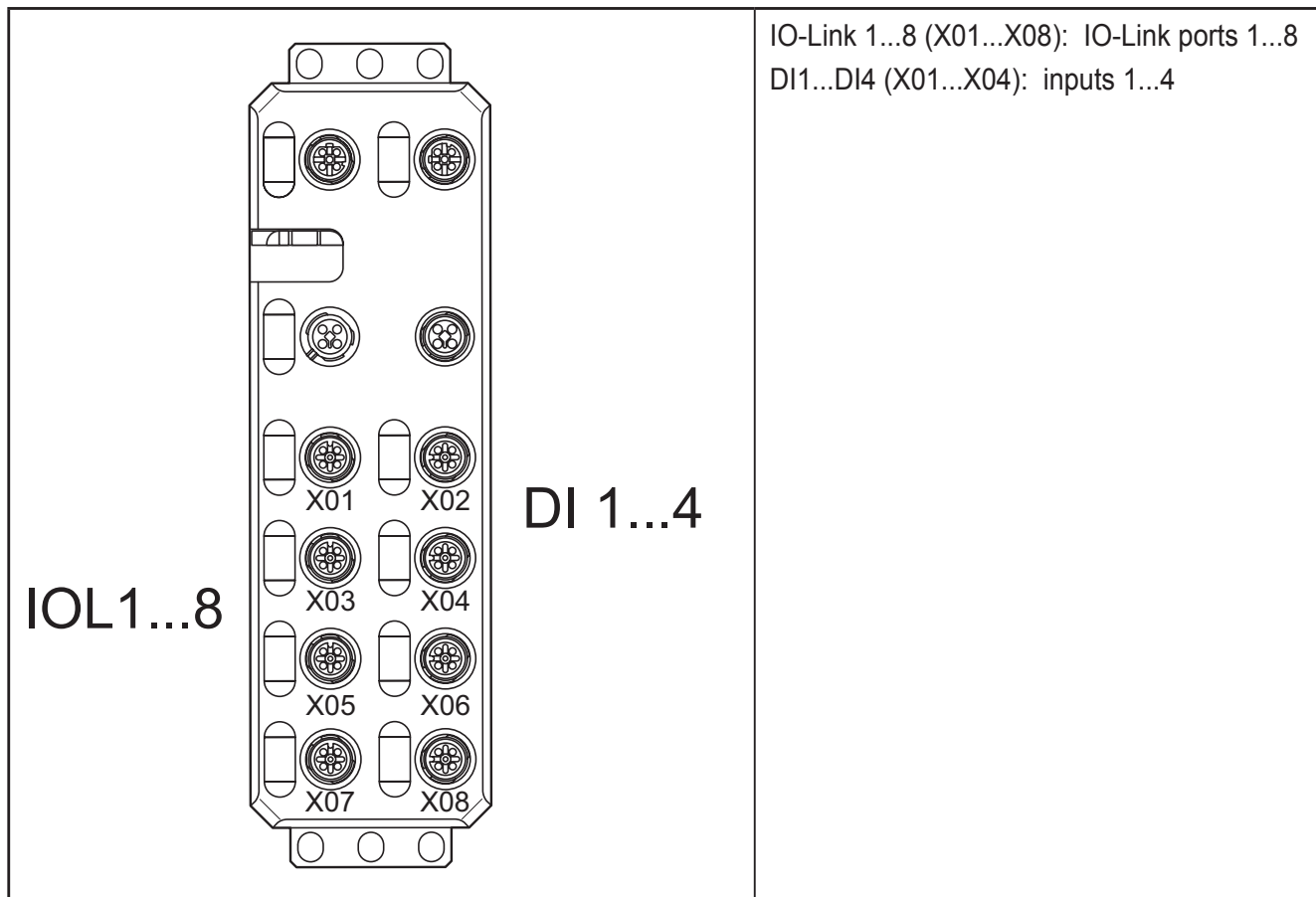
14.2 ProfiNet pin connection

	<p>Ethernet port 1 X21</p> <p>1: TX + 2: RX + 3: TX - 4: RX -</p>		<p>Ethernet port 2 X22</p> <p>1: TX + 2: RX + 3: TX - 4: RX -</p>
<p>The shield is connected to FE in the device. The thread is used for additional shielding.</p>			

14.3 Pin connection voltage supply U_S/U_A

	<p>IN X31</p> <p>1: + 24 V DC (U_S) brown 2: GND (U_A) white 3: GND (U_S) blue 4: + 24 V DC (U_A) black</p>		<p>OUT X32</p> <p>1: + 24 V DC (U_S) brown 2: GND (U_A) white 3: GND (U_S) blue 4: + 24 V DC (U_A) black</p>
<p>Pin connection voltage supply, T-coded</p>			

14.4 Connection of IO Link ports and digital inputs



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14.5 Pin connection of the inputs and IO-Link ports

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



Port class A (type A)

The IO-Link port according to type A is assigned an additional hardwired DI (digital input) 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 U_S / IOL actuator supplied via U_S and U_A)



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

To ensure IP65 / IP67 protection, cover unused sockets with protective caps.

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

Observe the correct polarity of the supply voltages U_S and U_A in order to prevent damage to the device.

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

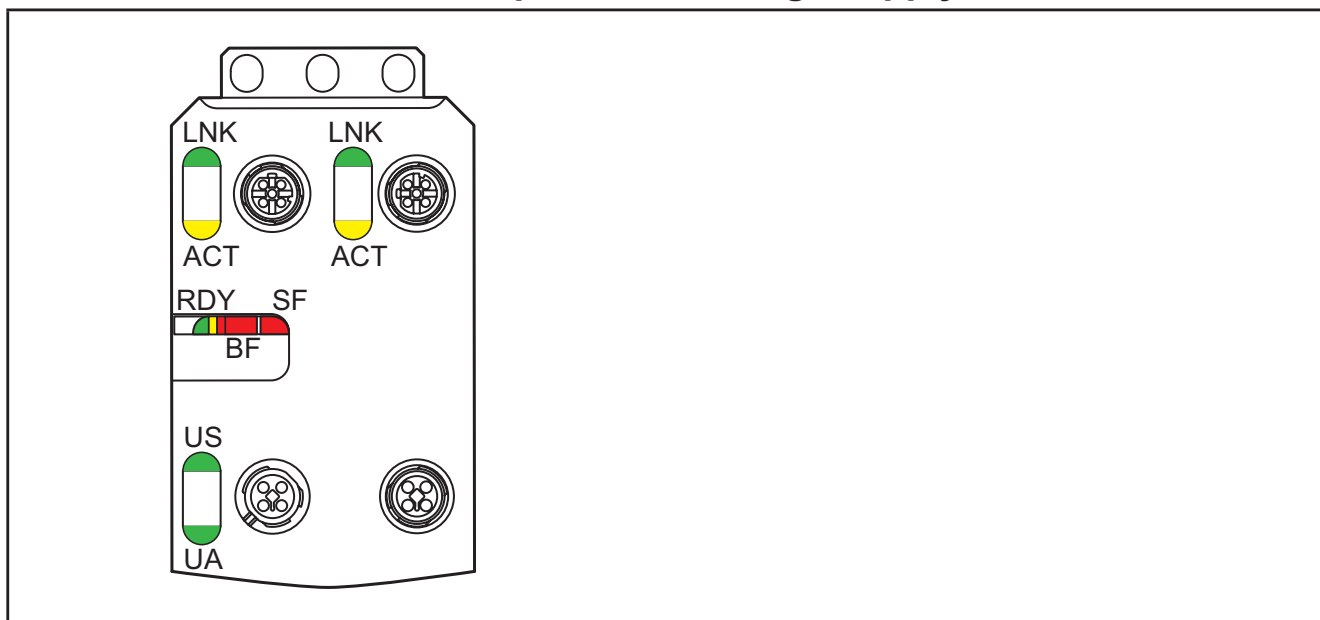


Fix the device to a flat surface or to a profile rail. Do not use this device to bridge gaps in order to prevent forces being transmitted via the device.

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

15 Local status and diagnostic indicators

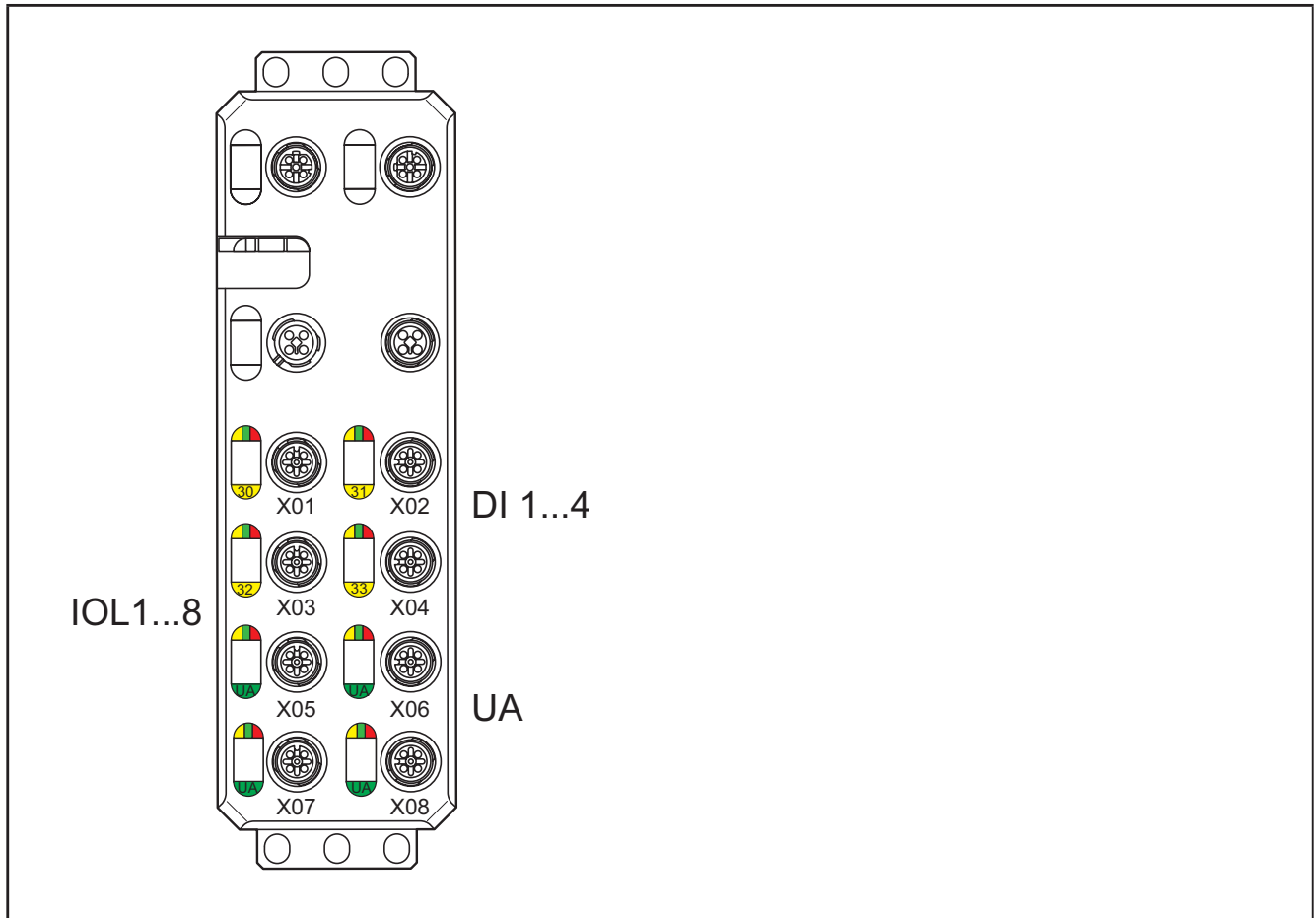
15.1 Indicators for Ethernet ports and voltage supply



Designation	Colour	Meaning	State	Description
LNK 1/2	Green	Link	Green ON	Connection present at port 1/2
			Green, OFF	Connection not present at port 1/2
ACT 1/2	Yellow	Activity	Yellow flashing	Data transmission present at port 1/2
			Yellow OFF	Data transmission not present at port 1/2

Designation	Colour	Meaning	State	Description
RDY	Green/ yellow / red	Ready	Green ON	Device is ready for operation
			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
			OFF	Device is not ready for operation
BF	Red	Bus Fault	Red ON	No link status available on any port
			Red flashing	SF LED not flashing: Link status available, no communication connection to the ProfiNet controller
			Red flashing	SF LED flashing: hardware watchdog has been triggered
			Red Off	A ProfiNet controller has established an active communication connection to the ProfiNet device
SF	Red	Station Fail	Red ON	ProfiNet diagnostics available
			Red flashing	Flashes only together with the BF LED; watchdog triggered
			Red OFF	ProfiNet diagnostics not available
US	Green / red	U_{sensors}	Green ON	Communications power/sensor voltage present
			OFF	Communications power/sensor voltage not present or too low
			Red ON	Sensor voltage overload
UA	Green	$U_{\text{actuators}}$	ON	Actuator voltage present
			OFF	Actuator voltage not present

15.2 Indicators for the IO-Link ports 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 IO-Link communication not present
			Yellow ON	In the DI or DO 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
			OFF	In DI or DO mode the digital input or output is not set
30 ... 33	Yellow	Status of the digital inputs	ON	Input is set
			OFF	Input is not set.

Designation	Colour	Meaning	State	Description
UA	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 position specifies the byte, the second position specifies the bit.

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16 ProfiNet data model

The design of the device is modular. The first slot 1.1 (slot 1 and subslot 1) always contains the "status/control module" with 4 bytes each of input and output process data.

In slots 1.2 to 1.9 the operating mode and the process data length for the respective IO-Link port are parameterised.

16.1 Status/control module

Input process data

Byte	Byte 0	Byte 1	Byte 2	Byte 3	
Bit	0...7	8...15	16...23	24...27	28...31
Function	Port state (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	-

Output process data

Bytes	Byte 0	Byte 1	Byte 2	Byte 3
Bit	0...7	8...15	16...23	24...31
Function	Port state (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 previously configured in the digital input mode (DI) to the 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 process data. The I/O-Link port must be set beforehand to function in the DO mode.

Start-up parameters

The status/control module in slot 1 contains the following start-up 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 ports running in the IO-Link mode
Diagnostic settings		
Channel-related diagnostics	0 = deactivated 1 = activated (def)	The channel-related diagnostics can be deactivated/activated.
Extended channel-related diagnostics	0 = deactivated 1 = activated (def)	The extended channel-related diagnostics can be deactivated / activated.
Diagnostics IOLM status	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, the IO-Link events of the IO-Link device are acknowledged on the respective port and mapped to the PROFIBUS diagnostics. If deactivated, the events are only acknowledged.
Substitute values		
Behaviour in the event of error for status / control module	0 = clear all (def) 1 = set all 2 = hold last value 3 = substitute value	Substitute value behaviour for the IO-Link ports in the DO mode (pin 4).

Parameter	Possible values	Description
Substitute values for DO	0 = zero (def) Possible values: 0 ... 255dec	Specification of a substitute value sample for the IO-Link ports in the DO mode (pin 4). In order to use this parameter, the value "Substitute values" must be set beforehand in the parameter "Behaviour in the event of error for status/control module".
Behaviour in the event of error port 1 ... behaviour in the event of error port 8	0 = clear all 1 = set all 2 = hold last value 4 = IO-Link master command (def)	Substitute value behaviour for the output process data of the IO-Link port in the IO-Link mode. The "IO-Link master command" option enables the use of IO-Link-specific mechanisms for valid/invalid output process data.

(def = default)

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16.2 Flexible module configuration

Up to eight further modules can be flexibly configured in slots 1.2 to 1.9, each of these represents a physical IO-Link port. The basic mode of the IO-Link port and the process data length are determined with the selection of 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 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 Device check (identification level) – Vendor ID (2 bytes) – Device ID (3 bytes) – Data storage 0 = deactivated 1 = download only 2 = upload only 3 = download and upload 4 = deactivated and deleted * 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 Device check (identification level): <ul style="list-style-type: none"> – Vendor ID (2 bytes) – Device ID (3 bytes) Data storage: <ul style="list-style-type: none"> 0 = deactivated 1 = download only 2 = upload only 3 = download and upload 4 = deactivated and deleted *Device parameter (DPP2): If such a submodule is selected, the device parameter DPP2 (byte 10 _{hex} ... 1F _{hex}) can be parameterised for the port during start-up. If the IO-Link process data length of the device is not available in the submodules, select the next largest constellation.

Start-up parameters

You can carry out start-up parameterisation for the IO-Link submodules. The following parameters can be set:

Parameter	Possible values	Description
Operating mode		
Port mode	Deactivated	In this mode the sensor supply voltage is switched off.
	Digital input	In this mode the IO-Link port functions as a standard digital input.
	Digital output	In this 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 state 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 acquired as a digital signal and not via an IO-Link communication.
	IO-Link	Use this mode to communicate with IO-Link sensors and actuators.
Device check (identification level)		

Parameter	Possible values	Description
Vendor ID	0000 _{hex} ... FFFF _{hex}	<p>Vendor ID, identification level 1</p> <p>The vendor ID of the connected IO-Link device for the respective port can be parameterised via the level.</p> <p>The vendor ID can be found in the data sheet of the IO-Link device.</p>
Device ID	000000 _{hex} ... FFFFFFFF _{hex}	<p>Device ID, identification level 2</p> <p>The device ID of the connected IO-Link device for the respective port can be parameterised via the level.</p> <p>The device ID can be found in the data sheet of the IO- Link device.</p> <p>To check the device ID, a vendor ID check must be carried out first.</p>



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. Only if the parameterised vendor ID and the device ID correspond to the information read (in the device), communication with 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	<p>The parameter data is sent to the device by the IO-Link master.</p> <p>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 default data.</p> <p>This means that it is possible to exchange the IO-Link device.</p>
	Upload only	<p>The parameter data is sent to the master by the IO-Link device.</p> <p>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 default data.</p> <p>This means that it is possible to replace the IO-Link master.</p>
	Download and Upload	<p>The parameter data is saved in both the IO-Link master and the device.</p> <p>In the event of an inconsistency between the parameter data of the IO-Link device or the master, the data of both devices is used as default data.</p> <p>Therefore it is possible to replace the IO-Link device or the IO-Link master.</p>

Data storage		
	Deactivated and deleted	The data storage mechanism is deactivated and the master deletes all stored parameters for the respective port.
The data storage mechanism is supported from IO-Link specification v1.1. Both the IO-Link master and the device must support at least IO-Link v1.1.		
Device parameters		
Device parameters (DPP2)	Byte 10 _{hex} ... Byte 1F _{hex}	<p>The device parameter page 2 describes the area between the IO-Link objects 10_{HEX} ... 1F_{hex}. This is the manufacturer-specific area of the IO-Link device data.</p> <p>The data is optionally provided by IO-Link devices and can be read and written by the master.</p>

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17 I&M functions

The ProfiNet device supports Identification & Maintenance functions (I&M). The general Identification & Maintenance functions 0 to 4 can be read via slot 0. IO-Link specific Identification & Maintenance functions 0, 16 ... 23 and 99 can be read via slot 1 and subslot 1.



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

I&M 0 (slot 0)

I&M data	Access / data type	Presets
MANUFACTURER_ID	Read / 2 bytes	B0 _{hex}
ORDER_ID	Read / 20 bytes	2701513
SERIAL_NUMBER	Read / 16 bytes	Defined in the production process
HARDWARE_Revision	Read / 2 bytes	Corresponds to the hardware revision of the device
SOFTWARE_REVISION	Read / 4 bytes	Corresponds to the firmware revision 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	Presets
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	Presets
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	Presets
DESCRIPTOR	Read/write / 54 bytes	"20 _{hex} " (empty)

I&M 4 (slot 0)

I&M data	Access / data type	Presets
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 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	Presets
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 revision of the device
SOFTWARE_Revision	Read / 4 bytes	Corresponds to the firmware revision 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}) to I&M 23 (index B007_{hex}). For I&M functions 16 to 23, the structure is made up of the following parameters:

I&M data	Access / data type	Presets
VENDOR_ID	Read / 2 bytes	Vendor ID of the connected IO-Link device. If no device is available, then 0000 _{hex} .
DEVICE_ID	Read / 4 bytes	Device ID of 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 of the connected IO-Link device. If no device is available, then 0000 _{hex} .
RESERVED	Read/10 bytes	Reserved

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Access is only with read permission and exclusively via slot 1 and subslot 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	Presets
IO-Link version	Read / 1 byte	11 _{hex} (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)



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

18 Set-up

18.1 On delivery/default settings

On delivery, the following functions and features are available:

IP settings

- ProfiNet name: no name assigned
- IP parameters: 0.0.0.0
- Subnet mask: 0.0.0.0
- Default gateway: 0.0.0.0
- Device designation: AL1000
- Device ID: 0104_{hex}

Firmware update

- Firmware update on next restart: deactivated
- TFTP server IP address: 192.168.210.211
- Firmware file name: FIRMWARE.NXF

System identification

- Device name: no name assigned
- Description: no description assigned
- Device location: no location assigned
- Contact: no contact assigned

Web-based Management (WBM)

- User name: admin
- Password: private

18.2 Restoring the default settings

The default settings can be restored via WBM. To do this, go to the web site Administration > Default settings and follow the instructions.

18.3 Start of firmware

Once you have connected power, the firmware is started. After completion of the firmware boot process, the green NET LED lights or flashes.

19 Parameterisation

PC Worx

Parameterisation of the ProfiNet device in PC Worx requires at least PC Worx version 6.30.601. This is part of the AUTOMATION Software Suite, version 1.81, article number 2985660.

An online data sheet of the device with important technical data and a configuration file are integrated into PC Worx. If several versions of the configuration file are available, make sure that you are working with the file version that corresponds to the firmware/hardware version used.

Other tools

The ProfiNet device is parameterised using the configuration tool of the ProfiNet controller. For parameterisation integrate the corresponding GSDML file of the device in the relevant software tool (STEP 7/HW Config, etc.).



Make sure you use the latest version of the FDCML / GSDML file and the latest documentation for the device. The latest files and documentation can be found on our web site at www.ifm.com.

20 LLDP - Link Layer Discovery Protocol

The device supports LLDP to IEEE 802.1AB and therefore enables topology detection of devices that also have activated LLDP.

Advantages of using LLDP:

- Improved error location detection
- Improved device replacement
- More efficient network configuration

The following information is received by or sent to neighbours if LLDP is activated:

- The device sends its own management and connection information to neighbouring devices.
- The device receives management and connection information from neighbouring devices.

Engineering tools can be used to represent the LLDP information as a topology overview.

21 MRP - Media Redundancy Protocol

The device supports the role of a Media Redundancy Client (MRC) in an MRP network.

22 SNMP - Simple Network Management Protocol

The device supports SNMP v1.

For the object descriptions, please refer to the ASN1 descriptions of this product.

The password for read access is "public" and cannot be changed.

On delivery, the password for write/read access is "private" and can be changed at any time.

23 FSU - Fast Start-Up

The device supports the fast start-up function. This function enables fast start-up of the ProfiNet device. The device is ready to operate in 3 s.

24 Shared Device

The device supports the shared device function. This enables two controllers to simultaneously establish a cyclic connection to the device. Only one of the two masters can establish a cyclic connection to each submodule. The I/O data of another submodule used by the other master in cyclic connection cannot be accessed.

25 IO-Link master

IO-Link is an internationally standardised I/O technology (IEC 61131-9) for communication with sensors and actuators. An IO-Link master is integrated in the ProfiNet 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.

26 WBM - Web-based management

The device has a web server which generates the required pages for web-based management and sends them to a standard web browser on request of the user. Web-based management can be used to access static information (e.g. technical data, MAC address) or dynamic information (e.g. IP address, status information).

26.1 Calling web-based management

The device web server can be addressed using the IP address if configured accordingly. The web site of the device is accessed by entering the URL "http://ip-address".

Example

http://172.16.113.38

The default user name is "admin", the default password is "private".



If you cannot access the WBM pages, check the connection settings in your browser and deactivate the proxy set.

27 Firmware update

In order to update the firmware of the device, the device must be provided with a firmware container via a TFTP server or it must be loaded into the device via FTP. To do so, any FTP client or TFTP server can be used. The update must always be initiated by the web-based management. When the firmware update is carried out, the yellow RDY LED flashes.

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28 Diagnostic alarms

ProfiNet enables the ProfiNet device to store diagnostic information together with the error location and error type.

On delivery the alarms are enabled, however, they can be deactivated with parameters on start-up. An incoming alarm informs the ProfiNet controller that diagnostic information has been entered.

If 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 available, the SF LED is off.

The following ProfiNet diagnostic messages are indicated by the ProfiNet 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 or overload of an output
- Cable break at IO-Link port n

29 Device replacement

In the ProfiNet network devices can be replaced without having to reconfigure them. Device replacement is only possible if the new device is in its default state. The controller must support the device replacement function.

The device name and the device address are assigned by the controller to the newly added ProfiNet device using the neighbourhood detection function.

30 Substitute value behaviour

If PROFINET communication fails, all device outputs are set to the parameterised substitute values.

Please refer to the "Status/control module -> Start-up parameters" and "Flexible module configuration -> Start-up parameters" chapters for the precise parameterisation of substitute values.

31 Firmware Update ProfiNet

This document describes how you can make a firmware update for AL1000.

32 Firmware update

To upload the firmware file you will need either an FTP tool or you can use the Windows Explorer.

This document describes the firmware update using the Windows Explorer.

The default login details are as follows:

- User: admin
- Password: private

If you use the FTP tool, please follow the appropriate steps in your tool.

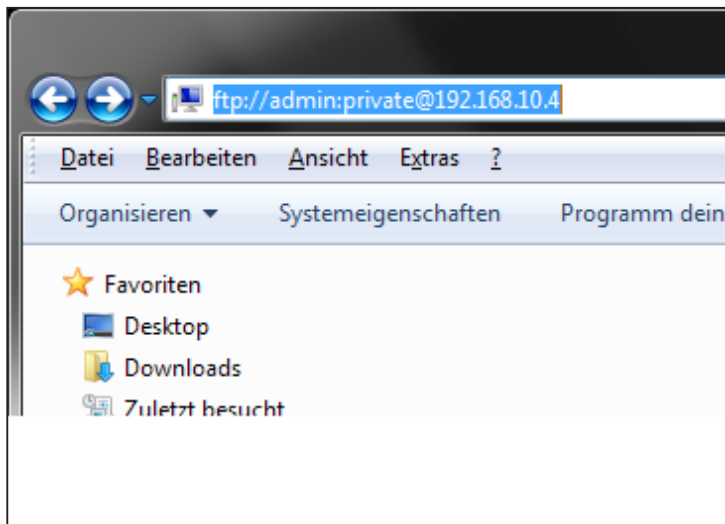
32.1 Access the FTP server

To access the FTP server on the device, please enter the address in the Windows Explorer in the following manner:

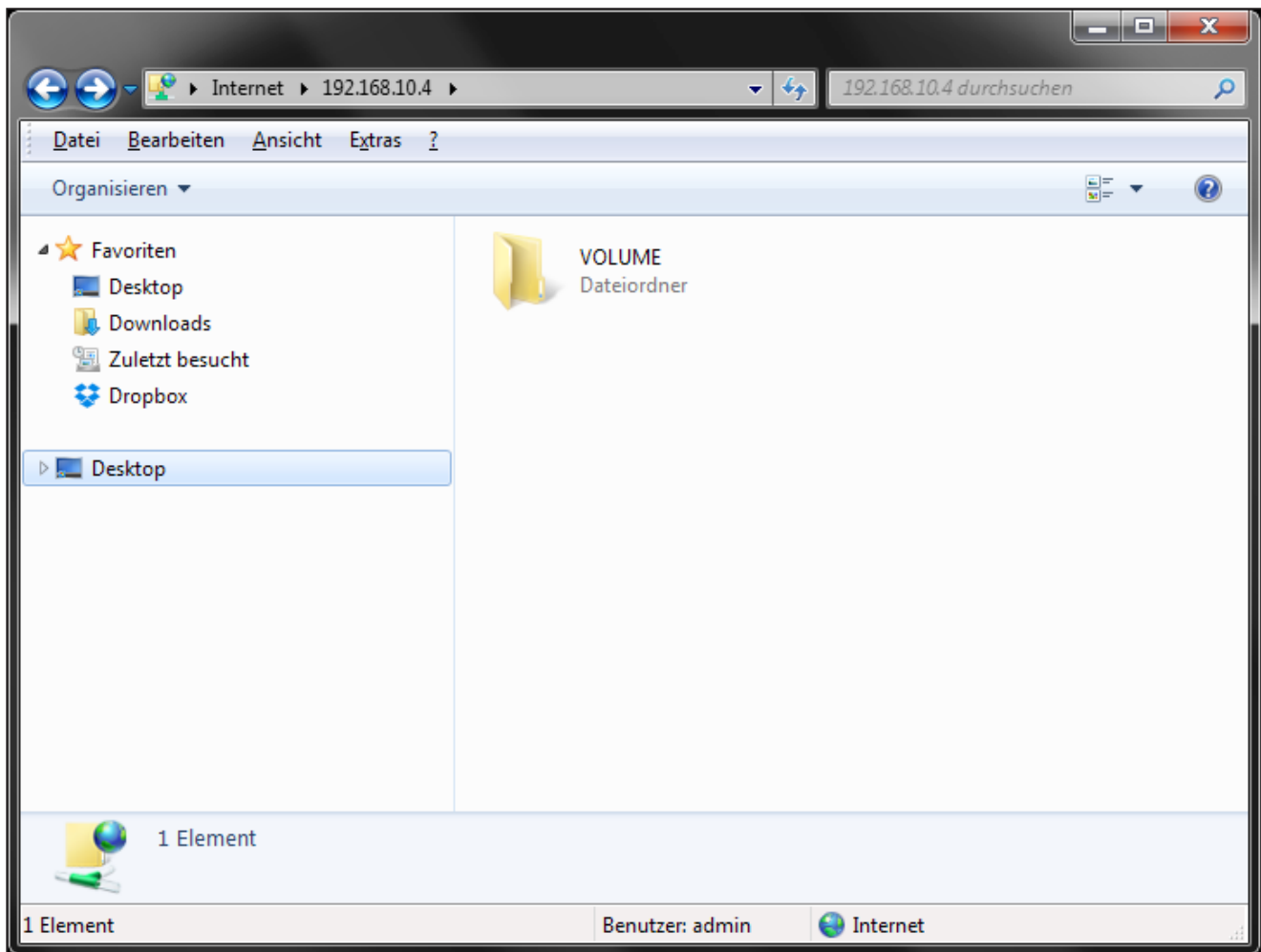
`ftp://user:password@ip.address`

Example

Here the default login details were used. The IP address is 172.16.49.10



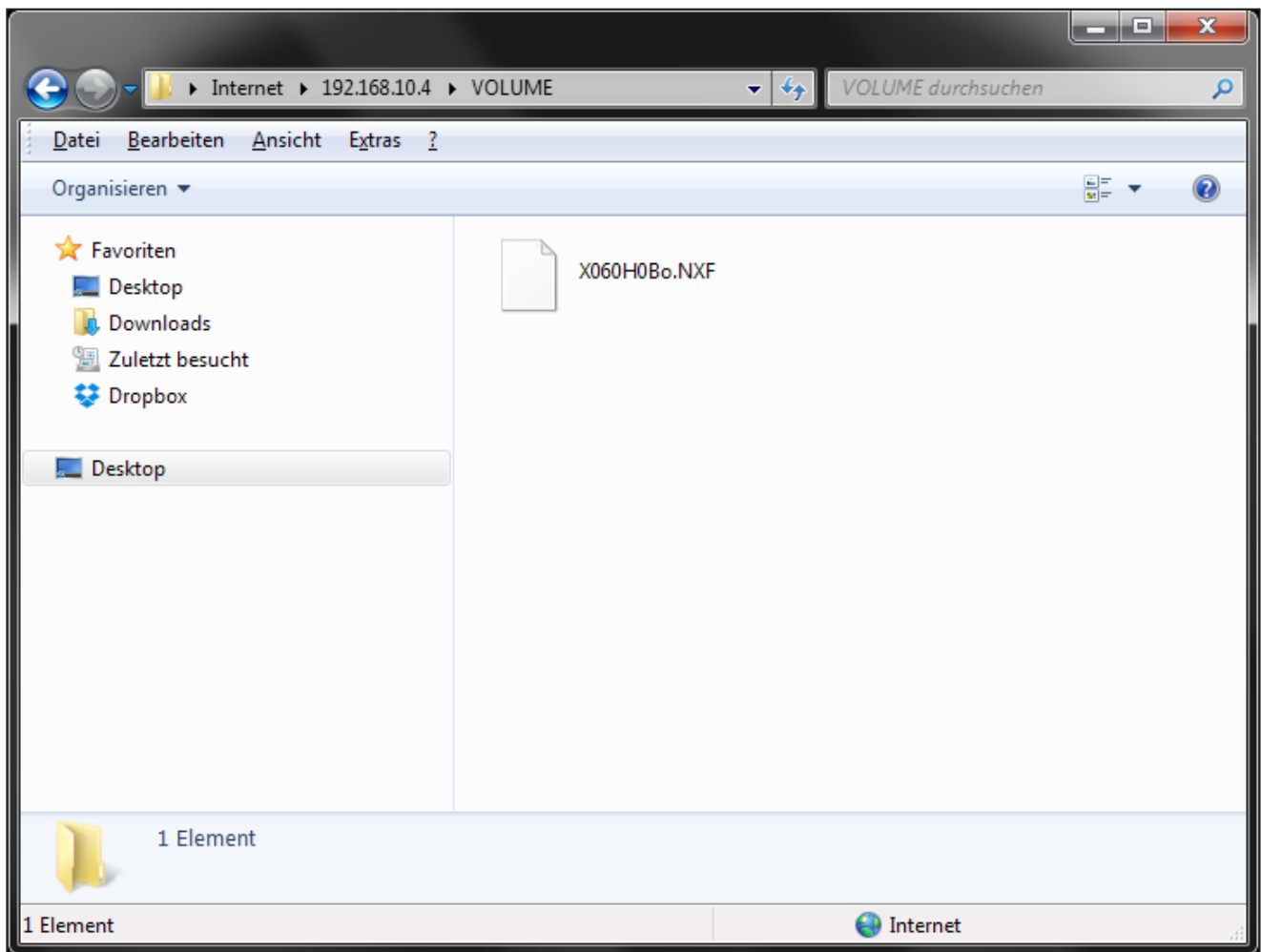
If the login is successful you will see the following window in the Windows Explorer: You see the following structure:



If you do not enter any login details or wrong details, you get a message. Please check your login details and try again.

32.2 Upload

- ▶ Open the [Volume] folder and copy the firmware file to the root of the [Volume] folder.

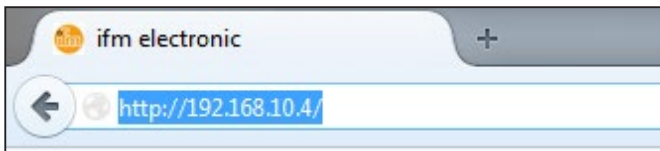


32.3 Firmware update

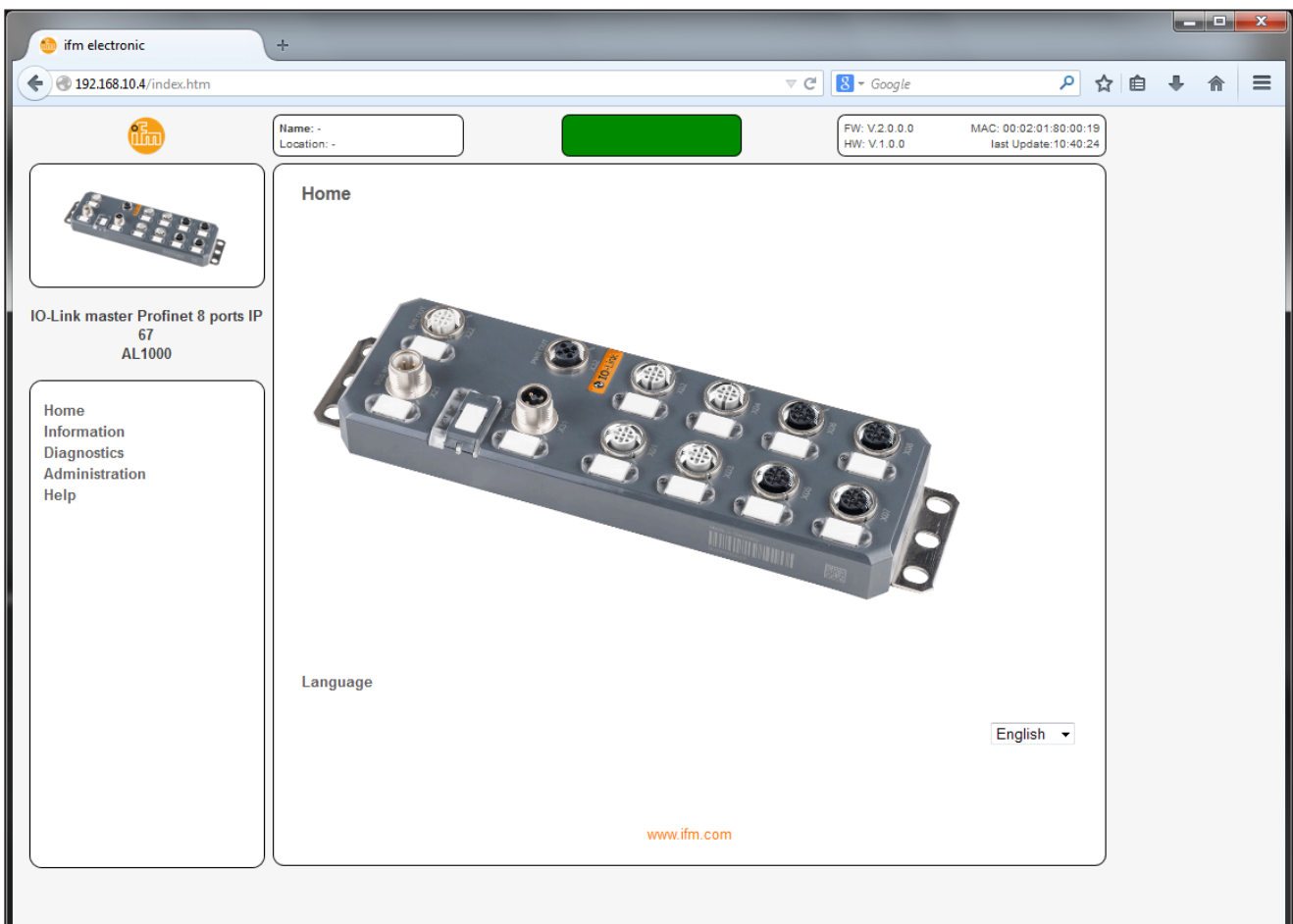
32.4 Access the web server

- ▶ Open the web browser.
- ▶ Enter the IP address of the device in the address line of the web browser.

Figure 4 shows the IP address in the address line of the Internet Explorer.

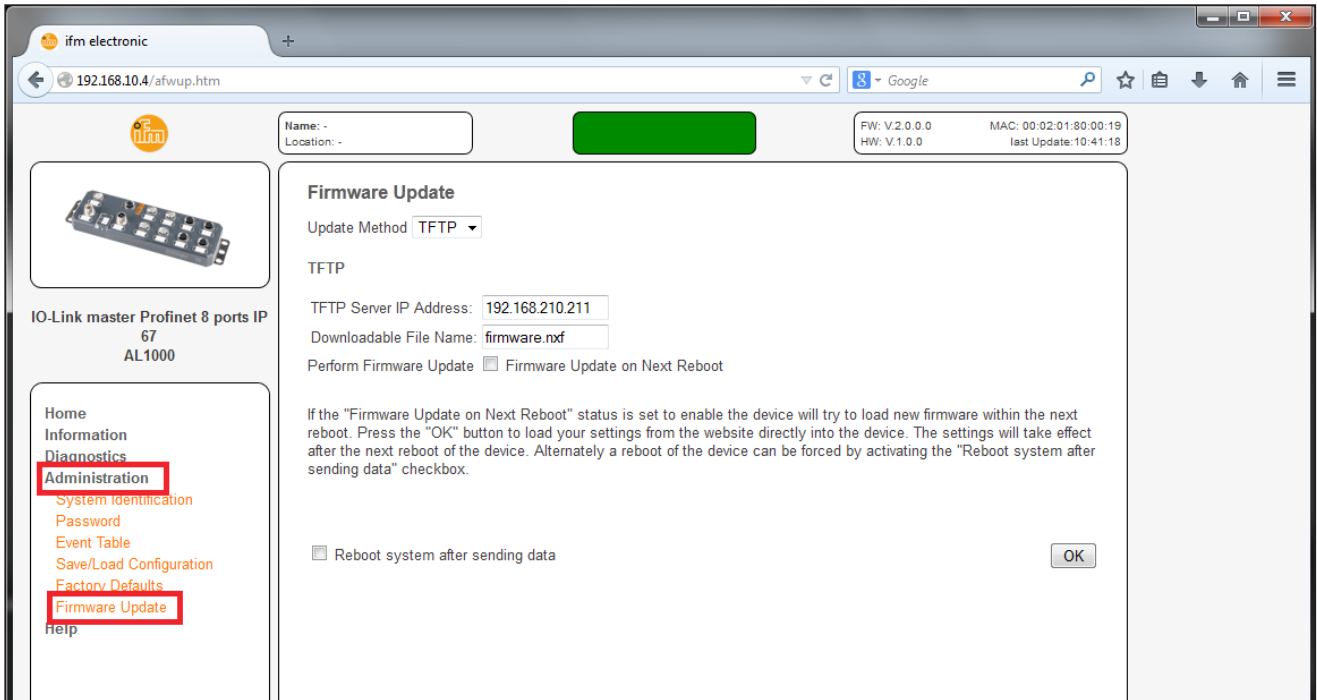


This takes you to the homepage of the respective device.

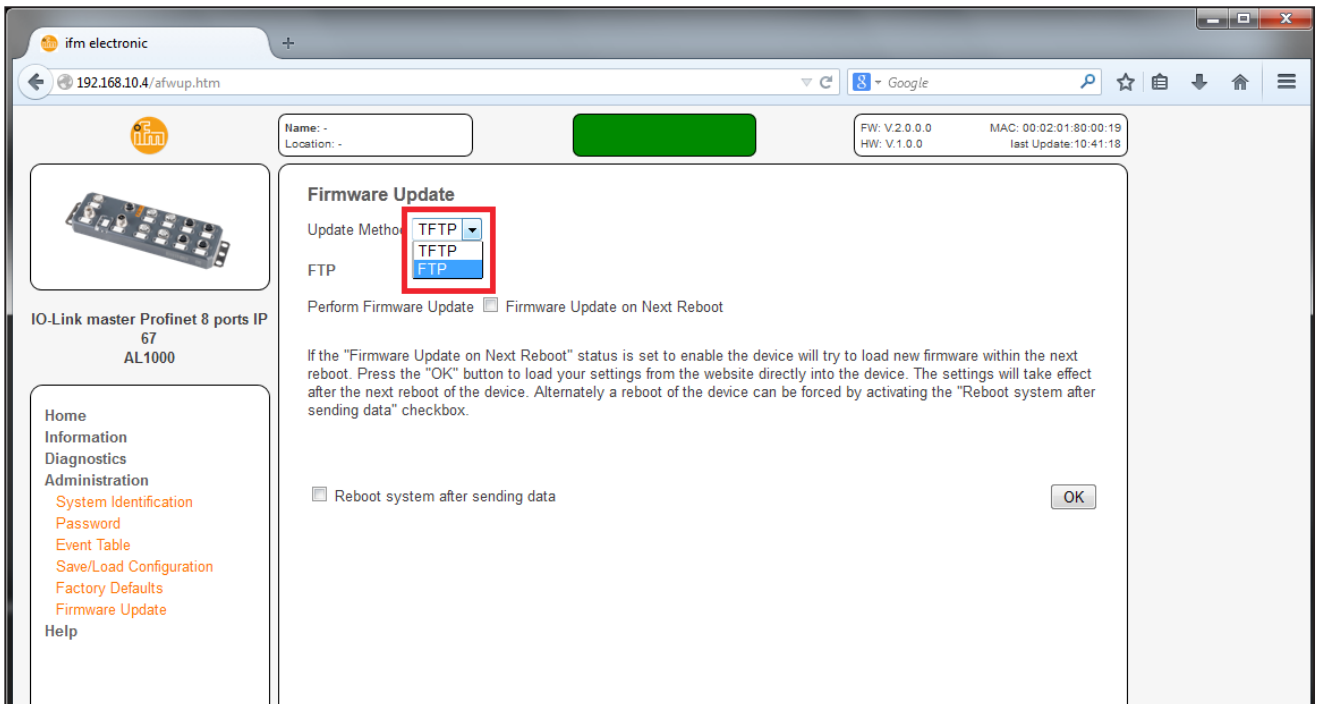


32.5 Setting the firmware update via FTP

Navigate to [Administration] (1) and then to the [Firmware Update] (2) page.



► In the next step select the setting FTP in the drop down menu.

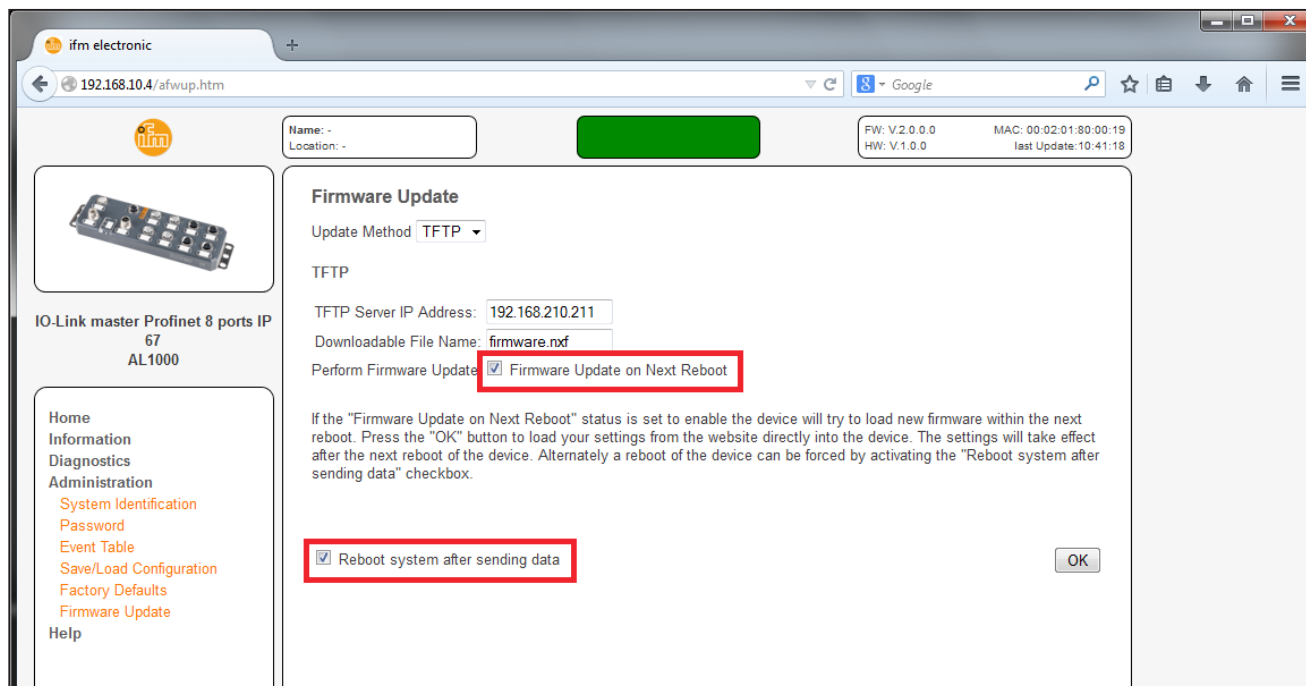


32.6 Perform the firmware update

To perform the firmware update, select the checkbox [Firmware Update on Next Reboot].

> The device then automatically updates the firmware upon the next reboot.

If you want to start the device immediately, also select the checkbox [Reboot system after sending data].

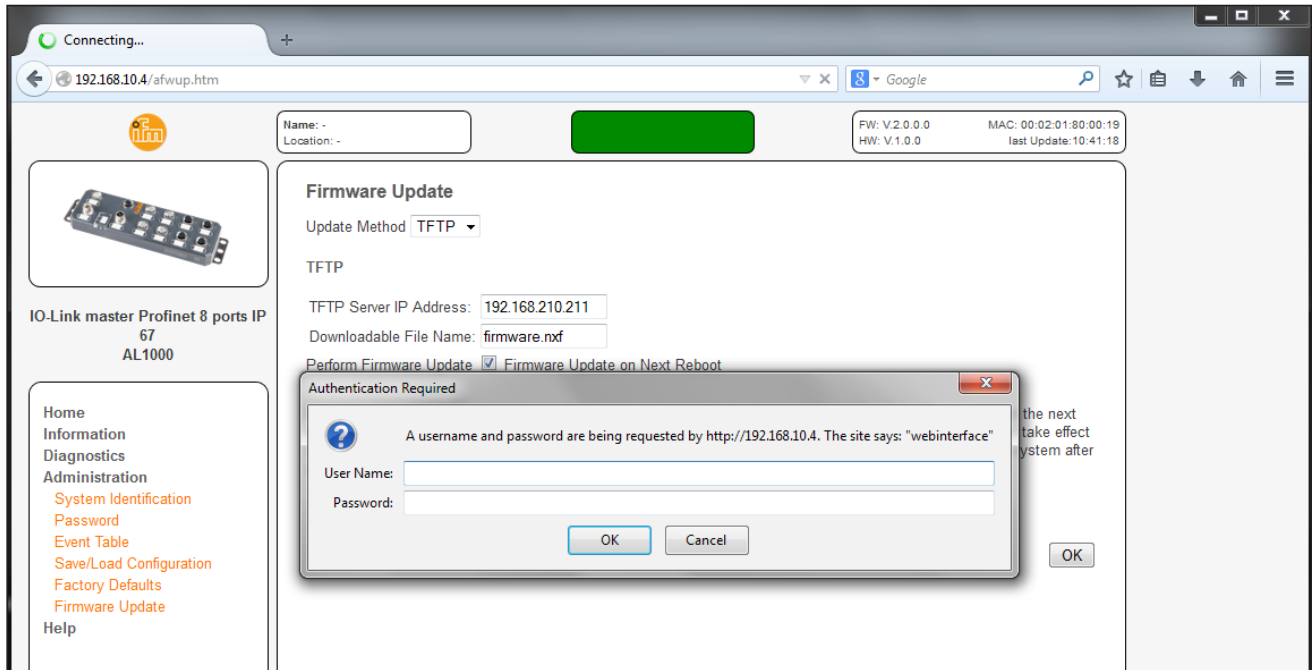


► Click on [OK].

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Now you will need to authenticate:

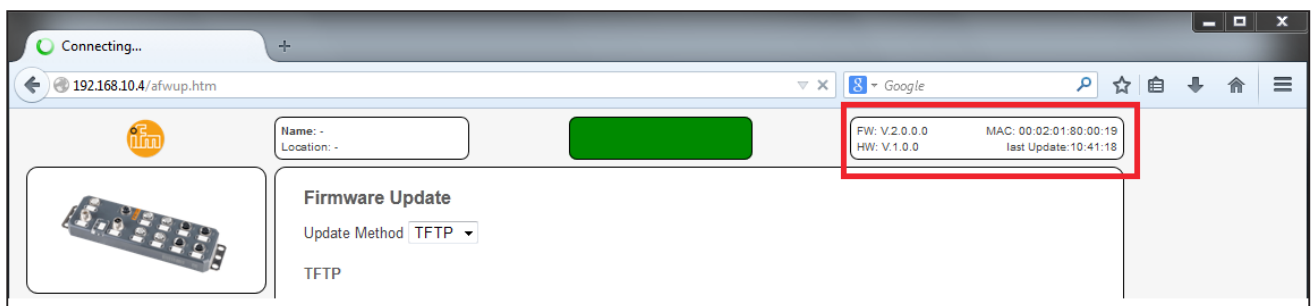
- ▶ Enter your login details.
- ▶ Click on [OK].



- ▶ Please wait a certain period of time and then refresh the web page or click on the picture of the product to reach the homepage.

32.7 Read out the firmware revision

- ▶ The information bar on the top right corner provides you with important details of your device, like firmware and hardware revision. If the firmware update was successful the new revision appears in the bar.



- ▶ Close the web page and use your device with the new firmware.
- ▶ If the firmware revision is not updated, perform a reboot.

33 Setup as per STEP 7

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

This document describes specific features associated with the setup of AL1000 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 that 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.

34 System requirements

34.1 Software

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

34.2 Hardware

Hardware requirements for the Siemens SIMATIC software:

Please refer to the S7 documentation for the hardware requirements.

35 Integrate ifm ProfiNet 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.

35.1 Creating/opening a project

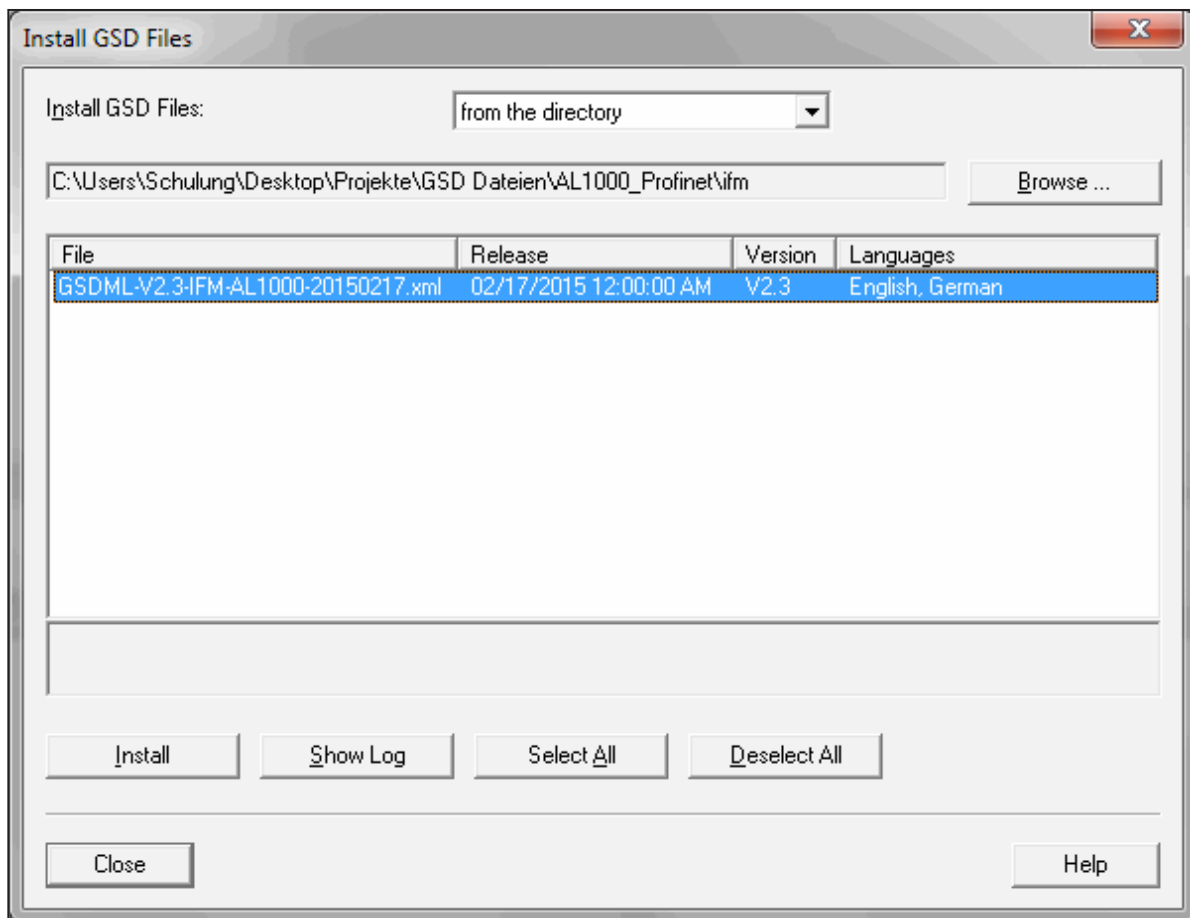
- ▶ In the Siemens SIMATIC Manager, create a new project or open an existing project.

35.2 Install the GSDML file

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

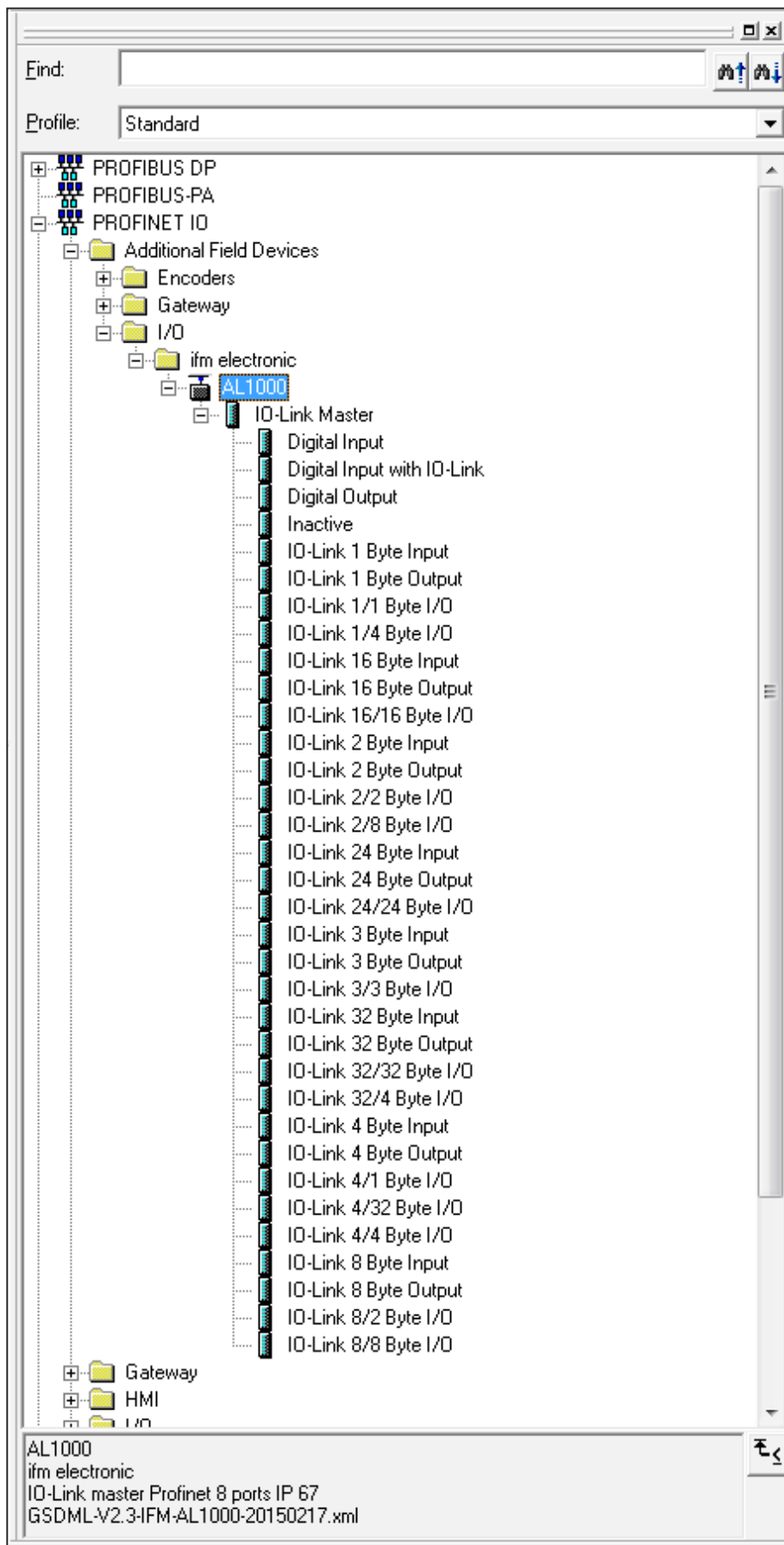
Make sure that the name of the downloaded GSDML file is the same as the name displayed in the Download area. If the file name differs after the download (e.g. after downloading with Mozilla Firefox), rename the file. Otherwise the file will not be recognised by STEP 7.

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



- ▶ Under [Install GSD Files], select [from the directory].
- ▶ Change to the folder where the GSDML file is located.
- ▶ Select the required GSDML 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] → [field
 modules].



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35.3 Inserting I/O devices in the hardware configurator

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

The devices all have modules with the same structure in slot zero. This is where the communication submodules are located.

35.4 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 figure below shows an example configuration for the AL1000 device:

The screenshot shows the HW Config software for a SIMATIC 300 station. The rack configuration is as follows:

Slot	Module
1	CPU 315-2 PN/DP
X1	PS 307 5A
X2	PI 309
X2 P1 R	Port 1
X2 P2 R	Port 2

The AL1000 module is configured as an IO-Link Master. The detailed I/O list for the AL1000 is shown in the table below:

Slot	Module	Order number	I Address	Q Address	Diagnostic Address	Comment	Access
0	AL1000	AL1000			2042*		Full
X7	PI 309				2041*		Full
X1 P1 R	Port 1				2040*		Full
X2 P2 R	Port 2				2039*		Full
1	IO-Link Master				0*		Full
1.1	Station-Steuerung/Modul		0..3	0..3			Full
1.2	Digitaler Eingang				2038*		Full
1.3	Digitaler Ausgang		256..257		2037*		Full
1.4	IO-Link 2 Byte Eingang		256..257				Full
1.5	IO-Link 4 Byte Input		258..261				Full
1.6	Digitaler Eingang				2034*		Full
1.7	Digitaler Eingang				2033*		Full
1.8	Digitaler Eingang				2032*		Full
1.9	Digitaler Eingang				2031*		Full

The right-hand pane shows the device tree with the following structure:

- PROFIBUS DP
- PROFIBUS-PA
- PROFINET IO
 - Additional Field Devices
 - Encoders
 - Gateway
 - I/O
 - Em electronic
 - AL1000
 - IO-Link Master
 - Digital Input with IO-Link
 - Digital Output
 - Inactive
 - IO-Link 1 Byte Input
 - IO-Link 1 Byte Output
 - IO-Link 1/1 Byte I/O
 - IO-Link 1/4 Byte I/O
 - IO-Link 1/8 Byte Input
 - IO-Link 1/8 Byte Output
 - IO-Link 1/16 Byte I/O
 - IO-Link 2 Byte Input
 - IO-Link 2 Byte Output
 - IO-Link 2/2 Byte I/O
 - IO-Link 2/8 Byte I/O
 - IO-Link 2/4 Byte Input
 - IO-Link 2/4 Byte Output
 - IO-Link 2/16 Byte I/O
 - IO-Link 2/24 Byte I/O
 - IO-Link 2/8 Byte Input
 - IO-Link 3 Byte Input
 - IO-Link 3 Byte Output
 - IO-Link 3/2 Byte I/O
 - IO-Link 3/24 Byte I/O
 - IO-Link 3/2 Byte Input
 - IO-Link 3/24 Byte I/O
 - IO-Link 4 Byte Input
 - IO-Link 4 Byte Output
 - IO-Link 4/1 Byte I/O
 - IO-Link 4/4 Byte I/O
 - IO-Link 4/8 Byte Input
 - IO-Link 4/8 Byte Output
 - IO-Link 8/2 Byte I/O
 - IO-Link 8/8 Byte I/O
 - IO-Link 8/8 Byte I/O

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35.5 Assigning device names

Profinet uses names to address the devices.



Make sure that the device name only occurs once in the Profinet system.

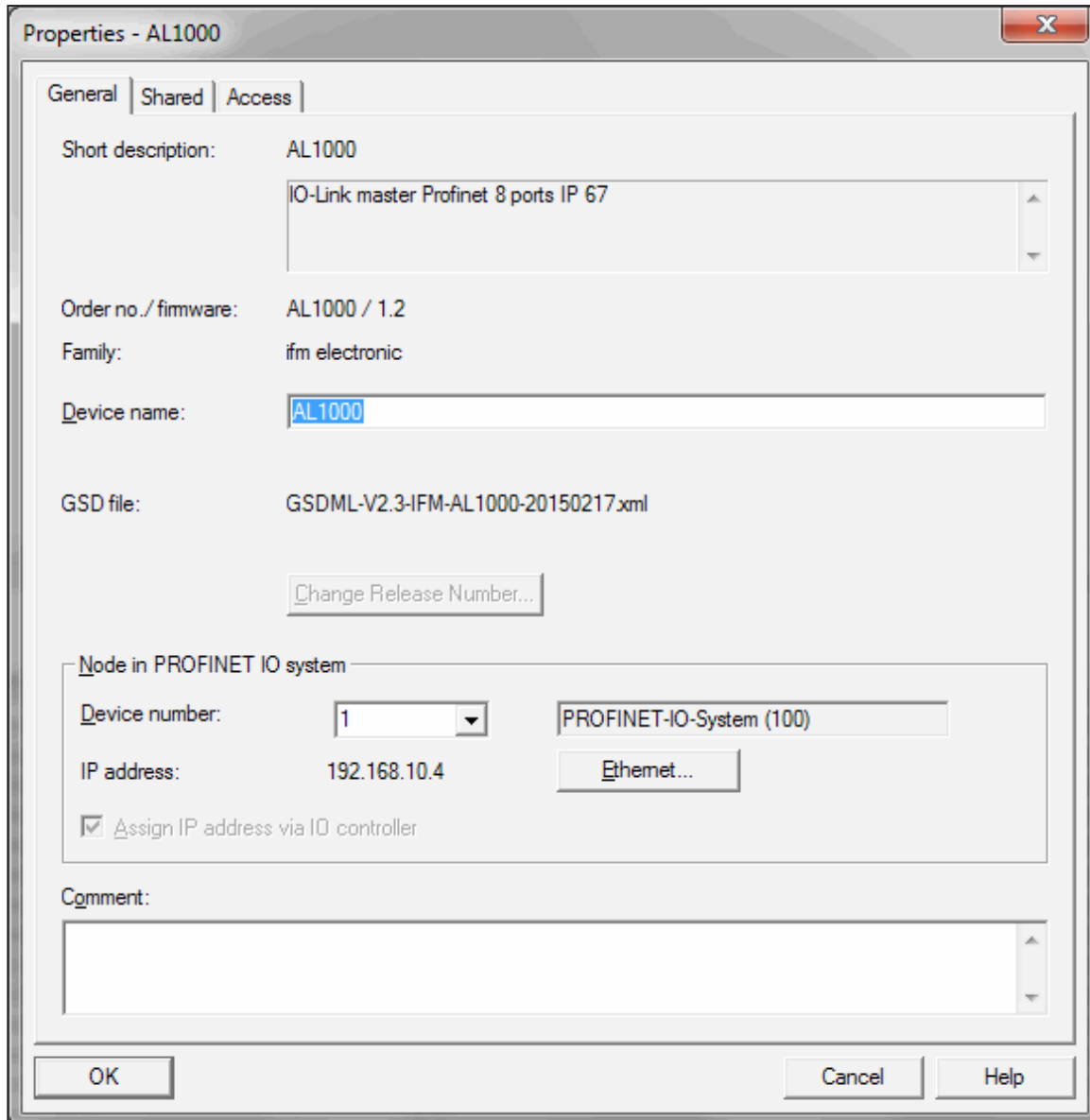
- Observe the naming conventions listed below when assigning the device name.

Naming conventions

- Limited to 127 characters (letters, numbers, dash, dot).
- A name component within the device name, i.e. a character string between two points, may be a maximum of 63 characters long.
- No special characters such as umlauts, brackets, underscore, slash, space, etc.
- A dash is the only special character permitted.
- The device name must not start or end with “-” or “.” characters.
- The device name must not start with numbers.
- The device name must not start with the character string “port-xyz-” (x, y, z = 0 ... 9).
- The device name must not take the form n.n.n.n (n = 0 ... 999).

First, the device is assigned a name in the configuration.

- ▶ Right-click on the device and select [Object Properties].
- ▶ In the dialogue box that appears, enter a name for the device under [Device name]. In the figure below [AL1000] is used.



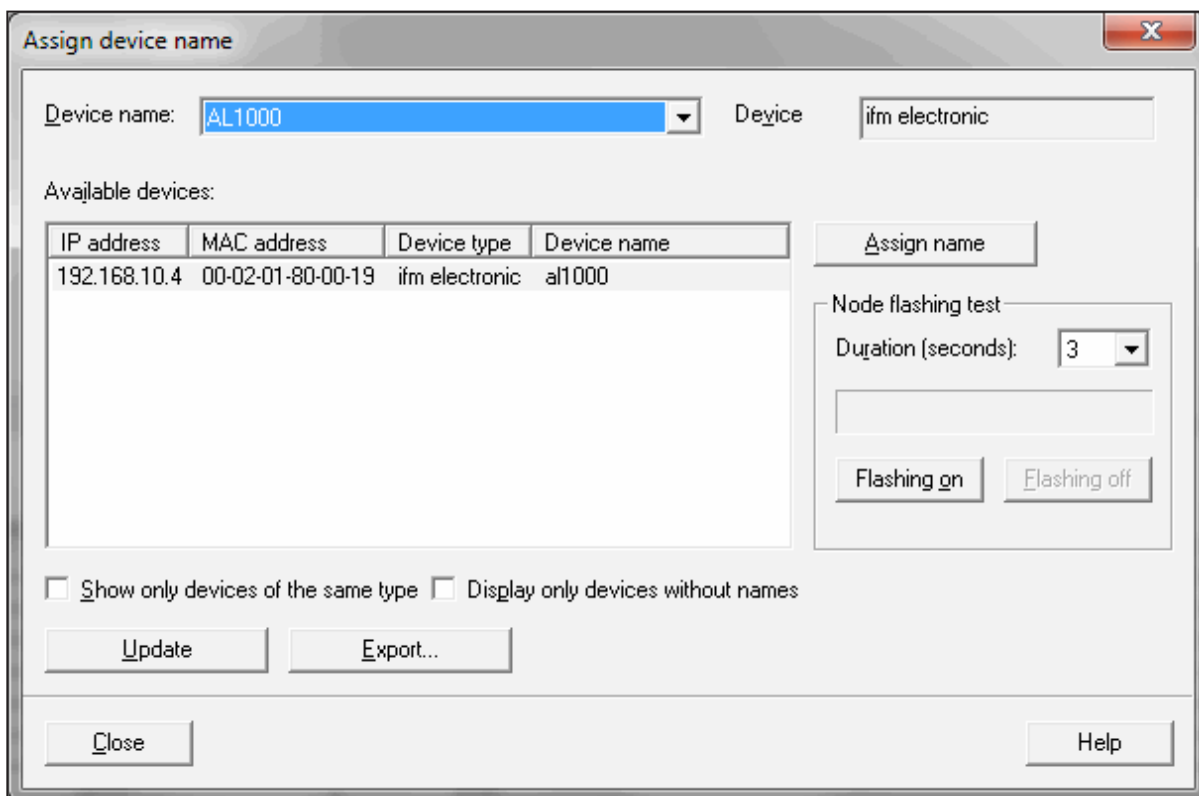
- ▶ Next, assign the same name to the device that was used in the hardware configuration. To do so, the device should be connected.

The following steps must be carried out:

- ▶ In [HW Config], select the [Target system, Ethernet, Assign device name] menu.

In the [Assign device name] dialogue box shown below, there should be an entry with the device MAC address.

- ▶ Select it and assign the desired configured name to it via [Assign name] under [Device name].
- ▶ Click [Close] to exit the dialogue box.



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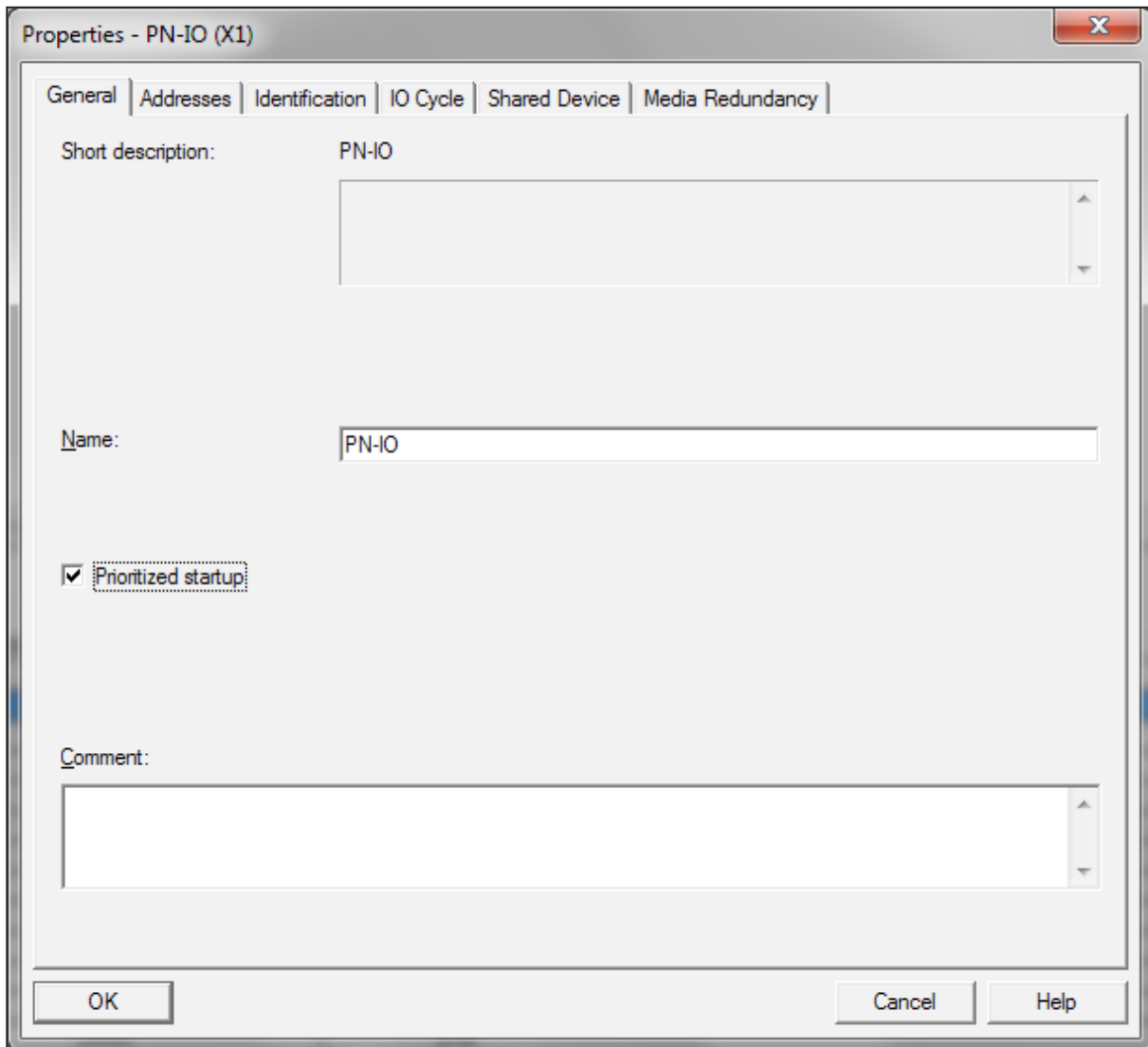
35.6 Fast startup

In order to use the [Fast startup] function, prioritised startup must be activated in the Profinet IO device interface submodule (PN-IO).

The following steps must be carried out:

Right-click on [PN-IO], then select [Object Properties].

- > The [Properties - PN-IO (X1)] dialogue box opens.
- ▶ In the [General] tab, activate the [Prioritized startup] checkbox.
- ▶ Acknowledge the dialogue box with [OK].

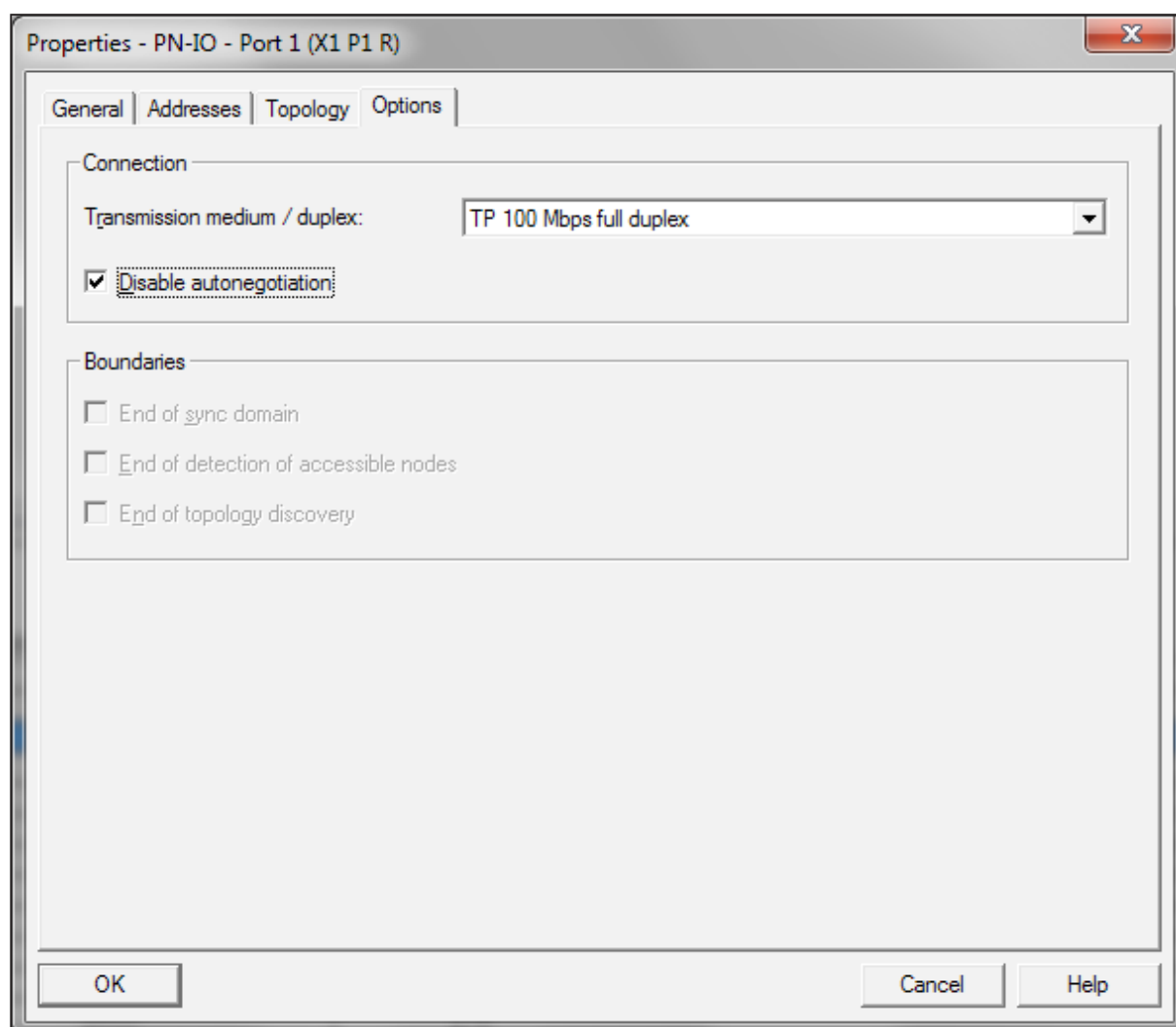


Furthermore, both ports should be set to fixed values. This saves time for startup that would otherwise be needed to arrange the port configuration.

The following steps must be carried out both for the device and the controller: Right-click on the ports, then select [Object Properties].

- > The [Properties - PN-IO - Port 1 (X1 P1 R)] dialogue box opens.
- ▶ In the [Options] tab in the [Connection] area, select the value [TP 100 Mbps full duplex] under [Transmission medium / duplex].
- ▶ Activate the [Disable autonegotiation] checkbox.
- ▶ Close the dialogue with [OK].

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35.7 Media Redundancy Protocol

In order to configure the Media Redundancy Protocol (MRP), the ring must be set for the corresponding dialogue boxes of the Profinet interfaces.

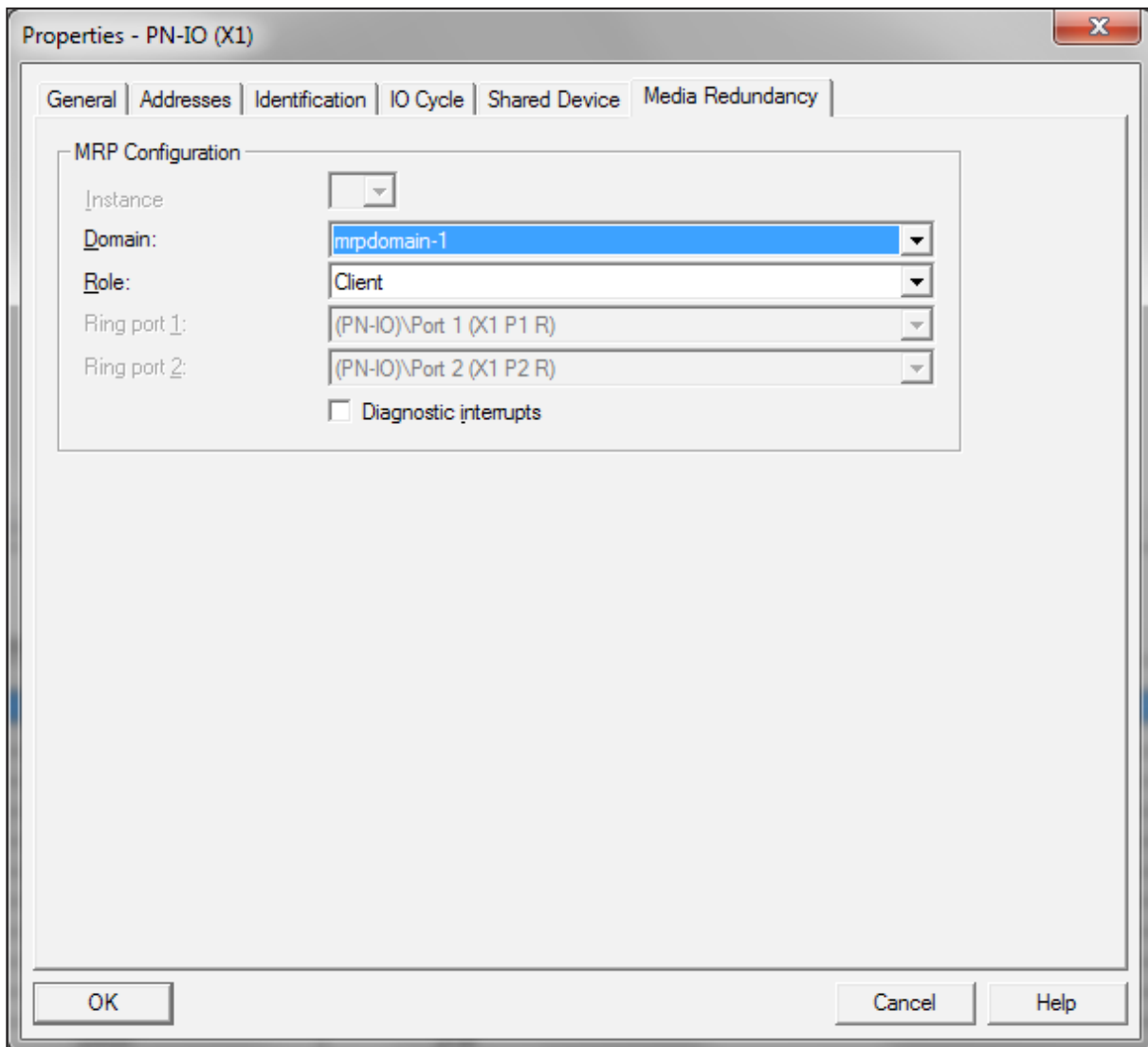
The following steps must be carried out

Right-click on [Profinet IO Interface (PN-IO)], then select [Object Properties].

- ▶ In the [Media Redundancy] tab, select the value [Client] under [Role].
- ▶ Close the dialogue with [OK].
- ▶ The corresponding settings must be made for the MRP manager.



- ▶ If an S7 controller with two Ethernet ports is used and auto negotiation is also deactivated, the second port must be set exactly like the first port. A crossed patch cable must therefore be used to establish a connection from the second port of the controller to the second port of a Profinet device.



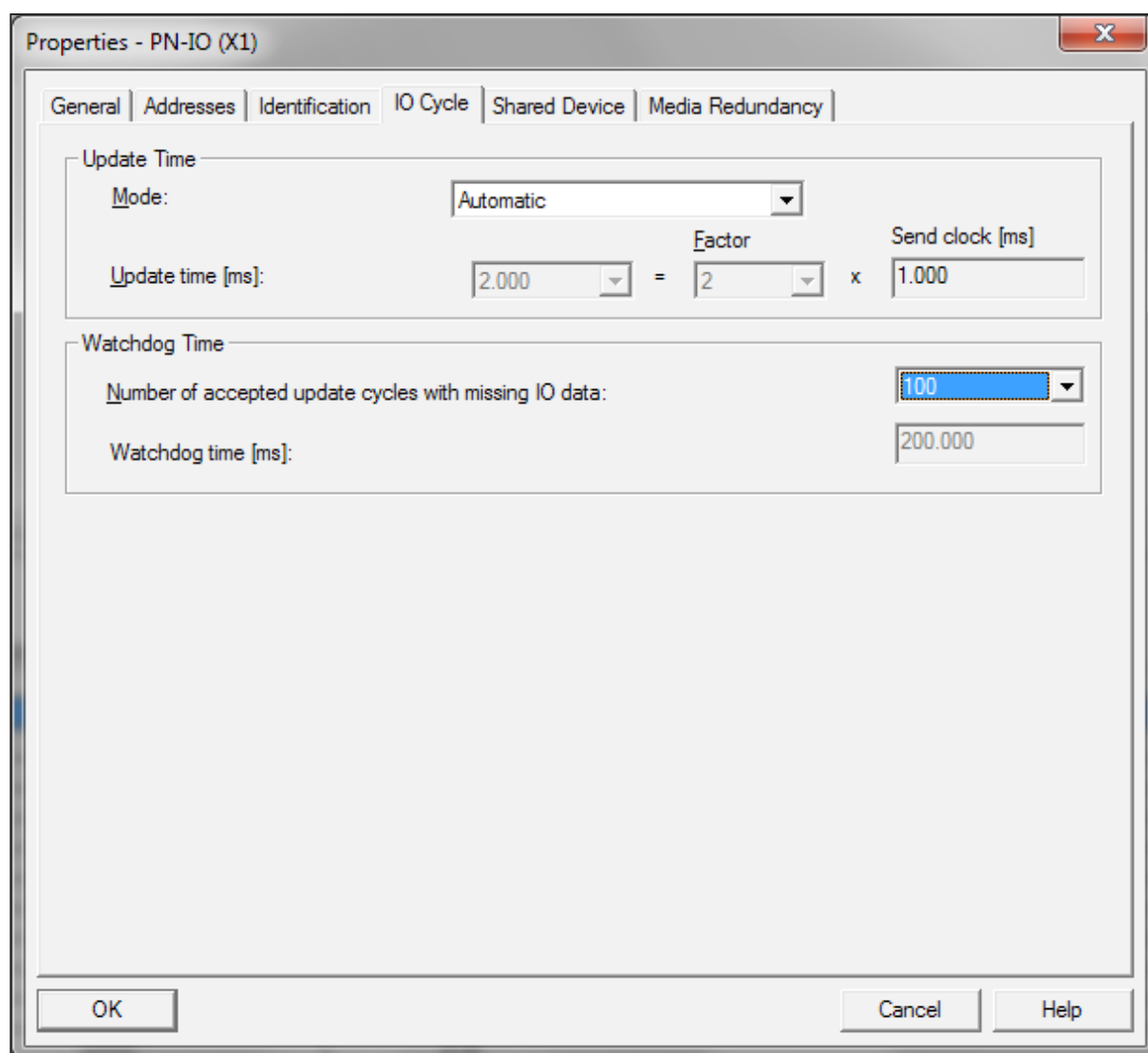
In order to ensure that the watchdog is not triggered during the MRP failure detection time, it must be set to a larger value than the expected MRP failure detection time.

The following steps must be carried out:

Right-click on [Profinet IO Interface (PN-IO)], then select [Object Properties].

- ▶ In the [IO Cycle] tab, set the value for [Number of accepted update cycles with missing IO data] under [Watchdog Time] so that the value under [Watchdog time (ms)] is greater than 200.
- ▶ Close the dialogue with [OK].

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35.8 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.

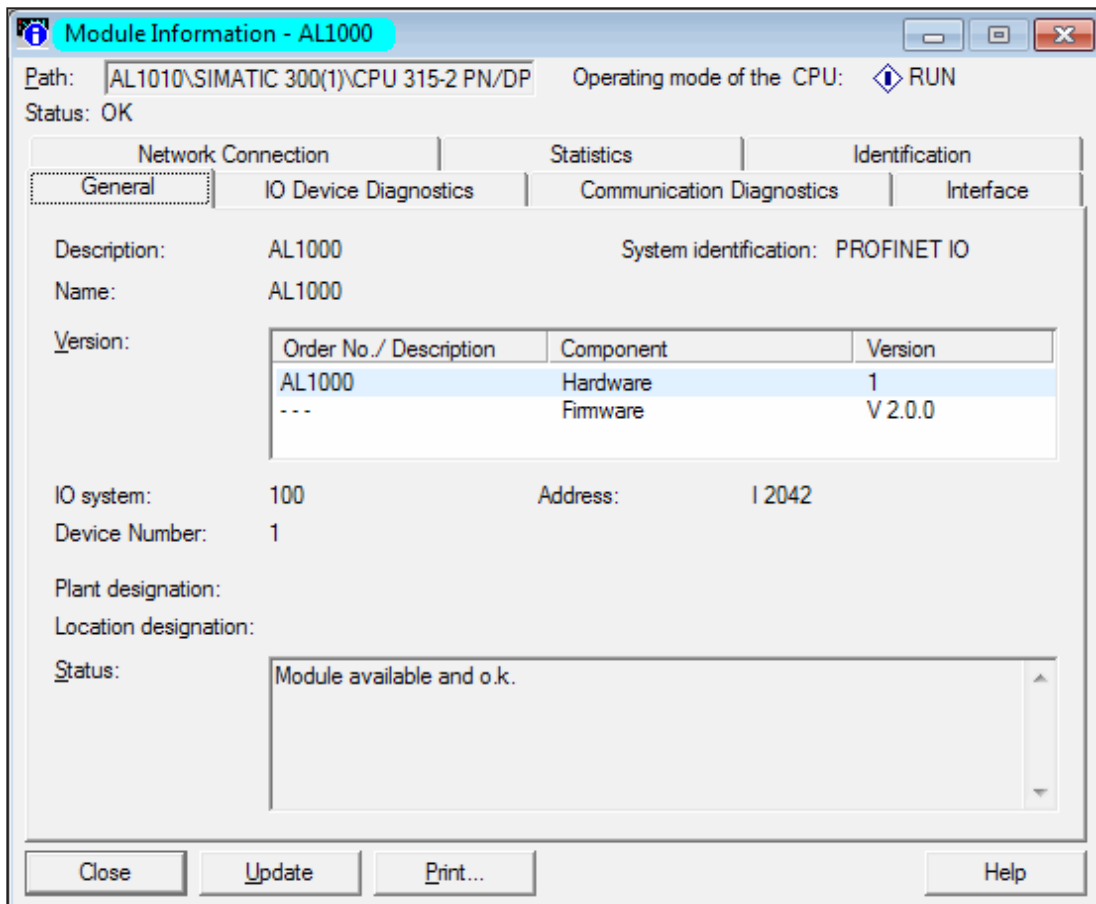
- ▶ Right-click on the module, then select [Module Information].
- ▶ In the [General] tab, the order number / description, hardware version and firmware version are listed in the [Version] area.

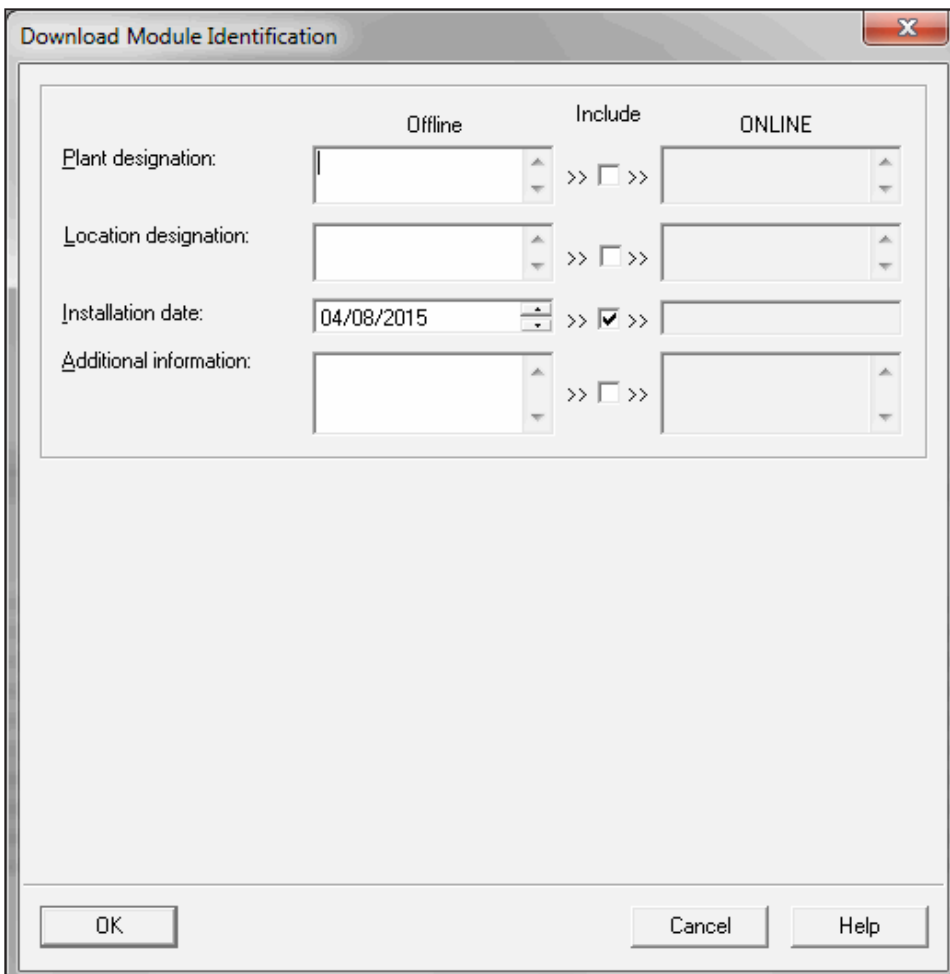
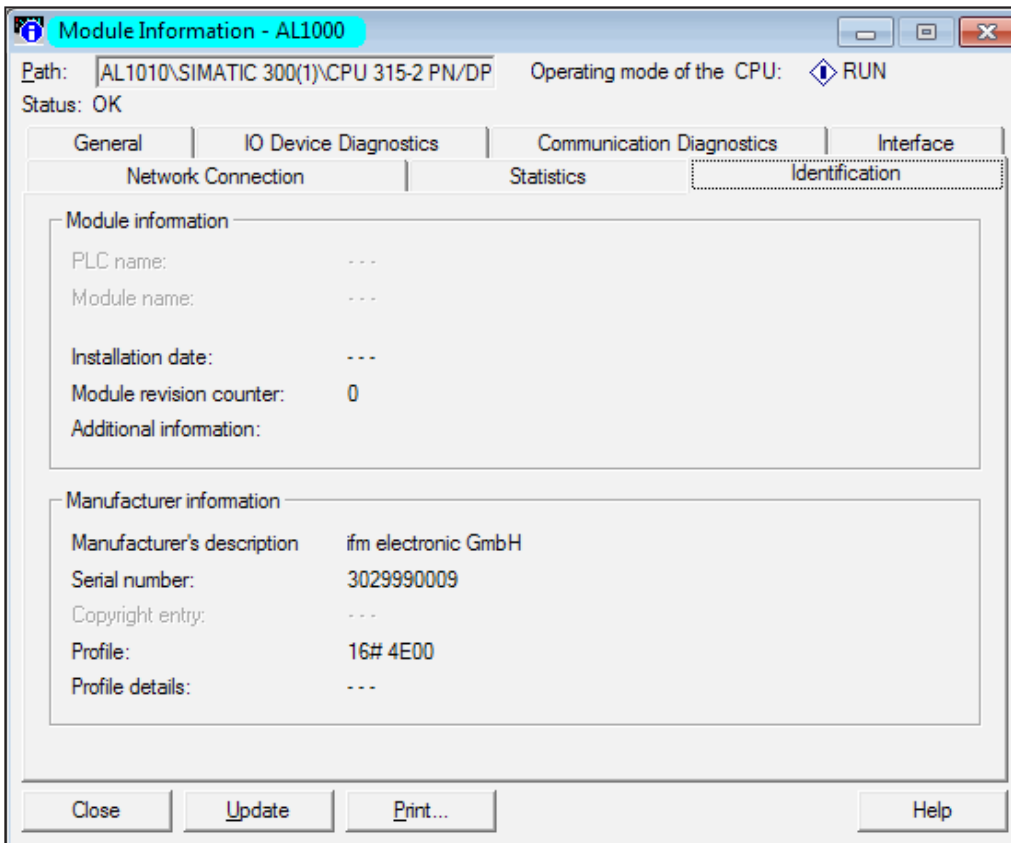
In the [Identification] tab, the module revision counter is listed in the [Module information] area and the vendor ID (manufacturer's description), serial number, profile, and profile details are listed in the [Manufacturer information] area.

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].





35.9 Diagnostic alarms

The devices support the following diagnostic alarms

Alarm code	Module	Alarm text	Description
0x0002	0	Undervoltage	Undervoltage U _S
0x0003	0	Overvoltage	Overvoltage U _S
0x0004	0	Overload	Overload U _S
0x0005	0	Overtemperature	Excess temperature
0x0100	0	Actuator undervoltage	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 [IO Device Diagnostics] tab to view the detailed text.

