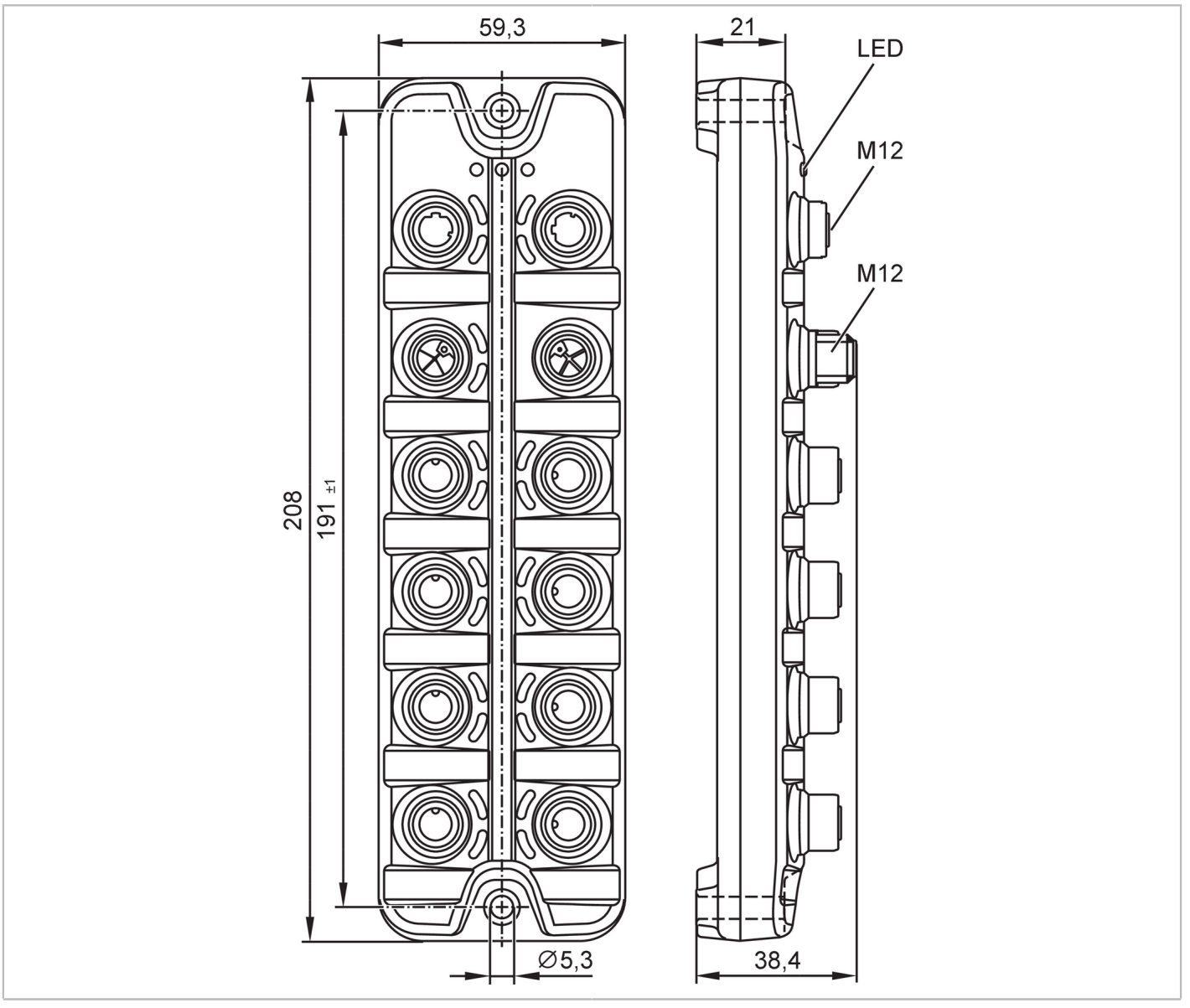
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IO-Link master with EtherNet/IP interface

IO-Link Master PFL EIP 8P IP69k



Application		
Application		hygienic systems; I/O modules for field applications
Daisy-chain function		voltage supply; fieldbus interface
Electrical data		
Operating voltage	[V]	20...28 DC; (US ; to PELV)
Current consumption	[mA]	300...3900; (US)
Protection class		III
Overvoltage category		II
Additional voltage supply	[V]	20...30 DC; (UA)
Actuator supply UA		
Max. current load total	[A]	8
Current rating per port	[A]	2; (adjustable: 0...2; Factory setting: 2)

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IO-Link master with EtherNet/IP interface

IO-Link Master PFL EIP 8P IP69k

Sensor supply US		
Max. current load total	[A]	3.6
Current rating per port	[A]	2; (adjustable: 0...2; Factory setting: 0,45)
Inputs / outputs		
Total number of inputs and outputs		16; (configurable)
Number of inputs and outputs		Number of digital inputs: 12; Number of digital outputs: 12
Inputs		
Number of digital inputs		12; (IO-Link Port Class A: 4 x 2; IO-Link Port Class B: 4 x 1)
Switching level high	[V]	11...30
Switching level low	[V]	0...5
Digital inputs protected against short circuits		yes
Outputs		
Number of digital outputs		12; (IO-Link Port Class A: 4 x 1; IO-Link Port Class B: 4 x 2)
Short-circuit proof		yes
Actuator supply UA		
Max. current load per output	[mA]	2000
Sensor supply US		
Max. current load per output	[mA]	2000
Interfaces		
Communication interface		Ethernet; IO-Link
Ethernet - EtherNet/IP		
Transmission standard		10Base-T; 100Base-TX
Transmission rate		10 MBit/s; 100 MBit/s
Protocol		EtherNet/IP; OPC UA
Factory settings		IP address: 192.168.1.250
		subnet mask: 255.255.255.0
		gateway IP address: 0.0.0.0
		MAC address: see type label
Note on interfaces		DHCP, BOOTP, static
		DLR (Device Level Ring)
		Supported network topologies: line
		ring
IO-Link Master		
Transmission type		COM1 (4,8 kBaud); COM2 (38,4 kBaud); COM3 (230,4 kBaud)
IO-Link revision		1.1
Number of ports class A		4
Number of ports class B		4
Operating conditions		
Ambient temperature	[°C]	-25...60
Storage temperature	[°C]	-25...85
Max. relative air humidity	[%]	90
Protection		IP 65; IP 66; IP 67; IP 69K; (operation with stainless steel protective caps: IP 69K)

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IO-Link master with EtherNet/IP interface

IO-Link Master PFL EIP 8P IP69k

Protection rating (NEMA 250)		6P	
Pollution degree		2	
Chemical media		ISO 16750-5	HLP, CC, DB, DC, DD, CA
		NEMA 250 5.13.1	AA
Tests / approvals			
EMC		EN 61000-6-2	
		EN 61000-6-4	
Shock resistance		DIN EN 60068-2-27	
Vibration resistance		DIN EN 60068-2-64 2009-04	
		DIN EN 60068-2-6 2008-10	
Mechanical data			
Weight	[g]	445.05	
Housing		rectangular	
Type of mounting		Backplane mounting	
Dimensions	[mm]	208 x 59.3 x 38.4	
Material		housing: PA grey; Socket: stainless steel (1.4404 / 316L)	
Sealing material		EPDM	
Accessories			
Items supplied		Protective cap: 1 x M12, stainless steel, E12542	
Remarks			
Remarks		Further information is available in the manual.	
Pack quantity		1 pcs.	

Electrical connection - Ethernet

Connector: 2 x M12; coding: D; Contacts: 4; sealing: EPDM

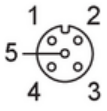


IN/OUT XF1, XF2

1:	DATA	TX +
2:	DATA	RX +
3:	DATA	TX -
4:	DATA	RX -
5:	n.c.	

Electrical connection - IO-Link

Connector: 8 x M12; coding: A; Contacts: 5; sealing: EPDM



IO-Link Port Class B X1...X4

1:	L+	(US; Sensor supply)
2:	L+	(UA; Actuator supply/ DO)
3:	L-	(US; Sensor supply)
4:	DATA	IO-Link (C/Q)
5:	L-	(UA; Actuator supply)

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IO-Link master with EtherNet/IP interface

IO-Link Master PFL EIP 8P IP69k

IO-Link Port Class A X5...X8		
1:	L+	(US; Sensor supply)
2:	IN	DI
3:	L-	(US; Sensor supply)
4:	DATA	IO-Link (C/Q)
5:	n.c.	

Electrical connection - voltage supply IN

Connector: 1 x M12; coding: L; Contacts: 5



XD1		
1:	L+	(US)
2:	L-	(UA)
3:	L-	(US)
4:	L+	(UA)
5:		FE

Electrical connection - voltage supply OUT

Connector: 1 x M12; coding: L; Contacts: 5; sealing: EPDM



XD2		
1:	L+	(US)
2:	L-	(UA)
3:	L-	(US)
4:	L+	(UA)
5:		FE

Operating instructions

IO-Link master with EtherNet/IP interface
PerformanceLine
OPC UA server

AL1427

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1 Preliminary note

You will find instructions, technical data, approvals, accessories and further information using the QR code on the device / packaging or at documentation.ifm.com.

1.1 Legal and copyright information

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All product names, pictures, companies or other brands used are the property of the respective rights owners.

1.2 Symbols used

✓	Requirement
▶	Instruction
▷	Reaction, result
bold	Designation of keys, buttons or indications
→	Cross-reference without link
→	Cross-reference with link
	Important note Non-compliance may result in malfunction or interference
	Information Supplementary note

1.3 Warnings

Warnings indicate the possibility of personal injury and damage to property. This enables safe product handling. Warnings are graded as follows:



WARNING

Warning of serious personal injury

▷ If the warning is not observed, fatal and serious injuries are possible.



CAUTION

Warning of minor to moderate personal injury

▷ If the warning is not observed, minor to moderate injuries are possible.



ATTENTION

Warning of damage to property

▷ If the warning is not observed, damage to property is possible.

1.4 Change history

Issue	Subject	Date
00	New creation of the document	11 / 2025

2 Safety instructions

- The unit described is a subcomponent for integration into a system.
  - The system architect is responsible for the safety of the system.
  - The system architect undertakes to perform a risk assessment and to create documentation in accordance with legal and normative requirements to be provided to the operator and user of the system. This documentation must contain all necessary information and safety instructions for the operator, the user and, if applicable, for any service personnel authorised by the architect of the system.
- Read this document before setting up the product and keep it during the entire service life.
- The product must be suitable for the corresponding applications and environmental conditions without any restrictions.
- Only use the product for its intended purpose (Intended use).
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property may occur.
- The manufacturer assumes no liability or warranty for any consequences caused by tampering with the product or incorrect use by the operator.
- Installation, electrical connection, set-up, operation and maintenance of the product must be carried out by qualified personnel authorised by the machine operator.
- Protect units and cables against damage.

2.1 Cyber security

ATTENTION

Operating the machine in an unprotected network environment

▷ Unauthorised read or write access to data is possible.

▷ Unauthorised manipulation of the device function is possible.

▶ Check and restrict access options to the device.

2.2 Safety symbol on the device

Safety symbol on the device:

▶ Adhere to the operating instructions for the safe operation of the device.

3 Transport, handling and storage

- Store the device in its original packaging.
- When the device is to be stored again, use the original packaging.
- Otherwise, provide unused connections with either a mating connector or a protective cap and pack the device in suitable packaging.
- Observe the permissible ambient conditions for the device during storage (→ Technical data).

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4 Intended use

The device may only be used for the following purposes:

- IO-Link master for configuration, management and operation of IO-Link devices
- Gateway between IO-Link devices and a higher-level EtherNet/IP control system

The device is designed for use without a control cabinet in the food industry.

5 Function

5.1 IO-Link

The device offers the following IO-Link functions:

- IO-Link master (IO-Link revision 1.0 and 1.1)
- 4 IO-Link ports (class A) for connection of IO-Link devices
- 4 IO-Link ports (class B) for connection of IO-Link devices

5.1.1 IO-Link supply

The device offers supplies for 8 IO-Link devices (sensors, actuators).

Ports X1...X4 are class B ports.

- Pin 2 (UA) of ports X1...X4 supports different operating modes (disconnected from power, supply voltage UA, digital output).
- The current intensity of the supply voltages US and UA of ports X1...X4 can be adjusted.

Ports X5...X8 are class A ports.

- The current intensity of the supply voltage US of ports X5...X8 can be set.

The device ensures fire protection for connected IO-Link devices by providing an energy-limited circuit at the ports (according to IEC61010-1 and class 2 to UL1310).

5.1.2 Digital inputs

Ports X5...X8 each have an additional digital input. The digital inputs are each at pin 2 of the port.

The digital inputs are supplied with the supply voltage US. They refer to the potential of US (pin 3).

5.1.3 Digital outputs

Ports X1...X4 each have an optionally activable switching output. The additional digital outputs are each at pin 2 of the port.

The digital switching outputs are supplied with the supply voltage UA. They refer to the potential of UA (pin 5).

5.2 Parameter setting

The device can be configured with the following options:

- Parameter setting software
  - ifm moneo|IIoT Core Cloud (art. no QCM100)
  - ifm moneo|IIoT Core On-Premises (art. no QM9112)
  - ifm moneo|configure free
- ifm IoT Core:
  - ifm IoT Core Visualizer
- EtherNet/IP
  - Projection software

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5.3 Visual indication

The device displays the following indications:

- Status and error indication of the EtherNet/IP gateway and the system
- Status of the voltage supplies US and UA
- Status and activity indication of the Ethernet connections
- Status and error indication of the IO-Link ports (class A)
- Status and error indication of the IO-Link ports (class B)

5.4 EtherNet/IP

The device supports the following EtherNet/IP functions:

- Device profile: EtherNet/IP adapter
- Network topologies: Line, Ring, DLR
- Min. cycle time: 1 ms (RPI)
- Connection classes: 1, 3
- Connection types:
  - Exclusive Owner
  - Input only
  - Listen only
- UCCM support
- Fieldbus objects:
  - Identity Object (0x01)
  - Message Router Object (0x02)
  - Assembly Object (0x04)
  - Connection Manager (0x06)
  - Device Level Ring Object (0x47)
  - Quality of Service Object (0x48)
  - IO-Link Request Object (0x80)
  - TCP/IP Interface Object (0xF5)
  - Ethernet Link Object (0xF6)
  - LLDP Management Object (0x109)
- Protocols: DHCP, BOOTP, ACD, DLR
- Device description: EDS file

5.5 ifm IoT Core

- Mapping of the data, events and services of the device to an object model (ifm IoT Core)
- Integration of the device in IIoT applications
- Access to the ifm IoT Core:
  - Browser-based interface (IoT Core Visualizer)
- Supported protocols: HTTP, TCP, JSON

5.6 OPC UA server

The device offers a server according to standard OPC Unified Architecture (OPC UA).

The OPC UA server provides access to the following device data:

- Parameter
- Process data
- Identification information
- Diagnostic and status information
- Services

Features:

- Supported OPC UA version: 1.04
- TCP port: 4840
- Authentication methods:
  - Anonymous
  - Username / password
- Max. number of simultaneously connected OPC UA clients: 5
- Max. lifetime per active session: 120 s
- Max. number of subscriptions per session: 5
- Max. number of monitored objects per subscription: 100

The OPC UA server is enabled in the factory settings.

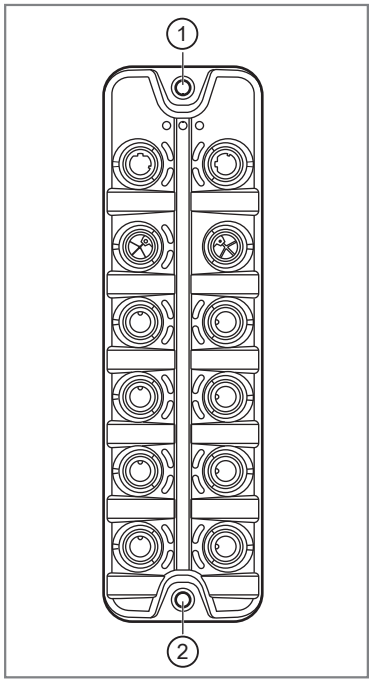
5.7 Voltage output

The device has a voltage output to supply an additional device. This makes it possible to supply several devices with one voltage source (daisy chain).

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6 Installation

6.1 Overview



1: Upper mounting lug
2: Lower mounting lug

6.2 Install device

▶ Disconnect the power of the machine before installation.

Available options:

- Installing the device without accessories 13
- Installing the device with DIN rail adapter 13Functional earthing 17

6.2.1 Installing the device without accessories

▶ Observe the notes on how to earth the device: Functional earthing 17

▶ Mount the device on a flat mounting surface.
▶ Use two M5 mounting screws and washers for installation (tightening torque: 1.8 Nm).

6.2.2 Installing the device with DIN rail adapter

Optional accessories are available for mounting: documentation.ifm.com

▶ Observe the instructions of the mounting accessories.



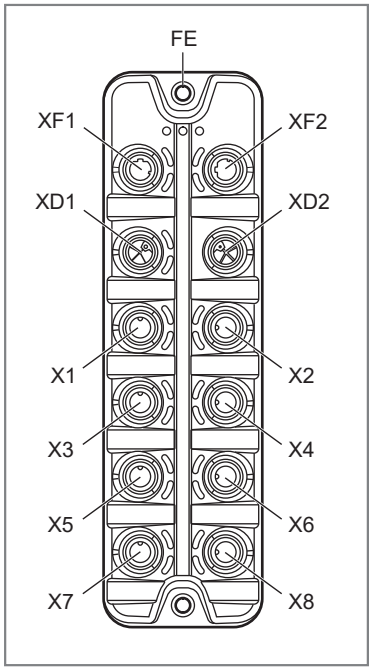
- Observe the notes on how to earth the device: Functional earthing 17

- Mount the adapter on the DIN rail.
- Secure the adapter with the enclosed set screw.
- Attach the device to the adapter.
- Use two M5 mounting screws and washers for fastening (max. tightening torque: 2.7 Nm).

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7 Electrical connection

7.1 Overview



FE: Functional earth (FE)
XF1: Ethernet port 1 (EtherNet/IP)
XF2: Ethernet port 2 (EtherNet/IP)
XD1: Power IN - voltage supply
XD2: Power OUT - voltage output
X1: IO-Link port (class B)
X2: IO-Link port (class B)
X3: IO-Link port (class B)
X4: IO-Link port (class B)
X5: IO-Link port (class A)
X6: IO-Link port (class A)
X7: IO-Link port (class A)
X8: IO-Link port (class A)

7.2 General wiring information

The unit must be connected by a qualified electrician.

- Observe the national and international regulations for the installation of electrical equipment.

The device is suitable for operation on PELV voltages.

- Observe the notes on IO-Link wiring.

This device contains components that may be damaged or destroyed by electrostatic discharge (ESD).

- Please observe the required precautions against electrostatic discharge!

The circuits are insulated from each other and from device surfaces that could be touched with basic insulation according to IEC 61010-1 (secondary circuit with max. 30 V DC, supplied from the mains circuit up to 300 V of overvoltage category II). The external wiring has to be carried out in a way that ensures the required separation from other circuits.

The communication interfaces are isolated from each other, from the electrical circuits and from the touch surfaces of the device with basic insulation in accordance with EN61010-1 (secondary circuit with maximum 30 V DC, derived from mains circuit up to 300 V of overvoltage category II). The external wiring has to be carried out in a way that ensures the required separation from other circuits.

7.2.1 Connection technology

The threaded connections in the device correspond to the M12 standard. To ensure compliance with the specified protection rating, only cables that comply with this standard may be used. In the case of self-assembled cables, the system manufacturer is responsible for the protection rating.

- Use connectors with gold-plated contacts.

- Check the screw connection 2 weeks after installation and retighten to the correct torque if necessary.
- During installation, place the connectors vertically so that the coupling nut will not damage the thread.
- Before connecting the connector, check that there is an undamaged O-ring in the socket.
- Observe the coding of the connectors during installation.
- Cover unused connections with protective covers. Tightening torque: 1.3 ± 0.1 Nm

For UL applications:

- To connect the device and the IO-Link devices, only use UL-certified cables belonging to category CY-JV or PVVA with a minimum temperature of 80 °C (75 °C in case of a maximum ambient temperature of 40 °C).

7.3 Ethernet ports

The device is connected to the EtherNet/IP network via the Ethernet ports (e.g. EtherNet/IP controller).

The device is connected to the IT network via the Ethernet ports. The user can configure the device via the IT network (e.g. laptop/PC with parameter setting software, web browser for access to IoT Core Visualizer).

Wiring:



1: DATA TX+
2: DATA RX+
3: DATA TX-
4: DATA RX-
5: n.c.

- Connect the device to the EtherNet/IP network via a free Ethernet port (XF1, XF2).
- Connect the device to the IT network via a free port (XF1, XF2).
- For connection, use M12 connectors (minimum protection rating: IP65 / IP66 / IP67 / IP69K).
- Tighten the cable plug using 1.3 ± 0.1 Nm.

7.4 IO-Link ports (class A)

IO-Link devices (sensors, actuators) are connected to the IO-Link ports (class A).

The IO-Link ports meet the requirements of the IO-Link specifications 1.0 to 1.1.2.

The ports are equipped with short-circuit detection (US).

The ports have an additional digital input (type 2, according to IEC 61131-2).

Wiring:



1: L+ (US)
2: IN2 DI2
3: L- (US)
4: MP1 DI1/DO1/IO-Link
5: n.c.

7.4.1 Connecting IO-Link devices (class A)

- Connect the IO-Link devices to ports X5...X8. Maximum cable length per port: 20 m.
- For connection, use M12 connectors (minimum protection rating: IP65 / IP66 / IP67 / IP69K).
- Tighten the cable plug using 1.3 ± 0.1 Nm.

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7.5 IO-Link ports (class B)

IO-Link devices (sensors, actuators) are connected to the IO-Link ports (class B).

The IO-Link ports meet the requirements of the IO-Link specifications 1.0 to 1.1.2.

The ports are equipped with short-circuit detection (US, UA).

The connected IO-Link devices must be supplied exclusively via the IO-Link master.

The additional digital output at pin 2 of the ports meets the requirements of utilisation category DC-13 according to standard IEC 60947-5-1, 20 W.

Wiring:



1: L+ (US)
2: MP2 DO2 (UA)
3: L- (US)
4: MP1 DI1/DO1/IO-Link
5: L- (UA)

7.5.1 Connecting IO-Link devices (class B)

- Connect the IO-Link devices to ports X1...X4. Maximum cable length per port: 20 m.
- For connection, use M12 connectors (minimum protection rating: IP65 / IP66 / IP67 / IP69K).
- Tighten the cable plug using 1.3 ± 0.1 Nm.

7.5.2 Connecting IO-Link devices (class A)

CAUTION

Connection of IO-Link devices (class A) to IO-Link ports (class B) with 4 or 5-pole connectors

- ▷ Risk of fire
- ▷ Malfunction
- To connect IO-Link devices (class A) to IO-Link ports (class B), use 3-pole connectors only.
- Observe the IO-Link planning directive: www.io-link.com.

- Connect the IO-Link devices to ports X1...X4. Maximum cable length per port: 20 m.
- For connection, use M12 connectors (minimum protection rating: IP65 / IP66 / IP67 / IP69K).
- Tighten the cable plug using 1.3 ± 0.1 Nm.

7.6 Functional earthing

The FE potential is connected to the following points of the device:

- Upper mounting lug of the housing
- Ports XD1 and XD2: Pin 5 (FE)
- Ports XF1 and XF2: socket thread

All points are interconnected in the device.

- Connect at least one FE terminal of the device to the system ground or GND of the supply.

To ensure electrical interference protection, proper functioning and safe operation of the device, always choose the shortest route for the FE connection.

7.7 Voltage output

An additional device can be supplied via the XD2 port (daisy chain). The supply voltages US and UA are looped through from Port XD1 to Port XD2.

Wiring:



1: L+ (US)
2: L- (UA)
3: L- (US)
4: L+ (UA)
5: FE

- Optional: Connect an additional device to the port XD2.
- For connection, use an L-coded M12 connector (minimum protection rating: IP65 / IP66 / IP67 / IP-69K).
- Tighten the cable plug using 1.3 ± 0.1 Nm.

7.8 Voltage supply

The device is connected to the supply voltages US and UA via the XD1 port.

The supply voltage US supplies the device and the devices connected to ports X1...X8 with voltage.

The supply voltage UA supplies the devices connected to the ports X1...X4.

CAUTION

Exceeding the maximum input current of 16 A

- ▷ Risk of fire
- Dimension the IU and IA of the supply sources US and UA, taking into account the derating behaviour of the device: Derating behaviour → 19

ATTENTION

The supply voltages US and UA are not protected against cross polarity.

- ▷ Damage to the device
- Ensure correct connection of the supply voltages US and UA.

- In case of cables that are longer than 25 m, take the voltage drop and the necessary minimum supply voltage of 20 V into consideration!

The XD1 port is equipped with overvoltage protection (US).

The XD1 port is equipped with reverse polarity protection (US, UA).

Wiring:



1: L+ (US)
2: L- (UA)
3: L- (US)
4: L+ (UA)
5: FE

- Disconnect power.
- Connect the device via Port XD1 to supply voltage US and UA with 24 V DC (18...28 V PELV; according to IEC 61010-1, secondary circuit with max. 30 V DC, supplied from main circuit up to 300 V of overvoltage category II).

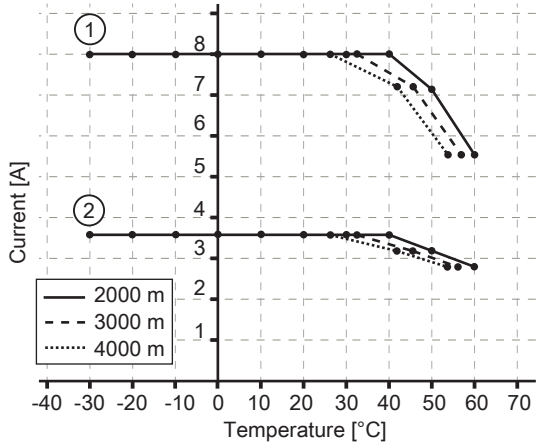
- For connection, use an L-coded M12 connector (minimum protection rating: IP65 / IP66 / IP67 / IP-69K).
- Tighten the cable sockets according to the torque specifications indicated by the cable vendor. Maximum permissible tightening torque: 0.8 Nm

7.8.1 Derating behaviour

The current I_{US} available at the Ports X1...X8, the current I_{UA} available at the Ports X1...X4, and the current $I_{US\text{-}daisy\text{-}chain}$ and $I_{UA\text{-}daisy\text{-}chain}$ available at port XD2 depend on the ambient temperature of the device.

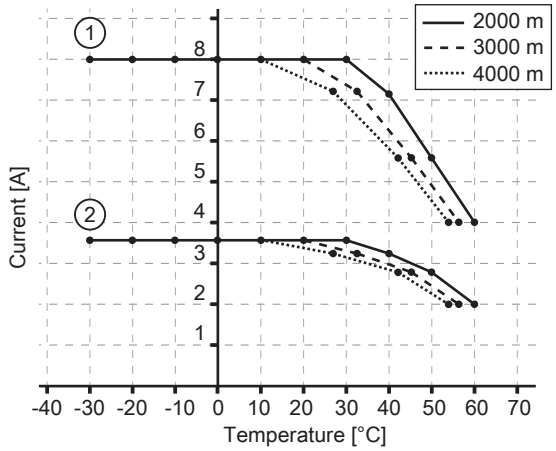
The derating measurements were carried out under the following conditions: Supply voltage US / UA: 24 V DC

7.8.1.1 Derating without daisy chain

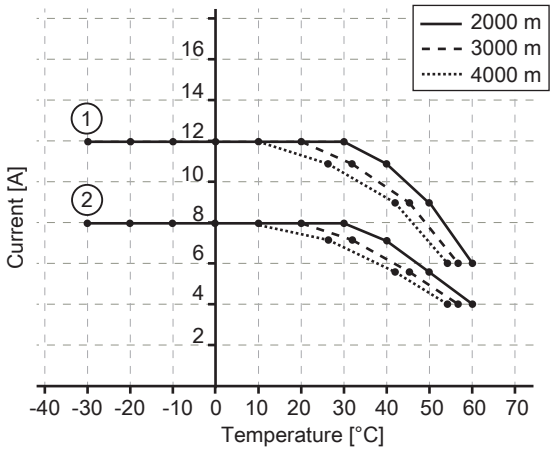


1: I_{UA} on port X1...X4
2: I_{US} on port X1...X8

7.8.1.2 Derating with daisy chain



1: I_{UA} on port X1...X4
2: I_{US} on port X1...X8

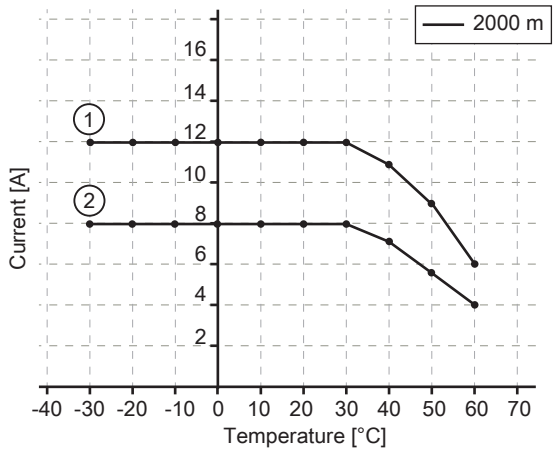


1: $I_{US\text{-}daisy\text{-}chain}$ on port XD2
2: $I_{UA\text{-}daisy\text{-}chain}$ on port XD2

Example:

Temperature	I_{UA} (X1…X4)	I_{US} (X1...X8)	$I_{UA\text{-}daisy\text{-}chain}$ (XD2)	$I_{US\text{-}daisy\text{-}chain}$ (XD2)
30 °C	8 A	3.6 A	8 A	12 A

For UL applications:



1: $I_{US\text{-}daisy\text{-}chain}$ on port XD2
2: $I_{UA\text{-}daisy\text{-}chain}$ on port XD2

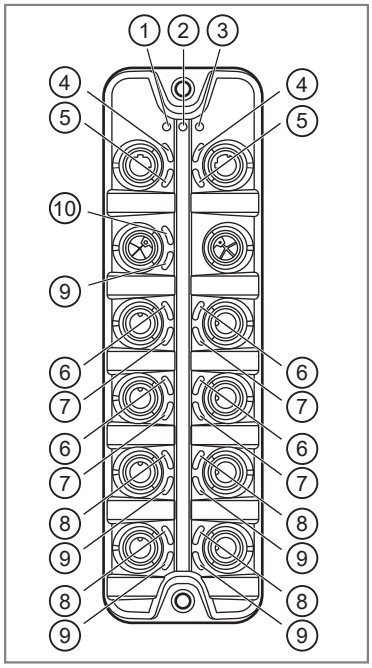
Example:

Temperature	I_{UA} (X1…X4)	I_{US} (X1...X8)	$I_{UA\text{-}daisy\text{-}chain}$ (XD2)	$I_{US\text{-}daisy\text{-}chain}$ (XD2)
30 °C	8 A	3.6 A	5 A	9 A

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8 Operating and display elements

8.1 LEDs



1: Status: RDY
2: Status: NET
3: Status: MOD
4: EtherNet/IP LINK
5: EtherNet/IP ACT
6: IO-Link:
7: IO-Link: DI
8: Power IN: UA
9: Power IN: US

8.1.1 Status

LED	Description	Colour	State	Description
RDY	Gateway status	--	Off	Not active or reboots
		green	flashes (5 Hz)	Error
			flashes (200 ms on, 800 ms off)	Firmware update running
			On	OK
NET	Network status	--	off	Not powered, no IP address: device has no IP address or no voltage applied or voltage applied is too low
		green / red	flashes	Self test: device in self-test after start (→ MOD-LED)
		green	flashes (1 Hz)	No connection: no CIP connection established and no Exclusive Owner connection timeout
			on	Connected: device has IP address and at least one CIP connection established and no Exclusive Owner connection timeout
		red	flashes (1 Hz)	Connection timeout: device has IP address and Exclusive Owner connection timeout
			on	Duplicate: IP address used twice
MOD	EtherNet/IP module status	--	off	No power: no voltage is applied or the applied voltage is too low
		green / red	flashes	Self test: device in self-test
		green	flashes (2 Hz)	Standby: device not yet configured (no IP address)

LED	Description	Colour	State	Description
			on	Device operational: device functions reliably (normal operation)
		red	flashes (1 Hz)	Major recoverable fault: serious, recoverable error (e.g. incorrect configuration)
			on	Major unrecoverable fault: serious, unrecoverable error (e.g. module failed)

8.1.2 Ethernet

LED	Description	Colour	State	Description
LNK	Status of the connection	--	Off	No Ethernet connection
		Green	On	Ethernet connection established
ACT	Status of the data transmission	--	Off	No data transmission
		Yellow	Flashes	Data transmission

8.1.3 Voltage supply

LED	Description	Colour	State	Description
US	Status of the supply voltage US	Green	Off	No supply voltage is applied or the applied voltage is too low
			On	Supply voltage applied
UA	Status of the supply voltage UA	Green	Off	No supply voltage is applied or the applied voltage is too low
			On	Supply voltage applied

8.1.4 IO-Link ports (class A)

LED	Description	Colour	State	Description
	Status of the IO-Link port (pin 4)	Yellow	Off	Port mode DI / DO: Pin 4 (C/Q) = OFF
			On	Port mode DI / DO: Pin 4 (C/Q) = ON
		Green	Flashes (1 Hz)	Port mode IO-Link: No IO-Link device found
			Flashes (5 Hz)	Port mode IO-Link: “PREOPERATE” state
			On	Port mode IO-Link: “OPERATE” state
		Red	Flashes (1.2 Hz)	IO-Link communication error
			On	Port configuration error or short circuit / overload at US
DI	Status of the digital input (pin 2)	Yellow	Off	Digital input: Pin 2 = OFF
			Flashes (5 Hz)	Digital input: Pin 2 = ON

8.1.5 IO-Link ports (class B)

LED	Description	Colour	State	Description
	Status of the IO-Link port (pin 4)	--	Off	Port mode DI / DO: Pin 4 (C/Q) = LOW
		Yellow	On	Port mode DI / DO: Pin 4 (C/Q) = HIGH
		Green	Flashes (1 Hz)	Port mode IO-Link: No IO-Link device found

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LED	Description	Colour	State	Description
			Flashes (5 Hz)	Port mode IO-Link: “PREOPERATE” state
			On	Port mode IO-Link: “OPERATE” state
		Red	Flashes (1.2 Hz)	Port configuration error or short circuit / overload at US
			On	Transmission error
UA/DO	Status of the IO-Link port (pin 2)	--	Off	Digital input Pin 2 (UA) = LOW
		Yellow	On	Digital input Pin 2 (UA) = HIGH
		Green	Off	IO-Link type A supply: Pin 2 (UA) = LOW
			On	IO-Link type B supply: Pin 2 (UA) = HIGH (not switchable)
		Red	On	Error: Overcurrent or undervoltage

9 Set-up

- ▶ Install the unit correctly.
- ▶ Establish a correct electrical connection with the device.
- ▷ Once connected to the supply voltage, the unit will start.
- ▷ The LEDs show status and error conditions.
- ▷ The unit is ready for operation.
- ▷ The device can be configured.

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10 Settings

10.1 Parameter setting software

10.1.1 Supported parameter setting software

Supported parameter setting options:

- ifm moneo|IIoT Core On-Premises (art. no QM9112)
- ifm moneo|IIoT Core Cloud (art. no QCM100)
- ifm moneo|configure free



▶ For correct installation: observe the installation instructions for ifm moneo.

▶ Install the desired parameter setting software.

▶ Activate the licences required for operation.

▷ The installed software can be used to configure the device.

10.1.2 Connect to the device

Requirements:

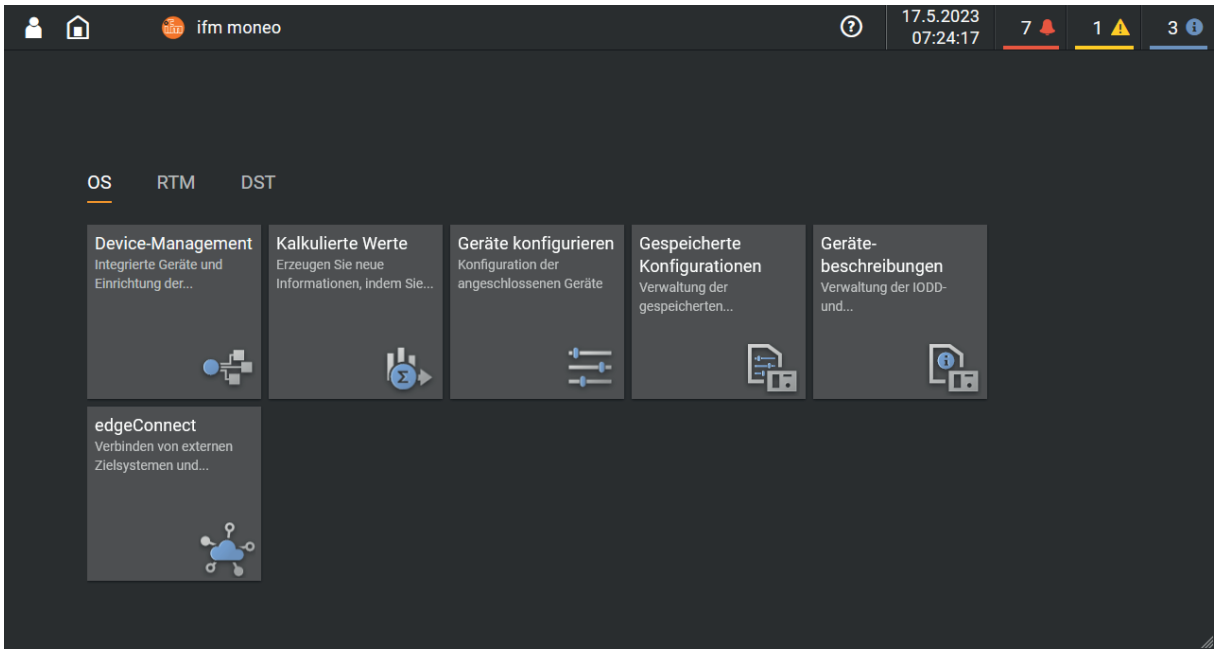
✓ ifm moneo|configure has been installed correctly on the laptop / PC.

✓ ifm moneo|configure has been set up.

✓ The laptop / PC is connected directly or via a suitable network coupling element (e.g. switch) to a EtherNet/IP port (XF1, XF2) of the device.

▶ Start ifm moneo.

▷ The user interface appears.



▶ Click on the **Configure devices** tile.

▷ The **Configure devices** view appears.

▶ Scan the network for devices.

▷ ifm moneo detects the IO-Link master.

▶ Optional: Adjust IP settings of the Ethernet interface of the device.

▶ In the line of the IO-Link master: Click on the symbol .

▷ Connecting to device.

▷ The view shows the IO-Link master and the connected IO-Link devices.

▶ In the line of the IO-Link master: Click on the symbol .

▷ The editor view of the IO-Link master appears.

10.1.2.1 Online parameter setting

The device supports parameter setting during operation (online parameter setting). During the parameter setting process, the IO-Link master and the connected IO-Link devices stay in operating mode. They continue to perform their functions with the existing parameters until the parameter setting has been completed.

If you change parameters during operation, this will influence the function of the plant.

▶ Ensure that there will be no malfunctions in your plant.

10.1.2.2 Offline parameter setting

The device supports parameter setting before installation and set-up (offline parameter setting). The user creates a configuration for the IO-Link master and the connected IO-Link devices without being connected to the device. The configuration created can be stored as a file (*.lrp) and loaded to the device and activated at a later point.

10.1.3 IoT interface

The **IoT** menu provides access to the parameters of the IoT interface.

10.1.3.1 Configuring access rights

The device can be integrated in parallel into a fieldbus environment and into an IT network structure for IIoT applications (“Y-path”). To avoid competing access to parameters and process data, the rights of the instances must be set.

Available parameters:

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Name	Description	Value range	Access
Access rights	Access rights to parameters, process data and alarms / events of the device	• **Fieldbus + IoT**: – Fieldbus and ifm IoT Core have read and write access rights to parameters and process data – Fieldbus and ifm IoT Core have read access rights to events/alarms • **Fieldbus + IoT (read only)**: – Fieldbus has read and write access rights to parameters and process data – Fieldbus has read access rights to events/ alarms – ifm IoT Core has read access rights to parameters, process data and events / alarms • **IoT only**: – ifm IoT Core has read and write access rights to parameters and process data – ifm IoT Core has read access rights to events / alarms – Fieldbus has no access rights	rw [1]

[1] Read and write

Please note the following when configuring access rights in ifm moneo|configure:

- If the access rights in the fieldbus configuration software and ifm moneo|configure are set to **Fieldbus + IoT**, the parameter values set on the fieldbus side always apply.
- If the access rights are set to the value **Fieldbus + IoT**, then also set the control instance for the parameters and outputs of the individual ports, Setting the control instance for the outputs 30.
- For exclusive access to the device via ifm moneo|configure, set the access rights to **IoT only** and set the access rights to **Keep settings** in the fieldbus configuration software.
- If the access rights are set to **Fieldbus + IoT (read only)**, the access rights can no longer be changed in ifm moneo|configure. To regain write access with ifm moneo|configure, set the access rights to the value **Fieldbus + IoT** in the fieldbus configuration software.

To configure the access rights:

Requirements:

✓ The parameter setting software has been started.

✓ The connection to the device has been established.

▶ Select the **IoT** menu.

▷ The menu page shows the current settings.

▶ Set the access rights.

▶ Write the changed values to the device.

▶ Restart the device.

▷ The changed access rights are active.

10.1.3.2 Enabling / disabling the OPC UA server

The device has an OPC UA server, OPC UA server 140.

The OPC UA server of the device can be enabled or disabled as required.

Available parameters:

Name	Description	Value range	Access
opcua_server	Enabling / disabling the OPC UA server	• **Disabled**: OPC UA server disabled • **Enabled**: OPC UA server enabled (default)	rw [1]

[1] Read and write

Requirements:

✓ The parameter setting software has been started.

✓ The connection to the device has been established.

▶ Select the **IoT** menu.

▷ The menu page shows the current settings.

To disable the OPC UA server

▶ Disabled OPC UA server.

▶ Write the changed values to the device.

▶ Restart the device.

▷ OPC UA server is disabled.

To enable the OPC UA server:

▶ Enable the OPC-UA server.

▶ Write the changed values to the device.

▶ Restart the device.

▷ The OPC UA server is enabled.

▷ Users can access the device via the OPC UA interface.

10.1.4 Fieldbus interface

The **Fieldbus** menu provides access to the parameters of the EtherNet/IP interface.

10.1.4.1 Configuring the EtherNet/IP interface

For communication with the EtherNet/IP network, the IP parameters of the EtherNet/IP interface must be configured.

Available parameters:

Name	Description	Value range	Access
DHCP	Enable / disable the DHCP client of the device	• **Static IP**: IP parameters are set by the user • **DHCP**: IP parameters are set by a DHCP server in the network • **BOOTP**: IP parameters are set via Bootstrap Protocol (BOOTP)	rw [1]
IP address	IP address of the EtherNet/IP interface	e.g. 192.168.82.100 192.168.1.250 (default)	rw [1]
Subnet mask	Subnet mask of the EtherNet/IP network	e.g. 255.255.0.0 • 255.255.255.0 (default)	rw [1]
Default gateway IP address	IP address of the network gateway	e.g. 192.168.82.1 • 0.0.0.0 (default)	rw [1]

Name	Description	Value range	Access
Host name	EtherNet/IP name of the device (max. 240 characters)	e.g. iol12.plant1	rw [1]
MAC address	MAC address of the device's EtherNet/IP interface	e.g. 00:02:01:0f:c8:8f	ro [2]
Fieldbus firmware	Version of the fieldbus firmware	e.g. 5.4.0.6 (EtherNet/IP Adapter)	ro [2]

[1] Read and write

[2] Read only

Requirements:

✓ The parameter setting software has been started.

✓ The connection to the device has been established.

✓ The detailed view of the device is active.

▶ Select the **Fieldbus** menu.

▷ The menu page shows the current settings.

▶ Set the parameters of the EtherNet/IP interface.

▶ Save the changes on the device.

▷ IP settings of the interface are configured.

10.1.4.2 Setting the EtherNet/IP configuration mode

The device supports the fieldbus configuration modes "top-down" and "independent". For the configuration mode "Independent", the user can additionally select the connection type.

Available parameters:

Parameter	Description	Value range	Access
Independent mode	EtherNet/IP configuration mode	• **Independent mode off**: Configuration via fieldbus PLC • **Independent mode on**: Configuration via the device	rw [1]
Process data mode	Activate / deactivate explicit PD mode and select the process data to be transmitted (connection type)	• **Explicit process data mode off**: explicit PD mode deactivated • **Explicit process data mode with IO-Link I/O + Acyclic + Diag**: explicit PD mode activated -- IO-Link inputs / outputs, acyclic and diagnostic data is transmitted • **Explicit process data mode with IO-Link I/O + Acyclic + Diag**: explicit PD mode activated -- IO-Link inputs / outputs and acyclic data, diagnostic data and data for energy monitoring are transmitted • **Explicit process data mode with IO-Link I/O**: Explicit PD Mode activated -- IO-Link inputs / outputs are transmitted	rw [2] [3]

Parameter	Description	Value range	Access
Process data length	Length of process data (per IO-Link port)	• **2 Bytes Input 2 Bytes Output**: 2 bytes input data, 2 bytes output data • **4 Bytes Input 4 Bytes Output**: 4 bytes input data, 4 bytes output data • **8 Bytes Input 8 Bytes Output**: 8 bytes input data, 8 bytes output data • **16 Bytes Input 16 Bytes Output**: 16 bytes input data, 16 bytes output data • **32 Bytes Input 32 Bytes Output**: 32 bytes input data, 32 bytes output data	rw [1]
Swap	Swap the order of the bytes in the data word of the process data	• **off**: as Array of Bytes • **on**: as Integer16 value; during an update of the process data, the bytes are exchanged	rw [1]

[1] Read and write; parameter can only be changed if no connection to fieldbus controller is established

[2] Read and write

[3] Parameters can only be changed in "Independent" configuration mode

Requirements:

✓ The parameter setting software has been started.

✓ The connection to the device has been established.

✓ The detailed view of the device is active.

▶ Select the **Fieldbus** menu.

▷ The menu page shows the current settings.

▶ Set the configuration mode.

▶ Optional: Select connection type.

▶ Set arrangement of the bytes in the process data.

▶ Save the changes on the device.

▷ EtherNet/IP configuration mode is set.

10.1.5 IO-Link ports

The **Port x**(x:1...8) menues provide access to the parameters of the IO-Link portsX1...X8.

10.1.5.1 Setting the control instance for the outputs

To grant the IoT Core and the OPC UA server write access to the configuration data and the process data of the IO-Link ports when operating the device in parallel in the fieldbus environment and an IT network environment ("Y-path"), the user can set the control instance.

▶ Please note: Access to port and IO-Link device data ➔ 71

Available parameters:

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Name	Description	Value range	Access
output_select_control	Control instance for parameters and process data of the port outputs (only valid if parameter **Access rights** = **Fieldbus + IoT**)	• **Fieldbus**: Feldbus (default) • **OPC-UA / IoT**: OPC UA server / IoT Core	rw [1]

[1] Read and write

Requirements:

✓ The parameter setting software has been started.

✓ The connection to the device has been established.

✓ Parameter **Access rights** is set to value **Fieldbus + IoT**, Configuring access rights → 26.

▶ Select the **Port x** (x = 1…8) menu.

▷ The menu page shows the current settings.

▶ Set control instance for port outputs.

▶ Write the changed values to the device.

▷ Control instance for outputs is set.

10.1.5.2 Setting the operating mode Pin 4 (US)

Pin 4 of ports X1...X8 supports the following operating modes:

- Disabled: No data transmission at pin 4 (C/Q) of the port
- Digital input: Binary input signal at pin 4 (C/Q) of the port
- Digital output: Binary output signal at pin 4 (C/Q) of the port
- IO-Link: IO-Link data transmission via pin 4 (C/Q) of the port

The set operating mode must match the operating mode of the device connected to the port (sensor, actuator, IO-Link device).

Available parameters:

Parameter	Description	Value range	Access
Mode Pin4 US	Operating mode of Pin 4 (C/Q) of the port	• **Disabled**: Port deactivated • **DI**: Digital input • **DO**: Digital output • **IO-Link**: IO-Link process data	rw [1]

[1] Read and write

Requirements:

✓ The parameter setting software has been started.

✓ The connection to the device has been established.

✓ The detailed view of the device is active.

▶ Select the **Port x** (x = 1…8) menu.

▷ The menu page shows the current settings.

▶ Set the operating mode.

▶ Save the changes on the device.

▷ Operating mode of pin 4 (US) of the port has been set.

10.1.5.3 Setting the operating mode pin 2 (UA)

Pin 2 of ports X1...X4 supports the following operating modes:

- Off: Port operates as IO-Link port (class A); Pin 2 is disconnected from the power supply
- On: Port operates as IO-Link port (class B); voltage UA is connected at pin 2;
- Digital output (DO): Port operates as a digital switching output; A binary output signal is available at pin 2

Available parameters:

Name	Description	Value range	Access
Mode Pin2 UA	Operating mode of pin 2 of the port	• **Off (IO-Link Type A Supply)**: IO-Link Port Class A • **On (IO-Link Type B Supply)**: IO-Link Port Class B • **Digital Output**: Digital switching output	rw [1]

[1] Read and write

To set the operating mode of pin 2 (UA) of a port:

Requirements:

✓ The parameter setting software has been started.

✓ The connection to the device has been established.

▶ Select the **Port x** (x = 1…8) menu.

▷ The menu page shows the current settings.

▶ Set the operating mode.

▶ Write the changed values to the device.

▷ Operating mode of pin 2 (UA) of the port has been set.

10.1.5.4 Setting the cycle time

In the IO-Link operating mode, the cycle time of the port can also be set.

Available parameters:

Parameter	Description	Value range	Access
Cycle time actual	Current cycle time between the IO-Link master and the IO-Link device (value in µs)	• 1: 1 µs … • 132800: 132800 µs	ro [1] [2]
Cycle time preset	Cycle time between the IO-Link master and the IO-Link device (value in µs)	• **0**: best possible cycle time • **1**: 1 µs … • 132800: 132800 µs	rw [3] [2]
Bit rate	Transmission rate between the IO-Link master and the IO-Link device	• **COM1**: 4.8k baud • **COM2**: 38.4 kBaud • **COM3**: 230.4 kBaud	ro [1] [2]

[1] Read only

[2] Parameter only available if operating mode pin 4 (US) = IO-Link and IO-Link device is connected to the port

[3] Read and write

Requirements:

✓ The parameter setting software has been started.

✓ The connection to the device has been established.

✓ The detailed view of the device is active.
✓ Operating mode of pin 4 of the port is "IO-Link".
▶ Select the **Port x** > **IO-Link** menu (x = 1…8).
▶ Set the cycle time.
▶ Write the changed values to the device.
▷ Cycle time of the IO-Link port is set.

10.1.5.5 Setting the device validation and data storage

The device supports the IO-Link functions of device validation and backup/restoration of parameter data for connected IO-Link devices.

The following options are available:

Option	Validation of the connected IO-Link device	Storage of the parameter values	Recovery of the parameter values
No check and clear	No	No	No
Type compatible V1.0 device	Yes, test compatibility with IO-Link standard V1.0 and identity of design (vendor ID, device ID)	No	No
Type compatible V1.1 device	Yes, test compatibility with IO-Link standard V1.1 and identity of design (vendor ID, device ID)	No	No
Type compatible V1.1 device with Backup + Restore	Yes, test compatibility with IO-Link standard V1.1 and identity of design (vendor ID, device ID)	Yes, automatic storage of the parameter values; Changes of the current parameter values will be stored.	Yes, restore of parameter values when connecting an identical IO-Link device with factory settings
Type compatible V1.1 device with Restore	Yes, test compatibility with IO-Link standard V1.1 and identity of design (vendor ID, device ID)	No, there is no automatic backup; Changes to the parameter values are not stored	Yes, restore of parameter values when connecting an identical IO-Link device with factory settings

Device validation and backup / restore of parameter values are only available if the “IO-Link” operating mode of the port has been activated.

For options **Type compatible V1.1 device with Backup + Restore** and **Type compatible V1.1 device with Restore**: If the **Vendor ID** or **Device ID** parameters are changed in online mode, the data memory is deleted and a new backup of the parameter values of the connected IO-Link device is created in the IO-Link master.

Available parameters:

Name	Description	Value range	Access
Validation / Data Storage	Validation of the connected IO-Link devices and automatic backup/recovery of the parameter sets of the IO-Link device	• **No check and clear**: – no validation – no data backup and data recovery • **Type compatible V1.0 device**: – Validation (IO-Link V1.0, identity of design) – no data backup and data recovery • **Type compatible V1.1 device**: – Validation (IO-Link V1.1, identity of design) – no data backup and data recovery • **Type compatible V1.1 device with Backup + Restore**: – Validation (IO-Link V1.1, identity of design) – Data backup and data recovery • **Type compatible V1.1 device with Restore**: – Validation (IO-Link V1.1, identity of design) – Data recovery – no data backup	rw [1] [2]
Vendor ID	Vendor ID of the IO-Link device to be validated against	e.g. 310: ifm electronic gmbh	rw [1] [2]
Device ID	Device ID of the IO-Link device to be validated against	e.g. 1129: TCC501 (ifm temperature sensor)	rw [1] [2]

[1] Read and write

[2] Parameter only available if operating mode pin 4 (US) = IO-Link and IO-Link device is connected to the port

To configure the device validation and the backup / restore of parameter values:

Requirements:

✓ The parameter setting software has been started.

✓ The connection to the device has been established.

✓ The detailed view of the device is active.

✓ Operating mode of pin 4 of the port is "IO-Link".

▶ Select the **Port x** > **IO-Link** menu (x = 1…8).

▷ The menu page shows the current settings.

▶ Set the parameters for device validation and backup / restore of parameter values.

▶ Optional: Enter the vendor ID and device ID.

▶ Save the changes on the device.

▷ Device validation and backup / restore of parameter values have been configured.

10.1.5.6 Setting fail-safe values

The user can set the fallback values of the outputs of the IO-Link ports for the "Independent" configuration mode. The fallback values will only be enabled if the EtherNet/IP connection is interrupted.

Available parameters:

Name	Description	Value range	Access
Fail-safe digital out	Fallback value for the output on pin 4 for "Digital output (DO)" operating mode	• **Reset**: LOW level (default) • **Old**: Last active process value • **Set**: HIGH level	rw [1]
Fail-safe IO-Link	Fall-back value of the output on pin 4 for "IO-Link" operating mode	• **Off**: Fail-safe disabled (default) • **Reset**: Fail-safe enabled – reset process value • **Old**: Fail-safe enabled - last active process value • **Pattern**: Fail-safe enabled - byte sequence	rw [1]
Fail-safe DO/UA	Fallback value for the output on pin 2 for "Digital output" operating mode (only available for ports X1...X4)	• **Reset**: LOW level (default value) • **Old**: Last active process value • **Set**: HIGH level	rw [1]

[1] Read and write; parameter can only be changed if no connection to fieldbus controller is established

Requirements:

✓ The parameter setting software has been started.

✓ The connection to the device has been established.

✓ The detailed view of the device is active.

✓ Configuration mode “Independent” is enabled.

▶ Select the **Port x** (x = 1…8) menu.

▷ The menu page shows the current settings.

▶ Setting fallback values

▶ Write the changed values to the device.

▷ Fallback values are configured.

10.1.5.7 Restricting current intensity

The following electrical properties can be set for ports X1...X4:

- Max. current intensity of the supply voltage US (pin 1 and pin 4)
- Max. current intensity of the supply voltage UA (pin 2)

The following electrical properties can be set for ports X5...X8:

- Max. current intensity of the supply voltage US (pin 1 and pin 4)

Available parameters:

Name	Description	Value range	Access
Current Limit Pin2 UA	Max. current of the supply voltage UA at the port (value in mA) (only available for ports X1...X4)	• **0**: 0 mA (default) … • **2000**: 2000 mA	rw [1]
Current Limit Pin1 + Pin4 US	Max. current intensity of the supply voltage US on the port (value in mA)	• **0**: 0 mA … • **450**: 450 mA (default) … • **2000**: 2000 mA	rw [1]

[1] Read and write

To restrict the current intensity of the ports:

Requirements:

✓ The parameter setting software has been started.
✓ The connection to the device has been established.
▶ Select the **Port x** (x = 1…8) menu.
▷ The menu page shows the current settings.
▶ Set the parameters.
▶ Write the changed values to the device.
▷ The output current intensities of the port are restricted.

10.1.6 Process data

The dashboard area provides access to the device's process data.

To display the dashboard area:
✓ The parameter value editor for the device is open.
▶ In the vertical bar at the right side of the screen: Click on .
▷ The dashboard view is displayed.

To hide the dashboard area:
✓ The dashboard area is displayed.
▶ Click on the vertical bar in the middle of the screen: Click on .
▷ The dashboard view is hidden.

10.1.6.1 Reading process data of the device

Available data:

Date	Description	Value range	Access
temperature	Temperature of the device	• -30 °C … • 80 °C	ro [1]
voltage	Current voltage value of the device supply US	• 0 mV … • 40000 mV	ro [1]
supervisionstatus	Status of the US device supply	• **Error**: Error • OK No error	ro [1]
current	Current amperage value of the device supply US	• 0 mA … • 40000 mA	ro [1]

[1] Read only

Requirements:
✓ The parameter setting software has been started.
✓ The connection to the device has been established.
✓ The dashboard area is displayed.
▶ Select the **Dashboard** tab.
▷ View shows the current process data of the device.

10.1.6.2 Reading digital input data

The input data can optionally be displayed in a time-value curve diagram.

Available data per port:

Date	Description	Value range	Access
PdIn	Status of the digital input on pin 4 of the port (operating mode: DI)	• 0: Off • 1: On	ro [1]
Pin2in	Status of the digital input on pin 2 of the port	• 0: Off • 1: On	ro [1]

[1] Read only

Requirements:

✓ The parameter setting software has been started.

✓ The connection to the device has been established.

✓ The dashboard area is displayed.

▶ Select the **Dashboard** tab.

▷ View shows the status of the digital input data.

10.1.6.3 Writing digital output data

Available data per port:

Element	Description	Value range	Access
PdOut	State of the digital output on pin 4 of the port	• **Off**: Off • **On**: On	rw [1]

[1] Read and write

Requirements:

✓ The parameter setting software has been started.

✓ The connection to the device has been established.

✓ The dashboard area is displayed.

✓ Operating mode pin 4 (US) of the IO-Link port is digital output (DO).

▶ Set the initial value.

▶ Write the changed values to the device.

▷ Set initial value is valid.

10.1.6.4 Reading IO-Link input data

Available elements per port:

Date	Description	Value range	Access
PdIn	IO-Link input data on pin 4 of the port (value as hexadecimal number)	depending on the connected IO-Link device; Process data structure: ➔ IODD of the IO-Link device	ro [1]

[1] Read only

Requirements:

✓ The connection to the device has been established.

✓ The parameter value editor for the device is open.

✓ The dashboard area is displayed.
✓ The operating mode of pin 4 (US) of the port is IO-Link.
✓ IO-Link device is connected to the port.
▶ Select the **Dashboard** tab.
▷ View shows the current IO-Link input data.

10.1.7 Device information

The **Info** menu provides access to the identification information of the device.

10.1.7.1 Reading identification information

Available information:

Name	Description	Value range	Access
Product code	Article number	AL1427	ro [1]
Device family	Family of the device	IO-Link master	ro [1]
Vendor	Manufacturer or vendor	ifm electronic	ro [1]
SW revision	Firmware version	e.g., AL1x2x_cn_ei_v3.10.13	ro [1]
HW revision	Hardware version	e.g. AA	ro [1]
Bootloader revision	Bootloader version	e.g. AL1xxx_bl_f7_v2.4.1	ro [1]
Serial number	Serial number	e.g. 000194610104	ro [1]
Fieldbus type	Fieldbus	EtherNet/IP	ro [1]

[1] Read only

To read the device information:

Requirements:

✓ The parameter setting software has been started.
✓ The connection to the device has been established.
✓ The detailed view of the device is active.
▶ Select **Info** menu.
▷ The menu page shows the identification information.

10.1.8 Device control

The **Firmware** menu provides access to functions for controlling the device.

10.1.8.1 Reset device to factory settings

Requirements:

✓ The parameter setting software has been started.
✓ The connection to the device has been established.
✓ The detailed view of the device is active.
▶ Select the **Firmware** menu.
▶ Click on **Factory reset**.
▷ The device is reset to factory settings.

- ▷ All parameters are set to their default values.
- ▷ The device is read again.

10.1.8.2 Restarting the device

Requirements:

- ✓ The parameter setting software has been started.
- ✓ The connection to the device has been established.
- ✓ The detailed view of the device is active.
- ▶ Select the **Firmware** menu.
- ▶ Click on **Reboot**.
- ▷ The device is restarted.
- ▷ All set parameter values will be retained.

10.1.8.3 Identifying the device

The device offers a signalling function for visual identification.

Requirements:

- ✓ The parameter setting software has been started.
- ✓ The connection to the device has been established.
- ✓ The detailed view of the device is active.
- ▶ Select the **Firmware** menu.
- ▶ Click on **Blink** .
  - ▷ Status LEDs of the device flash (flashing duration: 60 s).
- ▷ After the fixed flashing time has elapsed, the status LEDs stop flashing automatically.

10.1.9 Updating the firmware

To update the firmware of the device:

Requirements:

- ✓ New firmware has been downloaded. documentation.ifm.com
- ✓ The parameter setting software has been started.
- ✓ The connection to the device has been established.
- ✓ The detailed view of the device is active.
- ▶ In the header: Click on ⬆.
  - ▷ A dialogue window appears.
- ▶ Click on **Import firmware file**.
  - ▷ The file explorer appears.
- ▶ Select the firmware file (.bin) and click on **Open**.
  - ▷ The new firmware file is selected.
- ▶ Click on **OK**.
  - ▷ The firmware of the device is updated.
  - ▷ The status of the update process is displayed.
- ▷ The firmware of the device has been updated.

10.1.10 Setting the parameters of IO-Link devices

The device supports access to connected IO-Link devices (sensors, actuators).

Information about the parameters of the IO-Link device:
- Operating instructions IO-Link device
- IODD description of the IO-Link device

Requirements:
- ✓ ifm moneo|configure has been started.
- ✓ Operating mode pin 4 (US) of the port with the IO-Link device is „IO-Link“.
- ✓ IoT has read and write access rights for the IO-Link master.
- ✓ The IO-Link device is properly connected to the IO-Link port of the device.
- ✓ The IODD library of ifm moeno|configure contains the IODD of the IO-Link device.
- ▶ Scan the network for devices.
  - ▷ ifm moneo|configure detects the IO-Link master.
- ▶ Estblish connection to the IO-Link master.
  - ▷ ifm moneo|configure detects the connected IO-Link device.
- ▶ In the row of the IO-Link device: Click on ⚙.
  - ▷ The detailed view of the IO-Link device appears.
  - ▷ The detailed view shows the current parameter values of the IO-Link device.

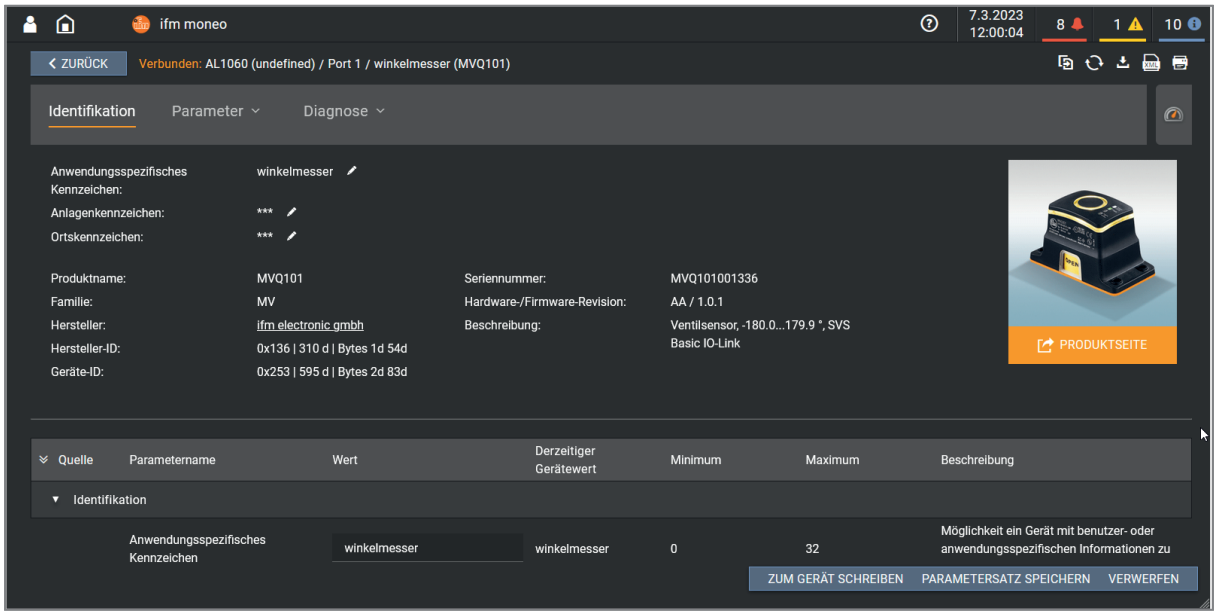


Fig. 1: Example: Detailed view of the MVQ101 sensor

- ▶ Configure the IO-Link device.
- ▶ Store the chenged configuration on the IO-Link device.
- ▷ The parameters of the IO-Link device have been set.

10.2 IoT Core Visualizer

The IoT Core Visualizer provides a graphical user interface to access the functions of the ifm IoT Core.

The ifm IoT Core Visualiser supports the following web browsers:

- Google Chrome, version 61 or higher
- Mozilla Firefox, version 93 or higher
- Microsoft Edge, version 107 or higher

10.2.1 Starting the IoT Core Visualizer

To start the IoT Core Visualizer:

Requirements:

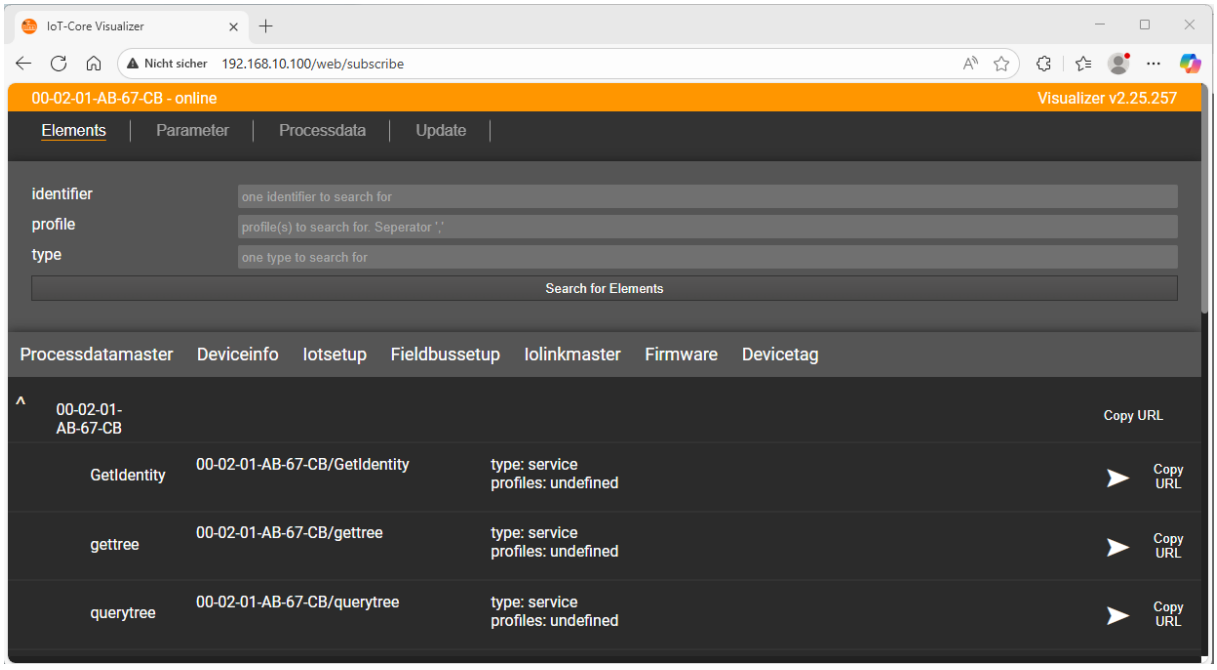
✓ The laptop / PC is connected directly or via a suitable network coupling element (e.g. switch) to a EtherNet/IP port (XF1, XF2) of the device.

✓ EtherNet/IP interface has been configured.

▶ Start web browser.

▶ Go to the following URL: http://<ip-address>/web/subscribe (e.g. `http://192.168.82.100/web/subscribe`)

▷ The web browser displays the start page of the IoT Core Visualizer.



The navigation menu gives the user access to the following functions:

- **Elements**: Accessing elements of the IoT Core 42
- **Parameter**: Configuring the device 43
- **Processdata**: Accessing the process data 54
- **Update**: Update firmware 60

10.2.2 Accessing elements of the IoT Core

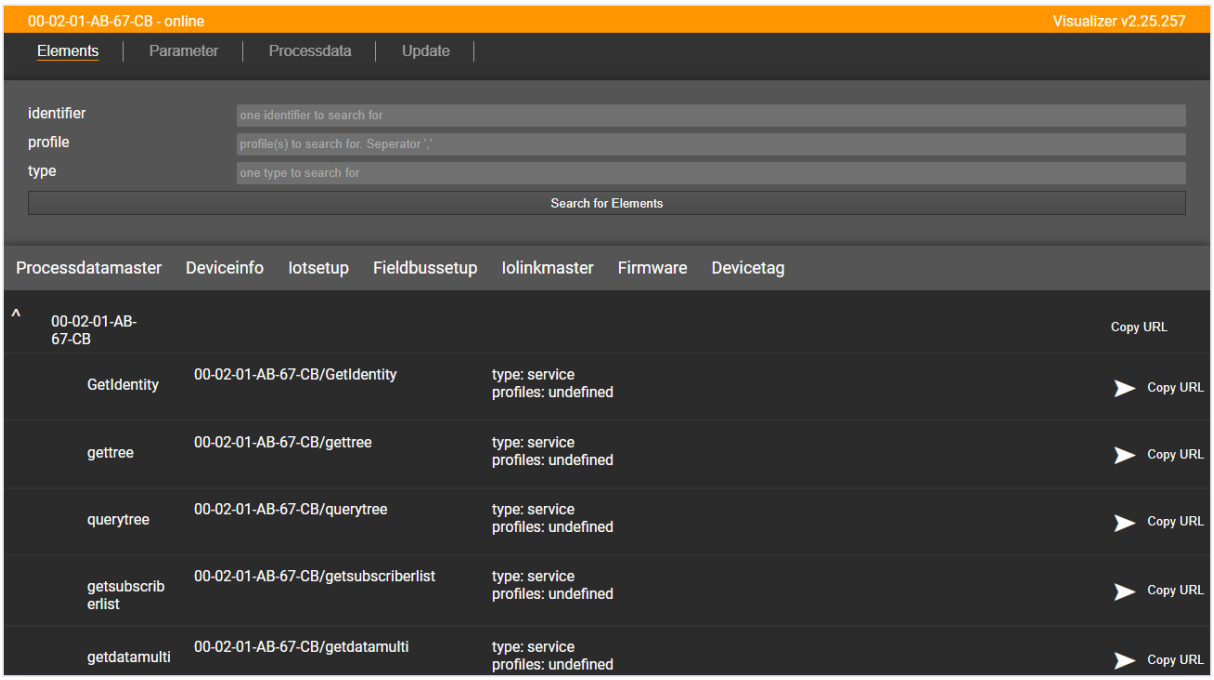
The **Elements** menu provides access to the structural elements of the ifm IoT Core of the device. The user can navigate freely in the ifm IoT Core using the tree view or alternatively access individual structural elements directly using the integrated search function.

Requirements:

✓ IoT Core Visualizer has been started.

▶ Select **Elements** menu.

▷ The menu page shows the tree view of the ifm IoT-Core of the device.



The view shows the following information:

- Input mask for the search function, Searching for elements of the ifm IoT Core 43
- Submenu generated from structural elements of the first level of the ifm IoT Core

The following information is displayed for each element:

- Tree view of the ifm IoT Core of the device with all elements
  - Name, e.g. port[1]
  - Path of the element in the ifm IoT core
  - Type (**type**) and profile (**profile**) of the element
  - Data type (**Type**) and coding (**Encoding**) of the data points
  - Value list (**valuelist**) or value range with minimum value (**min**), maximum value (**max**) and default value (**default**) of the data point

Notes on use:

▶ Click on ˅/^ to expand/collapse the tree view.

▶ Click on **COPY URL** to copy the URL of the item to the clipboard.

▶ Click on ➤ to execute the service, Executing services of the ifm IoT Core 43.

10.2.2.1 Searching for elements of the ifm IoT Core

The user can search the ifm IoT Core for elements with certain properties and output the search results.

Available search criteria:

- **identifier**: Name of the element
- **profile**: Profile of the element
- **typ**: Type of the element

Requirements:

✓ IoT Core Visualizer has been started.

✓ The **Elements** menu is active.

▶ Select the search criteria in the **identifier**, **profile** and **type** selection lists.

▶ Click on **SEARCH FOR ELEMENTS**.

▶ IoT Core Visualiser searches the IoT Core for elements with the selected search criteria.

▷ The result list shows all the elements found.

▷ Elements with the selected search criteria are highlighted in colour.

10.2.2.2 Executing services of the ifm IoT Core

The user can execute individual services in the tree view of the ifm IoT Core.

Requirements:

✓ IoT Core Visualizer has been started.

✓ The **Elements** menu is active.

▶ Navigate to the service in the tree view of the IoT Core.

▶ Click on ➤ in the service line.

▷ A dialogue window appears.

▶ For services with request parameters: Enter the request parameters in JSON format in the input field. Details on enquiry parameters: Services

▶ Click on **REQUEST**.

▷ The service is running.

▷ The dialogue window shows the response to the request.

10.2.3 Configuring the device

The **Parameter** menu page provides access to the configuration options of the device.

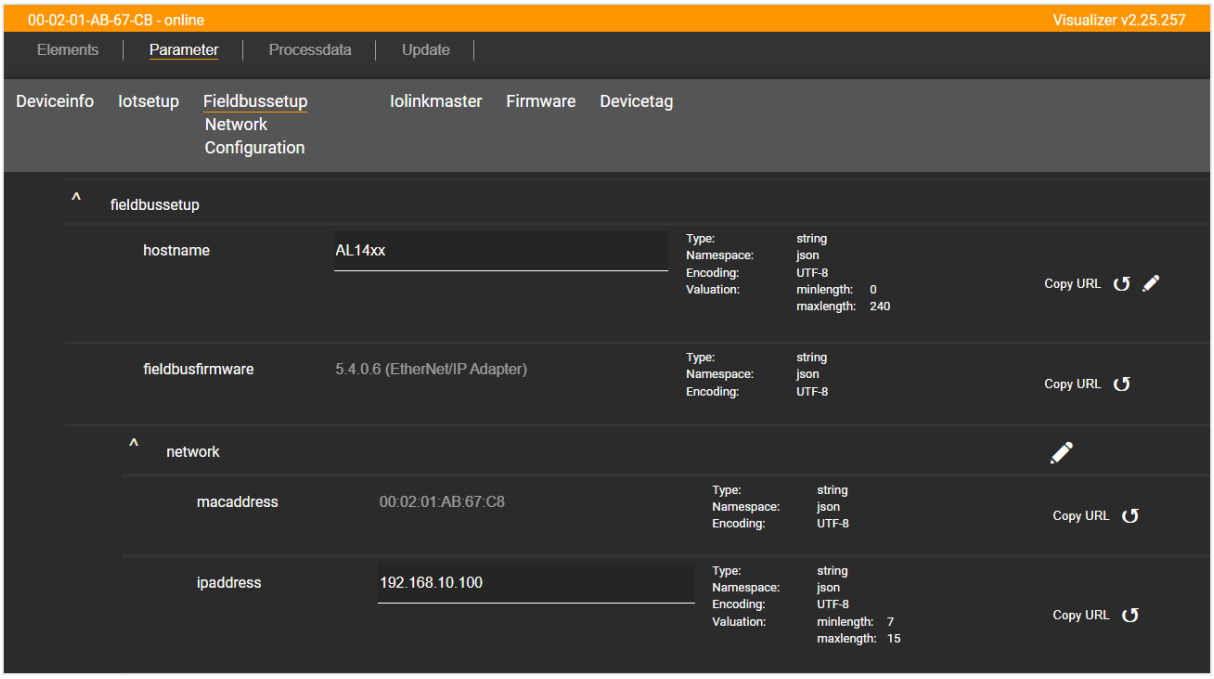
The configuration created with the IoT Core Visualizer will be overwritten when a Configuration Assembly Object is transferred to the device during connection to the EtherNet/IP PLC.

Requirements:

✓ IoT Core Visualizer has been started.

▶ Select the **Parameter** menu.

▷ The menu page shows the available parameters of the device.



Notes on operation:

Each parameter displayed corresponds to a data point of type parameter of the ifm IoT Core of the device. A parameter can be read-only or readable and changeable.

The following information is displayed for each data point:

- **Type**: Data type, e.g. structure, string, uint32
- **Namespace**: Namespace, e.g. json
- **Encoding**: Coding of the data value
- **Valuation**: Value range, e.g. min: 50, max: 3600000

Various functions can be executed on each data point:

▶ Click ↻ to read the data point again.

▶ Click **Copy URL** to copy the URL of the data point to the clipboard.

▶ Change a data value and then click ✎ to apply the changes.

10.2.3.1 Enabling / disabling the OPC UA server

The device has an OPC UA server, OPC UA server ↪ 140.

The OPC UA server of the device can be enabled or disabled as required.

Available parameters:

Name	Description	Value range	Access
opcua_server	Enabling / disabling the OPC UA server	• **disabled**: OPC UA server is disabled. • **enabled**: The OPC UA server is enabled (default).	rw [1]

[1] Read and write

Requirements:

✓ IoT Core Visualizer has been started.

✓ The **Parameter** menu is active.

▶ Select the **iotsetup** submenu.

▷ The menu page shows the current settings.

To disable the OPC UA server:

✓ The OPC UA server is enabled.

▶ Disabled OPC UA server.

▶ Restart the device.

▷ OPC UA server is disabled.

To enable the OPC UA server:

✓ OPC UA server is disabled.

✓ Enable the OPC-UA server.

▶ Restart the device.

▷ The OPC UA server is enabled.

10.2.3.2 Configuring the access rights to the device

The device can be integrated in parallel into a fieldbus environment and into an IT network structure for IIoT applications (“Y-path”). To avoid competing access to parameters and process data, the rights of the instances must be set.

Available parameters:

Name	Description	Value range	Access
accessrights	Access rights to the device	• **Fieldbus + IoT**: – Fieldbus and ifm IoT Core have read and write access rights to parameters and process data – Fieldbus and ifm IoT Core have read access rights to events/alarms • **Fieldbus + IoT (read only)**: – Fieldbus has read and write access rights to parameters and process data – Fieldbus has read access rights to events / alarms – ifm IoT Core has read access rights to parameters, process data and events / alarms • **IoT only**: – ifm IoT Core has read and write access rights to parameters and process data – ifm IoT Core has read access rights to events / alarms – Fieldbus has no access rights	rw [1]

[1] Read and write

When setting the parameters of the access rights in the parameter setting software, observe the following notes:

- If the access rights in the fieldbus configuration software are set to **EtherNet/IP + IoT** and in the IoT Core Visualiser to **Fieldbus + IoT**, the parameter values set on the fieldbus side always apply.
-
- For exclusive access to the device via the IoT Core Visualiser, set the access rights to **IoT only** and set the access rights to **Keep settings** in the fieldbus configuration software.
- If the access rights in the IoT Core Visualizer are set to the value **Feldbus + IoT (read only)**, the access rights in the IoT Core Visualizer can no longer be changed. To regain write access with the IoT Core Visualizer, set the access rights to the value **Feldbus + IoT** in the fieldbus projection software.

Requirements:

✓ IoT Core Visualizer has been started.

✓ The **Parameter** menu is active.

▶ Select the **iotsetup** submenu.

▷ The menu page shows the current settings.

▶ Set the access rights.

▶ Click on ✎ to save the changes to the device.

▷ The changed access rights are active.

10.2.3.3 Setting the IP configuration of the EtherNet/IP interface

The EtherNet/IP interface is used to connect the device to the EtherNet/IP network.

Available parameters:

Name	Description	Value range	Access
dhcp	Method for IP address assignment	• **Static**: Manual address assignment • **DHCP**: Address assignment by DHCP server • **BOOTP**: Address assignment via bootstrap protocol	rw [1]
ipaddress	IP address of the EtherNet/IP interface	E.g. 192.168.10.100 • 192.168.1.250 (default)	rw [1]
subnetmask	Subnet mask of the EtherNet/IP network	E.g. 255.255.255.0 • 255.255.255.0 (default)	rw [1]
ipdefaultgateway	IP address of the network gateway	E.g. 192.168.10.1 • 0.0.0.0 (default)	rw [1]
hostname	EtherNet/IP name of the device (max. 240 characters)	E.g. iol.plant1	rw [1]
macaddress	MAC address of the device's EtherNet/IP interface	E.g. 00:02:01:0f:c8:8f	ro [2]
fieldbusfirmware	Version of the EtherNet/IP firmware	E.g. 5.4.0.6 (EtherNet/IP Adapter)	ro [2]

[1] Read and write; parameter can only be changed if no connection to fieldbus controller is established

[2] Read only

To set the IP configuration of the EtherNet/IP interface:

✓ IoT Core Visualizer has been started.

▶ Select **Parameter** menu.

▶ Select the **Fieldbussetup** > **Network** submenu.

▷ The menu page shows the current settings.

▶ Set the parameters of the EtherNet/IP interface.

▶ Click on ✎ to save the changes to the device.

▷ The IP configuration of the EtherNet/IP interface is set.

10.2.3.4 Setting the EtherNet/IP configuration mode

The device supports the EtherNet/IP configuration modes Top-Dow and Independent.

For the Independentconfiguration mode, the user must set the desired connection type, the length of the process data and the arrangement of the bytes within the process data. Optionally, fallback values can be set in case the connection to the EtherNet/IP controller is interrupted.

Name	Description	Value range	Access
independentmode	EtherNet/IP configuration mode	• **Off**: Top-down mode active -- configuration via EtherNet/IP PLC (default) • **On**: Independent mode active -- configuration via device settings	rw [1]
explicitpdmode	Enable / disable explicit PD mode and select the process data to be transmitted (connection types)	• **Explicit process data mode off**: explicit PD mode disabled • **Explicit process data mode with IO-Link I/O + Acyclic + Diag**: explicit PD mode enabled -- IO-Link inputs / outputs, acyclic and diagnostic data is transmitted • **Explicit process data mode with IO-Link I/O + Acyclic + Diag + EnMo**: explicit PD mode enabled -- IO-Link inputs / outputs and acyclic data, diagnostic data and data for energy monitoring are transmitted • **Explicit process data mode with IO-Link I/O**: Explicit PD mode enabled -- IO-Link inputs/ outputs are transmitted	rw [1]
processdataconfiguration	Length of IO-Link process data per port	• **2 Bytes Input 2 Bytes Output**: 2 bytes input data, 2 bytes output data • **4 Bytes Input 4 Bytes Output**: 4 bytes input data, 4 bytes output data • **8 Bytes Input 8 Bytes Output**: 8 bytes input data, 8 bytes output data • **16 Bytes Input 16 Bytes Output**: 16 bytes input data, 16 bytes output data • **32 Bytes Input 32 Bytes Output**: 32-byte input data / 32-byte output data (default)	rw [1]
port[x] > **swap**	Arrangement of the bytes in process data	• **Disabled**: Array of byte • **Enabled**: Integer16 value; When the process data is updated, the bytes in the integer16 value are swapped (default)	rw [1]

Name	Description	Value range	Access
port[x] > **failsafeiolink**	Fallback value for IO-Link process data on pin 4 (C/Q) of port x (x: 1...8), operating mode: "IO-Link"	• **Off**: Fail-safe mode disabled (default) • **Reset**: Fail-safe mode enabled -- set outputs to LOW • **Old**: Fail-safe mode enabled -- outputs retain the last set process value • **Pattern**: Fail-safe mode enabled -- output the defined byte sequence at outputs	rw [2]
port[x] > **failsafedigitalout**	Fallback value of the digital output on pin 4 (C/Q) of port x (x: 1...8), operating mode: "Digital output (DO)"	• **Reset**: Fail-safe mode enabled - set outputs to LOW • **Old**: Fail-safe mode disabled -- output retains the last set process value (default) • **Set**: Fail-safe mode enabled - set the output to HIGH	rw [1]
port[x] > **failsafeiqout**	Fallback value for digital output on pin 2 (I/Q) of port x (x: 1...4), operating mode: “Digital output”	• **Reset**: Fail-safe mode enabled - set the output to LOW • **Old**: Fail-safe mode disabled – output retains the last set process value (default) • **Set**: Fail-safe mode enabled - set the output to HIGH	rw [1]

[1] Read and write; parameter can only be changed if no connection to fieldbus controller is established

[2] Read and write

Requirements:

✓ IoT Core Visualizer has been started.

▶ Select **Parameter** menu.

▶ Select the **Fieldbussetup** > **Configuration** submenu.

▷ The menu page shows the current settings.

▶ Select the configuration mode.

▶ If parameter **independentmode** = **Independent**: Set additional parameters.

▶ Click on ✎ to save the changes to the device.

▷ The selected configuration mode is active.

10.2.3.5 Setting the control instance for the outputs

To grant the IoT Core and the OPC UA server write access to the configuration data and the process data of the IO-Link ports when operating the device in parallel in the fieldbus environment and an IT network environment ("Y-path"), the user can set the control instance.

▶ Please note: Access to port and IO-Link device data ➔ 71

Available parameters:

Name	Description	Value range	Access
output_select_control	Control instance for parameters and process data of the port outputs (Only valid if parameter **access-rights** = **Fieldbus + IoT**)	• **Fieldbus**: Fieldbus • **OPC_UA / IoT**: OPC UA server / ifm IoT Core	rw [1]

[1] Read and write

Requirements:

✓ IoT Core Visualizer has been started.

✓ The **Parameter** menu is active.

✓ The parameter **accessrights** is set to value **fieldbus + iot**, Configuring the access rights to the device ➔ 45.

▶ Select the **Iolinkmaster** > **port[x]** submenu (x: 1…8).

▶ Set control instance for port outputs.

▶ Click on ✎ to save the changes to the device.

▷ Control instance for outputs is set.

10.2.3.6 Setting the operating mode pin 4 (US)

Pin 4 of ports X1...X8 supports the following operating modes:

- Disabled: No data transmission at pin 4 (C/Q) of the port
- Digital input: Binary input signal at pin 4 (C/Q) of the port
- Digital output: Binary output signal at pin 4 (C/Q) of the port
- IO-Link: IO-Link data transmission via pin 4 (C/Q) of the port

The set operating mode must match the operating mode of the device connected to the port (sensor, actuator, IO-Link device).

Available parameters:

Name	Description	Value range	Access
mode	Operating mode of pin 4 (US) of the port	• **Disabled**: Port deactivated • **DI**: Digital input • **DO**: Digital output • **IO-Link**: IO-Link data	rw [1]
mastercycletime_actual	Current cycle time of the data transfer between port and IO-Link device (value in µs)	• **1**: 1 µs … • **132800**: 132800 µs	ro [2]
comspeed	Current transfer rate between port and IO-Link device	• **COM1 (4.8 kbaud)**: 4.8 kBaud • **COM2 (38.4 kbaud)**: 38.4 kBaud • **COM3 (230.4 kbaud)**: 230.4 kBaud	ro [2]

[1] Read and write

[2] Read only

In the IO-Link operating mode, the following parameters can be set additionally:

Name	Description	Value range	Access
mastercycletime_preset	Cycle time of the data transfer between port and IO-Link device (value in µs);	• 0: best possible cycle time • 1: 1 µs … • 132800: 132800 µs	rw [1]

[1] Read and write

Requirements:

✓ IoT Core Visualizer has been started.

✓ The **Parameter** menu is active.

▶ Select the **Iolinkmaster** > **port[x]** submenu (x: 1…8).

▷ Set the operating mode pin 4 (US).

▶ Optional: Set the cycle time of the data transmission between the port and the IO-Link devices.

▶ Click on ✎ to save the changes to the device.

▷ Operating mode of pin 4 (US) of the port has been set.

10.2.3.7 Setting the operating mode pin 2 (UA)

Pin 2 of ports X1...X4 supports the following operating modes:

- Off: Port operates as IO-Link port (class A); Pin 2 is disconnected from the power supply
- On: Port operates as IO-Link port (class B); voltage UA is connected at pin 2;
- Digital output (DO): Port operates as a digital switching output; A binary output signal is available at pin 2

Available parameters:

Name	Description	Value range	Access
mode_ua	Operating mode of pin 2 of the port	• **Off (IO-Link Type A Supply)**: IO-Link Port Class A • **On (IO-Link Type B Supply)**: IO-Link Port Class B • **Digital Output**: Digital switching output	rw [1]

[1] Read and write

Requirements:

✓ IoT Core Visualizer has been started.

✓ The **Parameter** menu is active.

▶ Select the **Iolinkmaster** > **port[x]** > **powercontrol** submenu (x:1…8).

▶ Set the parameters.

▶ Click on ✎ to save the changes to the device.

▷ The operating mode of pin 2 (UA) has been set.

10.2.3.8 Restricting the current intensity of the supply voltages US / UA

The following electrical properties can be set for ports X1...X4:

- Max. current intensity of the supply voltage US (pin 1 and pin 4)
- Max. current intensity of the supply voltage UA (pin 2)

The following electrical properties can be set for ports X5...X8:

- Max. current intensity of the supply voltage US (pin 1 and pin 4)

Available parameters:

Name	Description	Value range	Access
current_us_max	Max. current intensity of the supply voltage US on the port (value in milliamps)	• 0: 0 mA … • 450: 450 mA (default) … • 2000: 2000 mA	rw [1]
current_ua_max	Max. current intensity of the supply voltage UA on the port (value in milliamps)	• 0: 0 mA (default) … • 2000: 2000 mA	rw [1]

[1] Read and write

Requirements:

✓ IoT Core Visualizer has been started.

✓ The **Parameter** menu is active.

▶ Select the **Iolinkmaster** > **port[x]** > **powercontrol** submenu (x:1…8).

▶ Set the parameters.

▶ Click on ✎ to save the changes to the device.

▷ The current intensities of the supply voltages have been restricted.

10.2.3.9 Configuring device validation and data storage

The device supports the IO-Link functions of device validation and backup/restoration of parameter data for connected IO-Link devices.

The following options are available:

Option	Validation of the connected IO-Link device	Storage of the parameter values	Recovery of the parameter values
No check and clear	No	No	No
Type compatible V1.0 device	Yes, test compatibility with IO-Link standard V1.0 and identity of design (vendor ID, device ID)	No	No
Type compatible V1.1 device	Yes, test compatibility with IO-Link standard V1.1 and identity of design (vendor ID, device ID)	No	No
Type compatible V1.1 device with Backup + Restore	Yes, test compatibility with IO-Link standard V1.1 and identity of design (vendor ID, device ID)	Yes, automatic storage of the parameter values; Changes of the current parameter values will be stored.	Yes, restore of parameter values when connecting an identical IO-Link device with factory settings
Type compatible V1.1 device with Restore	Yes, test compatibility with IO-Link standard V1.1 and identity of design (vendor ID, device ID)	No, there is no automatic backup; Changes to the parameter values are not stored	Yes, restore of parameter values when connecting an identical IO-Link device with factory settings

Device validation and backup / restore of parameter values are only available if the “IO-Link” operating mode of the port has been activated.

For options **Type compatible V1.1 device with Backup + Restore** and **Type compatible V1.1 device with Restore**: If the **Vendor ID** or **Device ID** parameters are changed in online mode, the data memory is deleted and a new backup of the parameter values of the connected IO-Link device is created in the IO-Link master.

Available parameters:

Name	Description	Value range	Access
validation_datastorage_mode	Validation of the connected IO-Link devices and automatic restore of parameter sets of the IO-Link device NOTE! Meaning of the parameter values: see table above	• **No check and clear** • **Type compatible V1.0 device** • **Type compatible V1.1 device** • **Type compatible V1.1 device with Backup + Restore** • **Type compatible V1.1 device with Restore**	rw [1]

Name	Description	Value range	Access
validation_vendorid	Vendor ID of the IO-Link device to be validated against	E.g. 310 ifm electronic gmbh	rw [1]
validation_deviceid	Device ID of the IO-Link device to be validated against	E.g. 1129: TCC501 (ifm temperature sensor)	rw [1]

[1] Read and write

Requirements:

- ✓ IoT Core Visualizer has been started.
- ✓ The **Parameter** menu is active.
- ✓ Operating mode of the port is IO-Link (parameter **mode** = **IO-Link**).
- ▶ Select the **Iolinkmaster** > **port[x]** submenu (x: 1…8).
- ▶ Set the parameters for device validation and backup / restore of parameter values.
- ▶ Optional: Enter the vendor ID and device ID.
- ▶ Click on ✎ to save the changes to the device.
- ▷ Device validation and backup / restore of parameter values have been configured.

10.2.3.10 Reading the firmware version

Available information:

Name	Description	Value range	Access
version	Firmware version	5.4.0.6 (EtherNet/IP Adapter)	ro [1]

[1] Read only

Requirements:

- ✓ IoT Core Visualizer has been started.
- ✓ The **Parameter** menu is active.
- ▶ Select the **Firmware** submenu.
- ▷ The menu page shows available information.

10.2.3.11 Setting the application tag

Available parameters:

Name	Description	Value range	Access
applicationtag	Designation of the device in the monitoring software	e.g., “factory 2 plant 1”	rw [1]

[1] Read and write

32 bytes are available on the device for storing the `applicationtag` parameter. If the memory range is exceeded, the device will abort the write process (diagnostic code 400).

- ▶ When writing the `applicationtag` parameter, observe the different memory requirements of the individual UTF-8 characters (characters 0-127: 1 byte per character; characters >127: more than 1 byte per character).

Requirements:

- ✓ IoT Core Visualizer has been started.
- ✓ The **Parameter** menu is active.

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- ▶ Select the **Devicetag** submenu.
  - ▷ The menu page shows the current settings.
- ▶ Enter the application tag.
- ▶ Click on ✎ to save the changes to the device.
- ▷ The new application tag has been set.

10.2.3.12 Reading identification information

Available information:

Name	Description	Value range	Access
productcode	Article number	AL1427	ro [1]
devicefamily	Device family	IO-Link master	ro [1]
vendor	Vendor	ifm electronic gmbh	ro [1]
swrevision	Firmware version	E.g. AL1x2x_cn_ei_v3.10.13	ro [1]
hwrevision	Hardware version	E.g. AA	ro [1]
bootloaderrevision	Bootloader version	E.g. AL1xxx_bl_f7_v2.4.1	ro [1]
serialnumber	Serial number	E.g. 000194610104	ro [1]

[1] Read only

Requirements:

- ✓ IoT Core Visualizer has been started.
- ✓ The **Parameter** menu is active.
- ▶ Select the **Deviceinfo** submenu.
- ▷ The menu page shows the device information.

10.2.4 Accessing the process data

The **Processdata** menu page provides access to the process data of the device.

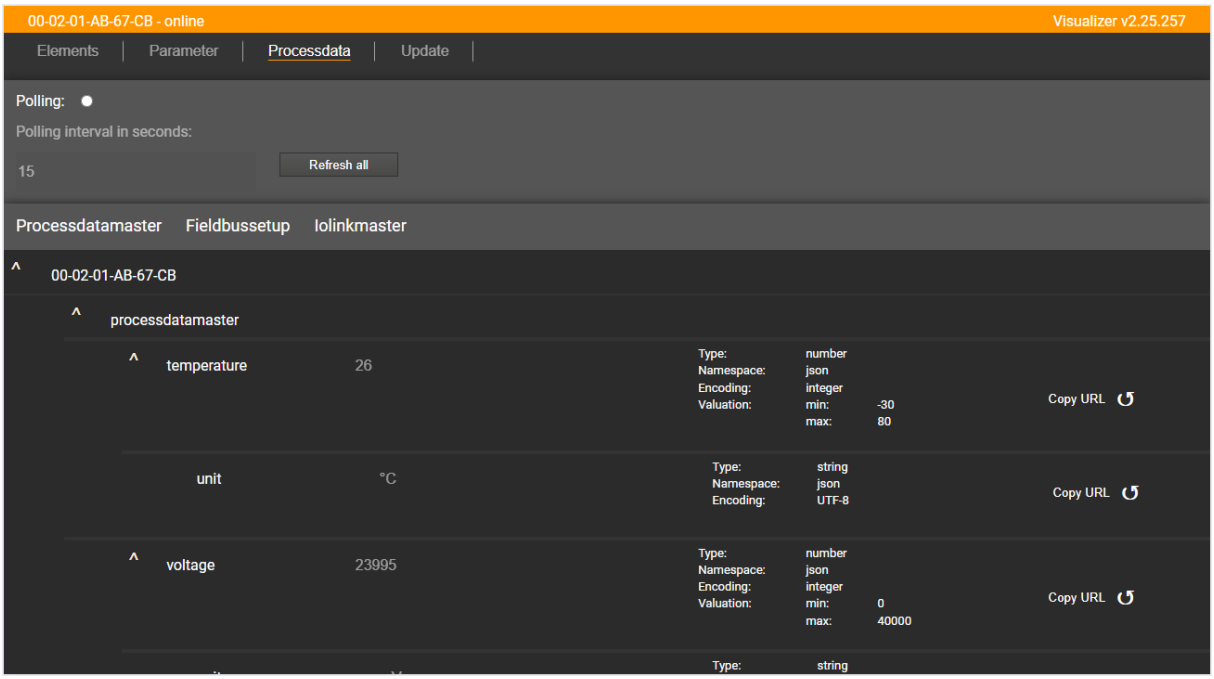
Requirements:

✓ IoT Core Visualizer has been started.

▶ Select the **Processdata** menu.

▷ The menu page shows the substructures of the device description that contains the process data.

▷ The current process values are displayed.



▶ Optional: In the header, activate the **Polling** option and set the polling interval.

▷ The process values will be refreshed with the set interval.

▶ Optional: Click on ↻ next to an element to manually refresh the process value.

10.2.4.1 Reading the status and diagnostic data of the device

Available information:

Name	Description	Value range	Access
temperature	Temperature of the device (value in °C)	• -30: -30 °C … • 80: 80 °C	ro [1]
voltage	Current voltage of the device supply US (value in millivolts)	• 0: 0 mV … • 4000: 4000 mV	ro [1]
supervisionstatus	Status of the voltage supply US	• ok: No error • fault: Error	ro [1]
current_ua	Present current intensity of the device supply UA (value in milliamps)	• 0: 0 mA … • 4000: 4000 mA	ro [1]
supervisionstatus_ua	Status of the voltage supply UA	• ok: No error • fault: Error	ro [1]

Name	Description	Value range	Access
current	Present current intensity of the device supply US (value in milliamps)	• 0: 0 mA … • 4000: 4000 mA	ro [1]
voltage_ua	Current voltage of the device supply UA (value in millivolts)	• 0: 0 mV … • 4000: 4000 mV	ro [1]

[1] Read only

Requirements:

✓ IoT Core Visualizer has been started.

✓ The **Processdata** menu is active.

▶ Select the **Processdatamaster** submenu.

▷ The menu page shows the status and diagnostic information of the device.

10.2.4.2 Reading the connection status

Available information:

Name	Description	Value range	Access
connectionstatus	Status of the connection to the EtherNet/IP network	• disconnected: not connected • Connected: connected	ro [1]

[1] Read only

Requirements:

✓ IoT Core Visualizer has been started.

✓ The **Processdata** menu is active.

▶ Select the **fieldbussetup** submenu.

▷ The menu page shows the connection status.

▷ The menu page shows the number of disconnections.

10.2.4.3 Reading the status and diagnostic data of the port

Available parameters:

Name	Description	Value range	Access
current_us	Present current intensity of the voltage supply US (value in milliamps)	• 0: 0 mA … • 2000: 2000 mA	ro [1]
current_ua	Present current intensity of the voltage supply UA (value in milliamps)	• 0: 0 mA … • 2000: 2000 mA	ro [1]
status	Status of the supply voltages US and UA	• ok: No error • fault us: Error in US • fault ua: Error in UA • fault us and ua: Error in US and UA	ro [1]

[1] Read only

Requirements:

✓ IoT Core Visualizer has been started.

✓ The **Processdata** menu is active.

▶ Select the **Iolinkmaster** > **port[x]** > **powercontrol** submenu (x:1…8).

▷ The menu page shows status and diagnostic information.

10.2.4.4 Reading port events

A port event contains information about events on the IO-Link port (e.g. IO-Link device connected or disconnected, change of the operating mode of the port).

Available parameters:

Name	Description	Value range	Access
portevent	Port event Structure: 0x00ZZYY • 0xYY: Device Status – status of the IO-Link device • 0xZZ: Connection Status - status of the connection	Device Status: • 0x00: No IO-Link device connected • 0x40: Wrong IO-Link device connected • 0x80: IO-Link device connected and in PREOPERATE state • 0xFF: IO-Link device connected and in OPERATE state Connection Status: • 0x00: Port deactivated • 0x01: Port activated, but no device connected • 0x02: Port activated and in “IO-Link” operating mode • 0x03: Port activated and in “DI” operating mode • 0x04: Port activated and in “DO” operating mode • 0x1B: Repetitions detected • 0x1E: Short circuit detected at pin 4 • 0x42: Wrong revision of the IO-Link device • 0x43: Wrong vendor ID (V1.1 Revision) • 0x44: Wrong device ID (V1.1 Revision) • 0x45: Wrong vendor ID (V1.0 Revision) • 0x46: Wrong device ID (V1.0 Revision) • 0x48: Wrong cycle time	ro [1]

[1] Read only

Requirements:

✓ IoT Core Visualizer has been started.

✓ The **Processdata** menu is active.

▶ Select the **Iolinkmaster** > **port[x]** submenu (x: 1…8).

▷ The menu page shows the port event of the port.

10.2.4.5 Reading and writing process data

Available parameters:

- IO-Link ports (class A)

Name	Description	Value range	Access
pin2in	Digital input (pin 4)	• 0: LOW • 1: HIGH	ro [1]
iolinkdevice > **pdin**	Input data (pin 4)	Operating mode DI: • 0x00: LOW • 0x01: HIGH Operating mode IO-Link: • Input value in hexadecimal representation	ro [1 2]
iolinkdevice > **pdout**	Output data (pin 4)	Operating mode DO: • 0x00: LOW • 0x01: HIGH Operating mode IO-Link: • Output value in hexadecimal representation	rw [3 4]

[1] Read only

[2] Parameter only available if operating mode pin 4 (US) = IO-Link and IO-Link device is connected to the port

[3] Read and write

[4] Read and write; parameter can only be changed if no connection to fieldbus controller is established

- IO-Link ports (class B):

Name	Description	Value range	Access
pin2out	Digital output (pin 2)	• 0: LOW • 1: HIGH	rw [1 2]
iolinkdevice > **pdin**	Input data (pin 4)	Operating mode DI: • 0x00: LOW • 0x01: HIGH Operating mode IO-Link: • Input value in hexadecimal representation	ro [3 4]
iolinkdevice > **pdout**	Output data (pin 4)	Operating mode DO: • 0x00: LOW • 0x01: HIGH Operating mode IO-Link: • Output value in hexadecimal representation	rw [1 2]

[1] Read and write

[2] Read and write; parameter can only be changed if no connection to fieldbus controller is established

[3] Read only

[4] Parameter only available if operating mode pin 4 (US) = IO-Link and IO-Link device is connected to the port

Requirements:

✓ IoT Core Visualizer has been started.

✓ The **Processdata** menu is active.

▶ Select the **Iolinkmaster** > **port[x]** submenu (x: 1…8).

▷ The menu page shows input and output data

▶ Optional: Enter the desired value in the output data fields.

▶ Click on ✎ to save the changes to the device.

▷ The set process value is set.

10.2.4.6 Reading and writing information about IO-Link devices

Available parameters:

Name	Description	Value range	Access
vendorid	Vendor ID of the IO-Link device	0…65535	ro [1]
deviceid	Device ID of the IO-Link device	0…16777215	ro [1]
productname	Article number of the IO-Link device	E.g. TCC501	ro [1]
serial	Serial number of the IO-Link device (12 digits)	e.g. 000008500706	ro [1]
status	State of the IO-Link device	• **state not connected**: Not connected • **state preoperate**: Device is in PREOPERATE state • **state operate**: Device is in OPERATE state • **state communiaction error**: Device has communication error	ro [1]
applicationspecifictag	Application-specific tag	***: *** (Default)	rw [2]

[1] read only; Parameter only available if operating mode pin 4 (US) = IO-Link and IO-Link device is connected to port

[2] Parameter only available if operating mode pin 4 (US) = IO-Link and IO-Link device is connected to the port

Requirements:

✓ IoT Core Visualizer has been started.

✓ The **Processdata** menu is active.

▶ Select the **Iolinkmaster** > **port[x]** > **iolinkdevice** submenu (x: 1…8).

▷ The menu page shows information about the IO-Link device.

▶ Optional: Enter the application-specific tag.

▶ Click on ✎ to save the changes to the device.

10.2.4.7 Reading IO-Link events

The device supports IO-Link events. IO-Link events are event and error messages. IO-Link events can be generated in the IO-Link master and in the connected IO-Link devices. IO-Link events generated in the IO-Link devices are forwarded to the IO-Link master and stored there.

Available parameters:

Name	Description	Value range	Access
iolinkevent	Active IO-Link event Structure of an IO-Link event (7 bytes): 0xIIMMTTVVSSCCCC • 0xII: Instance (IO-Link Event Qualifier - event trigger) • 0xMM: Mode (IO-Link Event Qualifier – event mode) • 0xTT: Type (IO-Link Event Qualifier – event type) • 0xVV: Validity (IO-Link Event Qualifier – validity) • 0xSS: Source (IO-Link Event Qualifier – event source) • 0xCCCC: Event Code (IO-Link Event Code)	Instance: • 0x00: unknown • 0x01: PL (Physical Layer) • 0x02: DL (Data Layer) • 0x03: AL (Application Layer) • 0x04: APPL (Application) Mode: • 0x40: One-time event or warning (single shot) • 0xC0: Error disappeared • 0x80: Error appeared Type: • 0x10: Notification • 0x20: Warning • 0x30: Error Validity: • 0x00: valid • 0x40: invalid Source: • 0x00: IO-Link device • 0xFF: IO-Link master Event Code: • ➔ IO-Link specification	ro [1] [2]

[1] Read only

[2] Parameter only available if operating mode pin 4 (US) = IO-Link and IO-Link device is connected to the port

Requirements:

✓ IoT Core Visualizer has been started.

✓ The **Processdata** menu is active.

▶ Select the **Iolinkmaster** > **port[x]** > **iolinkdevice** submenu (x: 1…8).

▷ The menu page shows IO-Link events of the port.

10.2.5 Update firmware

The **Update** menu page allows you to update the firmware of the device:

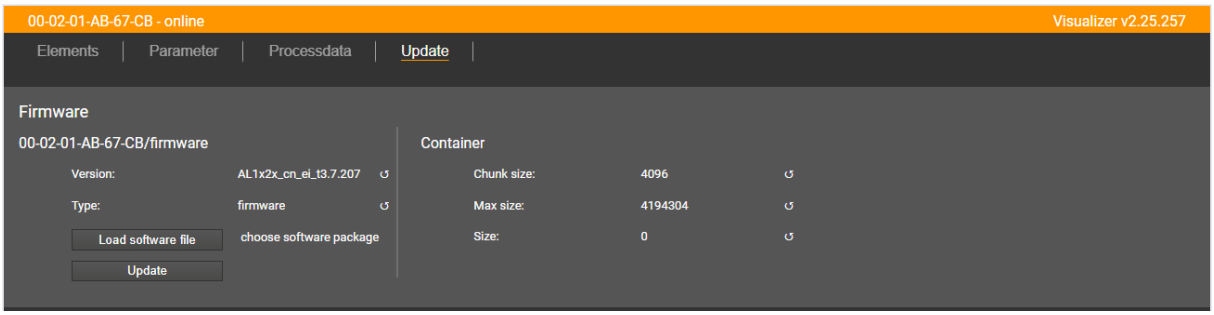
Requirements:

✓ IoT Core Visualizer has been started.

✓ New firmware has been downloaded. documentation.ifm.com

▶ Select the **Update** menu.

▷ Menu page shows information about the current firmware version.



▶ Click on **Load software file** and select the new firmware file (*.bin).

▶ Click on **Update** to start the update process.

▷ The firmware of the device is updated.

▷ The progress of the update process is displayed.

▷ After successful update: The device reboots automatically.

10.3 EtherNet/IP

10.3.1 Note: Startup package

ifm electronic provides Startup Packages for the integration of the device in EtherNet/IP environments with controllers from different manufacturers.

The Startup Packages can be downloaded from the ifm website: documentation.ifm.com

10.3.2 Integrating the device into a project

10.3.2.1 Top-down mode

In configuration mode Top-Down, the device parameters are set in the EtherNet/IP configuration software. The created configuration is transferred to the device and enabled when the connection to the EtherNet/IP controller is established.

10.3.2.1.1 Register the EDS file

For the mapping of the device in an EtherNet/IP configuration software ifm provides an Electronic Device Description (EDS). The device description file contains identification information, supported parameters, process data and fieldbus objects. The user can download the EDS file from the website documentation.ifm.com.

To add the device to the device catalogue of RSLogix 5000:

Requirements:

✓ Download the EDS file of the device.

▶ Start the EtherNet/IP projection software "RSLogix 5000".

▶ Select **Tools** > **EDS Hardware Installation Tool**.

▷ The wizard starts.

▶ Register the downloaded EDS file using the wizard.

▷ The device is added to the device catalogue of the EtherNet/IP projection software.

▷ RSLogix 5000 can access functions and data of the device.

10.3.2.1.2 Adding a device to the project

The device is integrated into the project using the installed EDS file.

Requirements:

✓ The EDS file is installed.

✓ A project with Ethernet/IP controller and Ethernet communication module has been created.

▶ In the Controller Organizer: Right-click on node **Ethernet** of the EtherNet/IP controller.

▷ The context menu appears.

▶ Select **New module...** in the context menu.

▷ A dialogue window appears.

▶ SelectAL1427 and click on **Create** .

▷ The **New module** window appears.

▶ Configure the IP settings of the device.

▶ Save the project.

10.3.2.1.3 Setting the connection type

The connection type determines which object instances of Configuration Assembly (parameters), Input Assembly (input data) and Output Assembly (output data) are used in the configuration.

Available connection types:

Connect	Description	Configuration Assembly	Input Assembly	Output Assembly
Exclusive Owner IO-Acyclic-Diag	• Process data (inputs, outputs) incl. PQI • Acyclical data • Diagnostic information, IO-Link events	Instance 199	Instance 100	Instance 150
Exclusive Owner IO-Acyclic-Diag-EnMo	• Process data (inputs, outputs) incl. PQI • Acyclical data • Diagnostic information, IO-Link events • energy monitoring,	Instance 199	Instance 103	Instance 150
Exclusive Owner IO	• Process data (inputs, outputs) incl. PQI	Instance 199	Instance 102	Instance 151
Input only	• Process data (inputs)	Instance 199	Instance 100	Instance 193 (empty)
Listen only	• Process data (inputs)	Instance 199	Instance 100	Instance 192 (empty)

The device only supports an active connection of types Exclusive Owner and Input. Connections of type Listen only can be selected as the second active connection.

To set the connections:

Requirements:

✓ The project is open.

✓ The device has been added to the project using the EDS.

▶ In the **Controller Organizer**: Double-click on the device node.

▷ A dialogue window appears.

▶ Click on **Change…**.

▷ The **Module Defintion** window appears.

▶ Select the desired connection in the **Connections** list (type: Exclusive Owner or Input).

▶ If necessary, set the data type to SINT.

▶ Optional: Select a second connection (type: Listen only).

▶ Click **OK** to adopt the changes.

▷ The connection type is set.

▷ RSLogix 5000 generates the **Controller Tags** of the device (Configuration, Input, Output) based on the selected connection type.

10.3.2.1.4 Device configuration

The device configuration includes the configuration of the gateway and the IO-Link ports.

Available parameters:

- Access rights (Communication Profile)

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- Length of the process data
- Ports X1...X8: Port configuration
  - Operating mode pin 4 (US)
  - Arrangement of the bytes in the process data
  - Cycle time of the data transmission of the IO-Link ports
  - Device validation and data storage mode
  - Device ID and manufacturer ID for device validation
  - Fallback mode for output data Pin 4 (US)
  - Fallback values for output data Pin 4 (US)
- Ports X1...X4: Operating mode pin 2 (UA)
- Ports X1...X4: Fallback value for digital output data Pin 2 (UA)
- Ports X1...X4: Limitation of output current on pin 2 (UA)
- Ports X1...X8: Limitation of output current on pin 1 and pin 4 (US)
- Ports X1...X8: Control instance for outputs

The parameters of the device are defined in the following object:

- Configuration Assembly (Instance 199) 79

The Controller Tags provide access to the parameters.

Requirements:

✓ The device is integrated into the project.

▶ In the **Controller Organizer**: Double-click the **Controller Tags** node.

▷ Controller Tags window appears.

▷ The structure **AL1x2x.C** > **AL1x2x:Data** contains the parameters.

▶ Set the parameters.

▶ Save the project.

▷ Device configuration has been set.

10.3.2.1.5 Transferring the configuration to the device

To activate the configuration on the device, the device configuration must be loaded onto the PLC.

Requirements:

✓ The project is open.

✓ The device has been added to the project using the EDS.

✓ The device has been configured.

▶ Select the **Communications** > **Download** menu.

▷ Project is loaded onto the controller.

▷ The configuration is saved on the device and activated.

▷ The control changes to Run Mode.

To test the connection to the device:

▶ In the **Controller Organizer**: double-click on the **Controller Tags** node.

▷ The **Controller Tags** window appears.

▷ Variable **AL1x2x:I** > **AL1x2x:I.ConnectionFaulted** shows the status of the connection (0: OK, 1: error)

10.3.2.2 Independent mode

In configuration mode Independent Mode, the device is configured using the parameter setting software or the IoT Core. In the fieldbus configuration software, the device is integrated into the project as a generic device. The length of the input data and output data must then be set according to the device configuration. The settings of the configuration assembly object are ignored when the project is transferred to the controller.

10.3.2.2.1 Device configuration

The device can be configured locally with the following options:

- ifm moneo: Setting the EtherNet/IP configuration mode 29
- ifm IoT Core Visualizer: Setting the EtherNet/IP configuration mode 46

The user must make the following parameter settings:

Feldbus settings

Parameter (ifm moneo) Parameter (IoT Core Visualizer)	Description	Parameter value
Independent mode independentmode	Enable independent mode	On
Process data mode explicitpdmode	Enable Explicit PD Mode	According to the requirements of the application
Process data length processdataconfiguration	Length of the process data	According to the requirements of the application

Port settings

Parameter (ifm moneo) Parameter (IoT Core Visualizer)	Description	Parameter value
Mode Pin2 UA mode_ua	Operating mode pin 2: Only available for ports X1...X4	According to the requirements of the application
Mode Pin4 US mode	Operating mode pin 4	IO-Link
Fail-safe digital out failsafedigitalout	Fallback value of digital output pin 4	According to the requirements of the application
Fail-safe DO/UA failsafepin2	Fallback value digital output pin 2 (I/Q)	According to the requirements of the application
Fail-safe IO-Link failsafeiolink	Fallback value IO-Link process data (outputs) pin 4	According to the requirements of the application
Swap swap	Arrangement of the bytes in the process data of the ports	According to the requirements of the application
Current Limit Pin1+Pin4 US current_us_max	Max. current value of the supply voltage US at the port (pin 1 + pin 4)	According to the requirements of the application
Current Limit Pin2 UA current_ua_max	Max. current value of the supply voltage UA at the port (pin 2)	According to the requirements of the application

To configure the device:

- ▶ Access the device with the desired parameter setting option:
- ▶ Set the parameters.
- ▶ Write the changed values to the device.

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▷ The device has been configured.

10.3.2.2.2 Adding a device to the project

The device is integrated into the project as a generic Ethernet module.

The connection settings must be entered manually. The connection settings define the structure and scope of the cyclic input data (Input Assembly) and output data (Output Assembly). The size of the input assembly and the output assembly depends on the process data length set on the device.

The connection settings must match the set process data length.

The following table shows the sizes of the assembly instances depending on the selected connection type:

Connection type	Input Assembly	Set process data length				
	Output Assembly	2 bytes	4 bytes	8 bytes	16 bytes	32 bytes
	Configuration Assembly					
Exclusive Owner IO	102	36 bytes	52 bytes	84 bytes	148 bytes	276 bytes
	151	18 bytes	34 bytes	66 bytes	130 bytes	258 bytes
	199	0 bytes	0 bytes	0 bytes	0 bytes	0 bytes
Exclusive Owner IO-Acyc-Diag-EnMo	103	238 bytes	254 bytes	286 bytes	350 bytes	478 bytes
	150	62 bytes	78 bytes	110 bytes	174 bytes	302 bytes
	199	0 bytes	0 bytes	0 bytes	0 bytes	0 bytes
Exclusive Owner IO-Acyc-Diag	100	206 bytes	222 bytes	254 bytes	318 bytes	446 bytes
	150	62 bytes	78 bytes	110 bytes	174 bytes	302 bytes
	199	0 bytes	0 bytes	0 bytes	0 bytes	0 bytes
Input Only IO	100	206 bytes	222 bytes	254 bytes	318 bytes	446 bytes
	193	0 bytes	0 bytes	0 bytes	0 bytes	0 bytes
	199	0 bytes	0 bytes	0 bytes	0 bytes	0 bytes
Listen Only IO	100	206 bytes	222 bytes	254 bytes	318 bytes	446 bytes
	192	0 bytes	0 bytes	0 bytes	0 bytes	0 bytes
	199	0 bytes	0 bytes	0 bytes	0 bytes	0 bytes

Requirements:

✓ A project with Ethernet/IP controller and Ethernet communication module has been created.

✓ The project is open.

▶ In the **Controller Organizer**: right-click on the node **Ethernet** (Ethernet communication module).

▷ The context menu appears.

▶ Select **New module...** in the context menu.

▷ A dialogue window appears.

▶ Select the device type **ETHERNET-MODULE** (Generic Ethernet module).

▶ Click on **Create**.

▷ The **New module** window appears.

▶ Enter the name of the device, e.g. AL1x2x.

▶ In the field **Comm Format**, select **Data – SINT**.

▶ Configure the IP settings of the device.

▶ Enter the length of the input data and output data in the **Connection Parameters** area (→ table).

▶ Click **OK** to adopt the changes.
▷ The device node is added to the project tree.
▷ The device is configured for operation in independent mode.

10.3.2.2.3 Transferring the configuration to the device

To transfer the configuration to the device:

Requirements:

✓ The project is open.
✓ The device has been added to the project using the EDS.
✓ The device has been configured.
▶ Select the **Communications** > **Download** menu.
▷ Project is loaded onto the controller.
▷ The configuration is saved on the device and activated.
▷ The control changes to Run Mode.

10.3.3 Accessing the process data

The cyclical process data of the device is transmitted via the Controller Tags.

The type, scope and position of the process data within the assembly instances depend on the selected connection type and the set process data length.

Available data:

- Ports X1...X4: Digital input data (pin 4)
- Ports X1...X4: Digital output data (pin 2 + pin 4)
- Ports X1...X8: IO-Link input data + output data

The cyclic input data is part of the following input assembly instances:

- Input Assembly (Instance 100) 85
- Input Assembly (Instance 102) 91
- Input Assembly (Instance 103) 96

The cyclic output data is part of the following output assembly instances:

- Output Assembly (Instance 150) 105
- Output Assembly (Instance 151) 107

The Port Qualifier Information (PQI) is available in the diagnostic and status information to check the validity of the cyclical process data.

▶ To check the validity of the process data, analyse the Port Qualifier Information (PQI).

If the EtherNet/IP connection is interrupted, the Port Qualifier Information (PQI) indicates that the process data is valid.

▷ Unintended effects on the control process

▶ Take suitable measures to detect the interruption of the EtherNet/IP connection.

Requirements:

✓ The project is open.
✓ The device is integrated into the project.
✓ The device has been configured.

- ▶ In the **Controller Organizer**: double-click on the **Controller Tags** node.
  - ▷ The **Controller Tags** window appears.
  - ▷ The structure **AL1x2x.I** > **AL1x2x.I:Data** contains the cyclic input data.
  - ▷ The structure **AL1x2x.O** > **AL1x2x.O:Data** contains the cyclic output data.
- ▶ If required: Link the cyclic input data and output data with the application variables.
- ▶ Save the project.

10.3.4 Accessing IO-Link events

The device supports the transmission of up to 3 IO-Link events per port. The IO-Link events are mapped as part of the diagnostic information in the cyclical input data.

The IO-Link events are part of the following input assembly instances:

- Input Assembly (Instance 100) 🡒 85

To access the IO-Link events:

Requirements:

- ✓ Operating mode pin 4 (US) of the port is IO-Link.
- ✓ The IO-Link device is connected to the port.
- ✓ The project is open.
- ✓ The device is integrated into the project.
- ✓ The device has been configured.
- ✓ A connection type with the required assembly instance is set.
- ▶ In the **Controller Organizer**: double-click on the **Controller Tags** node.
  - ▷ The **Controller Tags** window appears.
  - ▷ Structure **AL1x2x.I** > **AL1x2x.I:Data** contains the IO-Link events of the IO-Link ports.
- ▶ If required: link the IO-Link events with the application variables.
- ▶ Save the project.

10.3.5 Accessing diagnostic and status information

Diagnostic and status information is transmitted in the cyclical input data.

Available information:

- Status indication supply voltages US / UA of the device
- Short-circuit and overload indicator for the IO-Link ports
- Port Qualifier Information (PQI) of the IO-Link ports

The diagnostic and status information is part of the following input assembly instances:

- Input Assembly (Instance 100) 🡒 85
- Input Assembly (Instance 102) 🡒 91
- Input Assembly (Instance 103) 🡒 96

Requirements:

- ✓ The project is open.
- ✓ The device is integrated into the project.
- ✓ The device has been configured.
- ▶ In the **Controller Organizer**: double-click on the **Controller Tags** node.
  - ▷ The **Controller Tags** window appears.

▷ The structure **AL1x2x.I** > **AL1x2x.I:Data** contains the diagnostic and status information.

▶ If required: link the diagnostic and status information with the application variables.

▶ Save the project.

In addition, the diagnostic and status information of the CIP object classes of the device can be read acyclically, Using acyclic services 68.

10.3.6 Using energy monitoring

The energy monitoring information is transmitted in the cyclical input data:

Available information:

- Voltage and current values of the supply voltages US / UA of the device
- Current values of the voltage UA of the IO-Link ports (pin 2)
- Current values of the voltage US of the IO-Link ports (pin 1+ pin 4)

Energy monitoring is part of the following input assembly instances:

- Input Assembly (Instance 103) 96

Requirements:

✓ The project is open.

✓ The device is integrated into the project.

✓ The device has been configured.

▶ In the **Controller Organizer**: double-click on the **Controller Tags** node.

▷ The **Controller Tags** window appears.

▷ Structure **AL1x2x.I** > **AL1x2x.I:Data** contains the information for energy monitoring.

▶ If required: Link information on energy monitoring with application variables.

▶ Save the project.

10.3.7 Accessing IO-Link devices

The device supports access to the connected IO-Link devices from the application. The Indexed Service Data Unit (ISDU) is used to access the parameters, process data, diagnostics and status information. Each data object of an IO-Link device can be addressed via index and subindex.

The available data objects depend on the IO-Link device, IODD description of the IO-Link device.

Available access options:

- Via the acyclic command channel within the cyclic process data, Acyclic command channel 110
- Via the manufacturer-specific CIP object class IO-Link Request, IO-Link Request Object (Class Code: 0x80) 128
  - Available services:

Service	Description	Reference
Read ISDU	Read ISDU object	Read ISDU 129
Write ISDU	Write ISDU object	Write ISDU 131

10.3.8 Using acyclic services

The device supports the following mechanisms for acyclic read and write access to data on the IO-Link ports and the connected IO-Link devices.

- Acyclical command channel within the cyclical process data: Using the acyclic command channel 69
- EtherNet/IP mechanisms for accessing objects in the object dictionary: EtherNet/IP mechanisms for acyclic commands 70

10.3.8.1 Using the acyclic command channel

The device features an acyclic command channel. This provides acyclical read and write access to the parameters of the device and the connected IO-Link devices. The command channel uses special sections within the cyclic input data and output data.

An acyclic command consists of a request and a response. The command request is transmitted in the Output Assembly. The command response of the IO-Link master is transmitted in the input assembly.

Structure of the acyclic command channel: Acyclic command channel 110

To use the acyclic command channel:

Requirements:

✓ The device has been integrated into the project.

✓ In the Top-Down Mode: a connection type is active that provides acyclical ranges in the input data and output data.

✓ In the Independent Mode: The **Process data mode** parameter is set to a value that provides acyclical ranges in the input and output data.

▶ Execute the read and write commands to the acyclic areas.

10.3.8.1.1 Principle of the command channels

General procedure of acyclic communication:

1. Write Command Request

▶ In the request channel: write the required command data (except **Trigger**)

▶ Set **Trigger** = 1.

▷ Change to **Trigger** = 1 signals a new command.

▷ In the response channel: bytes are set to 0.

▷ Processing of the command is started.

2. Check status

▶ In the response channel: check **Handshake**.

  ▷ If **Handshake** <>0: command processing finished, continue with step 3.

  ▷ If **Handshake** == 0: command is still being processed, repeat step 2.

3. Read Command Response

▶ In the response channel: read returned user data.

▶ In the request channel: set **Trigger** = 0.

▷ Command processing completed.

▷ New command can be executed.

10.3.8.2 Acyclic port commands

For the acyclic access to the configuration of the IO-Link port of the device, the following commands are available:

Command	Description	Reference
Set Mode	Set the operating mode of the IO-Link port	Set Mode (0x10) 115
Set Validation ID / Data Storage	Set the device validation and the data storage of the IO-Link port	Set validation ID / data storage (0x20) 117
Set Fail-safe Data Pattern	Set the behaviour of the outputs when the EtherNet/IP connection is interrupted and the corresponding fallback values of the IO-Link port	Set fail-safe data pattern (0x30) 119

The port commands use the mechanisms of the acyclic command channel.

10.3.8.3 EtherNet/IP mechanisms for acyclic commands

The device supports the acyclic access to the objects in the object directory, Object directory 120. The EtherNet/IP command Message (MSG) can be used for acyclic read and write access.



Detailed information on the Message (MSG) command: User documentation RSLogix 5000

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10.4 OPC UA server

10.4.1 Notes

10.4.1.1 Access to gateway data

Access to variables and the executability of gateway methods depend on the following settings:

- Configured access rights to the device
- Status of the connection to the EtherNet/IP PLC
- Authentication method used for OPC-UA Server

The following table shows the access rights from the perspective of the OPC UA server:

Authentication Method	Username + Password				Anonymous
Access rights	Fieldbus + IoT		Fieldbus + IoT (ro)	IoT only	
Connection to the fieldbus PLC	Connected	Disconnected			
Variables (rw)	ro	rw	ro	rw	ro
Methods	Not executable	Executable	Not executable	Executable	Not executable

The variable MasterConfigurationDisabled 149 indicates whether changes to the configuration of the gateway are permitted via OPC UA.

▶ Before a planned access to variables or methods, check whether the desired function can be executed.

Affected variables:

- ApplicationSpecificTag 150
- FunctionTag 150
- LocationTag 150

Affected methods:

- Restart 150
- Restart Abort 151
- Change Independentmode 144
- Change Explicitpdmode 143
- Change Hostname 144
- Change Network Configuration 145
- Change Processdataconfiguration 146
- Change Accessrights 140

If not all requirements for the execution of the method are met, the execution of the method is cancelled and the status code BadNotExecutable is output.

10.4.1.2 Access to port and IO-Link device data

Access to variables and the executability of methods of the ports and IO-Link devices depend on the following settings:

- Configured access rights to the device
- Status of the connection to the EtherNet/IP PLC
- Authentication method used for OPC-UA Server
- Control instance set for the outputs

The following table shows the access rights from the perspective of the OPC UA server:

Authentication Method	Username + Password					Anony-mous
Access rights	Fieldbus + IoT			Fieldbus + IoT (ro)	IoT only	
Connection to the fieldbus PLC	Connected		Disconnected			
Control instance of the outputs	Fieldbus	OPC_UA + IoT				
Variables (rw)	ro	rw	rw	ro	rw	ro
Methods	Not executa-ble	Executable	Executable	Not executa-ble	Executable	Not exe-cutable

The variable DeviceConfgurationDisabled 154 indicates whether changes to the configuration of the ports and the connected IO-Link devices are permitted via OPC-UA.

▶ Before a planned access to variables and methods, check whether the desired function can be executed.

Affected variables:

- pin2out 162
- pin4out 162
- ProcessDataOutput 164
- MaxCurrentUS 155
- MaxCurrentUA 155
- ApplicationSpecificTag 164
- FunctionTag 164
- LocationTag 164

Affected methods:

- Failsafe Pattern 148
- Change Failsafe Portx (x: 1...8) 147
- UpdateConfiguration 156
- ReadISDU 164
- WriteISDU 166

If not all requirements for the execution of the method are met, the execution of the method is cancelled and the status code BadNotExecutable is output.

10.4.2 Connecting to the OPC UA server

The OPC UA server is accessed via the endpoint URL: opc.tcp://<ip-address>:4840

The device supports the following security settings:

- Security Policies:
  - none (None)

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- Security Modes:
  - none (None)
- Authentication methods:
  - Anonymous (Anonymous)
  - User name / password (Username, Password)

Factory settings:

- User name: administrator
- Password: admin1

The factory-set user name for accessing the OPC UA server cannot be changed.

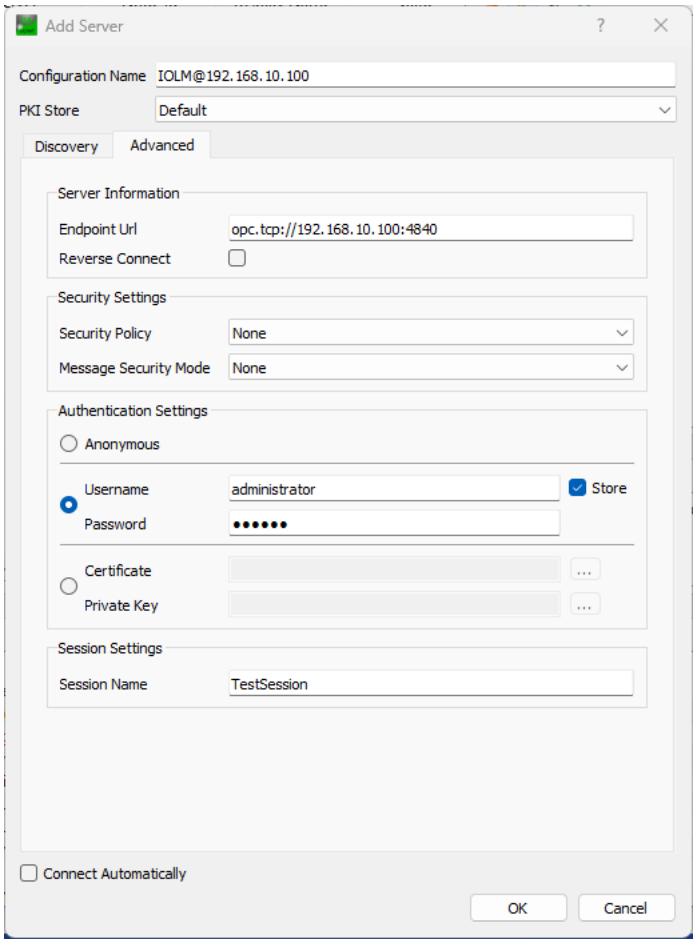
When setting up the device, change the factory-set password for access to the OPC UA server, Change Password 141.

Requirements:

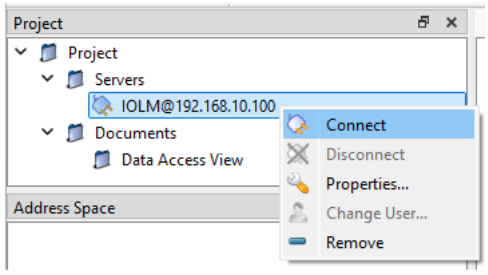
✓ OPC UA server of the device is enabled.
✓ Port XF1, XF2 is connected to the IT network.
✓ Port 4840 (TCP) is enabled (firewall configuration).
▶ Start the OPC UA client.
▶ Create new profile for OPC UA server.
▶ Establish a connection to the OPC UA server using the created profile.
▷ OPC UA client shows the address space of the device.

10.4.2.1 Example: Accessing the OPC UA server with Uaexpert

✓ The Uaexpert software has been properly installed.
▶ Start Uaexpert.
▶ Select **Server** > **Add…**.
  ▷ A window for creating a new server profile appears.
▶ Select the **Advanced** tab.
  ▷ The **Add Server** window for manual entry of profile properties appears.

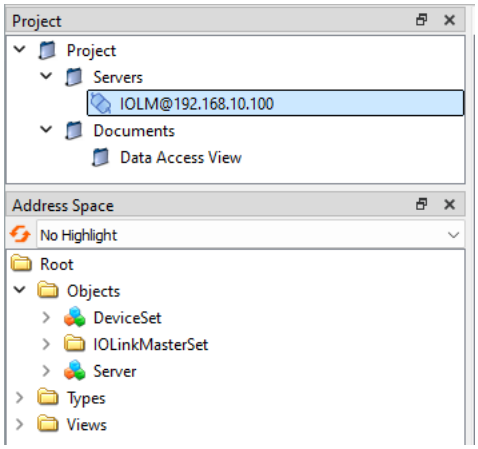


- ▶ Set the parameters as shown in the picture:
- **Configuration Name**, e.g. IOLM@192.168.10.100.
- **Endpoint Url**: opc.tcp://<ipaddress>:4840, e.g. ocp.tcp://192.168.10.100:4840.
- **Security Policy**: None
- **Message Security Mode**: None
- **Authentication Settings**: Username / Password, Connecting to the OPC UA server 72.
- ▶ Click on **OK** to save the server profile.
  - ▷ The new server profile is saved under **Projects** > **Servers**.
- ▶ In the project tree: Right-click on the created server profile.
  - ▷ The context menu appears.



- ▶ Select the **Connect** menu item.
  - ▷ Uaexpert establishes a connection to the OPC UA server of the device.
  - ▷ A warning appears.
- ▶ The **Ignore** window for manual entry of profile properties appears.
- ▷ Connection to the OPC UA server has been established.

▷ The window **Address Space** shows address space of the OPC UA server.

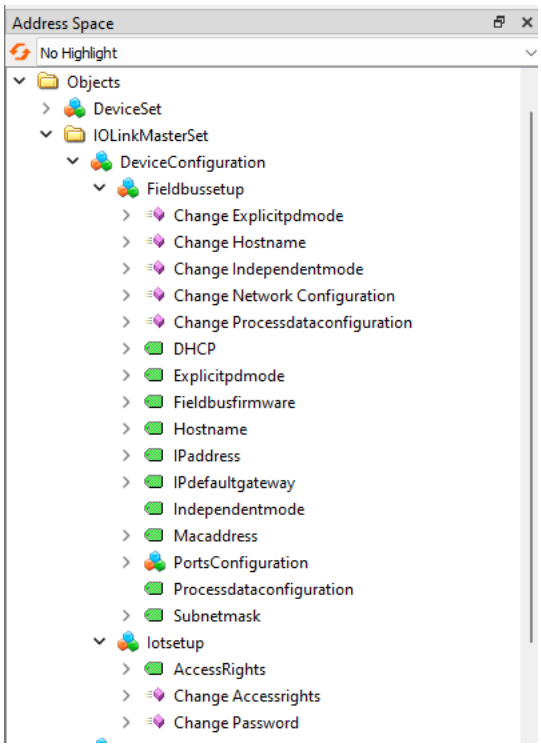


10.4.3 Address space of the OPC UA server

The device-specific address space of the OPC UA server is organised as follows:

```
IOLinkMasterSet
    - DeviceConfiguration
    - ifm-AL1427/iolinkmaster
        - port[1]
            - iolinkdevice
        - port[2]
            - iolinkdevice
        - port[3]
            - iolinkdevice
        - port[4]
            - iolinkdevice
        - port[5]
            - iolinkdevice
        - port[6]
            - iolinkdevice
        - port[7]
            - iolinkdevice
        - port[8]
            - iolinkdevice
```

10.4.3.1 Gateway



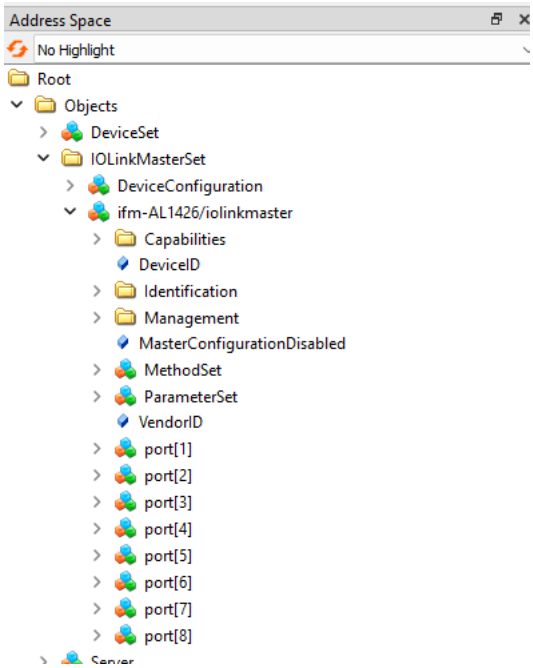
Name: `DeviceConfiguration`

Data type: DeviceIoTConfiguration 140

The structure provides access to the following data:

- Configuration of the IoT interface
  - Access rights
  - Changing the password
- Configuration of the fieldbus interface
  - Interface configuration
  - Fail-save values of the port outputs

10.4.3.2 IO-Link master



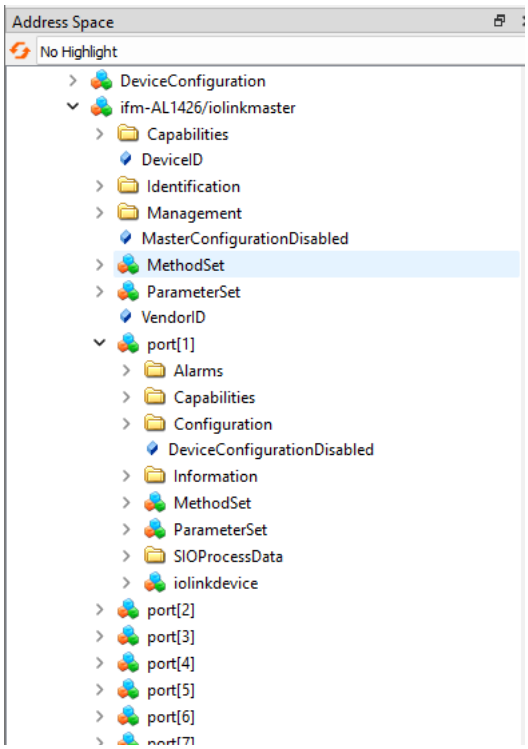
Name: `ifm-AL14xx/iolinkmaster`

Data type: IOLinkMasterType 149

The structure provides access to the following data:

- Identification information
- Status and diagnostic information
- Methods for controlling the device (restart)
- Structures for the ports of the device 77

10.4.3.3 IO-Link ports



Name: `port[x]` (x: 1...8)

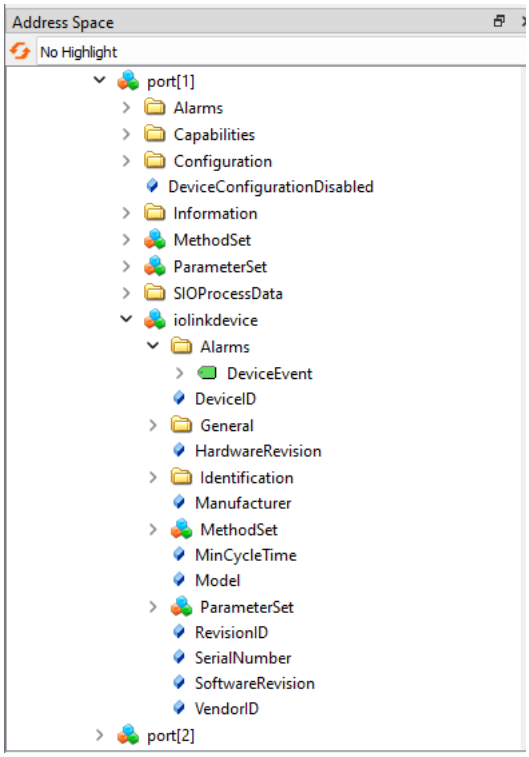
Data type: IOLinkPortType 153

There is a separate substructure for each port.

The structure provides access to the following data:

- Port configuration
  - Operating mode (pin 2, pin 4)
  - Validation and data storage fuction
  - Cycle time
- Limitation for output currents (US, UA)
- Identification information
- Status and diagnostic information
- SIO process data (digital inputs, digital outputs)
- Structure for the connected IO-Link device 77

10.4.3.4 IO-Link devices



Name: `iolinkdevice`

Data type: IOLinkDeviceType 162

There is a separate substructure for each IO-Link device.

The structure provides access to the following data of the IO-Link device:

- Identification information
- Status and diagnostic information
- IO-Link process data (inputs, outputs)
- Acyclic read and write access to ISDU objects

11 Maintenance, repair and disposal

The operation of the unit is maintenance-free.

- Dispose of the device in an environmentally friendly way in accordance with the applicable national regulations when it is no longer used.

11.1 Cleaning the housing surface

Clean the surface of the device when necessary.

- Disconnect the device.
- Clean the device from dirt using a soft, chemically untreated and dry cloth.
- In case of severe soiling, use a cloth moistened with water.
- Do not use any caustic cleaning agents for this!

11.2 Update firmware

The firmware of the device can be updated using the following methods:

- ifm IoT Core Visualizer: Update firmware 60
- ifm moneo: Updating the firmware 39

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12 Appendix

12.1 EtherNet/IP

12.1.1 Parameters

12.1.1.1 Configuration Assembly (Instance 199)

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
0	Communication Profile							
1	Port Process Data Size							
2…13	X1 (B-Port) - Port Configuration							
14…25	X2 (B-Port) - Port Configuration							
26…37	X3 (B-Port) - Port Configuration							
38…49	X4 (B-Port) - Port Configuration							
50…61	X5 (A-Port) - Port Configuration							
62…73	X6 (A-Port) - Port Configuration							
74…85	X7 (A-Port) - Port Configuration							
86…97	X8 (A-Port) - Port Configuration							
98	X1 (B-Port) - Mode Pin2 UA							
99	X2 (B-Port) - Mode Pin2 UA							
100	X3 (B-Port) - Mode Pin2 UA							
101	X4 (B-Port) - Mode Pin2 UA							
102	X1 (B-Port) – Fail Safe DO Mode Pin2 UA							
103	X2 (B-Port) – Fail Safe DO Mode Pin2 UA							
104	X3 (B-Port) – Fail Safe DO Mode Pin2 UA							
105	X4 (B-Port) – Fail Safe DO Mode Pin2 UA							
106…107	X1 (B-Port) - Current Limit Pin2 UA							
108…109	X2 (B-Port) - Current Limit Pin2 UA							
110…111	X3 (B-Port) - Current Limit Pin2 UA							
112…113	X4 (B-Port) - Current Limit Pin2 UA							
114…115	X1 (B-Port) - Current Limit Pin1 + Pin4 US							
116…117	X2 (B-Port) - Current Limit Pin1 + Pin4 US							
118…119	X3 (B-Port) - Current Limit Pin1 + Pin4 US							
120…121	X4 (B-Port) - Current Limit Pin1 + Pin4 US							
122…123	X5 (A-Port) - Current Limit Pin1 + Pin4 US							
124…125	X6 (A-Port) - Current Limit Pin1 + Pin4 US							
126…127	X7 (A-Port) - Current Limit Pin1 + Pin4 US							
128…129	X8 (A-Port) - Current Limit Pin1 + Pin4 US							
130	X1 (B-Port) - Output Select Control							
131	X2 (B-Port) - Output Select Control							
132	X3 (B-Port) - Output Select Control							
133	X4 (B-Port) - Output Select Control							

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
134	X5 (A-Port) - Output Select Control							
135	X6 (A-Port) - Output Select Control							
136	X7 (A-Port) - Output Select Control							
137	X8 (A-Port) - Output Select Control							

Legend:

• Communication Profile	Access rights to the parameter data, process data and events / diagnostic messages of the IO-Link master and the connected IO-Link devices	USINT	• 0x00: EtherNet/IP + IoT • 0x01: EtherNet/IP + IoT (read-only) • 0x02: EtherNet/IP only • 0x03: Keep current Communication Profile (default)
• Port Process Data Size	Length of the process input data and process output data per IO-Link port	SINT	• 0x00: 2 Bytes • 0x01: 4 Bytes • 0x02: 8 Bytes • 0x03: 16 Bytes • 0x04: 32 Bytes (default)
• Port Configuration	Area for configuring the port (pin 4)		Mapping: Port Configuration ➔ 81
• Mode Pin2 UA	Operating mode pin 2 of the port	USINT	• 0x00: Off: IO-Link Type A Supply • 0x01: On: IO-Link Type B Supply (default) • 0x02: Digital Output
• Fail Safe DO Mode Pin2 UA	Fallback mode for port output data when the EtherNet/IP connection is interrupted (only valid forMode Pin2 UA: Digital Output	UINT	• 0x00: Failsafe Reset Value (default) • 0x01: Failsafe Old Value • 0x02: Failsafe Set Value
• Current Limit Pin1 + Pin4 US	Max. current value pin 1 and pin 4 of the port (US)		Mapping: Current Limit Pin1 + Pin4 US ➔ 83
• Current Limit Pin2 UA	Max. current value at pin 2 of the port (UA)		Mapping: Current Limit Pin2 UA ➔ 82
• Output Control Select	Control instance for output data (only valid if parameter Communication Profile = Ethernet/IP + IoT)	UINT	• 0x00: Fieldbus (default) • 0x01: OPCUA / IoT

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12.1.1.1.1 Mapping: Port Configuration

Byte (Offset)	Content
n	Port Mode
n+1	Port Cycle Time
n+2	Swap
n+3	Validation / Data Storage
n+4	Vendor ID (VID)[0]
n+5	Vendor ID (VID)[1]
n+6	Device ID (DID)[0]
n+7	Device ID (DID)[1]
n+8	Device ID (DID)[2]
n+9	Device ID (DID)[3]
n+10	Fail Safe Mode Pin4
n+11	Fail Safe DO Mode Pin4

Legend:

• Port Mode	Operating mode of pin 4 of the port	SINT	• 0x00: Disabled • 0x01: Digital Input (Pin 4) • 0x02: Digital Output (Pin 4) • 0x03: IO-Link (Pin 4) (default)
• Port Cycle Time	Cycle time of the data transmission between IO-Link master and IO-Link device	USINT	• 0x00: As fast as possible (default) • 0x01: 2 ms • 0x02: 4 ms • 0x03: 8 ms • 0x04: 16 ms • 0x05: 32 ms • 0x06: 64 ms • 0x07: 128 ms
• Swap	Swap arrangement of bytes in process data NOTE! EtherNet/IP uses little-endian format (Intel), IO-Link uses big-endian format (Motorola)	SINT	• 0x00: Enabled • 0x01: Disabled (default)
• Validation / Data Storage	Validation mode / data storage mode	SINT	• 0x00: No device check and clear (default) • 0x01: Type compatible V1.0 device • 0x02: Type compatible V1.1 device • 0x03: Type compatible V1.1 device with Backup + Restore • 0x04: Type compatible V1.1 device with Restore
• Vendor ID	Vendor ID of the manufacturer of the IO-Link device (for validation) Vendor ID = 0x1234 • Vendor ID [1]: 0x12 • Vendor ID [0]: 0x34	UINT	• 0x0000 (default) … • 0x7FFF
• Device ID	Device ID of the IO-Link device (for validation) Device ID = 0x00123456	UDINT	• 0x00000000 (default) … • 0x00FFFFFF

			• Device ID [3]: 0x00 • Device ID [2]: 0x12 • Device ID [1]: 0x34 • Device ID [0]: 0x56
• Fail Safe Mode Pin4	Fail-safe mode for output data of the port (pin 4) in case of interruption of the EtherNet/IP connection (only valid if Parameter Port Mode = IO-Link (Pin 4))	SINT	• 0x00: No Fail Safe (default) • 0x01: Fail Safe Reset Value • 0x02: Fail Safe Old Value • 0x03: Fail Safe with Pattern
• Fail Safe DO Mode Pin4	Fail-safe value for output data of the port (pin 4) if the EtherNet/IP connection is interrupted (only valid if parameter Port Mode = Digital Output (Pin 4))	SINT	• 0x00: Fail Safe Reset Value • 0x01: Fail Safe Old Value (default) • 0x02: Fail Safe Set Value

12.1.1.1.2 Mapping: Current Limit Pin2 UA

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	Current Limit Pin2 UA[0]							
n+1	Current Limit Pin2 UA[1]							

Legend:

• Current Limit Pin2 UA	Current limitation of the supply voltage UA at the IO-Link port (value in mA) Current Limit Pin2 UA = 0x1234 • Current Limit Pin2 UA[1] = 0x12 • Current Limit Pin2 UA[0] = 0x34	UINT	• 0x0000: 0 mA ... • 0x07D0: 2000 mA (default)

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12.1.1.1.3 Mapping: Current Limit Pin1 + Pin4 US

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	Current Limit Pin1 + Pin4 US[0]							
n+1	Current Limit Pin1 + Pin4 US[1]							

Legend:

• Current Limit Pin1 + Pin4 US	Current limitation of the supply voltage US on the IO-Link port (value in mA) Current Limit Pin1 + Pin4 US = 0x1234 • Current Limit Pin1 + Pin4 US[1] = 0x12 • Current Limit Pin1 + Pin4 US[0] = 0x34	UINT	• 0x0000: 0 mA ... • 0x01C2: 450 mA (default) ... • 0x07D0: 2000 mA

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12.1.2 Cyclic data

12.1.2.1 Input Assembly (Instance 100)

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
0…1	Digital Input							
2…3	Status Information							
4…45	Acyclic Command Channel: Response							
46…47	Port X1: Port Qualifier Information (PQI)							
48…63	Port X1: IO-Link Information + IO-Link Events							
64…65	Port X2: Port Qualifier Information (PQI)							
66…81	Port X2: IO-Link Information + IO-Link Events							
82…83	Port X3: Port Qualifier Information (PQI)							
84…99	Port X3: IO-Link Information + IO-Link Events							
100…101	Port X4: Port Qualifier Information (PQI)							
102…117	Port X4: IO-Link Information + IO-Link Events							
118…119	Port X5: Port Qualifier Information (PQI)							
120…135	Port X5: IO-Link Information + IO-Link Events							
136…137	Port X6: Port Qualifier Information (PQI)							
138…153	Port X6: IO-Link Information + IO-Link Events							
154…155	Port X7: Port Qualifier Information (PQI)							
156…171	Port X7: IO-Link Information + IO-Link Events							
172…173	Port X8: Port Qualifier Information (PQI)							
174…189	Port X8: IO-Link Information + IO-Link Events							
190	Port X1: Input Data (n Bytes)							
190+n	Port X2: Input Data (n Bytes)							
190+2n	Port X3: Input Data (n Bytes)							
190+3n	Port X4: Input Data (n Bytes)							
190+4n	Port X5: Input Data (n Bytes)							
190+5n	Port X6: Input Data (n Bytes)							
190+6n	Port X7: Input Data (n Bytes)							
190+7n	Port X8: Input Data (n Bytes)							

Legend:

• Digital Input	Digital input data of the ports		Mapping: Digital Input ➔ 86
• Status Information	Status information of the device		Mapping: Status Information ➔ 87
• Acyclic Command Channel: Response	Acyclic command channel - answer		Response channel ➔ 112
• IO-Link Information + IO-Link Events	IO-Link information and IO-Link events of the port		Mapping: IO-Link information + IO-Link events ➔ 89
• Input Data (n Bytes)	IO-Link input data of the port (n bytes) n: {2, 4, 8, 16, 32}; n is determined by parameter Port Process Data Size	USINT	Per byte: • 0x00…0xFF

12.1.2.1.1 Mapping: Digital Input

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	Port X8: DI Pin 4	Port X7: DI Pin 4	Port X6: DI Pin 4	Port X5: DI Pin 4	Port X4: DI Pin 4	Port X3: DI Pin 4	Port X2: DI Pin 4	Port X1: DI Pin 4
n+1	Port X8: DI Pin 2	Port X7: DI Pin 2	Port X6: DI Pin 2	Port X5: DI Pin 2	reserved	reserved	reserved	reserved

Legend:

• DI Pin 4	Signal status of the digital input on Pin 4 of the port	1 BIT	• 0x0: LOW • 0x1: HIGH
• DI Pin 2	Signal status of the digital input on Pin 2 of the port	1 BIT	• 0x0: LOW • 0x1: HIGH

12.1.2.1.2 Mapping: Status Information

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	Port X8: SC / OL	Port X7: SC / OL	Port X6: SC / OL	Port X5: SC / OL	Port X4: SC / OL	Port X3: SC / OL	Port X2: SC / OL	Port X1: SC / OL
n+1	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	SENS PWR	AUX PWR

Legend:

• SC / OL	Short Circuit / Overload: Indication of a short circuit or of an overvoltage on the IO-Link port	1 BIT	• 0x0: No error • 0x1: Short-circuit or overvoltage
• SENS PWR	Status of the US supply voltage	1 BIT	• 0x0: no fault / no warning • 0x1: Excessive current on US (> 3.6 V)
• AUX PWR	status of the UA supply voltage	1 BIT	• 0x0: UA available and no fault • 0x1: no UA connected

12.1.2.1.3 Mapping: Port Qualifier Information (PQI)

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	Diagnosis present	Wrong Length PDout	Wrong Length PDin	Wrong Cycle Time	Wrong VID / DID	Invalid Data	Dev Not Con	IOL Mode
n+1	PQ	DevErr	DevCom	Reserved	Reserved	Reserved	SENS PWR	AUX PWR

Legend:

• IOL Mode	Operating mode of the port (pin 4)	1 BIT	• 0x0: Otherwise • 0x1: IO-Link
• Dev Not Con	Connection status to IO-Link device on the port	1 BIT	• 0x0: connected • 0x1: not connected
• Invalid Data	Status of the process data	1 BIT	• 0x0: valid • 0x1: invalid
• Wrong VID / DID	Match between configured and recognised Vendor ID / Device ID	1 BIT	• 0x0: OK • 0x1: no match
• Wrong Cycle Time	Conformity of configured and detected cycle time	1 BIT	• 0x0: OK • 0x1: no match
• Wrong Length PDin	Match between configured and detected process data length (inputs)	1 BIT	• 0x0: OK • 0x1: configured process data length too small
• Wrong Length PDout	Match between configured and detected process data length (outputs)	1 BIT	• 0x0: OK • 0x1: configured process data length too small
• Diagnosis present	Indication of new IO-Link events (Coming Event, Single Shot Event) • Coming Events disappears when the corresponding Disappearing Event occurs • Single Shot Events disappear automatically	1 BIT	• 0x0: no IO-Link event • 0x1: new IO-Link event detected
• AUX PWR	Status of the supply voltage UA on pin 2 of the port (only for Class B Ports)	1 BIT	• 0x0: No error • 0x1: UA not connected
• SENS PWR	Status of the supply voltage US on pin 1 and pin 4 of the port	1 BIT	• 0x0: No error • 0x1: US not connected or too low (<3.6 A)
• DevCom	Device Communication: Status display of communication with IO-Link device	1 BIT	• 0x0: No IO-Link device available or IO-Link device in error state (e.g. validation error) OR port in operating state DI, DO, disabled • 0x1: IO-Link device detected IO-Link device is in OPERATE state and not in error state
• DevErr	Device Error: Error display for port or connected device	1 BIT	• 0x0: no fault / no warning • 0x1: Error / warning occurred on port or connected IO-Link device
• PQ	Port Qualifier: Validity indicator for the process data of the connected IO-Link device	1 BIT	• 0x0: Invalid process data OR incorrect process data length OR incorrect cycle time OR incorrect validation settings (operating status DI, DO, disabled)

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- 0x1: Valid process data of the IO-Link device (IO-Link operating mode and OPERATE status)

12.1.2.1.4 Mapping: IO-Link information + IO-Link events

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	Vendor ID (VID)[0]							
n+1	Vendor ID (VID)[1]							
n+2	Device ID (DID)[0]							
n+3	Device ID (DID)[1]							
n+4	Device ID (DID)[2]							
n+5	Device ID (DID)[3]							
n+6	Event 1: Mode		Event 1: Type		Event 1: Src	Event 1: Instance		
n+7	Event 1: Code[0]							
n+8	Event 1: Code[1]							
n+9	Event 2: Mode		Event 2: Type		Event 2: Src	Event 2: Instance		
n+10	Event 2: Code[0]							
n+11	Event 2: Code[1]							
n+12	Event 3: Mode		Event 3: Type		Event 3: Src	Event 3: Instance		
n+13	Event 3: Code[0]							
n+14	Event 3: Code[1]							
n+15	Reserved							

Legend:

• Vendor ID (VID)	Vendor ID of the connected IO-Link device VID = 0x1234 • DID[1]: 0x12 • DID[0]: 0x34	UINT	0x0000...0x7FFF
• Device ID (DID)	Device ID of the connected IO-Link device DID = 0x00123456 • DID[3]: 0x00 • DID[2]: 0x12 • DID[1]: 0x34 • DID[0]: 0x56	UDINT	0x00000000...0x00FFFFFF
• Event m: Mode	Mode: Mode of the event	2 BIT	• 0x0: reserved • 0x1: One-time event • 0x2: Event has disappeared • 0x3: Event has appeared
• Event m: Type	Type: category of the event	2 BIT	• 0x0: reserved • 0x1: Notification • 0x2: Warning • 0x3: Error
• Event m: Src	Src: Source of the event	1 BIT	• 0x0: IO-Link device

			• 0x1: IO-Link master
• Event m: Instance	Instance: Trigger of the event	3 BIT	• 0x0: Unknown • 0x1...0x3: Reserved • 0x4: Application • 0x5...0x7: Reserved
• Event m: Code	Code: Event code Code = 0x1234 • Code (MSB)[1]: 0x12 • Code (LSB)[0]: 0x34	UINT	depending on the device (↪ IODD description of the IO-Link device)

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12.1.2.2 Input Assembly (Instance 102)

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
0…1	Digital Input							
2…3	Status Information							
4…5	Port X1: Port Qualifier Information (PQI)							
6…7	Port X2: Port Qualifier Information (PQI)							
8…9	Port X3: Port Qualifier Information (PQI)							
10…11	Port X4: Port Qualifier Information (PQI)							
12…13	Port X5: Port Qualifier Information (PQI)							
14…15	Port X6: Port Qualifier Information (PQI)							
16…17	Port X7: Port Qualifier Information (PQI)							
18…19	Port X8: Port Qualifier Information (PQI)							
20	Port X1: Input Data (n Bytes)							
20+n	Port X2: Input Data (n Bytes)							
20+2n	Port X3: Input Data (n Bytes)							
20+3n	Port X4: Input Data (n Bytes)							
20+4n	Port X5: Input Data (n Bytes)							
20+5n	Port X6: Input Data (n Bytes)							
20+6n	Port X7: Input Data (n Bytes)							
20+7n	Port X8: Input Data (n Bytes)							

Legend:

• Digital Input	Digital input data of the ports		Mapping: Digital Input 92
• Status Information	Status information of the device		Mapping: Status Information 93
• Port Qualifier Information (PQI)	Status information of the IO-Link port		Mapping: Port Qualifier Information (PQI) 94
• Input Data (n Bytes)	IO-Link input data of the port (n bytes) n: {2, 4, 8, 16, 32}; n is determined by parameter Port Process Data Size	USINT	Per byte: • 0x00…0xFF

12.1.2.2.1 Mapping: Digital Input

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	Port X8: DI Pin 4	Port X7: DI Pin 4	Port X6: DI Pin 4	Port X5: DI Pin 4	Port X4: DI Pin 4	Port X3: DI Pin 4	Port X2: DI Pin 4	Port X1: DI Pin 4
n+1	Port X8: DI Pin 2	Port X7: DI Pin 2	Port X6: DI Pin 2	Port X5: DI Pin 2	reserved	reserved	reserved	reserved

Legend:

• DI Pin 4	Signal status of the digital input on Pin 4 of the port	1 BIT	• 0x0: LOW • 0x1: HIGH
• DI Pin 2	Signal status of the digital input on Pin 2 of the port	1 BIT	• 0x0: LOW • 0x1: HIGH

12.1.2.2.2 Mapping: Status Information

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	Port X8: SC / OL	Port X7: SC / OL	Port X6: SC / OL	Port X5: SC / OL	Port X4: SC / OL	Port X3: SC / OL	Port X2: SC / OL	Port X1: SC / OL
n+1	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	SENS PWR	AUX PWR

Legend:

• SC / OL	Short Circuit / Overload: Indication of a short circuit or of an overvoltage on the IO-Link port	1 BIT	• 0x0: No error • 0x1: Short-circuit or overvoltage
• SENS PWR	Status of the US supply voltage	1 BIT	• 0x0: no fault / no warning • 0x1: Excessive current on US (> 3.6 V)
• AUX PWR	status of the UA supply voltage	1 BIT	• 0x0: UA available and no fault • 0x1: no UA connected

12.1.2.2.3 Mapping: Port Qualifier Information (PQI)

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	Diagnosis present	Wrong Length PDout	Wrong Length PDin	Wrong Cycle Time	Wrong VID / DID	Invalid Data	Dev Not Con	IOL Mode
n+1	PQ	DevErr	DevCom	Reserved	Reserved	Reserved	SENS PWR	AUX PWR

Legend:

• IOL Mode	Operating mode of the port (pin 4)	1 BIT	• 0x0: Otherwise • 0x1: IO-Link
• Dev Not Con	Connection status to IO-Link device on the port	1 BIT	• 0x0: connected • 0x1: not connected
• Invalid Data	Status of the process data	1 BIT	• 0x0: valid • 0x1: invalid
• Wrong VID / DID	Match between configured and recognised Vendor ID / Device ID	1 BIT	• 0x0: OK • 0x1: no match
• Wrong Cycle Time	Conformity of configured and detected cycle time	1 BIT	• 0x0: OK • 0x1: no match
• Wrong Length PDin	Match between configured and detected process data length (inputs)	1 BIT	• 0x0: OK • 0x1: configured process data length too small
• Wrong Length PDout	Match between configured and detected process data length (outputs)	1 BIT	• 0x0: OK • 0x1: configured process data length too small
• Diagnosis present	Indication of new IO-Link events (Coming Event, Single Shot Event) • Coming Events disappears when the corresponding Disappearing Event occurs • Single Shot Events disappear automatically	1 BIT	• 0x0: no IO-Link event • 0x1: new IO-Link event detected
• AUX PWR	Status of the supply voltage UA on pin 2 of the port (only for Class B Ports)	1 BIT	• 0x0: No error • 0x1: UA not connected
• SENS PWR	Status of the supply voltage US on pin 1 and pin 4 of the port	1 BIT	• 0x0: No error • 0x1: US not connected or too low (<3.6 A)
• DevCom	Device Communication: Status display of communication with IO-Link device	1 BIT	• 0x0: No IO-Link device available or IO-Link device in error state (e.g. validation error) OR port in operating state DI, DO, disabled • 0x1: IO-Link device detected IO-Link device is in OPERATE state and not in error state
• DevErr	Device Error: Error display for port or connected device	1 BIT	• 0x0: no fault / no warning • 0x1: Error / warning occurred on port or connected IO-Link device
• PQ	Port Qualifier: Validity indicator for the process data of the connected IO-Link device	1 BIT	• 0x0: Invalid process data OR incorrect process data length OR incorrect cycle time OR incorrect validation settings (operating status DI, DO, disabled)

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- 0x1: Valid process data of the IO-Link device (IO-Link operating mode and OPERATE status)

12.1.2.3 Input Assembly (Instance 103)

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
0…1	Digital Input							
2…3	Status Information							
4…45	Acyclic Command Channel: Response							
46…47	Port X1: Port Qualifier Information (PQI)							
48…63	Port X1: IO-Link Information + IO-Link Events							
64…65	Port X2: Port Qualifier Information (PQI)							
66…81	Port X2: IO-Link Information + IO-Link Events							
82…83	Port X3: Port Qualifier Information (PQI)							
84…99	Port X3: IO-Link Information + IO-Link Events							
100…101	Port X4: Port Qualifier Information (PQI)							
102…117	Port X4: IO-Link Information + IO-Link Events							
118…119	Port X5: Port Qualifier Information (PQI)							
120…135	Port X5: IO-Link Information + IO-Link Events							
136…137	Port X6: Port Qualifier Information (PQI)							
138…153	Port X6: IO-Link Information + IO-Link Events							
154…155	Port X7: Port Qualifier Information (PQI)							
156…171	Port X7: IO-Link Information + IO-Link Events							
172…173	Port X8: Port Qualifier Information (PQI)							
174…189	Port X8: IO-Link Information + IO-Link Events							
190…193	Voltage + Current Actuator Supply UA							
194…197	Voltage + Current Sensor Supply US							
198…199	Port X1: Current Pin 2 (UA)							
200…201	Port X2: Current Pin 2 (UA)							
202…203	Port X3: Current Pin 2 (UA)							
204…205	Port X4: Current Pin 2 (UA)							
206…207	Port X1: Current Pin 1 + Pin 4 (US)							
208…209	Port X2: Current Pin 1 + Pin 4 (US)							
210…211	Port X3: Current Pin 1 + Pin 4 (US)							
212…213	Port X4: Current Pin 1 + Pin 4 (US)							
214…215	Port X5: Current Pin 1 + Pin 4 (US)							
216…217	Port X6: Current Pin 1 + Pin 4 (US)							
218…219	Port X7: Current Pin 1 + Pin 4 (US)							
220…221	Port X8: Current Pin 1 + Pin 4 (US)							
222	Port X1: Input Data (n Bytes)							
222+n	Port X2: Input Data (n Bytes)							
222+2n	Port X3: Input Data (n Bytes)							
222+3n	Port X4: Input Data (n Bytes)							
222+4n	Port X5: Input Data (n Bytes)							
222+5n	Port X6: Input Data (n Bytes)							
222+6n	Port X7: Input Data (n Bytes)							
222+7n	Port X8: Input Data (n Bytes)							

Legend:

• Digital Input	Digital input data of the ports		Mapping: Digital Input 98
• Status Information	Status information of the device		Mapping: Status Information 99
• Acyclic Command Channel: Response	Acyclic command channel - answer		Response channel 112
• IO-Link Information + IO-Link Events	IO-Link information and IO-Link events of the port		Mapping: IO-Link information + IO-Link events 101
• Voltage + Current Actuator Supply UA	Voltage value and current value of the supply voltage UA		Mapping: Voltage + Current Actuator Supply UA 103
• Voltage + Current Sensor Supply US	Voltage value and current value of the supply voltage US		Mapping: Voltage + Current Sensor Supply US 103
• Current Pin 2 (UA)	Current value of the supply voltage UA at pin 2 of the port		Mapping: Current Pin 2 (UA) 103
• Current Pin 1 + Pin 4 (US)	Current value of the supply voltage US on pin 1 and pin 4 of the port		Mapping: Current Pin 2 (UA) 103
• Input Data (n Bytes)	IO-Link input data of the port (n bytes) n: {2, 4, 8, 16, 32}; n is determined by parameter Port Process Data Size	USINT	Per byte: • 0x00…0xFF

12.1.2.3.1 Mapping: Digital Input

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	Port X8: DI Pin 4	Port X7: DI Pin 4	Port X6: DI Pin 4	Port X5: DI Pin 4	Port X4: DI Pin 4	Port X3: DI Pin 4	Port X2: DI Pin 4	Port X1: DI Pin 4
n+1	Port X8: DI Pin 2	Port X7: DI Pin 2	Port X6: DI Pin 2	Port X5: DI Pin 2	reserved	reserved	reserved	reserved

Legend:

• DI Pin 4	Signal status of the digital input on Pin 4 of the port	1 BIT	• 0x0: LOW • 0x1: HIGH
• DI Pin 2	Signal status of the digital input on Pin 2 of the port	1 BIT	• 0x0: LOW • 0x1: HIGH

12.1.2.3.2 Mapping: Status Information

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	Port X8: SC / OL	Port X7: SC / OL	Port X6: SC / OL	Port X5: SC / OL	Port X4: SC / OL	Port X3: SC / OL	Port X2: SC / OL	Port X1: SC / OL
n+1	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	SENS PWR	AUX PWR

Legend:

• SC / OL	Short Circuit / Overload: Indication of a short circuit or of an overvoltage on the IO-Link port	1 BIT	• 0x0: No error • 0x1: Short-circuit or overvoltage
• SENS PWR	Status of the US supply voltage	1 BIT	• 0x0: no fault / no warning • 0x1: Excessive current on US (> 3.6 V)
• AUX PWR	status of the UA supply voltage	1 BIT	• 0x0: UA available and no fault • 0x1: no UA connected

12.1.2.3.3 Mapping: Port Qualifier Information (PQI)

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	Diagnosis present	Wrong Length PDout	Wrong Length PDin	Wrong Cycle Time	Wrong VID / DID	Invalid Data	Dev Not Con	IOL Mode
n+1	PQ	DevErr	DevCom	Reserved	Reserved	Reserved	SENS PWR	AUX PWR

Legend:

• IOL Mode	Operating mode of the port (pin 4)	1 BIT	• 0x0: Otherwise • 0x1: IO-Link
• Dev Not Con	Connection status to IO-Link device on the port	1 BIT	• 0x0: connected • 0x1: not connected
• Invalid Data	Status of the process data	1 BIT	• 0x0: valid • 0x1: invalid
• Wrong VID / DID	Match between configured and recognised Vendor ID / Device ID	1 BIT	• 0x0: OK • 0x1: no match
• Wrong Cycle Time	Conformity of configured and detected cycle time	1 BIT	• 0x0: OK • 0x1: no match
• Wrong Length PDin	Match between configured and detected process data length (inputs)	1 BIT	• 0x0: OK • 0x1: configured process data length too small
• Wrong Length PDout	Match between configured and detected process data length (outputs)	1 BIT	• 0x0: OK • 0x1: configured process data length too small
• Diagnosis present	Indication of new IO-Link events (Coming Event, Single Shot Event) • Coming Events disappears when the corresponding Disappearing Event occurs • Single Shot Events disappear automatically	1 BIT	• 0x0: no IO-Link event • 0x1: new IO-Link event detected
• AUX PWR	Status of the supply voltage UA on pin 2 of the port (only for Class B Ports)	1 BIT	• 0x0: No error • 0x1: UA not connected
• SENS PWR	Status of the supply voltage US on pin 1 and pin 4 of the port	1 BIT	• 0x0: No error • 0x1: US not connected or too low (<3.6 A)
• DevCom	Device Communication: Status display of communication with IO-Link device	1 BIT	• 0x0: No IO-Link device available or IO-Link device in error state (e.g. validation error) OR port in operating state DI, DO, disabled • 0x1: IO-Link device detected IO-Link device is in OPERATE state and not in error state
• DevErr	Device Error: Error display for port or connected device	1 BIT	• 0x0: no fault / no warning • 0x1: Error / warning occurred on port or connected IO-Link device
• PQ	Port Qualifier: Validity indicator for the process data of the connected IO-Link device	1 BIT	• 0x0: Invalid process data OR incorrect process data length OR incorrect cycle time OR incorrect validation settings (operating status DI, DO, disabled)

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- 0x1: Valid process data of the IO-Link device (IO-Link operating mode and OPERATE status)

12.1.2.3.4 Mapping: IO-Link information + IO-Link events

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	Vendor ID (VID)[0]							
n+1	Vendor ID (VID)[1]							
n+2	Device ID (DID)[0]							
n+3	Device ID (DID)[1]							
n+4	Device ID (DID)[2]							
n+5	Device ID (DID)[3]							
n+6	Event 1: Mode		Event 1: Type		Event 1: Src	Event 1: Instance		
n+7	Event 1: Code[0]							
n+8	Event 1: Code[1]							
n+9	Event 2: Mode		Event 2: Type		Event 2: Src	Event 2: Instance		
n+10	Event 2: Code[0]							
n+11	Event 2: Code[1]							
n+12	Event 3: Mode		Event 3: Type		Event 3: Src	Event 3: Instance		
n+13	Event 3: Code[0]							
n+14	Event 3: Code[1]							
n+15	Reserved							

Legend:

• Vendor ID (VID)	Vendor ID of the connected IO-Link device VID = 0x1234 • DID[1]: 0x12 • DID[0]: 0x34	UINT	0x0000...0x7FFF
• Device ID (DID)	Device ID of the connected IO-Link device DID = 0x00123456 • DID[3]: 0x00 • DID[2]: 0x12 • DID[1]: 0x34 • DID[0]: 0x56	UDINT	0x00000000...0x00FFFFFF
• Event m: Mode	Mode: Mode of the event	2 BIT	• 0x0: reserved • 0x1: One-time event • 0x2: Event has disappeared • 0x3: Event has appeared
• Event m: Type	Type: category of the event	2 BIT	• 0x0: reserved • 0x1: Notification • 0x2: Warning • 0x3: Error
• Event m: Src	Src: Source of the event	1 BIT	• 0x0: IO-Link device

			• 0x1: IO-Link master
• Event m: Instance	Instance: Trigger of the event	3 BIT	• 0x0: Unknown • 0x1...0x3: Reserved • 0x4: Application • 0x5...0x7: Reserved
• Event m: Code	Code: Event code Code = 0x1234 • Code (MSB)[1]: 0x12 • Code (LSB)[0]: 0x34	UINT	depending on the device (↪ IODD description of the IO-Link device)

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12.1.2.3.5 Mapping: Voltage + Current Actuator Supply UA

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	Voltage - Actuator Supply UA[0]							
n+1	Voltage -Actuator Supply UA[1]							
n+2	Current - Actuator Supply UA[0]							
n+3	Current - Actuator Supply UA[1]							

Legend:

• Voltage - Actuator Supply UA	voltage value of the supply voltage UA (value in mV) Voltage - Actuator Supply UA = 0x1234 • Voltage - Actuator Supply UA[1] = 0x12 • Voltage - Actuator Supply UA[0] = 0x34	UINT	• 0x4E20: 20000 mV … • 0x7530: 30000 mV
• Current - Actuator Supply UA	Current intensity value of the supply voltage UA (value in mA) Current - Actuator Supply UA = 0x1234 • Current - Actuator Supply UA[1] = 0x12 • Current - Actuator Supply UA[0] = 0x34	UINT	• 0x0000: 0 mA … • 0x1F40: 8000 mA

12.1.2.3.6 Mapping: Voltage + Current Sensor Supply US

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	Voltage - Actuator Supply US[0]							
n+1	Voltage -Actuator Supply US[1]							
n+2	Current - Actuator Supply US[0]							
n+3	Current - Actuator Supply US[1]							

Legend:

• Voltage - Actuator Supply US	Voltage value of the supply voltage US (value in mV) Voltage - Actuator Supply US = 0x1234 • Voltage - Actuator Supply US[1] = 0x12 • Voltage - Actuator Supply US[0] = 0x34	UINT	• 0x4E20: 20000 mV … • 0x7530: 30000 mV
• Current - Actuator Supply US	Current intensity value of the supply voltage US (value in mA) Current - Actuator Supply US = 0x1234 • Current - Actuator Supply US [1] = 0x12 • Current - Actuator Supply US [0] = 0x34	UINT	• 0x0000: 0 mA … • 0x0E10: 3600 mA

12.1.2.3.7 Mapping: Current Pin 2 (UA)

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	Current Pin 2 (UA)[0]							
n+1	Current Pin 2 (UA)[1]							

Legend:

• Current Pin 2 (UA)	Current intensity value of the supply voltage UA on pin 2 of the port (value in mA) Current Pin 2 (UA) = 0x1234 • Current Pin 2 (UA)[1] = 0x12 • Current Pin 2 (UA)[0] = 0x34	UINT	• 0x0000: 0 mV … • 0x07D0: 2000 mV

12.1.2.3.8 Mapping: Current Pin 1 + Pin 4 (US)

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	Current Pin 1 + Pin 4 (US)[0]							
n+1	Current Pin 1 + Pin 4 (US)[1]							

Legend:

• Current Pin 1 + Pin 4 (US)	Current intensity value of the supply voltage US on pin 1 and pin 4 of the Xm port (value in mA) Current Pin 1 + Pin 4 (US) = 0x1234 • Current Pin 1 + Pin 4 (US)[1] = 0x12 • Current Pin 1 + Pin 4 (US)[0] = 0x34	UINT	• 0x0000: 0 mV … • 0x07D0: 2000 mV

12.1.2.4 Output Assembly (Instance 150)

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
0…1	Digital Output							
2…3	reserved							
4…45	Acyclic Command Channel: Request							
46	Port X1: Output Data (n Bytes)							
46+n	Port X2: Output Data (n Bytes)							
46+2n	Port X3: Output Data (n Bytes)							
46+3n	Port X4: Output Data (n Bytes)							
46+4n	Port X5: Output Data (n Bytes)							
46+5n	Port X6: Output Data (n Bytes)							
46+6n	Port X7: Output Data (n Bytes)							
46+7n	Port X8: Output Data (n Bytes)							

Legend:

• Digital Output	Digital output data of the ports	Mapping: Digital output ➔ 106
• Acyclic Command Channel: Request	Acyclic command channel - request	Request channel ➔ 111
• Output Data (n Bytes)	IO-Link output data of the port (n bytes) n: {2, 4, 8, 16, 32}; n is determined by parameter Port Process Data Size	Per byte: • 0x00…0xFF

12.1.2.4.1 Mapping: Digital output

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	Port X8: DO Pin 4	Port X7: DO Pin 4	Port X6: DO Pin 4	Port X5: DO Pin 4	Port X4: DO Pin 4	Port X3: DO Pin 4	Port X2: DO Pin 4	Port X1: DO Pin 4
n+1	Reserved	Reserved	Reserved	Reserved	Port X4: DO Pin 2	Port X3: DO Pin 2	Port X2: DO Pin 2	Port X1: DO Pin 2

Legend:

• DO Pin 4	Digital output signal status on pin 4 of the port	1 BIT	• 0x0: LOW • 0x1: HIGH
• DO Pin 2	Digital output signal status on pin 2 of the port	1 BIT	• 0x0: LOW • 0x1: HIGH

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12.1.2.5 Output Assembly (Instance 151)

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
0…1	Digital Output							
2	Port X1: Output Data (n Bytes)							
2+n	Port X2: Output Data (n Bytes)							
2+2n	Port X3: Output Data (n Bytes)							
2+3n	Port X4: Output Data (n Bytes)							
2+4n	Port X5: Output Data (n Bytes)							
2+5n	Port X6: Output Data (n Bytes)							
2+6n	Port X7: Output Data (n Bytes)							
2+7n	Port X8: Output Data (n Bytes)							

Legend:

- Digital Output — Digital output data of the ports
- Output Data (n Bytes) — IO-Link output data of the port (n bytes)
  n: {2, 4, 8, 16, 32}; n is determined by parameter Port Process Data Size

Mapping: Digital output ➔ 108

Per byte:

- 0x00…0xFF

12.1.2.5.1 Mapping: Digital output

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	Port X8: DO Pin 4	Port X7: DO Pin 4	Port X6: DO Pin 4	Port X5: DO Pin 4	Port X4: DO Pin 4	Port X3: DO Pin 4	Port X2: DO Pin 4	Port X1: DO Pin 4
n+1	Reserved	Reserved	Reserved	Reserved	Port X4: DO Pin 2	Port X3: DO Pin 2	Port X2: DO Pin 2	Port X1: DO Pin 2

Legend:

• DO Pin 4	Digital output signal status on pin 4 of the port	1 BIT	• 0x0: LOW • 0x1: HIGH
• DO Pin 2	Digital output signal status on pin 2 of the port	1 BIT	• 0x0: LOW • 0x1: HIGH

12.1.3 Acyclical data

12.1.3.1 Acyclic command channel

In the cyclic process data, command channels for the transmission of acyclic data is available.

Assembly Objects	Content	Byte	Access
• Output Assembly (Instance 150)	Request channel (EtherNet/IP controller ➜ IO-Link master) Request channel 111	4…45	rw [1]
• Input Assembly (Instance 100) • Input Assembly (Instance 103)	Response channel (IO-Link master ➜ EtherNet/IP controller) Response channel 112	4…45	ro [2]

[1] Read and write

[2] Read only

12.1.3.1.1 Request channel

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	Port No. (LSB)							
n+1	Port No. (MSB)							
n+2	Index (LSB)							
n+3	Index (MSB)							
n+4	Subindex (LSB)							
n+5	Subindex (MSB)							
n+6	Trigger	Command ID						
n+7	Data Length							
n+8	Data (Byte 0)							
n+9	Data (Byte 1)							
…	…							
n+39	Data (Byte 31)							
n+40	reserved							
n+41	reserved							

Legend:

• Port No.	IO-Link Port Port No. 0x1234 • Port No. (MSB): 0x12 • Port No. (LSB): 0x34	Unsigned16	• 0x0001: Port 1 • 0x0002: Port 2 • 0x0003: Port 3 • 0x0004: Port 4 • 0x0005: Port 5 • 0x0006: Port 6 • 0x0007: Port 7 • 0x0008: Port 8
• Index	Index of the ISDU object Index: 0x1234 • Index (MSB): 0x12 • Index (LSB): 0x34	Unsigned16	0x0000…0xFFFF
• Subindex	Subindex of the ISDU object Subindex 0x1234 • Subindex (MSB): 0x12 • Subindex (LSB): 0x34	Unsigned16	0x0000…0xFFFF
• Trigger	Control of the command execution	1 BIT	• 0x0: no action • 0x1: Execute command
• Command ID	Command number	7 BIT	• 0x01: Get • 0x02: Write
• Data Length	Number of bytes that contain relevant user data	Unsigned8	• 0x00: 0 bytes … • 0x20: 32 bytes
• Data (Byte n)	User data (byte n)	Unsigned8	Per byte: • 0x00…0xFF

12.1.3.1.2 Response channel

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	Port No. (LSB)							
n+1	Port No. (MSB)							
n+2	Index (LSB)							
n+3	Index (MSB)							
n+4	Subindex (LSB)							
n+5	Subindex (MSB)							
n+6	Hand-shake	Command ID						
n+7	Result							
n+8	Data Length							
n+9	Data (Byte 0) | Error Code							
n+10	Data (Byte 1) | Additional Code							
	…							
n+40	Data (Byte 31)							
n+41	reserved							

Legend:

- Port No. — IO-Link Port
Port No. 0x1234
• Port No. (MSB): 0x12
• Port No. (LSB): 0x34 — Unsigned16 — • 0x0001: Port 1
• 0x0002: Port 2
• 0x0003: Port 3
• 0x0004: Port 4
• 0x0005: Port 5
• 0x0006: Port 6
• 0x0007: Port 7
• 0x0008: Port 8
- Index — Index of the ISDU object
Index: 0x1234
• Index (MSB): 0x12
• Index (LSB): 0x34 — Unsigned16 — 0x0000…0xFFFF
- Subindex — Subindex of the ISDU object
Subindex 0x1234
• Subindex (MSB): 0x12
• Subindex (LSB): 0x34 — Unsigned16 — 0x0000…0xFFFF
- Handshake — Validity of the IO-Link response data — 1 BIT — • 0x0: data invalid
• 0x1: data valid
- Command ID — Command number — 7 BIT — • 0x01: Get
• 0x02: Write
- Result — Status of the command processing — Unsigned8 — • 0x00: OK
• 0x0F: OK, data user read > 32 bytes
• 0xFF: Error
- Data Length — Number of bytes that contain relevant user data — Unsigned8 — • 0x00: 0 bytes
…
• 0x20: 32 bytes

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• Data (Byte 0) | Error Code	User data (byte 0) or error codes	Unsigned8	• User data: 0x00…0xFF • Error Code: Error Code 114
• Data (Byte 1) | Additional Code	User data (byte 1) or additional error codes	Unsigned8	• User data: 0x00…0xFF • Additional Code: Additional Code 114
• Data (byte n)	User data (byte n)	Unsigned8	Per byte: 0x00…0xFF

12.1.3.1.3 Error Code

Error code	Description
0x71	Service not available (unknown command has been sent to the IO-Link port)
0x72	Port blocked (another cyclic process accesses the IO-Link port)
0x73	Forbidden (access rights prohibit command execution)
0x74	Invalid data (wrong parameter has been sent in the command)
0x76	Wrong port (wrong port number)
0x77	Wrong port function (wrong port function or wrong parameter has been sent to the device)
0x78	Invalid length (set length is > 0x20)
0x80	Error in the device application Consider additional code (Additional Code 114)

12.1.3.1.4 Additional Code

Additional Code only valid if Error Code = 0x80 114.

Code	Name	Description
0x00	APP_DEV	Error in the device application - no details
0x11	IDX_NOTAVAIL	Index not available
0x12	SUBIDX_NOTAVAIL	Subindex not available
0x20	SERV_NOTAVAIL	Service temporarily unavailable
0x21	SERV_NOTAVAIL_LOCCTRL	Service temporarily unavailable - local
0x22	SERV_NOTAVAIL_DEVCTRL	Service temporarily unavailable - device
0x23	IDX_NOT_WRITEABLE	Access denied
0x30	PAR_VALOUTOFRNG	Parameter value outside the valid range
0x31	PAR_VALGTLIM	Parameter value above the threshold
0x32	PAR_VALLTLIM	Parameter value below the threshold
0x33	VAL_LENOVRRUN	Parameter length exceeded
0x34	VAL_LENUNDRUN	Parameter length not reached
0x35	FUNC_NOTAVAIL	Function not available
0x36	FUNC_UNAVAILTEMP	Function temporarily unavailable
0x40	PAR_SETINVALID	Invalid parameter set
0x41	PAR_SETINCONSIST	Inconsistent parameter set
0x82	APP_DEVNOTRDY	Application not ready

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12.1.3.2 Acyclic commands

Available commands:

- Set Mode (0x10) 115
- Set validation ID / data storage (0x20) 117
- Set fail-safe data pattern (0x30) 119

12.1.3.2.1 Set Mode (0x10)

The command changes the operating mode of an IO-Link port of the device.

12.1.3.2.1.1 Command request

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	Port No. (LSB)							
n+1	Port No. (MSB)							
n+2	reserved							
n+3	reserved							
n+4	reserved							
n+5	reserved							
n+6	Trigger	0x10						
n+7	Target Mode							
n+8	reserved							
…	…							
n+41	reserved							

Legend:

- Port No. — IO-Link Port. Port No. 0x1234: • Port No. (MSB): 0x12 • Port No. (LSB): 0x34 — Unsigned16 — • 0x0001: Port 1 • 0x0002: Port 2 • 0x0003: Port 3 • 0x0004: Port 4 • 0x0005: Port 5 • 0x0006: Port 6 • 0x0007: Port 7 • 0x0008: Port 8
- Trigger — Control of the command execution — 1 BIT — • 0x0: no action • 0x1: Execute command
- Target Mode — Operating mode of the IO-Link port — Unsigned8 — • 0x00: deactivated • 0x01: Digital input (DI) • 0x02: Digital output (DO) • 0x03: IO-Link

12.1.3.2.1.2 Command response

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	Port No. (LSB)							
n+1	Port No. (MSB)							
n+2	reserved							
n+3	reserved							
n+4	reserved							
n+5	reserved							
n+6	Hand-shake	0x10						
n+7	Result							
n+8	Target Mode							
n+9	reserved							
…	…							
n+41	reserved							

Legend:

• Port No.	IO-Link Port Port No. 0x1234 • Port No. (MSB): 0x12 • Port No. (LSB): 0x34	Unsigned16	• 0x0001: Port 1 • 0x0002: Port 2 • 0x0003: Port 3 • 0x0004: Port 4 • 0x0005: Port 5 • 0x0006: Port 6 • 0x0007: Port 7 • 0x0008: Port 8
• Handshake	Validity of the IO-Link response data	1 BIT	• 0x0: data invalid • 0x1: data valid
• Result	Status of the command processing	Unsigned8	• 0x00: OK • 0x0F: OK, data user read > 32 bytes • 0xFF: Error
• Target Mode	Operating mode of the IO-Link port	Unsigned8	• 0x00: deactivated • 0x01: Digital input (DI) • 0x02: Digital output (DO) • 0x03: IO-Link

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12.1.3.2.2 Set validation ID / data storage (0x20)

The command sets the behaviour of the IO-Link master when connecting a new IO-Link device to an IO-Link port of the device.

12.1.3.2.2.1 Command request

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	Port No. (LSB)							
n+1	Port No. (MSB)							
n+2	reserved							
n+3	reserved							
n+4	reserved							
n+5	reserved							
n+6	Trigger	0x20						
n+7	Validation ID							
n+8	reserved							
…	…							
n+41	reserved							

Legend:

• Port No.	IO-Link Port Port No. 0x1234 • Port No. (MSB): 0x12 • Port No. (LSB): 0x34	Unsigned16	• 0x0001: Port 1 • 0x0002: Port 2 • 0x0003: Port 3 • 0x0004: Port 4 • 0x0005: Port 5 • 0x0006: Port 6 • 0x0007: Port 7 • 0x0008: Port 8
• Trigger	Control of the command execution	1 BIT	• 0x0: no action • 0x1: Execute command
• Validation ID	Validation type and data storage behaviour of the port	1 BYTE	• 0x00: No check • 0x01: Type compatible V1.0 device • 0x02: Type compatible V1.1 device • 0x03: Type compatible V1.1 device with Backup + Restore • 0x04: Type compatible V1.1 device with Restore

12.1.3.2.2.2 Command response

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	Port No. (LSB)							
n+1	Port No. (MSB)							
n+2	reserved							
n+3	reserved							
n+4	reserved							
n+5	reserved							
n+6	Hand-shake	0x20						
n+7	Result							
n+8	Validation ID							
n+9	reserved							
…	…							
n+41	reserved							

Legend:

- Port No. — IO-Link Port
Port No. 0x1234
• Port No. (MSB): 0x12
• Port No. (LSB): 0x34 — Unsigned16 — • 0x0001: Port 1 • 0x0002: Port 2 • 0x0003: Port 3 • 0x0004: Port 4 • 0x0005: Port 5 • 0x0006: Port 6 • 0x0007: Port 7 • 0x0008: Port 8
- Handshake — Validity of the IO-Link response data — 1 BIT — • 0x0: data invalid • 0x1: data valid
- Result — Status of the command processing — Unsigned8 — • 0x00: OK • 0x0F: OK, data user read > 32 bytes • 0xFF: Error
- Validation ID — Validation type and data storage behaviour of the port — 1 BYTE — • 0x00: No check • 0x01: Type compatible V1.0 device • 0x02: Type compatible V1.1 device • 0x03: Type compatible V1.1 device with Backup + Restore • 0x04: Type compatible V1.1 device with Restore

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12.1.3.2.3 Set fail-safe data pattern (0x30)

The command sets the behaviour of the outputs when the EtherNet/IP connection and the corresponding fail-safe values are interrupted.

12.1.3.2.3.1 Command response

Byte (Offset)	Bit							
	7	6	5	4	3	2	1	0
n	Port No. (LSB)							
n+1	Port No. (MSB)							
n+2	reserved							
n+3	reserved							
n+4	reserved							
n+5	reserved							
n+6	Hand-shake	0x30						
n+7	Result							
n+8	Fail-safe Mode							
n+9	reserved							
…	…							
n+41	reserved							

- Handshake — Validity of the IO-Link response data — 1 BIT
  - 0x0: data invalid
  - 0x1: data valid
- Result — Status of the command processing — Un-signed8
  - 0x00: OK
  - 0x0F: OK, data user read > 32 bytes
  - 0xFF: Error
- Fail-safe mode — Fail-safe mode for the outputs of the IO-Link ports in case of an interruption of the EtherNet/IP connection — 1 BYTE
  - 0x00: No Fail-safe
  - 0x01: Fail-safe - Reset Value
  - 0x02: Fail-safe - Old Value
  - 0x03: Fail-safe - Pattern

12.1.4 Object directory

12.1.4.1 CIP object classes

Supported object classes:

Class Code	Name	Description
0x01	Identity Object	Identity Object (Class Code: 0x01) 121
0x02	Message Router Object	Message Router Object (Class Code: 0x02) 123
0x04	Assembly Object	Assembly Object (Class Code: 0x04) 124
0x06	Connection Manager Object	Connection Manager Object (Class Code: 0x06) 125
0x47	Device Level Ring Object	Device Level Ring Object (Class Code: 0x47) 126
0x48	Quality Of Service Object	Quality Of Service Object (Class Code: 0x48) 127
0x80	IO-Link Request Object	IO-Link Request Object (Class Code: 0x80) 128
0xF5	TCP/IP Object	TCP/IP Object (Class Code: 0xF5) 135
0xF6	Ethernet Link Object	Ethernet Link Object (Class Code: 0xF6) 137

12.1.4.2 CIP class and instance services

Supported class and instance services:

Service code	Name	Description
0x01	Get Attribute All	Read all attributes
0x02	Set Attribute All	Write all attributes
0x05	Reset	Reset
0x09	Delete	Delete
0x0E	Get Attribute Single	Read single attribute
0x10	Set Attribute Single	Write single attribute
0x4B	Read ISDU	Read ISDU
0x4C	Write ISDU	Write ISDU
0x4D	Write Failsafe Pattern	Write fail-safe values
0x4E	Forward Close	Close connection
0x54	Forward Open	Open new connection

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12.1.4.3 Identity Object (Class Code: 0x01)

12.1.4.3.1 Class attributes

Attr. ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	2.003
2	Get	Max. Instance	UINT	Max. number of instances of the object	1
6	Get	Max. ID Number Class Attributes	UINT	Max. ID number of a class attribute	7
7	Get	Max. ID Number Instance Attributes	UINT	Max. ID number of the instance attribute	9

12.1.4.3.2 Instance attributes

Attr. ID	Access	Name	Data type	Description	Default
1	Get	Vendor ID	UINT	Manufacturer ID	322
2	Get	Device Type	UINT	Device type	12
3	Get	Product Code	UINT	Product code of the device	1010
4	Get	Revision	STRUCT	Revision of the device	2.003
		• Major Revision	USINT	Major revision (1...127)	2
		• Minor Revision	USINT	Minor revision (3 digits)	003
5	Get	Status	WORD	Overall status of the device	
6	Get	Serial Number	UDINT	Serial number of the device	--
7	Get	Product Name	SHORT STRING	Product name of the device	IO-Link Master PFL EIP 8P IP-69K
8	Get	State	USINT	State of the device (State machine) • 0: Nonexistent • 1: Device Self Testing • 2: Standby • 3: Operational • 4: Major Recoverable Fault • 5: Major Unrecoverable Fault • 6-254: Reserved • 255: Default for “Get_Attributes_All” service	
9	Get	Configuration Consistency Value	UINT	The content shows the configuration of the device	0

12.1.4.3.3 Services

Code	Service	Class	Instance	Description
0x01	Get Attribute All	Yes	Yes	Read all attributes
0x05	Reset	Yes	Yes	Reset
0x0E	Get Attribute Single	Yes	Yes	Read single attribute
0x10	Set Attribute Single	Yes	Yes	Write single attribute

If an Identity Object receives a reset request, it carries out the following actions:

- It checks if it supports the requested reset type.
- It responds to the request.

- It tries to execute the requested reset type.

Supported reset types:

- 0: reboot the device (mandatory for all EtherNet/IP devices).
- 1: restore factory settings and reboot the device.

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12.1.4.4 Message Router Object (Class Code: 0x02)

12.1.4.4.1 Class attributes

Attr. ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	1
2	Get	Max. Instance	UINT	Max. number of instances of the object	1
3	Get	Number of instances	UINT	Number of instances	1
6	Get	Max. ID Number Class Attributes	UINT	Max. ID number of a class attribute	7
7	Get	Max. ID Number Instance Attributes	UINT	Max. ID number of the instance attribute	0

12.1.4.4.2 Instance attributes

The object class has no instance attributes.

12.1.4.4.3 Services

Code	Service	Class	Instance	Description
0x0E	Get Attribute Single	Yes	Yes	Read single attribute

12.1.4.5 Assembly Object (Class Code: 0x04)

12.1.4.5.1 Class attributes

Attr. ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	2
2	Get	Max. Instance	UINT	Max. number of instances of the object	0x00C7
3	Get	Number of instances	UINT	Number of instances	3
6	Get	Max. ID Number Class Attributes	UINT	Max. ID number of the class attribute	7
7	Get	Max. ID Number Instance Attributes	UINT	Max. ID number of the instance attribute	4

12.1.4.5.2 Instance attributes

Attr. ID	Access	Name	Data type	Description	Default
1	Get	Number of Members	UINT	Number of members in list	--
2	Get	Member	UINT	List of members	--
3	Get / Set	Data	UINT	Current process data image	--
4	Get	Size	UINT	Process data length (number of bytes)	--
300	--	Member data list	UINT	Data of the Assembly members	--
301	Get	Parameter	UINT	Assembly parameters	--
302	Get	Status	UINT	Assembly status	--

The following object instances are available:

Links ergänzen!

12.1.4.5.3 Services

Code	Service	Class	Instance	Description
0x0E	Get Attribute Single	Yes	Yes	Read single attribute
0x10	Set Attribute Single	No	Yes	Write single attribute

12.1.4.6 Connection Manager Object (Class Code: 0x06)

12.1.4.6.1 Class attributes

Attr. ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	1
2	Get	Max. Instance	UINT	Max. number of instances of the object	1
3	Get	Number of instances	UINT	Number of instances	3
6	Get	Max. ID Number Class Attributes	UINT	Max. ID number of a class attribute	7
7	Get	Max. ID Number Instance Attributes	UINT	Max. ID number of the instance attribute	0

12.1.4.6.2 Instance attributes

The object class has no instance attributes.

12.1.4.6.3 Services

Code	Service	Class	Instance	Description
0x0E	Get Attribute Single	Yes	Yes	Read single attribute
0x10	Set Attribute Single	No	Yes	Write single attribute
0x4E	Forward Close	Yes	No	Close connection
0x54	Forward Open	Yes	No	Open new connection

12.1.4.7 Device Level Ring Object (Class Code: 0x47)

12.1.4.7.1 Class attributes

Attr. ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	3
2	Get	Max. Instance	UINT	Max. number of instances of the object	1
6	Get	Max. ID Number Class Attributes	UINT	Max. ID number of the class attribute	7
7	Get	Max. ID Number Instance Attributes	UINT	Max. ID number of the instance attribute	12

12.1.4.7.2 Instance attributes

Attr. ID	Access	Name	Data type	Description	Default
1	Get	Network topology	USINT	Current network topology • 0: linear	0
2	Get	Network status	USINT	Current network status • 0: OK	0
10	Get	Active Supervisor	STRUCT	Identification of the supervisor	0
			• UDINT	IP address	
			• ARRAY(6) of USINT	MAC address of the active supervisor	
12	Get	Capability Flags	DWORD	DLR capability of the device • 0x82: Beacon based Ring Node, Flush Table Frame support	0x82

12.1.4.7.3 Services

Code	Service	Class	Instance	Description
0x01	Get Attribute All	No	Yes	Read all attributes
0x0E	Get Attribute Single	Yes	Yes	Read single attribute

12.1.4.8 Quality Of Service Object (Class Code: 0x48)

12.1.4.8.1 Class attributes

Attr. ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	1
2	Get	Max. Instance	UINT	Max. number of instances of the object	1
3	Get	Number of instances	UINT	Number of instances of the object	1
6	Get	Max. ID Number Class Attributes	UINT	Max. ID number of a class attribute	7
7	Get	Max. ID Number Instance Attributes	UINT	Max. ID number of the instance attribute	8

12.1.4.8.2 Instance attributes

Attr. ID	Access	Name	Data type	Description	Default
1	Get	802.1Q Tag Enable	USINT	Current network topology	0: deactivated
2	Get / Set	DSCP PTP Event	USINT	DSCP value for PTP event frames	59
3	Get / Set	DSCP PTP General	USINT	DSCP value for PTP general frames	47
4	Get / Set	DSCP PTP Urgent	USINT	DSCP value for implicit messages with “urgent” priority	55
5	Get / Set	DSCP Scheduled	USINT	DSCP value for implicit messages with “scheduled” priority	47
6	Get / Set	DSCP High	USINT	DSCP value for implicit messages with “high” priority	43
7	Get / Set	DSCP Low	USINT	DSCP value for implicit messages with “low” priority	31
8	Get / Set	DSCP Explicit	USINT	DSCP value for explicit messages with “explicit” priority	27

12.1.4.8.3 Services

Code	Service	Class	Instance	Description
0x01	Get Attribute All	Yes	Yes	Read all attributes
0x0E	Get Attribute Single	No	Yes	Read single attribute

12.1.4.9 IO-Link Request Object (Class Code: 0x80)

12.1.4.9.1 Class attributes

Attr. ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	4
2	Get	Max. Instance	UINT	Max. number of instances of the object	2
6	Get	Max. ID Number Class Attributes	UINT	Max. ID number of a class attribute	8

12.1.4.9.2 Instance attributes

The required IO-Link port of the device is addressed via the instance attribute.

12.1.4.9.3 Services

Code	Service	Class	Instance	Description
0x4B	Read ISDU 129	no	yes	Read ISDU
0x4C	Write ISDU 131	no	yes	ISDU write
0x4D	Write Failsafe Pattern 133	no	yes	Write fail-safe values

12.1.4.9.4 Read ISDU

With Read_ISDU, parameters of a connected IO-Link device can be read.

12.1.4.9.4.1 Request

CIP Attributes determines the IO-Link port to which the IO-Link device is connected. The area "CIP User Specific Service Data" contains the IO-Link index and the IO-Link sub-index of the IO-Link object whose value is to be read:

CIP Format	Data type	MSG Config	Description
CIP Class ID	UINT	0x80	IO-Link acyclic access
CIP Instance ID	UINT	0x01	IO-Link master
CIP attributes	USINT	0x01…0x08	Port number
CIP Service Code ID	USINT	0x4B	“Read ISDU” service
CIP User Specific Service Data	UINT	0x0000…0xFFFF	ISDU object index
	USINT	0x00…0xFF	ISDU object subindex

12.1.4.9.4.2 Response

12.1.4.9.4.2.1 Fault-free processing

If the service has been executed successfully (CIP Error Code = 0), the read data are returned bit by bit (CIP User Specific Service Data). The response has the following format:

CIP Format	Data type	MSG Config	Description
CIP Class ID	UINT	0x80	IO-Link acyclic access
CIP Instance ID	UINT	0x01	IO-Link master
CIP attributes	USINT	0x01…0x08	Port number
CIP Service Code ID	USINT	0x4B	“Read ISDU” service
CIP Error Code	USINT	0x00	Fault-free processing
CIP Extended Error Code	USINT	0x00	--
CIP User Specific Service Data	USINT	0x00…0xFF	Data (byte 0)
	USINT	0x00…0xFF	Data (byte 1)
	…	…	…
	USINT	0x00…0xFF	Data (byte n)

The read data is in the IO-Link format. If necessary, the user needs to adapt the byte arrangement of the read data to the CIP format.

12.1.4.9.4.2.2 Fault

If an error occurs while executing the service (CIP Error Code <> 0), an extended error code will be transmitted (CIP Extended Error Code). If the CIP Error Code = 0x1E, the CIP Extended Error Code is = 0x00 and the IO-Link Error Code and the IO-Link Additional Code will be transmitted in the CIP User Specific Service Data area. The response has the following format:

CIP Format	Data type	MSG Config	Description
CIP Class ID	UINT	0x80	IO-Link acyclic access
CIP Instance ID	UINT	0x01	IO-Link master
CIP attributes	USINT	0x01…0x08	Port number
CIP Service Code ID	USINT	0x4B	“Read ISDU” service

CIP Format	Data type	MSG Config	Description
CIP Error Code	USINT	<> 0x00	Error code (see below)
CIP Extended Error Code	USINT	0x00	Extended error code
CIP User Specific Service Data	USINT	<> 0x00	IO-Link Error Code: Error Code 114
	USINT	<> 0x00	IO-Link Additional Code: Additional Code 114

CIP Error Code:

Code	Description
0x02	Resource not available: The IO-Link port is busy processing another acyclic service.
0x05	Invalid class ID or instance ID
0x08	Wrong service ID: only service 0x4B, 0x4C or 0x4D is permitted
0x09	Wrong attribute ID: wrong port number
0x20	Invalid parameter value (e.g. invalid length)
0x1E	Embedded service error: Error occurred during an IO-Link service. Byte 0 and byte 1 of the CIP User Specific Service Data contain the IO-Link error code and an additional code returned by the IO-Link master.

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12.1.4.9.5 Write ISDU

With Write_ISDU, the parameters of a connected IO-Link device can be changed.

12.1.4.9.5.1 Request

CIP Attributes determines the IO-Link port to which the IO-Link device is connected. The area "User Specific Service Data" contains the IO-Link index, the IO-Link sub-index of the IO-Link object whose value is to be changed. The value to be assigned to the parameter follows byte by byte.

CIP Format	Data type	MSG Config	Description
CIP Class ID	UINT	0x80	IO-Link acyclic access
CIP Instance ID	UINT	0x01	IO-Link master
CIP attributes	USINT	0x01…0x08	Port number
CIP Service Code ID	USINT	0x4C	“Write ISDU” service
CIP User Specific Service Data	UINT	0x0000…0xFFFF	ISDU object index
	USINT	0x00…0xFF	ISDU object subindex
	USINT	0x00…0xFF	ISDU data (byte 0)
	USINT	0x00…0xFF	ISDU data (byte 1)

12.1.4.9.5.2 Response

12.1.4.9.5.2.1 Fault-free processing

If the service was executed successfully (CIP Error Code = 0), the area "User Specific Data" will remain empty. The response has the following format:

CIP Format	Data type	MSG Config	Description
CIP Class ID	UINT	0x80	IO-Link acyclic access
CIP Instance ID	UINT	0x01	IO-Link master
CIP attributes	USINT	0x01…0x08	Port number
CIP Service Code ID	USINT	0x4C	“Write ISDU” service
CIP Error Code	USINT	0x00	Fault-free processing
CIP Extended Error Code	USINT	0x00	--

12.1.4.9.5.2.2 Fault

If an error occurs while executing the service (CIP Error Code <> 0), an extended error code is transmitted (CIP Extended Error Code). If the CIP Error Code = 0x1E, the CIP Extended Error Code is = 0x00 and the IO-Link Error Code and the IO-Link Additional Code will be transmitted in the CIP User Specific Service Data area. The response has the following format:

CIP Format	Data type	MSG Config	Description
CIP Class ID	UINT	0x80	IO-Link acyclic access
CIP Instance ID	UINT	0x01	IO-Link master
CIP attributes	USINT	0x01…0x08	Port number
CIP Service Code ID	USINT	0x4C	“Write ISDU” service
CIP Error Code	USINT	<> 0x00	Error code (see below)
CIP Extended Error Code	USINT	0x00	Extended error code
CIP User Specific Service Data	USINT	<> 0x00	IO-Link Error Code: Error Code 114
	USINT	<> 0x00	IO-Link Additional Code: Additional Code 114

CIP Error Code:

Code	Description
0x02	Resource not available: The IO-Link port is busy processing another acyclic service.
0x05	Invalid class ID or instance ID
0x08	Wrong service ID: only service 0x4B, 0x4C or 0x4D is permitted
0x09	Wrong attribute ID: wrong port number
0x20	Invalid parameter value (e.g. invalid length)
0x1E	Embedded service error: Error occurred during an IO-Link service. Byte 0 and byte 1 of the CIP User Specific Service Data contain the IO-Link error code and an additional code returned by the IO-Link master.

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12.1.4.9.6 Write Failsafe Pattern

Write Failsafe Pattern can be used to write the failsafe value of an IO-Link port.

12.1.4.9.6.1 Request

CIP Attribute determines the IO-Link port. The area CIP User Specific Service Data includes the fail-safe mode and the fail-safe value (Failsafe Pattern).

CIP Format	Data type	MSG Config	Description
CIP Class ID	UINT	0x80	IO-Link acyclic access
CIP Instance ID	UINT	0x01	IO-Link master
CIP attributes	USINT	0x01…0x08	Port number
CIP Service Code ID	USINT	0x4D	“Write Failsafe Pattern” service
CIP User Specific Service Data	USINT	• 0x00: No Fail-safe • 0x01: Fail-safe Reset Value • 0x02: Fail-safe Old Value • 0x03: Fail-safe with Pattern	Fail-safe Mode
	USINT	0x00…0xFF	Fail-safe Pattern (MSB)
	USINT	0x00…0xFF	Fail-safe Pattern (LSB)

12.1.4.9.6.2 Response

12.1.4.9.6.2.1 Fault-free processing

If the service was executed successfully (CIP Error Code = 0), the area "User Specific Data" will remain empty. The response has the following format:

CIP Format	Data type	MSG Config	Description
CIP Class ID	UINT	0x80	IO-Link acyclic access
CIP Instance ID	UINT	0x01	IO-Link master
CIP attributes	USINT	0x01…0x08	Port number
CIP Service Code ID	USINT	0x4D	“Write Failsafe Pattern” service
CIP Error Code	USINT	0x00	Fault-free processing
CIP Extended Error Code	USINT	0x00	--

12.1.4.9.6.2.2 Fault

If an error occurs while executing the service (CIP Error Code <> 0), an extended error code will be transmitted (CIP Extended Error Code). The response has the following format:

CIP Format	Data type	MSG Config	Description
CIP Class ID	UINT	0x80	IO-Link acyclic access
CIP Instance ID	UINT	0x01	IO-Link master
CIP attributes	USINT	0x01…0x08	Port number
CIP Error Code	USINT	<> 0x00	Error code (see below)
CIP Extended Error Code	USINT	0x00	Extended error code

CIP Error Code:

Code	Description
0x02	Resource not available: The IO-Link port is busy processing another acyclic service.

Code	Description
0x05	Invalid class ID or instance ID
0x08	Wrong service ID: only service 0x4B, 0x4C or 0x4D is permitted
0x09	Wrong attribute ID: wrong port number
0x20	Invalid parameter value (e.g. invalid length)
0x1E	Embedded service error: Error occurred during an IO-Link service. Byte 0 and byte 1 of the CIP User Specific Service Data contain the IO-Link error code and an additional code returned by the IO-Link master.
0x0F	Insufficient access rights

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12.1.4.10 TCP/IP Object (Class Code: 0xF5)

12.1.4.10.1 Class attributes

Attr. ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	4
2	Get	Max. Instance	UINT	Max. number of instances of the object	1
3	Get	Number of instances	UINT	Number of instances of the object	1
6	Get	Max. ID Number Class Attributes	UINT	Max. ID number of a class attribute	7
7	Get	Max. ID Number Instance Attribute	UINT	Max. ID number of the instance attribute	13

12.1.4.10.2 Instance attributes

Attr. ID	Access	Name	Data type	Description	Default
1	Get	Status	UINT	Status of the TCP/IP interface • 0: interface not configured • 1: interface configured with DHCP, BOOTP or non-volatile memory	
2	Get	Configuration Capability	DWORD	Configuration options for interface • Bit 0: BOOTP Client • Bit 2: DHCP Client • Bit 4: configuration adjustable • Bit 7: ACD-capable	0x95 (BOOTP, DHCP, TCP/IP configurable, ACD capable)
3	Get / Set	Configuration Control	DWORD	Configuration control Bit 0..3: startup configuration • 0: statically assigned IP address • 1: configuration via BOOTP • 2: configuration via DHCP	0
4	Get	Physical Link Object Path	STRUCT of	Logical path to the physical communication interface (Ethernet link object)	
		• Path Size	UINT	Length (number of words, little endian format)	0x02 00
		• Path	Padded EPATH	Class ID: 0xF6 (Ethernet Link Object) • Instance ID: 0x1	0x20 F6 24 01
5	Get / Set	Interface configuration	STRUCT of	TCP/IP interface configuration	
		• IP Address	UDINT	IP address	192.168.1.250
		• Network Mask	UDINT	Network mask	255.255.255.0
		• Gateway Address	UDINT	Gateway address	0.0.0.0
		• Name Server	UDINT	Primary name server	0.0.0.0
		• Name Server 2	UDINT	Secondary name server	0.0.0.0
		• Domain Name	STRING	Default domain name	0
6	Get / Set	Host Name	STRING	Host Name • 0: not configured	0
8	Get	TTL Value	UINT	TTL value	1

Attr. ID	Access	Name	Data type	Description	Default
9	Get / Set	Mcast Config	UINT	Mcast configuration	0
10	Get / Set	SelectAcd	BOOL	ACD activation / deactivation • 0: deactivated • 1: activated	1
11	Get / Set	Last conflict detected	STRUCT of	Last conflict detected	0
		• AcdActivity	USINT	Condition of ACD activity at last conflict detected • 0: Noconflictdetected • 1: Probelpv4Address • 2: Ongoing Detection • 3: SemiActiveprobe	
		• Remote MAC	ARRAY(6) of USINT	MAC address of the remote node of the ARP PDU in which the conflict was detected	
		• ArpPdu	ARRAY(28) of USINT	Copy of the data of the ARP PDU in which the conflict was detected	
13	Get / Set	Encapsulation Inactivity Timeout	UINT	Inactivity before the TCP connection is deactivated (in seconds)	120

12.1.4.10.3 Services

Code	Service	Class	Instance	Description
0x01	Get Attribute All	No	Yes	Read all attributes
0x0E	Get Attribute Single	Yes	Yes	Read single attribute
0x10	Set Attribute Single	No	Yes	Write single attribute

12.1.4.11 Ethernet Link Object (Class Code: 0xF6)

12.1.4.11.1 Class attributes

Attr. ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	4
2	Get	Max. Instance	UINT	Max. number of instances of the object	2
3	Get	Number of instances	UINT	Number of instances	2
6	Get	Max. ID Number Class Attributes	UINT	Max. ID number of a class attribute	7
7	Get	Max. ID Number Instance Attribute	UINT	Max. ID number of the instance attribute	768

12.1.4.11.2 Instance attributes

Attr. ID	Access	Name	Data type	Description	Default
1	Get	Interface Speed	UDINT	Current transmission rate • 10: 10 Mbit/s • 100: 100 Mbit/s	100
2	Get	Interface Status Flag	DWORD	Interface status flags • Bit 0: link status • Bit 1: half/full duplex • Bit 2…4: negotiation status • Bit 5: manual change requires reset • Bit 6: local hardware error • Bit 7…31: reserved	0x20
3	Get	Physical Address	ARRAY(6) of USINT	MAC address	
4	Get	Interface Counters	STRUCT(11) of UDINT	Interface-specific counter	
5	Get	Media Counters	STRUCT(12) of UDINT	Medium-specific counter	
6	Get / Set	Interface Control	STRUCT of	Interface control	
		• Interface Settings	DWORD	Settings Bit 0: • 0: auto-negotiation on • 1: auto-negotiation off Bit 1: • 0: half duplex • 1: full duplex	0
		• Interface Speed	UINT	Transmission rate • 10: 10 Mbit/s • 100: 100 Mbit/s	
7	Get	Interface type	USINT	• 0: unknown • 1: internal interface • 2: twisted pair • 3: optical fibre	2

Attr. ID	Access	Name	Data type	Description	Default
8	Get	Interface State	USINT	Current status of the interface • 0: unknown • 1: active; ready for transmission and reception • 2: not active • 3: test mode	0
9	Get / Set	Admin State	USINT	Control of the access to the interface • 1: activate • 2: deactivate	1
10	Get	Interface Label	SHORT_STRING	Interface identifier	• XF1 (instance 1) • XF2 (instance 2)
11	Get	Interface Capability	STRUCT of	Interface capability	
		• Interface Speed	DWORD	Transmission rate • 10: 10 Mbit/s • 100: 100 Mbit/s	
		• Interface Duplex Mode	DWORD	Duplex mode • HD: half duplex • FD: full duplex	
768	Get / Set	MDIX	USINT	MDIX configuration • 1: MDIX_AUTO • 2: MDIX_MDI • 3: MDIX_MDIX	1

12.1.4.11.3 Services

Code	Service	Class	Instance	Description
0x01	Get Attribute All	No	Yes	Read all attributes
0x0E	Get Attribute Single	Yes	Yes	Read single attribute
0x10	Set Attribute Single	No	Yes	Write single attribute

12.1.4.12 LLDP Management Object (Class Code: 0x109)

12.1.4.12.1 Class attributes

Attr. ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	1
2	Get	Max. Instance	UINT	Max. number of instances of the object	1
3	Get	Number of instances	UINT	Number of instances of the object	1
6	Get	Max. ID Number Class Attributes	UINT	Max. ID number of a class attribute	7
7	Get	Max. ID Number Instance Attributes	UINT	Max. ID number of the instance attribute	5

12.1.4.12.2 Services

Code	Service	Class	Instance	Description
0x0E	Get Attribute Single	Yes	Yes	Read single attribute
0x10	Set Attribute Single	No	Yes	Write single attribute

12.2 OPC UA server

12.2.1 DeviceIoTConfiguration

Type: DeviceIoTConfiguration

Description: Structure for the representation of the gateway

Objects

Name	Description	Reference
Iotsetup	Structure for the configuration of the IoT interface	Iotsetup 140
Fieldbussetup	Structure for configuring the fieldbus interface	Fieldbussetup 142

12.2.1.1 Iotsetup

Type: Object

Description: Structure for the configuration of the IoT interface

Variables:

Name	Data type	Description	Value range	Access
AccessRights	BYTE	Access rights to the device NOTE! The parameter **output_select_control**controls access to the parameters and process data of the ports.	• 0: EtherNet/IP, ifm IoT Core and OPC UA have read and write access to parameters and process data of the ports. • 1: EtherNet/IP has read and write access to parameters and process data of the ports as well as read access to alarms/events; ifm IoT Core and OPC UA have read access to parameters and process data of the ports • 3: ifm IoT Core and OPC UA have read and write access to parameters and process data of the ports	ro [1]

[1] Read only

Methods:

Name	Description	Reference
Change Accessrights	Set access rights to the device	• Change Accessrights 140
Change Password	Change password for the OPC UA authentication function	• Change Password 141

12.2.1.1.1 Change Accessrights

Type: Method

Description: Set access rights to the device

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The method must always be executed with all input arguments, even if only one parameter is to be changed.

The method can only be executed if the variable **MasterConfigurationDisabled** = **false**.

▶ Please note: Access to gateway data 71

Initial arguments:

Name	Data type	Description	Value range
AccessRights	BYTE	Access rights to the device NOTE! Access to the parameters and process data of the ports is controlled by the parameter**output_select_control**.	• 0: EtherNet/IP, ifm IoT Core and OPC UA have write rights to parameters and process data of the ports • 1: EtherNet/IP has read and write access to parameters and process data of the ports as well as read access to alarms/events; ifm IoT Core and OPC UA have read access to parameters and process data of the ports • 3: ifm IoT Core and OPC UA have read and write access to parameters and process data of the ports

Initial arguments:

Name	Data type	Description	Value range
Result	INT32	Processing status	• 0: Method successfully executed • 1: Error - New and old value of parameter Accessrights are the same • 3: Error - Method not executed due to an invalid input value

12.2.1.1.2 Change Password

Type: Method

Description: Change password for the OPC UA authentication function

The method must always be executed with all input arguments, even if only one parameter is to be changed.

Initial arguments:

Name	Data type	Description	Value range
Old password	STRING	Old password	e.g. admin1 (default)
New password	STRING	New password (max. 28 ASCII characters)	
Confirm password	STRING	New password for confirmation (max. 28 ASCII characters)	

Initial arguments:

Name	Data type	Description	Value range
Result	INT32	Processing status	• 0: Method successfully executed • -1: Error - New and old password are the same • -2: Error - New and confirmation password are not the same • -3: Error - Password too long • -4: Error - Old password is wrong • -5: Error

12.2.1.2 Fieldbussetup

Type: Object

Description: Structure for configuring the fieldbus interface

Variables:

Name	Type	Description	Value range	Access
DHCP	BYTE	Enable / disable the DHCP client of the device	• 0: Static IP - IP parameters are set by the user • 1: DHCP -IP parameters are set by a DHCP server in the network • 2: BOOTP - IP parameters are set via Bootstrap Protocol (BOOTP)	ro [1]
IPaddress	STRING	IP address of the EtherNet/IP interface	E.g. 192.168.82.100 • 192.168.1.250 (default)	ro [1]
Subnetmask	STRING	Subnet mask of the EtherNet/IP network	e.g. 255.255.0.0 • 255.255.255.0 (default)	ro [1]
IPdefaultgateway	STRING	IP address of the network gateway	e.g. 192.168.82.1 • 0.0.0.0 (default)	ro [1]
Macaddress	STRING	MAC address of the EtherNet/IP interface of the device	E.g. 00:02:01:0f:c8:8f	ro [1]
Hostname	STRING	EtherNet/IP name of the device (max. 240 characters)	E.g. iol12.plant1	ro [1]
Fieldbusfirmware	STRING	Version of the fieldbus firmware	5.4.0.6 (EtherNet/IP Adapter)	ro [1]
Explicitpdmode	BYTE	Enable / disable explicit PD mode and select the process data to be transmitted (connection type)	• 0: Explicit process data mode off - Explicit PD Mode disabled • 1: Explicit process data mode with IO-Link I/O + Acyclic + Diag - Explicit PD Mode enabled -- IO-Link input/output, acyclic data and diagnostic data is transmitted • 2: Explicit process data mode with IO-Link I/O + Acyclic + Diag + EnMo - Explicit PD Mode enabled -- IO-Link inputs/outputs and acyclic data, diagnostic data and data for energy monitoring is transmitted • 3: Explicit process data mode with IO-Link I/O - Explicit PD Mode enabled -- IO-Link inputs/outputs are transmitted	ro [1]

Name	Type	Description	Value range	Access
Processdataconfiguration	BYTE	Length of process data (per IO-Link port)	• 0: 2 Bytes Input 2 Bytes Output - 2 bytes input data, 2 bytes output data • 1: 4 Bytes Input 4 Bytes Output - 4 bytes input data, 4 bytes output data • 2: 8 Bytes Input 8 Bytes Output - 8 bytes input data, 8 bytes output data • 3: 16 Bytes Input 16 Bytes Output - 16 bytes input data, 16 bytes output data • 4: 32 Bytes Input 32 Bytes Output - 32 bytes input data, 32 bytes output data	ro [1]

[1] Read only

Objects

Name	Description	Reference
PortsConfiguration	Structure for fieldbus-specific port settings	PortsConfiguration 146

Methods:

Name	Description	Reference
Change Explicitpdmode	Select connection type (Explicit PD)	Change Explicitpdmode 143
Change Hostname	Setting the host name	Change Hostname 144
Change Independentmode	Setting the configuration mode	Change Independentmode 144
Change Network Configuration	Set EtherNet/IP interface	Change Network Configuration 145
Change Processdataconfiguation	Set the length of the IO-Link process data	Change Processdataconfiguration 146

12.2.1.2.1 Change Explicitpdmode

Type: Method

Description: Change the parameter Explicitpdmode

The method must always be executed with all input arguments, even if only one parameter is to be changed.

The method can only be executed if the variable **MasterConfigurationDisabled** = **false**.

▶ Please note: Access to gateway data 71

Initial arguments:

Name	Data type	Description	Value range
Explicitpdmode	BYTE	Enable / disable explicit PD mode and select the process data to be transmitted (connection type)	• 0: Explicit process data mode off - Explicit PD Mode disabled • 1: Explicit process data mode with IO-Link I/O + Acyclic + Diag - Explicit PD Mode enabled -- IO-Link inputs / outputs, acyclic and diagnostic data is transmitted • 2: Explicit process data mode with IO-Link I/O + Acyclic + Diag + EnMo - Explicit PD mode enabled -- IO-Link inputs / outputs and acyclic data, diagnostic data and data for energy monitoring are transmitted • 3: Explicit process data mode with IO-Link I/O - Explicit PD mode enabled -- IO-Link inputs/outputs are transmitted

Initial arguments:

Name	Data type	Description	Value range
Result	INT32	Processing status	• 0: Method successfully executed • -3: Error - Method not executed due to an invalid input value

12.2.1.2.2 Change Hostname

Type: Method

Description: Change the parameter Hostname

The method must always be executed with all input arguments, even if only one parameter is to be changed.

The method can only be executed if the variable **MasterConfigurationDisabled** = **false**.

▶ Please note: Access to gateway data 71

Initial arguments:

Name	Data type	Description	Value range
Hostname	STRING	EtherNet/IP name of the device (max. 64 ASCII characters)	E.g. iol12.plant1

Initial arguments:

Name	Data type	Description	Value range
Result	INT32	Processing status	• 0: Method successfully executed • -3: Error - Method not executed due to an invalid input value

12.2.1.2.3 Change Independentmode

Type: Method

Description: Change the parameter Independentmode

The method must always be executed with all input arguments, even if only one parameter is to be changed.

The method can only be executed if the variable **MasterConfigurationDisabled** = **false**.

▶ Please note: Access to gateway data 71

Initial arguments:

Name	Data type	Description	Value range
Independentmode	BYTE	Setting the EtherNet/IP configuration mode	• 0: Independent mode disabled - Configuration via fieldbus PLC • 1: Independent mode enabled - configuration via device

Initial arguments:

Name	Data type	Description	Value range
Result	INT32	Processing status	• 0: Method successfully executed • -3: Error - Method not executed due to an invalid input value

12.2.1.2.4 Change Network Configuration

Type: Method

Description: Set the IP configuration of the EtherNet/IP interface

The method must always be executed with all input arguments, even if only one parameter is to be changed.

The method can only be executed if the variable **MasterConfigurationDisabled** = **false**.

▶ Please note: Access to gateway data 71

Initial arguments:

Name	Data type	Description	Value range
ipaddress	STRING	IP address of the EtherNet/IP interface	E.g. 192.168.82.100 • 192.168.1.250 (default)
subnetmask	STRING	Subnet mask of the EtherNet/IP network	E.g. 255.255.0.0 • 255.255.255.0 (default)
ipdefaultgateway	STRING	IP address of the network gateway	E.g. 192.168.82.1 • 0.0.0.0 (default)
dhcp	BYTE	Enable / disable the DHCP client of the device	• 0: Static IP - IP parameters are set by the user • 1: DHCP - IP parameters are set by a DHCP server in the network • 2: BOOTP - IP parameters are set via Bootstrap Protocol (BOOTP)

Initial arguments:

Name	Data type	Description	Value range
Result	INT32	Processing status	• 0: Method successfully executed • -3: Error - Method not executed due to an invalid input value

12.2.1.2.5 Change Processdataconfiguration

Type: Method

Description: Change the parameter Processdataconfiguration

The method must always be executed with all input arguments, even if only one parameter is to be changed.

The method can only be executed if the variable **MasterConfigurationDisabled** = **false**.

▶ Please note: Access to gateway data 71

Initial arguments:

Name	Data type	Description	Value range
Processdataconfigura-tion	BYTE	Length of the IO-Link process data (per IO-Link port)	• 0: 2 Bytes Input 2 Bytes Output - 2 bytes input data, 2 bytes output data • 1: 4 Bytes Input 4 Bytes Output - 4 bytes input data, 4 bytes output data • 2: 8 Bytes Input 8 Bytes Output - 8 bytes input data, 8 bytes output data • 3: 16 Bytes Input 16 Bytes Output - 16 bytes input data, 16 bytes output data • 4: 32 Bytes Input 32 Bytes Output - 32 bytes input data, 32 bytes output data

Initial arguments:

Name	Data type	Description	Value range
Result	INT32	Processing status	• 0: Method successfully executed • -3: Error - Method not executed due to an invalid input value

12.2.1.2.6 PortsConfiguration

Type: Object

Description: Structure for fieldbus-specific port settings

Objects

Name	Description	Reference
port[1]	Structure for fieldbus-specific configuration Port 1	portx (x: 1...8) 147
port[2]	Structure for fieldbus-specific configuration Port 2	portx (x: 1...8) 147
port[3]	Structure for fieldbus-specific configuration Port 3	portx (x: 1...8) 147
port[4]	Structure for fieldbus-specific configuration Port 4	portx (x: 1...8) 147
port[5]	Structure for fieldbus-specific configuration Port 5	portx (x: 1...8) 147
port[6]	Structure for fieldbus-specific configuration Port 6	portx (x: 1...8) 147

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Name	Description	Reference
port[7]	Structure for fieldbus-specific configuration Port 7	portx (x: 1...8) 147
port[8]	Structure for fieldbus-specific configuration Port 8	portx (x: 1...8) 147

Methods:

Name	Description	Reference
Failsafe Pattern	Set fallback value for IO-Link process data (outputs) of the ports	Failsafe Pattern 148

12.2.1.2.6.1 portx (x: 1...8)

Type: Object

Description: Structure for the fail-safe settings of an IO-Link port (Class B)

Variables:

Name	Type	Description	Value range	Access
FailsafePattern	BYTE ARRAY	Set fallback value of the port (max. 32 array elements)	• Empty (default) Per byte: • 0x00…0xFF	ro [1]
Failsafedigitalout	BYTE	Fail-safe setting of the output for operating mode 'Digital output (DO)'	• 0: Reset - Fail-safe enabled - LOW • 1: Old - Fail-safe disabled - last active process value (default) • 2: Set - Fail-safe enabled - HIGH	ro [1]
Failsafeiolink	BYTE	Fail-safe setting of the output for operating mode "IO-Link"	• 0: Off – Fail-safe disabled • 1: Reset – Fail-safe enabled - OFF • 2: Old – Fail-safe enabled – last valid process value (default) • 3: Pattern – Fail-safe enabled – provide byte sequence in FailsafePattern 147 variable	ro [1]
Failsafepin2	BYTE	Fail-safe setting of the output on pin 2 for operating mode 'Digital output (DO)' NOTE! Available for ports only X1...X4	• 0x0: LOW • 0x1: HIGH (default)	ro [1]
Swap	BYTE	Arrangement of the bytes in process data	• 0: Disabled: as array of bytes • 1: Enabled: - as an Integer16 value; When the process data is updated, the bytes in the integer16 value are swapped (default)	ro [1]

[1] Read only

Methods:

Name	Description	Reference
Change Failsafe Portx	Setting the fail-safe settings for the outputs	Change Failsafe Portx (x: 1...8) 147

12.2.1.2.6.1.1 Change Failsafe Portx (x: 1...8)

Type: Method

Description: Change the fail-safe settings of the port.

The method must always be executed with all input arguments, even if only one parameter is to be changed.

The method can only be executed if the variable **DeviceConfigurationDisabled** = **false**.

▶ Please note: Access to port and IO-Link device data 71

Initial arguments:

Name	Data type	Description	Value range
Failsafedigitalout	BYTE	Fail-safe setting of the output on pin 4 for operating mode 'Digital output (DO)'	• 0: Reset - Fail-safe enabled - LOW • 1: Old - Fail-safe disabled - last active process value (default) • 2: Set - Fail-safe enabled - HIGH
Failsafeiolink	BYTE	Fail-safe setting of the output on pin 4 for operating mode 'IO-Link'	• 0: Off – Fail-safe disabled • 1: Reset – Fail-safe enabled - • 2: Old – Fail-safe enabled – last valid process value (default) • 3: Pattern – Fail-safe enabled – provide byte sequence in FailsafePattern 147 variable
Failsafepin2	BYTE	Fail-safe setting of the output on pin 2 for operating mode 'Digital output (DO)' NOTE! Available for ports only X1...X4	• 0: Reset - LOW level (default) • 1: Old - last active process value • 2: Set - HIGH level
Swap	BYTE	Arrangement of the bytes in process data	• 0: Disabled: as Array of Bytes • 1: Enabled: as Integer16 value; When the process data is updated, the bytes in the integer16 value are swapped (default)

Initial arguments:

Name	Data type	Description	Value range
Result	INT32	Processing status	• 0: Method successfully executed • -3: Error - Method not executed due to an invalid input value

12.2.1.2.6.2 Failsafe Pattern

Type: Method

Description: Set the fallback value of the IO-Link process data (outputs) of the port

The method must always be executed with all input arguments, even if only one parameter is to be changed.

The method can only be executed if the variable **DeviceConfigurationDisabled** = **false**.

▶ Please note: Access to port and IO-Link device data 71

Initial arguments:

Name	Data type	Description	Value range
Port	BYTE	Port number	• 1: Port X1 • 2: Port X2 • 3: Port X3 • 4: Port X4 • 5: Port X5 • 6: Port X6 • 7: Port X7 • 8: Port X8
Pattern length	BYTE	Length of the pattern (number of bytes)	• 1: 1 byte … • 32: 32 bytes
Pattern data	STRING	Pattern value (max. 64 ASCII characters) • Correct value (example): – 0102FFAA • Incorrect value (examples): – 0102FFA - the first byte (LSB) is incomplete – 0102FFLL - the last byte is not a HEX value	Per byte: • 0x00…0xFF

Initial arguments:

Name	Data type	Description	Value range
Status	UINT32	Processing status	• 0: Method successfully executed • -1: Error - Invalid port • -2: Error - Invalid pattern length • -3: Error - Invalid pattern value • -4: Error - port is controlled by EtherNet/IP

12.2.2 IOLinkMasterType

Type: IOLinkMasterType

Description: Structure with nodes of an IO-Link master

Variables:

Name	Data type	Description	Value range	Access
DeviceID	UINT32	ID of the IO-Link master	• 1074: AL1427	ro [1]
VendorID	UINT16	ID of the manufacturer	• 310: ifm electronic	ro [1]
MasterConfigura-tionDisabled	BOOLEAN	Display whether the settings of the IO-Link master can be changed via OPC UA	• FALSE: Change possible (no connection to the fieldbus PLC) • TRUE: Change not possible (connection to fieldbus PLC established)	ro [1]

[1] Read only

Objects

Name	Description	Reference
ParameterSet	Structure with available parameters	ParameterSet 150

Name	Description	Reference
MethodSet	Structure with available methods	MethodSet 150
Identification	Structure with identification information of the IO-Link master	Identification 151
Capabilities	Structure with the properties of the IO-Link master	Capabilities 152
Management	Structure with methods for managing the IO-Link master	Management 152
port[1]	Structure for port 1	IOLinkPortType 153
port[2]	Structure for port 2	IOLinkPortType 153
port[3]	Structure for port 3	IOLinkPortType 153
port[4]	Structure for port 4	IOLinkPortType 153
port[5]	Structure for port 5	IOLinkPortType 153
port[6]	Structure for port 6	IOLinkPortType 153
port[7]	Structure for port 7	IOLinkPortType 153
port[8]	Structure for port 8	IOLinkPortType 153

12.2.2.1 ParameterSet

Type: Object

Description: Structure with available variable

Variables:

Name	Data type	Description	Value range	Access
ApplicationSpecificTag	STRING	Application-specific identifier	AL1427 (default)	rw [1]
FunctionTag	STRING	Function identifier	E.g. IOLinkMaster	rw [1]
LocationTag	STRING	Location identifier	E.g. Plant 1 Machine 3	rw [1]
MaxNumberOfPorts	BYTE	Number of the IO-Link ports	• 8 Ports	ro [2]
MaxPowerSupply	DOUBLE	Maximum current (value in A)	• 11.6: 11.6 A	ro [2]

[1] Read and write; Can only be changed if variable **MasterConfigurationDisabled** = **false**; note: Access to gateway data 71

[2] Read only

12.2.2.2 MethodSet

Type: Object

Description: Structure with available methods

Methods:

Name	Description	Reference
Restart	Reboot the device	Restart 150
Restart Abort	Cancel the restart of the device	Restart Abort 151

12.2.2.2.1 Restart

Type: Method

Description: Rebooting the device.

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The method must always be executed with all input arguments, even if only one parameter is to be changed.

The method can only be executed if the variable **MasterConfigurationDisabled** = **false**.

▶ Please note: Access to gateway data 71

Initial arguments:

Name	Data type	Description	Value range
Delay	DOUBLE	Delay for restarting the device (value in s)	• 0: 0 s … • 7200: 7200 s (=2 h)

Initial arguments:

Name	Data type	Description	Value range
Result	BYTE	Processing status	• 0: Method successfully executed • -1: Method is already executed • -3: Method is not executed due to invalid input arguments

12.2.2.2.2 Restart Abort

Type: Method

Description: Cancel the restart of the device.

The method can only be executed if the variable **MasterConfigurationDisabled** = **false**.

▶ Please note: Access to gateway data 71

Initial arguments:

- none

Initial arguments:

Name	Data type	Description	Value range
Result	BYTE	Processing status	• 0: Method successfully executed • -1: Restart method is not active

12.2.2.3 Identification

Type: Object

Description: Structure with identification information of the device

Variables:

Name	Data type	Description	Value range	Access
ApplicationSpecificTag	STRING	Application-specific identifier	AL1427 (default)	rw [1]
FieldbusType	STRING	Fieldbus device profile	• EtherNet/IP Adapter	ro [2]
FirmwareVersion	STRING	Firmware version	• AL1x2x_cn_ei_v3.10.13	ro [2]
FunctionTag	STRING	Function identifier	E.g. IOLinkMaster	rw [1]
HardwareRevision	STRING	Hardware version	E.g. AA	ro [2]

Name	Data type	Description	Value range	Access
LocationTag	STRING	Location identifier	E.g. Plant 1 Machine 3	rw [1]
ProductCode	STRING	Article number of the device	• AL1427	ro [2]
VendorID	UINT16	ID of the manufacturer	• 310: ifm electronic	ro [2]
DeviceID	UINT32	ID of the IO-Link master	• 1074: AL1427	ro [2]

[1] Read and write; Can only be changed if variable **MasterConfigurationDisabled** = **false**; note: Access to gateway data 71

[2] Read only

12.2.2.4 Capabilities

Type: Object

Description: Structure with properties of the device

Variables:

Name	Data type	Description	Value range	Access
CurrentUS	UINT16	Current value of the supply voltage US (value in mA)	E.g. 92 92 mA	ro [1]
CurrentUA	UINT16	Present current intensity value of the UA supply voltage (value in mA) NOTE! Variable only available for ports X1...X4	E.g. 92 92 mA	ro [1]
VoltageUS	UINT16	Present voltage value of US supply voltage (in mV)	E.g. 24256 24256 mV	ro [1]
VoltageUA	UINT16	Present voltage value of the UA supply voltage (value in mV)	E.g. 24002 24002 mV	ro [1]
MaxNumberOfPorts	BYTE	Number of the IO-Link ports	• 8 Ports	ro [1]
MaxPowerSupply	DOU-BLE	Maximum current (value in A)	• 11.6: 11.6 A	ro [1]

[1] Read only

12.2.2.5 Management

Type: Object

Description: Structure with services for controlling the device

Methods:

Name	Description	Reference
Restart	Reboot the device	Restart 152
Restart Abort	Cancel the restart of the device	Restart Abort 153

12.2.2.5.1 Restart

Type: Method

Description: Rebooting the device.

The method must always be executed with all input arguments, even if only one parameter is to be changed.

The method can only be executed if the variable **MasterConfigurationDisabled** = **false**.

▶ Please note: Access to gateway data 71

Initial arguments:

Name	Data type	Description	Value range
Delay	DOUBLE	Delay for restarting the device (value in s)	• 0: 0 s … • 7200: 7200 s (=2 h)

Initial arguments:

Name	Data type	Description	Value range
Result	BYTE	Processing status	• 0: Method successfully executed • -1: Method is already executed • -3: Method is not executed due to invalid input arguments

12.2.2.5.2 Restart Abort

Type: Method

Description: Cancel the restart of the device.

The method can only be executed if the variable **MasterConfigurationDisabled** = **false**.

▶ Please note: Access to gateway data 71

Initial arguments:

- none

Initial arguments:

Name	Data type	Description	Value range
Result	BYTE	Processing status	• 0: Method successfully executed • -1: Restart method is not active

12.2.3 IOLinkPortType

Data type: IOLinkPortType

Description: Structure for the representation of a port

Variables:

Name	Data type	Description	Value range	Access
DeviceConfigurationDisabled	BOOLEAN	Display whether settings of the connected IO-Link device are possible via OPC UA	• FALSE: Changes possible (connection to fieldbus PLC interrupted or connection to fieldbus PLC established and parameter OutputSelectControl = opc_ua/iot) • TRUE: No changes possible (connection to fieldbus PLC established and parameter OutputSelectControl = fieldbus)	ro [1]

[1] Read only

Objects

Name	Description	Reference
Paramterset	Structure with available parameters	ParameterSet 154
MethodSet	Structure with available methods	MethodSet 156
Alarms	Structure with available alarms	Alarms 157
Capabilities	Structure with properties of the port	Capabilities 158
Configuration	Structure for configuring the port	Configuration 158
Information	Structure with status information of the port	Information 161
SIOProcessData	Structure with SIO process data of the port (digital inputs, digital outputs)	SIOProcessData 162
iolinkdevice	Structure for the representation of the IO-Link device	IOLinkDeviceType 162

12.2.3.1 ParameterSet

Type: Object

Description: Structure with available parameters

Variables:

Name	Data type	Description	Value range	Access
ActualCycleTime	DURATION	Current cycle time between the IO-Link master and the IO-Link device (value in ms)	• 0: 0 ms … • 132.8: 132.8 ms	ro [1]
Baudrate	BYTE	Transmission rate between the IO-Link master and the IO-Link device	• 0: NOT_DETECTED - No communication on the port • 1: COM1 - Transmission rate 4.8 kBaud • 2: COM2 - Transmission rate 38.4 kBaud • 3: COM3 - Transmission rate 230.4 kBaud	ro [1]
CycleTime	DURATION	Cycle time between the IO-Link master and the IO-Link device (value in ms)	• 0: best possible cycle time • 1: 1 ms … • 132.8: 132.8 ms	ro [1]

Name	Data type	Description	Value range	Access
DeviceID	UINT32	Identifier of the IO-Link device for validation	E.g. 1129 TCC501 (ifm temperature sensor)	ro [1]
MaxCurrentUS	UINT16	Max. current value of the supply voltage US at the port (value in mA)	• 0: 0 mA … • 2000: 2000 mA	rw [2]
MaxCurrentUA	UINT16	Max. current value of the supply voltage UA at the port (value in mA) NOTE! Variable only available for ports X1...X4	• 0: 0 mA … • 2000: 2000 mA	rw [2]
MaxPowerSupply	DOUBLE	Max. available current at the port (fixed value)	Ports X5...X8: • 2: 2 A Ports X1...X4: • 4: 4 A	ro [1]
Pin2Configuration	BYTE	Operating mode of pin 2 of the port NOTE! Variable only available for ports X1...X4	• 0: Not supported • 1: Digital Input - Digital input (ports X5...X8) • 2: Digital Output – Digital output (ports X1...X4) • 5: Power 2 - Port Class B (Ports X1...X4)	ro [1]
Pin2Support	BOOLEAN	Support for additional pin 2 functionality (fixed value)	• TRUE: Pin 2 is supported	ro [1]
PortClass	BYTE	Type of port (fixed value)	Ports X5...X8: • 0: CLASS A Ports X1...X4: • 2: CLASS B	ro [1]
PortMode	BYTE	Operating mode of pin 4 of the port	• 0: DEACTIVATED - Port is disabled • 1: IOL_MANUAL - Target mode based on user-specific configuration with validation of RID, vendor ID and device ID • 2: IOL_AUTOSTART Target mode without validation of vendor ID and device ID (No Device Check); User-specific configuration of RID, Vendor ID and Device ID • 3: DI_C/Q (Pin4) – digital input • 4: DO_C/Q (Pin4) – digital output	ro [1]
Quality	BYTE	Validity of the process data • Bit 0: Status PDIn • Bit 1: Status PDOut	• 0: PDIn and PDOut valid • 1: PDIn invalid, PDOut valid • 2: PDIn valid, PDOut invalid • 3: PDIn and PDout invalid	ro [1]

Name	Data type	Description	Value range	Access
Status	BYTE	Status of the port	• 0: NO_DEVICE • 1: DEACTIVATED • 2: INCORRECT_DEVICE. Wrong RID, DID, VID or cycletime • 4: OPERATE • 5: DI_C/Q (Pin4) • 6: DO_C/Q (Pin4) • 254: PORT_FAULT. Power supply related problems	ro [1]
UseIODD	BOOLEAN	Use IODD for the connected IO-Link device (fixed value)	• FALSE: No	ro [1]
ValidationAndBackup	BYTE	Validation of connected IO-Link devices and automatic storage/restoration of IO-Link device parameter sets	• 0: No Device check • 1: Type compatible Device V1.0 • 2: Type compatible Device V1.1 • 3: Type compatible Device V1.1, Backup + Restore • 4: Type compatible Device V1.1., Restore	ro [1]
VendorID	UINT16	Identification of the manufacturer of the IO-Link device for validation purposes	E.g. 310 ifm electronic	ro [1]

[1] Read only

[2] Reading and writing; Can only be changed if variable **DeviceConfigurationDisabled** = **false**; note: Access to port and IO-Link device data 71

12.2.3.2 MethodSet

Type: Object

Description: Structure with available methods

Methods:

Name	Description	Reference
UpdateConfiguration	Update port configuration	UpdateConfiguration 156

12.2.3.2.1 UpdateConfiguration

Type: Method

Description: Update port configuration

The method must always be executed with all input arguments, even if only one parameter is to be changed.

The method can only be executed if the variable **DeviceConfigurationDisabled** = **false**.

▶ Please note: Access to port and IO-Link device data 71

Initial arguments:

Name	Data type	Description	Value range
CycleTime	DURATION	Cycle time between the IO-Link master and the IO-Link device (value in ms)	• 0: best possible cycle time • 1: 1 ms … • 132.8: 132.8 ms
ValidationAndBackup	BYTE	Validation of connected IO-Link devices and automatic storage/ restoration of IO-Link device parameter sets	• 0: No check and clear • 1: Type compatible V1.0 device • 2: Type compatible V1.1 device • 3: Type compatible V1.1 device with Backup + Restore • 4: Type compatible V1.1 device with Restore
PortMode	BYTE	Operating mode of pin 4 of the port	• 0: DEACTIVATED - Port is disabled • 1: IOL_MANUAL - Target mode based on user-specific configuration with validation of RID, vendor ID and device ID • 2: IOL_AUTOSTART - Target mode without validation of vendor ID and device ID (No Device Check); User-specific configuration of RID, Vendor ID and Device ID • 3: DI_C/Q (Pin4) – Digital input • 4: DO_C/Q (Pin4) – Digital output
Pin2Configuration	BYTE	Operating mode of pin 2 of the port	• 0: Not supported • 1: Digital Input - Digital input (ports X5...X8) • 2: Digital Output – Digital output (ports X1...X4) • 5: Power 2 - Port Class B (Ports X1...X4)
UseIODD	BOOLEAN	Use IODD for the connected IO-Link device	• FALSE: No • TRUE: Yes
DeviceID	UINT32	Identifier of the IO-Link device for validation	e.g. 1129: TCC501 (ifm temperature sensor)
VendorID	UINT16	Identification of the manufacturer of the IO-Link device for validation purposes	e.g. 310: ifm electronic

Initial arguments:

Name	Data type	Description	Value range
Status	UINT32	Processing status	• 0: Method successfully executed • -1: Error - Invalid configuration

12.2.3.3 Alarms

Type: Object

Description: Structure with available alarms

Available variables:

Name	Type	Description	Value range	Access
PortEvent	STRING	Port event (max. 13 ASCII characters) Structure: 0x00ZZYY • 0xYY: Port Status - status of the IO-Link device • 0xZZ: Connection Status - status of the connection	Port Status: • 0x00: No IO-Link device connected • 0x40: Wrong IO-Link device connected • 0xFF: IO-Link device connected and in OPERATE state Connection Status: • 0x00: Port deactivated • 0x01: Port activated, but no device connected • 0x02: Port activated and in “IO-Link” operating mode • 0x03: Port activated and in “DI” operating mode • 0x04: Port activated and in “DO” operating mode	ro [1]

[1] Read only

12.2.3.4 Capabilities

Type: Object

Description: Structure with properties of the port

Variables:

Name	Data type	Description	Value range	Access
CurrentUS	UINT16	Current value of the supply voltage US (value in mA)	E.g. 92 92 mA	ro [1]
CurrentUA	UINT16	Present current intensity value of the UA supply voltage (value in mA) NOTE! Variable only available for ports X1...X4	E.g. 92 92 mA	ro [1]
MaxPowerSupply	DOUBLE	Max. available current at the port (fixed value)	Ports X5...X8: • 2: 2 A Ports X1...X4: • 4: 4 A	ro [1]
Pin2Support	BOOLEAN	Support for additional pin 2 functionality (fixed value)	• TRUE: Pin 2 is supported	ro [1]
PortClass	BYTE	Type of port (fixed value)	Ports X5...X8: • 0: CLASS A Ports X1...X4: • 2: CLASS B	ro [1]

[1] Read only

12.2.3.5 Configuration

Type: Object

Description: Structure for configuring the port

Variables:

Name	Data type	Description	Value range	Access
CycleTime	DURATION	Cycle time between the IO-Link master and the IO-Link device (value in ms)	• 0: best possible cycle time • 1: 1 ms … • 132.8: 132.8 ms	ro [1]
Pin2Configuration	BYTE	Operating mode of pin 2 of the port NOTE! Variable only available for ports X1...X4	• 0: Not supported • 1: Digital Input - Digital input (ports X5...X8) • 2: Digital Output – Digital output (ports X1...X4) • 5: Power 2 - Port Class B (Ports X1...X4)	ro [1]
PortMode	BYTE	Operating mode of pin 4 of the port	• 0: DEACTIVATED - Port is disabled • 1: IOL_MANUAL - Target mode based on user-specific configuration with validation of RID, vendor ID and device ID • 2: IOL_AUTOSTART Target mode without validation of vendor ID and device ID (No Device Check); User-specific configuration of RID, Vendor ID and Device ID • 3: DI_C/Q (Pin4) – digital input • 4: DO_C/Q (Pin4) – digital output	ro [1]
UseIODD	BOOLEAN	Use IODD for the connected IO-Link device (fixed value)	• FALSE: No	ro [1]
ValidationAndBackup	BYTE	Validation of connected IO-Link devices and automatic storage/restoration of IO-Link device parameter sets	• 0: No Device check • 1: Type compatible Device V1.0 • 2: Type compatible Device V1.1 • 3: Type compatible Device V1.1, Backup + Restore • 4: Type compatible Device V1.1., Restore	ro [1]

[1] Read only

Objects

Name	Description	Reference
ConfiguredDevice	Identifier of the IO-Link device for validation	ConfiguredDevice 159

Methods:

Name	Description	Reference
UpdateConfiguration	Update port configuration	UpdateConfiguration 160

12.2.3.5.1 ConfiguredDevice

Type: Object

Description: Identifiers of the connected IO-Link device

Variables:

Name	Data type	Description	Value range	Access
VendorID	UINT16	Identification of the manufacturer of the IO-Link device for validation purposes	E.g. 310 ifm electronic	ro [1]
DeviceID	UINT32	Identifier of the IO-Link device for validation	E.g. 1129 TCC501 (ifm temperature sensor)	ro [1]

[1] Read only

12.2.3.5.2 UpdateConfiguration

Type: Method

Description: Update port configuration

The method must always be executed with all input arguments, even if only one parameter is to be changed.

The method can only be executed if the variable **DeviceConfigurationDisabled** = **false**.

▶ Please note: Access to port and IO-Link device data → 71

Initial arguments:

Name	Data type	Description	Value range
CycleTime	DURATION	Cycle time between the IO-Link master and the IO-Link device (value in ms)	• 0: best possible cycle time • 1: 1 ms … • 132.8: 132.8 ms
ValidationAndBackup	BYTE	Validation of connected IO-Link devices and automatic storage/ restoration of IO-Link device parameter sets	• 0: No check and clear • 1: Type compatible V1.0 device • 2: Type compatible V1.1 device • 3: Type compatible V1.1 device with Backup + Restore • 4: Type compatible V1.1 device with Restore
PortMode	BYTE	Operating mode of pin 4 of the port	• 0: DEACTIVATED - Port is disabled • 1: IOL_MANUAL - Target mode based on user-specific configuration with validation of RID, vendor ID and device ID • 2: IOL_AUTOSTART - Target mode without validation of vendor ID and device ID (No Device Check); User-specific configuration of RID, Vendor ID and Device ID • 3: DI_C/Q (Pin4) – Digital input • 4: DO_C/Q (Pin4) – Digital output

Name	Data type	Description	Value range
Pin2Configuration	BYTE	Operating mode of pin 2 of the port	• 0: Not supported • 1: Digital Input - Digital input (ports X5...X8) • 2: Digital Output – Digital output (ports X1...X4) • 5: Power 2 - Port Class B (Ports X1...X4)
UseIODD	BOOLEAN	Use IODD for the connected IO-Link device	• FALSE: No • TRUE: Yes
DeviceID	UINT32	Identifier of the IO-Link device for validation	e.g. 1129: TCC501 (ifm temperature sensor)
VendorID	UINT16	Identification of the manufacturer of the IO-Link device for validation purposes	e.g. 310: ifm electronic

Initial arguments:

Name	Data type	Description	Value range
Status	UINT32	Processing status	• 0: Method successfully executed • -1: Error - Invalid configuration

12.2.3.6 Information

Type: Object

Description: Structure with status information of the port

Variables:

Name	Data type	Description	Value range	Access
ActualCycleTime	DURATION	Current cycle time between the IO-Link master and the IO-Link device (value in ms)	• 0: 0 ms … • 132.8: 132.8 ms	ro [1]
Baudrate	BYTE	Transmission rate between the IO-Link master and the IO-Link device	• 0: NOT_DETECTED - No communication on the port • 1: COM1 - Transmission rate 4.8 kBaud • 2: COM2 - Transmission rate 38.4 kBaud • 3: COM3 - Transmission rate 230.4 kBaud	ro [1]
Quality	BYTE	Validity of the process data • Bit 0: Status PDIn • Bit 1: Status PDOut	• 0: PDIn and PDOut valid • 1: PDIn invalid, PDOut valid • 2: PDIn valid, PDOut invalid • 3: PDIn and PDout invalid	ro [1]

Name	Data type	Description	Value range	Access
Status	BYTE	Status of the port	• 0: NO_DEVICE • 1: DEACTIVATED • 2: INCORRECT_DEVICE. Wrong RID, DID, VID or cycletime • 4: OPERATE • 5: DI_C/Q (Pin4) • 6: DO_C/Q (Pin4) • 254: PORT_FAULT. Power supply related problems	ro [1]

[1] Read only

12.2.3.7 SIOProcessData

Type: Object

Description: Structure with SIO process data of the port (digital inputs, digital outputs)

Variables:

Name	Data type	Description	Value range	Access
pin2in	BOOLEAN	Digital input - pin 2 NOTE! Available for ports only X1...X8	• FALSE: LOW • TRUE: HIGH	ro [1]
pin2out	BOOLEAN	Digital output – pin 2 (Pin2Configuration = Digital Output) NOTE! Available for ports only X1...X4	• FALSE: LOW • TRUE: HIGH	rw [2]
pin4in	BOOLEAN	Digital input – pin 4 (PortMode = DI)	• FALSE: LOW • TRUE: HIGH	ro [1]
pin4out	BOOLEAN	Digital output – pin 4 (PortMode = DO)	• FALSE: LOW • TRUE: HIGH	rw [2]

[1] Read only

[2] Reading and writing; Can only be changed if variable **DeviceConfigurationDisabled** = **false**; note: Access to port and IO-Link device data 71

12.2.4 IOLinkDeviceType

Type: IOLinkDeviceType

Description: Structure for the representation of an IO-Link device

Variables:

Name	Data type	Description	Value range	Access
DeviceID	UINT32	Identifier of the connected IO-Link device (index 0, subindex 0, byte 10...12)	• 0: IO-Link device not connected or port status not OPERATE • 1…16777215: Identification of the IO-Link device	ro [1]

Name	Data type	Description	Value range	Access
VendorID	UINT16	Identifier of the manufacturer of the connected IO-Link device (index 0, subindex 0, byte 8...9)	• 0: IO-Link device not connected or port status not OPERATE • 1…32767: ID of the manufacturer	ro [1]
HardwareRevision	STRING	Hardware version of the connected IO-Link device (index 22, subindex 0)	• Blank: IO-Link device not connected or index is not supported Variable • e.g. 'AB'	ro [1]
Manufacturer	Localized-Text	Manufacturer of the connected IO-Link device (index 16, subindex 0)	• "en", "***": Index is not supported • "en", "": IO-Link device not connected • E.g. "en", "ifm electronic gmbh	ro [1]
MinCycleTime	DURATION	Minimum cycle time supported by the connected IO-Link device (value in ms) (index 0, subindex 0, byte 2)	• 0: IO-Link device not connected or port status not OPERATE or INCORRECT_DEVICE • 1…132.8: 1…132.8 ms	ro [1]
Model	Localized-Text	Product name of the connected IO-Link device (index 18, subindex 0)	• "en","***": Index is not supported • "en","": IO-Link device not connected • E.g. "en","TN2531"	ro [1]
RevisionID	STRING	IO-Link revision of the connected IO-Link device (index 0, subindex 0, byte 4)	• Blank: IO-Link device not connected or port status not OPERATE or INCORRECT_DEVICE • 1.0: IO-Link Revision 1.0 • 1.1: IO-Link Revision 1.1	ro [1]
SerialNumber	STRING	Serial number of the connected IO-Link device (index 21, subindex 0)	• Blank: IO-Link device not connected • ***: Index is not supported • E.g. G0214280710	ro [1]
SoftwareRevision	STRING	Firmware version of the connected IO-Link device (index 23, subindex 0)	• Blank: IO-Link device not connected or index not supported E.g. ???	ro [1]

[1] Read only

Objects

Name	Description	Reference
ParameterSet	Structure with available parameters	ParameterSet 164
MethodSet	Structure with available methods	MethodSet 164
Alarms	Structure with available alarms	Alarms 167
General	Structure with IO-Link process data (inputs, outputs)	General 168
Identification	Structure with identification information of the IO-Link device	Identification 172

12.2.4.1 ParameterSet

Type: Object

Description: Structure with available parameters

Variables:

Name	Data type	Description	Value range	Access
ApplicationSpecificTag	STRING	Application-specific tag	E.g. Brewing1	rw [1]
FunctionTag	STRING	Function identifier	E.g. Temperature1	rw [1]
LocationTag	STRING	Location identifier	E.g. Plant 1 Machine 3	rw [1]
ProcessDataInput	BYTE ARRAY	IO-Link input data	• Blank: IO-Link device not connected or ProcessDataIn not supported Per byte: • 0x00…0xFF	ro [2]
ProcessDataOutput	BYTE ARRAY	IO-Link output data	• Blank: IO-Link device not connected or ProcessDataOut not supported Per byte: • 0x00…0xFF	rw [1]

[1] Reading and writing; Can only be changed if variable **DeviceConfigurationDisabled** = **false**; note: Access to port and IO-Link device data 71

[2] Read only

12.2.4.2 MethodSet

Type: Object

Description: Structure with available methods

Methods:

Name	Description	Reference
ReadISDU	Read ISDU data from an IO-Link device acyclically (ISDU – Index Service Data Units)	ReadISDU 164
WriteISDU	Write ISDU data from an IO-Link device acyclically (ISDU – Index Service Data Units)	WriteISDU 166

12.2.4.2.1 ReadISDU

Type: Method

Description: Read ISDU data from an IO-Link device acyclically (ISDU – Index Service Data Units)

The method must always be executed with all input arguments, even if only one parameter is to be changed.

The method can only be executed if the variable **DeviceConfigurationDisabled** = **false**.

▶ Please note: Access to port and IO-Link device data 71

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Initial arguments:

Name	Data type	Description	Value range
Index	UINT16	Index of the data object	0…65535
Subindex	BYTE	Subindex of the data object	• 0: all elements of the data object • 1…255

Initial arguments:

Name	Data type	Description	Value range
Result	STRING	Return value of the IO-Link device (value as HEX string, max. 64 characters) HEX string is output as a HEX array. Example: • HEX string: 0x0105ffaa • HEX array: [0x01, 0x05, 0xff, 0xaa]	• In case of successful processing: – content of the data object • In case of incorrect processing: – empty string
ErrorType	UINT16	Indication of occurring errors Structure: 0xEEAA • 0xEE: Error Code • 0xAA: Additional Code	• 0x0000: The method is executed without errors • 0x8000: Error in the device application - no details • 0x8011: Index not available • 0x8012: Subindex not available • 0x8020: Service temporarily unavailable • 0x8021: Service temporarily unavailable - device • 0x8022: Service temporarily unavailable - device • 0x8023: Access denied • 0x8030: Parameter value outside the valid range • 0x8031: Parameter value above the threshold • 0x8032: Parameter value below the threshold • 0x8033: Parameter length exceeded • 0x8034: Parameter length not reached • 0x8035: Function not available • 0x8036: Function temporarily unavailable • 0x8040: Invalid parameter set. • 0x8041: Inconsistent parameter set • 0x8082: Application not ready • 0x8101…0x81FF: Manufacturer-specific error (➔ IODD description)

Name	Data type	Description	Value range
Status	UINT32	Processing status	• 0: Method successfully executed • -1: Method already executed (same or different ReadISDU or WriteISDU command) • -2: IO-Link device not active (IO-Link device not connected or not in OPERATE status, or port operating mode is IO-Link) • -3: Method executed, but IO-Link device returned Error Code (details: ➔ Error Type)

12.2.4.2.2 WriteISDU

Type: Method

Description: Write ISDU data from an IO-Link device acyclically (ISDU – Index Service Data Units)

The method must always be executed with all input arguments, even if only one parameter is to be changed.

The method can only be executed if the variable **DeviceConfigurationDisabled** = **false**.

▶ Please note: Access to port and IO-Link device data ➔ 71

Initial arguments:

Name	Data type	Description	Value range
Index	UINT16	Index of the data object	0…65535
Subindex	BYTE	Subindex of the data object	• 0: all elements of the data object • 1…255
Data	STRING	Data to be written to the IO-Link device (value as HEX string, max. 64 characters) HEX array is passed as a HEX string. Example: • HEX array: [0x01, 0x05, 0xff, 0xaa] • HEX string: 0x0105ffaa	E.g. 0x0105ffaa

Initial arguments:

Name	Data type	Description	Value range
ErrorType	UINT16	Indication of occurring errors Structure: 0xEEAA • 0xEE: Error Code • 0xAA: Additional Code	• 0x0000: The method is executed without errors • 0x8000: Error in the device application - no details • 0x8011: Index not available • 0x8012: Subindex not available • 0x8020: Service temporarily unavailable • 0x8021: Service temporarily unavailable - device • 0x8022: Service temporarily unavailable - device • 0x8023: Access denied • 0x8030: Parameter value outside the valid range • 0x8031: Parameter value above the threshold • 0x8032: Parameter value below the threshold • 0x8033: Parameter length exceeded • 0x8034: Parameter length not reached • 0x8035: Function not available • 0x8036: Function temporarily unavailable • 0x8040: Invalid parameter set. • 0x8041: Inconsistent parameter set • 0x8082: Application not ready • 0x8101…0x81FF: Manufacturer-specific error (➔ IODD description)
Status	UINT32	Processing status	• 0: The method is executed without errors • -2: IO-Link device not active (IO-Link device not connected or not in OPERATE status, or port operating mode is IO-Link) • -3: Method executed, but IO-Link device returned Error Code (details: ➔ Error Type)

12.2.4.3 Alarms

Type: Object

Description: Structure with available alarms

Variables:

Name	Type	Description	Value range	Access
DeviceEvent	STRING	IO-Link event (14 ASCII characters) Structure: 0xIIMMTTVVSSCCCC • 0xII: Instance (IO-Link event qualifier - event trigger) • 0xMM: Mode (IO-Link event qualifier - event mode) • 0xTT: Type (IO-Link event qualifier - event type) • 0xVV: Validity (IO-Link event qualifier - validity) • 0xSS: Source (IO-Link event qualifier - event source) • 0xCCCC: Event Code (IO-Link event code) – NOTE! The bytes are swapped.	• Blank: IO-Link device not connected Instance: • 0x00: unknown • 0x01: PL (Physical Layer) • 0x02: DL (Data Layer) • 0x03: AL (Application Layer) • 0x04: APPL (Application) Mode: • 0x40: One-time event or warning (single shot) • 0xC0: Error disappeared • 0x80: Error appeared Type: • 0x10: Notification • 0x20: Warning • 0x30: Error Validity: • 0x00: Process data is valid • 0x40: Process data is invalid Source: • 0x00: IO-Link device • 0xFF: IO-Link master Event Code: • ➔ IODD description	ro [1]

[1] Read only

12.2.4.4 General

Type: Object

Description: Structure with IO-Link process data (inputs, outputs)

Variables:

Name	Data type	Description	Value range	Access
ProcessDataInput	BYTE ARRAY	IO-Link input data	• Blank: IO-Link device not connected or ProcessDataIn not supported Per byte: • 0x00…0xFF	ro [1]
ProcessDataOutput	BYTE ARRAY	IO-Link output data	• Blank: IO-Link device not connected or ProcessDataOut not supported Per byte: • 0x00…0xFF	rw [2]

[1] Read only

[2] Reading and writing; Can only be changed if variable **DeviceConfigurationDisabled** = **false**; note: Access to port and IO-Link device data ➔ 71

Methods:

Name	Description	Reference
ReadISDU	Read ISDU data from an IO-Link device acyclically (ISDU – Index Service Data Units)	ReadISDU 169
WriteISDU	Write ISDU data from an IO-Link device acyclically (ISDU – Index Service Data Units)	WriteISDU 170

12.2.4.4.1 ReadISDU

Type: Method

Description: Read ISDU data from an IO-Link device acyclically (ISDU – Index Service Data Units)

The method must always be executed with all input arguments, even if only one parameter is to be changed.

The method can only be executed if the variable **DeviceConfigurationDisabled** = **false**.

▶ Please note: Access to port and IO-Link device data 71

Initial arguments:

Name	Data type	Description	Value range
Index	UINT16	Index of the data object	0…65535
Subindex	BYTE	Subindex of the data object	• 0: all elements of the data object • 1…255

Initial arguments:

Name	Data type	Description	Value range
Result	STRING	Return value of the IO-Link device (value as HEX string, max. 64 characters) HEX string is output as a HEX array. Example: • HEX string: 0x0105ffaa • HEX array: [0x01, 0x05, 0xff, 0xaa]	• In case of successful processing: – content of the data object • In case of incorrect processing: – empty string

Name	Data type	Description	Value range
ErrorType	UINT16	Indication of occurring errors Structure: 0xEEAA • 0xEE: Error Code • 0xAA: Additional Code	• 0x0000: The method is executed without errors • 0x8000: Error in the device application - no details • 0x8011: Index not available • 0x8012: Subindex not available • 0x8020: Service temporarily unavailable • 0x8021: Service temporarily unavailable - device • 0x8022: Service temporarily unavailable - device • 0x8023: Access denied • 0x8030: Parameter value outside the valid range • 0x8031: Parameter value above the threshold • 0x8032: Parameter value below the threshold • 0x8033: Parameter length exceeded • 0x8034: Parameter length not reached • 0x8035: Function not available • 0x8036: Function temporarily unavailable • 0x8040: Invalid parameter set. • 0x8041: Inconsistent parameter set • 0x8082: Application not ready • 0x8101…0x81FF: Manufacturer-specific error (➔ IODD description)
Status	UINT32	Processing status	• 0: Method successfully executed • -1: Method already executed (same or different ReadISDU or WriteISDU command) • -2: IO-Link device not active (IO-Link device not connected or not in OPERATE status, or port operating mode is IO-Link) • -3: Method executed, but IO-Link device returned Error Code (details: ➔ Error Type)

12.2.4.4.2 WriteISDU

Type: Method

Description: Write ISDU data from an IO-Link device acyclically (ISDU – Index Service Data Units)

The method must always be executed with all input arguments, even if only one parameter is to be changed.

The method can only be executed if the variable **DeviceConfigurationDisabled** = **false**.

▶ Please note: Access to port and IO-Link device data ➔ 71

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Initial arguments:

Name	Data type	Description	Value range
Index	UINT16	Index of the data object	0…65535
Subindex	BYTE	Subindex of the data object	• 0: all elements of the data object • 1…255
Data	STRING	Data to be written to the IO-Link device (value as HEX string, max. 64 characters) HEX array is passed as a HEX string. Example: • HEX array: [0x01, 0x05, 0xff, 0xaa] • HEX string: 0x0105ffaa	E.g. 0x0105ffaa

Initial arguments:

Name	Data type	Description	Value range
ErrorType	UINT16	Indication of occurring errors Structure: 0xEEAA • 0xEE: Error Code • 0xAA: Additional Code	• 0x0000: The method is executed without errors • 0x8000: Error in the device application - no details • 0x8011: Index not available • 0x8012: Subindex not available • 0x8020: Service temporarily unavailable • 0x8021: Service temporarily unavailable - device • 0x8022: Service temporarily unavailable - device • 0x8023: Access denied • 0x8030: Parameter value outside the valid range • 0x8031: Parameter value above the threshold • 0x8032: Parameter value below the threshold • 0x8033: Parameter length exceeded • 0x8034: Parameter length not reached • 0x8035: Function not available • 0x8036: Function temporarily unavailable • 0x8040: Invalid parameter set. • 0x8041: Inconsistent parameter set • 0x8082: Application not ready • 0x8101…0x81FF: Manufacturer-specific error (➔ IODD description)

Name	Data type	Description	Value range
Status	UINT32	Processing status	• 0: The method is executed without errors • -2: IO-Link device not active (IO-Link device not connected or not in OPERATE status, or port operating mode is IO-Link) • -3: Method executed, but IO-Link device returned Error Code (details: Error Type)

12.2.4.5 Identification

Type: Object

Description: Structure with identification information of the IO-Link device

Variables:

Name	Data type	Description	Value range	Access
ApplicationSpecificTag	STRING	Application-specific tag	E.g. Brewing1	rw [1]
FunctionTag	STRING	Function identifier	E.g. Temperature1	rw [1]
LocationTag	STRING	Location identifier	E.g. Plant 1 Machine 3	rw [1]
DeviceID	UINT32	Identifier of the connected IO-Link device (index 0, subindex 0, byte 10...12)	• 0: IO-Link device not connected or port status not OPERATE • 1…16777215: Identification of the IO-Link device	ro [2]
VendorID	UINT16	Identifier of the manufacturer of the connected IO-Link device (index 0, subindex 0, byte 8...9)	• 0: IO-Link device not connected or port status not OPERATE • 1…32767: ID of the manufacturer	ro [2]

[1] Reading and writing; Can only be changed if variable **DeviceConfigurationDisabled** = **false**; note: Access to port and IO-Link device data 71

[2] Read only

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