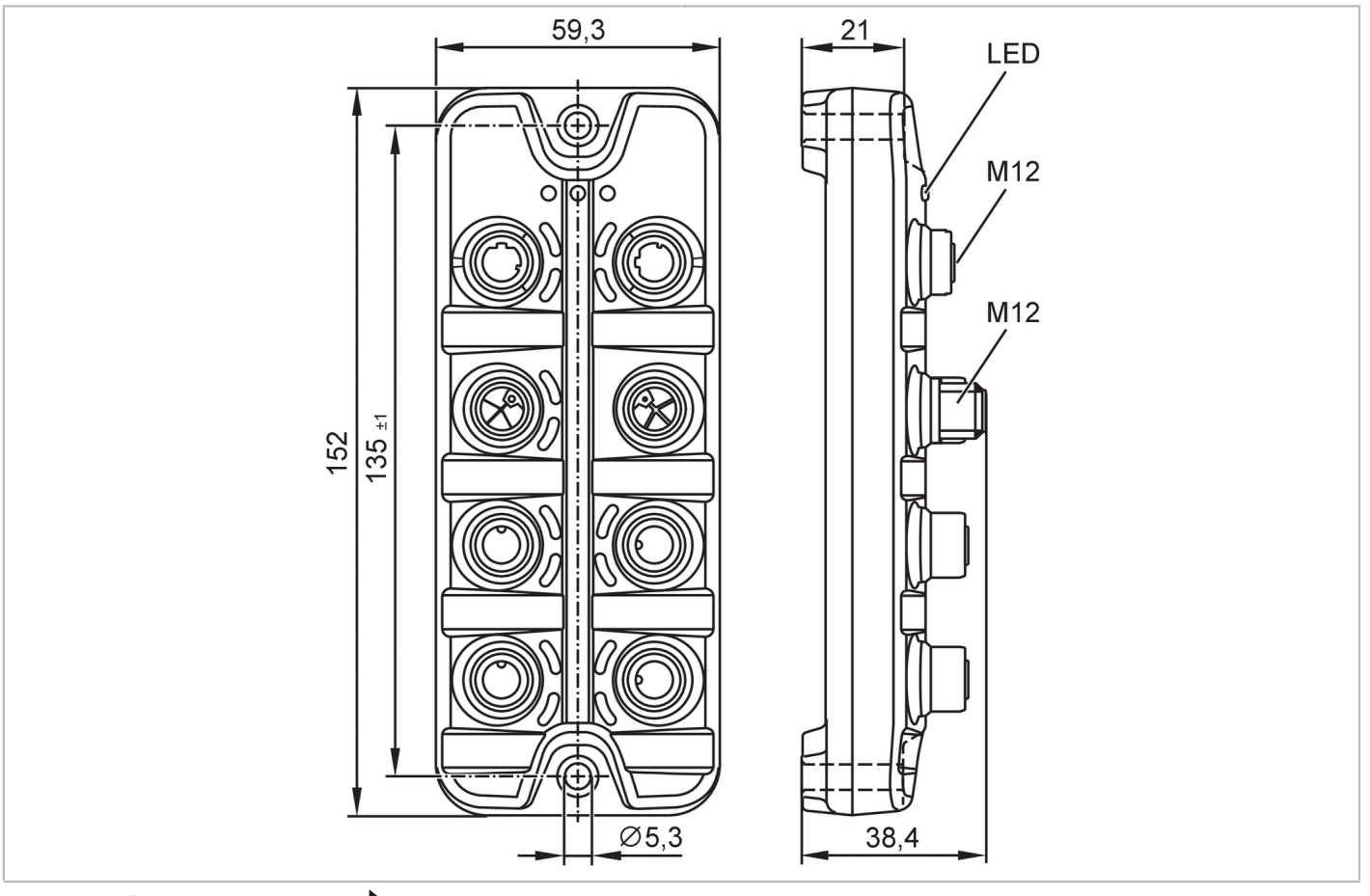
AL1431

IO-Link master with EtherCAT interface

IO-Link Master PFL EC 4P 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
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)
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		12; (configurable)
Number of inputs and outputs		Number of digital inputs: 4; Number of digital outputs: 8

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IO-Link master with EtherCAT interface

IO-Link Master PFL EC 4P IP69K

Inputs			
Number of digital inputs		4; (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		8; (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 - EtherCAT			
Transmission standard		100Base-TX	
Transmission rate		100 MBit/s	
Protocol		EtherCAT	
Factory settings		MAC address: see type label	
Note on interfaces		AoE (ADS over EtherCAT)	
		CoE (CANopen over EtherCAT)	
		EoE (Ethernet over EtherCAT)	
		FoE (File Access over EtherCAT)	
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 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)	
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	

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IO-Link master with EtherCAT interface

IO-Link Master PFL EC 4P IP69K

Mechanical data		
Weight	[g]	322.4
Housing		rectangular
Type of mounting		Backplane mounting
Dimensions	[mm]	152 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

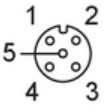


IN / OUT XF1, XF2

1	TX +
2	RX +
3	TX -
4	RX -
5	not used

Electrical connection - IO-Link

Connector: 4 x M12; coding: A; Contacts: 5; sealing: EPDM



IO-Link Port Class B X1...X4

1	Sensor supply (US) L +
2	Actuator supply / Digital output (UA) L+
3	Sensor supply (US) L-
4	C/Q IO-Link
5	Actuator supply (UA) L-

Electrical connection - voltage supply IN

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



XD1

1	+ 24 V DC (US) brown
2	GND (UA) white
3	GND (US) blue
4	+ 24 V DC (UA) black
5	FE grey

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IO-Link master with EtherCAT interface

IO-Link Master PFL EC 4P IP69K

Electrical connection - voltage supply OUT

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



XD2	
1	+ 24 V DC (US) brown
2	GND (UA) white
3	GND (US) blue
4	+ 24 V DC (UA) black
5	FE grey

GB

Operating instructions

IO-Link master with EtherCAT interface PerformanceLine

AL1431

11489156 / 02 02 / 2024

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1 Preliminary note

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

1.1 Legal and copyright information

© All rights reserved by ifm electronic gmbh. No part of these instructions may be reproduced and used without the consent of ifm electronic gmbh.

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

- EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

1.2 Symbols used

✓	Requirement
▶	Instructions
▷	Reaction, result
[...]	Designation of keys, buttons or indications
→	Cross-reference
	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 Safety symbol on the device



Safety symbol on the device:

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

1.5 Change history

Issue	Subject	Date
00	New creation of the document	11 / 2022
01	Added: Chapter EtherCAT (→ 🗋 35)	05 / 2023
02	• Corrected: Object dictionary, Configuration Area (0x8000 - 0x8FFF) (→ 🗋 62) • Added: EtherCAT trademark, Legal and copyright information (→ 🗋 4)	02 / 2024

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.

3 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 EtherCAT control system

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

4 Function

4.1 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 B) for connection of IO-Link devices

4.1.1 IO-Link supply

The device offers supplies for 4 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.

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).

4.1.2 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).

4.2 Parameter setting

Parameter setting with ifm moneo and ifm IoT Core Visualizer is only possible if the Ethernet over EtherCAT (EoE) protocol is activated and configured on the EtherCAT master and the EtherCAT slave.

▶ Observe the notes: Using Ethernet over EtherCAT (EoE) (→ 🗋 35)

The device can be configured with the following options:

- Parameter setting software
  - ifm moneo OS + ifm moneo|configure
  - ifm moneo|configure free
- ifm IoT Core
  - ifm IoT Core Visualizer
- EtherCAT
  - Projection software

4.3 Visual indication

The device displays the following indications:

- Status and error indication of the EtherCAT 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 B)

4.4 EtherCAT

- Device profile: Module device profile (EtherCAT slave)
- Supported protocols:
  - AoE (ADS over EtherCAT)
  - CoE (CANopen over EtherCAT)
  - EoE (Ethernet over EtherCAT)
  - File Access over EtherCAT (FoE)
- Device description: ESI file

4.5 ifm IoT Core

Access to the functions of ifm IoT Core is only possible if the Ethernet over EtherCAT (EoE) protocol is activated and configured on the EtherCAT master and the EtherCAT slave.

▶ Observe the notes: Using Ethernet over EtherCAT (EoE) (→ 🗋 35)

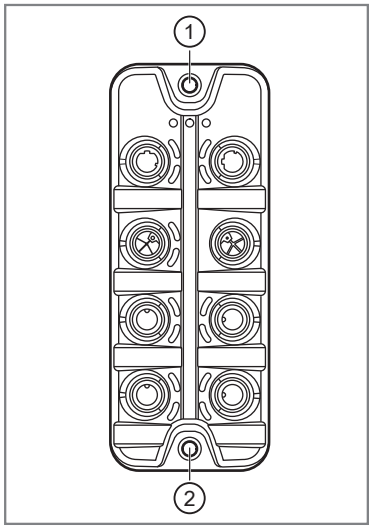
- Mapping of the data, events and services of the device to an object model (ifm IoT Core)
- Integration of the device in IIoT applications
- Access to the ifm IoT Core:
  - Browser-based interface (IoT Core Visualizer)
- Supported protocols: HTTP, TCP, JSON

4.6 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).

5 Installation

5.1 Overview



1: Upper mounting lug
2: Lower mounting lug

5.2 Install device

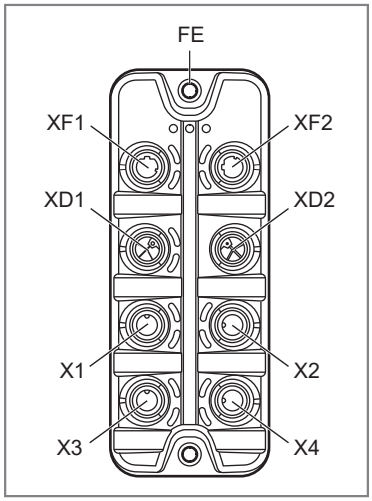
- ▶ Disconnect the power of the machine before installation.
- ▶ Use a flat mounting surface for installation.
- ▶ Observe the maximum tightening torque.

▶ Fasten the module onto the mounting surface using two M5 screws and washers (tightening torque: 1.8 Nm).

▶ Observe the notes on how to earth the device: Ground connection (→ 🗋 13)

6 Electrical connection

6.1 Overview



FE: Functional earth (FE)
XF1: Ethernet port 1 (EtherCAT)
XF2: Ethernet port 2 (EtherCAT)
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)

6.2 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 unit is only suitable for operation using SELV/PELV voltages.

▶ Take information about IO-Link configuration into consideration!

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

▶ Please observe the required precautions against electrostatic discharge!

By means of basic insulation according to EN61010-1, the circuits are isolated from each other and from device surfaces that could be touched (secondary circuit with max. 30 V DC, supplied from mains circuit up to 300 V overvoltage category II).

By means of basic insulation according to EN61010-1, the communication interfaces are separated from each other and from device surfaces that could be touched (secondary circuit with V DC maximum, supplied from mains circuit up to 300 V overvoltage category II). They are designed for network environment 0 according to IEC TR62102).

6.2.1 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 CYJV or PVVA with a minimum temperature of 80 °C (75 °C in case of a maximum ambient temperature of 40 °C).

6.3 Ethernet ports

The device is connected to the EtherCAT network via the Ethernet ports (e.g. EtherCAT control).

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).

Parameter setting with ifm moneo and ifm IoT Core Visualizer is only possible if the Ethernet over EtherCAT (EoE) protocol is activated and configured on the EtherCAT master and the EtherCAT slave.

▶ Observe the notes: Using Ethernet over EtherCAT (EoE) (→ 🗋 35)

Wiring:



1: TX +
2: RX +
3: TX -
4: RX -
5: not used

▶ Use a free port (XF1, XF2) to connect the device to the EtherCAT network.

▶ For connection, use M12 connectors (minimum protection rating: IP 65 / IP 66 / IP 67 / IP 69K).

▶ Tighten the cable plug using 1.3 ± 0.1 Nm.

6.4 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: Sensor supply L+ (US)
2: Digital output / Actuator supply L+ (UA)
3: Sensor supply L- (US)
4: C/Q IO-Link
5: Actuator supply L- (UA)

6.4.1 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: IP 65 / IP 66 / IP 67 / IP 69K).

▶ Tighten the cable plug using 1.3 ± 0.1 Nm.

6.4.2 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 Design Guideline: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: IP 65 / IP 66 / IP 67 / IP 69K).

▶ Tighten the cable plug using 1.3 ± 0.1 Nm.

6.5 Ground connection

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

To ensure the protection of the device against electrical interference and to ensure the safe function of the device, the housing has to be connected to the GND of the installation using the shortest possible route.

▶ Ground the device via the mounting screw of the upper mounting lug.

▶ Optional: Connect pin 5 of port XD1 or XD2 via an L-coded M12 connector to the FE socket of the power supply.

6.6 Voltage supply

The device is connected to the supply voltage US via port XD1.

The supply voltage US supplies the device and the devices connected to ports X1...X4 with voltage.

Optionally, an additional supply voltage UA can be fed to the device via port XD1.

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 (→ 🗋 14)

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!

Port XD1 is equipped with overvoltage protection (US).

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

Wiring:



1: +24 V DC (US)
2: GND (UA)
3: GND (US)
4: +24 V DC (UA)
5: FE

▶ Disconnect power.

▶ Connect the device via port XD1 to the supply voltage US with 24 V DC (20...30 V SELV/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).

▶ Optional: Connect the device via port XD1 to the supply voltage UA with 24 V DC (20...30 V SELV/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: IP 65 / IP 66 / IP 67 / IP 69K).

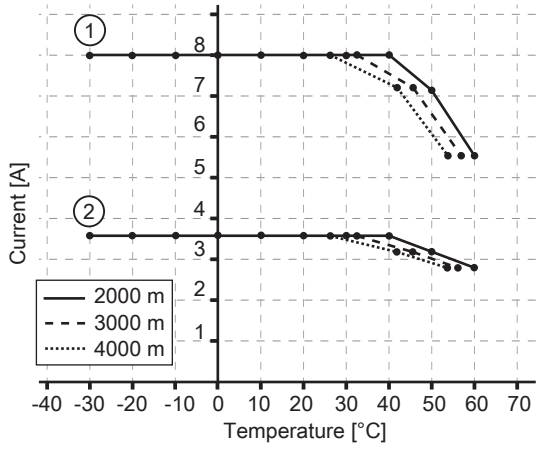
▶ Tighten the cable sockets according to the torque specifications indicated by the cable vendor. Maximum permissible tightening torque: 0.8 Nm

6.6.1 Derating behaviour

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

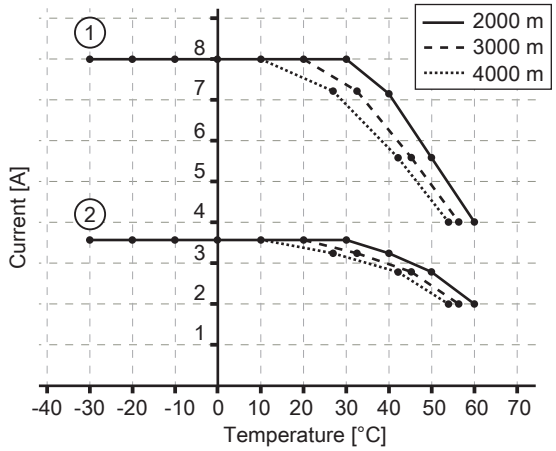
The derating measurements were carried out under the following conditions: Supply voltage US / UA: 24 V DC

6.6.1.1 Derating without daisy chain

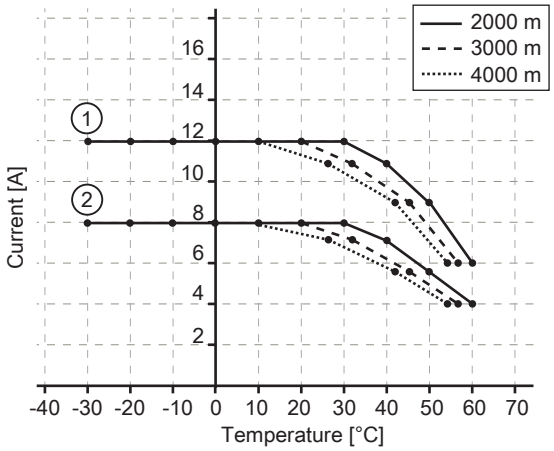


1: I_{UA} on port X1...X4
2: I_{US} on port X1...X4

6.6.1.2 Derating with daisy chain



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

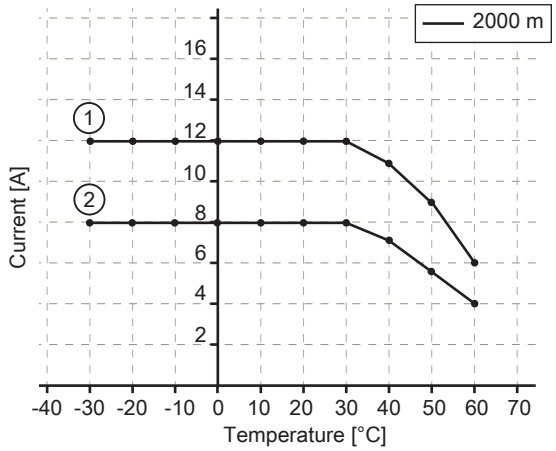


1: $I_{US\text{-}daisy\text{-}chain}$ on port XD2
2: $I_{UA\text{-}daisy\text{-}chain}$ on port XD2

Example:

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

6.7 Voltage output

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

Wiring:



1: +24 V DC (US)
2: GND (UA)
3: GND (US)
4: +24 V DC (UA)
5: FE

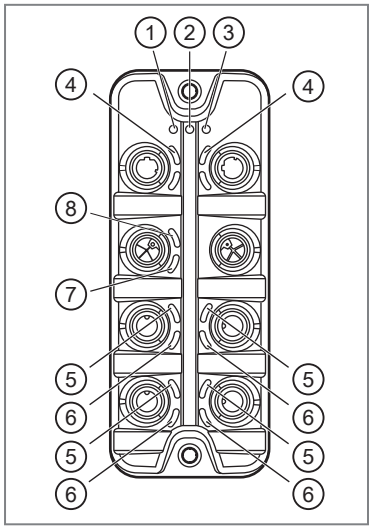
▶ Optional: Connect an additional device to port XD2.

▶ Use an L-coded M12 connector (minimum protection rating: IP 65 / IP 66 / IP 67 / IP 69K).

▶ Tighten the cable plug using 1.3 ± 0.1 Nm.

7 Operating and display elements

7.1 LEDs



1: Status: RDY
2: Status: ERR
3: Status: RUN
4: EtherCAT: L/A
5: IO-Link:
6: IO-Link: UA DO
7: Power IN: UA
8: Power IN: US

7.1.1 Status

LED	Description	Colour	State	Description
RDY	Gateway status	Green	Off	Gateway: Not active or reboots
			Flashes (5 Hz)	Gateway: Error
			Flashes (200 ms on, 800 ms off)	Gateway: Firmware update running
			On	Gateway: OK
RUN	EtherCAT status	-	Off	Device in “INIT” state
		Green	Flashes (2.5 Hz)	Device in “PRE-OPERATIONAL” state
			Flashes (200 ms on, 1000 ms off)	Device in “SAFE-OPERATIONAL” state
			Flashes (10 Hz)	Device starts and is not yet in the “INIT” state or device is in the “BOOTSTRAP” state
			On	Device in “OPERATIONAL” state
ERR	Error indication	-	Off	No error
		Red	Flashes (10 Hz)	Boot error
			Flashes (200 ms on, 200 ms off, 200 ms on, 1000s off)	Watchdog error (EtherCAT or process data)
			Flashes (200 ms on, 1000 ms off)	Local error
			Flashes (2.5 Hz)	Invalid configuration
			On	Error in application controller

7.1.2 Ethernet

LED	Description	Colour	State	Description
L/A	Status of the connection	Green	Off	No Ethernet connection
			Flashes	Data transmission

LED	Description	Colour	State	Description
L/A	Status of the connection	Green	On	Ethernet connection established

7.1.3 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

7.1.4 IO-Link ports (class B)

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)	Port configuration error or short circuit / overload at US
			On	Transmission error
UA/DO	Status of the IO-Link port (pin 2)	Yellow	Off	Digital input: Pin 2 (UA) = OFF
			On	Digital input: Pin 2 (UA) = ON
		Green	Off	IO-Link type A supply: Pin 2 (UA) = OFF
			On	IO-Link type B supply: Pin 2 (UA) = ON (not switchable)
		Red	On	Error: Overcurrent or undervoltage

8 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.

9 Settings

9.1 IoT Core Visualizer

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

9.1.1 Starting the IoT Core Visualizer

Access to the functions of ifm IoT Core is only possible if the Ethernet over EtherCAT (EoE) protocol is activated and configured on the EtherCAT master and the EtherCAT slave.

▶ Observe the notes: Using Ethernet over EtherCAT (EoE) (→ 🗋 35)

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 EtherCAT port (XF1, XF2) of the device.

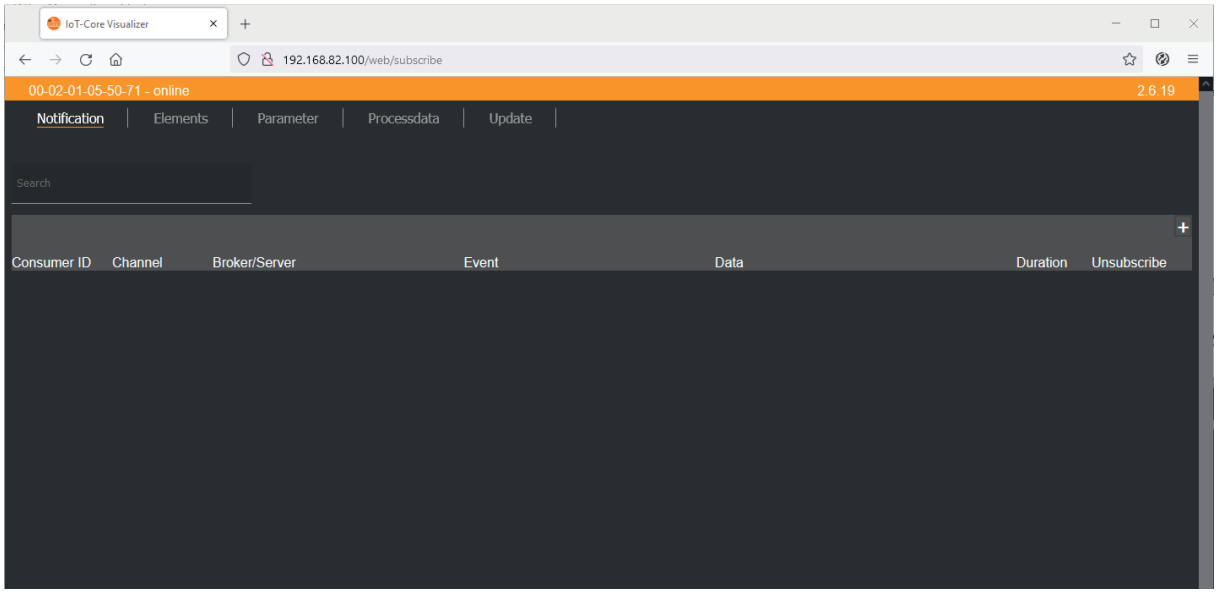
✓ Ethernet over EtherCAT (EoE) has been activated and configured.

✓ The device has a valid IP configuration.

▶ 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:

- [Notification]: Not available
- [Elements]: Searching for elements of the IoT Core (→ 🗋 21)
- [Parameter]: Configuring the device (→ 🗋 22)
- [Processdata]: Accessing the process data (→ 🗋 29)
- [Update]: Update firmware (→ 🗋 34)

9.1.2 Searching for elements of the IoT Core

The [Elements] menu page allows you to search the IoT Core tree for elements with specific properties and output the results.

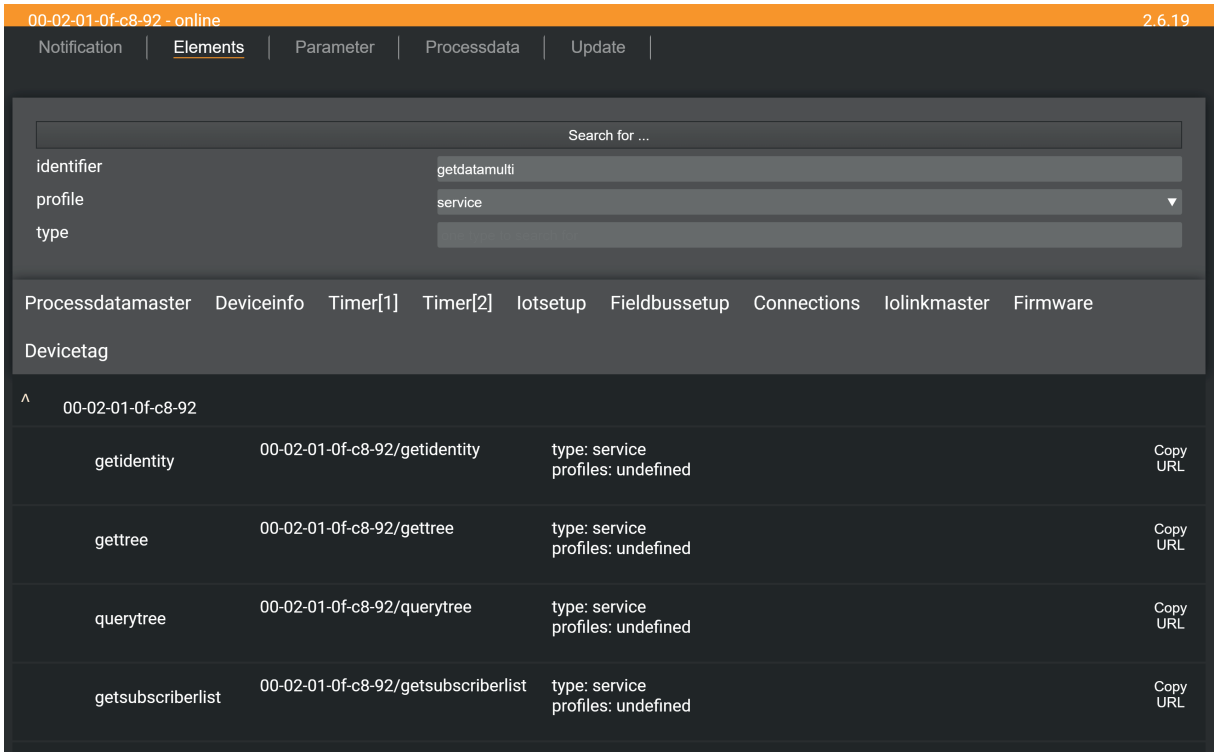
The following properties can be searched for:

- [identifier]: Name of the element
- [profile]: Profile of the element
- [type]: Type of the element

Requirements:

✓ IoT Core Visualizer has been started.

✓ The [Elements] menu is active.



▶ Select the search criteria for the required element in the selection lists [identifier], [profile] and [type].

▶ Click on [Search for…].

▷ IoT Core Visualizer searches the device description for elements with selected search criteria.

▷ The result list shows all the elements found.

9.1.3 Configuring the device

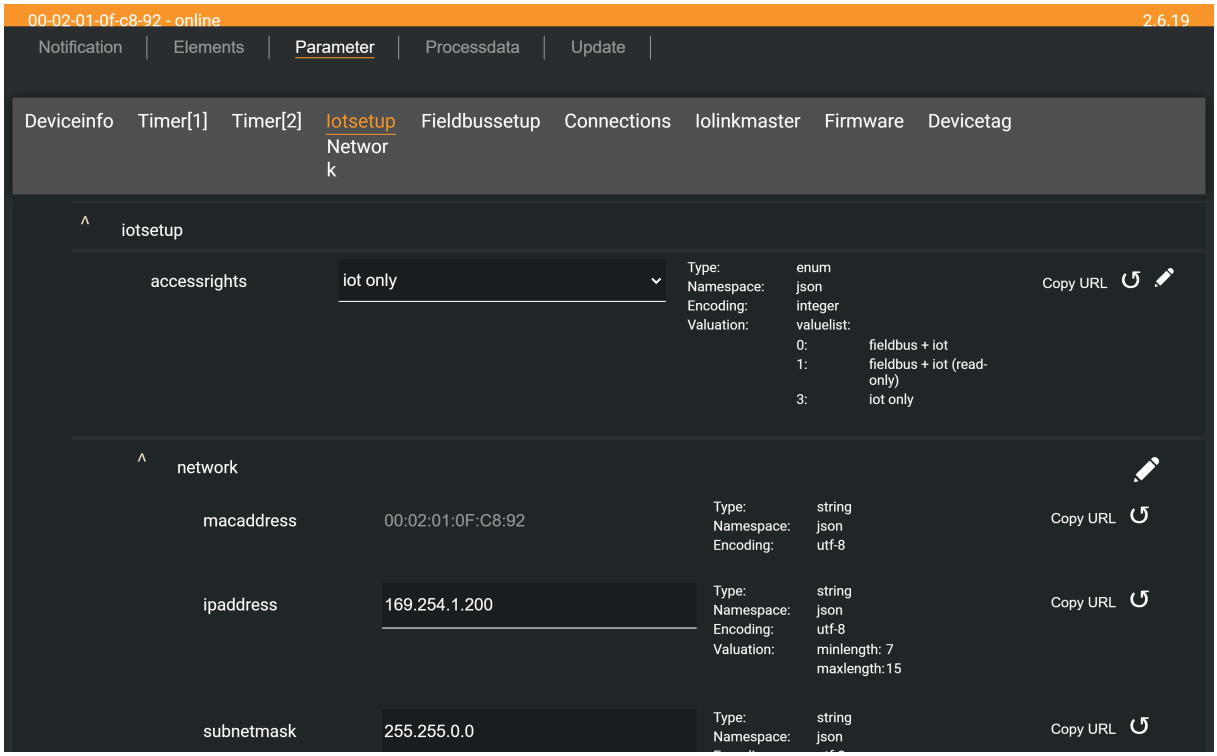
The [Parameter] menu page provides access to the configuration options of the device.

Requirements:

✓ IoT Core Visualizer has been started.

▶ Select the [Parameter] menu.

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



9.1.3.1 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”).

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 and write access rights to parameters and process data • 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 projection software and in the IoT Core Visualizer are set to the value *fieldbus + iot*, the parameter values set on the fieldbus side always apply.
- For exclusive access to the device via the IoT Core Visualizer, set the access rights to the value *iot only* and set the access rights to Keep settings in the fieldbus projection software.
- If the access rights in the IoT Core Visualizer are set to the value *fieldbus + 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 *fieldbus + iot* in the fieldbus projection software.

Requirements:

✓ IoT Core Visualizer has been started.

✓ The [Parameter] menu is active.

▶ Select the [iotsetup] submenu.

9.1.3.2 Configuring the interface to the monitoring software

To enable transmission of the process data of the IO-Link master to the monitoring software (e.g. ifm moneo suite), the interface must be configured accordingly.

Available parameters:

Name	Description	Value range	Access
[smobip]	IP address of the interface to the monitoring software	e.g., 255.255.255.255 (default)	rw [1]
[smobport]	Port number of the interface to the monitoring software	• 0: 0 … • 35100: 35100 (default) … • 65535: 65535	rw [1]
[smobinterval]	Interval for data transmission to the monitoring software	• disabled: No transmission (default) • 500: 500 ms … • 2147483647: 2147483647 ms	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.

▶ Set the parameters of the interface.

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

▷ Interface to the monitoring software has been set.

9.1.3.3 Configuring the EtherCAT interface

The EtherCAT interface is used to connect the device to the EtherCAT network.

Available parameters:

Parameter	Description	Value range	Access
[hostname]	EtherCAT hostname	e.g., alxx3x	rw [1]

Parameter	Description	Value range	Access
[fieldbusfirmware]	Firmware of the fieldbus	e.g., 4.7.0.3 (EtherCAT Slave)	ro

[1] Read and write

Requirements:

✓ IoT Core Visualizer has been started.

✓ The [Parameter] menu is active.

▶ Select the [Fieldbussetup] submenu.

▷ The menu page shows the current settings.

▶ Set the parameters of the EtherCAT interface.

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

▷ The EtherCAT interface of the device has been configured.

9.1.3.4 Setting the interval of the timer

Available parameters:

Name	Description	Value range	Access
[interval]	Interval of the counter (value in ms)	• 0: deactivated • 500: 500 ms … • 2147483647: 2147483647 ms	rw [1]

[1] Read and write

Requirements:

✓ IoT Core Visualizer has been started.

✓ The [Parameter] menu is active.

▶ Select the [Timer[n]] submenu (n: 1…2).

▷ The menu page shows the current settings.

▶ Set the parameters.

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

▷ The intervals of the counter have been set.

9.1.3.5 Setting the operating mode pin 4 (US)

Pin 4 of ports X1...X4 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 disabled • di: Digital input • do: Digital output • io-link: IO-Link data	rw [1]

Name	Description	Value range	Access
[mastercycletime_actual]	Current cycle time of the data transmission between the port and the IO-Link device (value in microseconds)	• 0: Best possible cycle time • 1: 1 µs … • 132800: 132800 µs	ro
[comspeed]	Current transmission rate between the port and the 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

[1] Read and write

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 transmission between the port and the IO-Link device (value in microseconds)	• 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…4).

▷ 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.

9.1.3.6 Setting the operating mode pin 2 (UA)

Pin 2 of ports 1…4 supports the following operating modes:

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

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…4).

▶ Set the parameters.

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

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

9.1.3.7 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)

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…4).

▶ Set the parameters.

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

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

9.1.3.8 Configuring device validation and data storage

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

The following options are available:

Option	Validation of the connected IO-Link device	Backup of parameter values	Restore of parameter values
[No check and clear]	No	No	No
[Type compatible V1.0 device]	Yes, test compatibility with IO-Link standard V1.0	No	No
[Type compatible V1.1 device]	Yes, test compatibility with IO-Link standard V1.1	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 backup of parameter values; Changes to 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 parameters [Vendor ID] or [Device ID] are changed in online mode, the data memory is deleted and the parameter values of the connected IO-Link device are backed-up again 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	• 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]
[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.

▶ Select the [Iolinkmaster] > [port[x]] submenu (x: 1…4).

▶ 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.

9.1.3.9 Setting data transmission to the monitoring software

Available parameters:

Name	Description	Value range	Access
[senddatatosmob]	Enable / Disable the transmission of process data of the port to the monitoring software	• disabled: Process data not transmitted • enabled: Process data transmitted	rw [1]

[1] Read and write

Requirements:

✓ IoT Core Visualizer has been started.

✓ The [Parameter] menu is active.

✓ Interface to the monitoring software has been configured.

▶ Select the [Iolinkmaster] > [port[x]] submenu (x: 1…4).

▷ The menu page shows the current settings.

▶ Set the parameters.

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

▷ Data transmission to the monitoring software has been set.

9.1.3.10 Reading the firmware version

Available information:

Name	Description	Value range	Access
[version]	Firmware version	4.7.0.3 (EtherCAT Slave)	ro

Requirements:

✓ IoT Core Visualizer has been started.

✓ The [Parameter] menu is active.

▶ Select the [Firmware] submenu.

▷ The menu page shows available information.

9.1.3.11 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.

▶ 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.

9.1.3.12 Reading device information

Available information:

Name	Description	Value range	Access
[productcode]	Article number	AL1431	ro
[devicefamily]	Family of the device	IO-Link master	ro
[vendor]	Manufacturer or vendor	ifm electronic gmbh	ro
[swrevision]	Firmware version	e.g., AL1x3x_cn_ec_v3.5.56	ro
[hwrevision]	Hardware version	e.g., AA	ro
[bootloaderrevision]	Bootloader version	e.g., AL1xxx_bl_f7_v2.4.1	ro
[serialnumber]	Serial number	e.g., 000194610104	ro

Requirements:

✓ IoT Core Visualizer has been started.

✓ The [Parameter] menu is active.

▶ Select the [Deviceinfo] submenu.

▷ The menu page shows the device information.

9.1.4 Accessing the process data

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

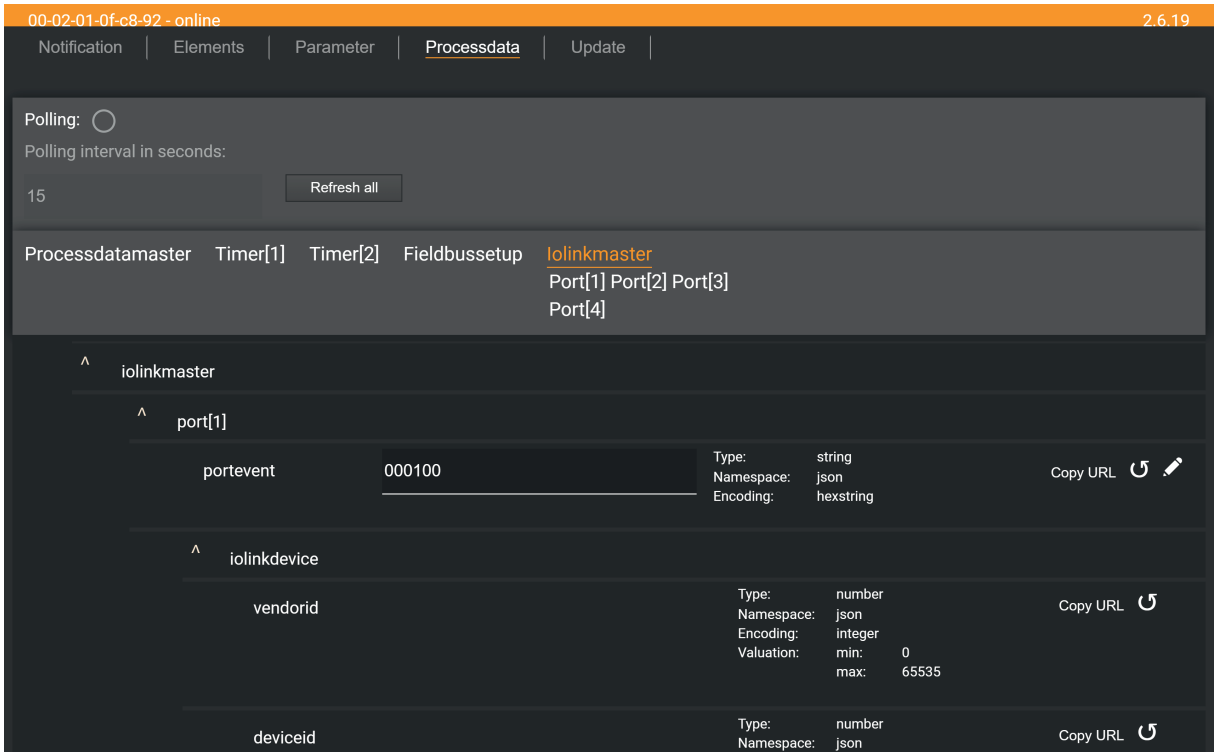
Requirements:

✓ 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.

9.1.4.1 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
[voltage]	Current voltage of the device supply US (value in millivolts)	• 0: 0 mV … • 4000: 4000 mV	ro
[supervisionstatus]	Status of the voltage supply US	• ok: No error • fault: Error	ro
[current_ua]	Present current intensity of the device supply UA (value in milliamps)	• 0: 0 mA … • 4000: 4000 mA	ro
[supervisionstatus_ua]	Status of the voltage supply UA	• ok: No error • fault: Error	ro

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

Requirements:

✓ IoT Core Visualizer has been started.

✓ The [Processdata] menu is active.

▶ Select the [Processdatamaster] submenu.

▷ Menu page shows the status and diagnostic information of the device.

9.1.4.2 Setting the counter value

Available parameters:

Name	Description	Value range	Access
[counter]	Value of the counter x (x: 1…2)		rw [1]

[1] Read and write

Requirements:

✓ IoT Core Visualizer has been started.

✓ The [Processdata] menu is active.

▶ Select the [Timer[x]] submenu (x: 1…2).

▷ The menu page shows the current settings.

▶ Enter the counter value.

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

▷ The new counter value is active.

9.1.4.3 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
[current_ua]	Present current intensity of the voltage supply UA (value in milliamps)	• 0: 0 mA … • 2000: 2000 mA	ro
[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

Requirements:

✓ IoT Core Visualizer has been started.

✓ The [Processdata] menu is active.

▶ Select the [Iolinkmaster] > [port[x]] > [powercontrol] submenu (x: 1…4).

▷ The menu page shows status and diagnostic information.

9.1.4.4 Reading and writing input and output data

Available parameters:

- 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 • 0x1: HIGH Operating mode IO-Link • Input value in hexadecimal representation	ro
[iolinkdevice] > [pdout]	Output data (pin 4)	Operating mode DO • 0x00: LOW • 0x1: HIGH Operating mode IO-Link • Output value in hexadecimal representation	rw [1] [2]

[1] Read and write

[2] The parameter can only be changed if no connection to the fieldbus controller is active

Requirements:

✓ IoT Core Visualizer has been started.

✓ The [Processdata] menu is active.

▶ Select the [Iolinkmaster] > [port[x]] submenu (x: 1…4).

▷ 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.

9.1.4.5 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
[deviceid]	Device ID of the IO-Link device	0…16777215	ro
[productname]	Article number of the IO-Link device	e.g. TCC501	ro
[serial]	Serial number of the IO-Link device (12 digits)	e.g., 000008500706	ro
[status]	State of the IO-Link device	• state not connected: Device is not connected • state preoperate: Device is in PREOPERATE state • state operate: Device is in OPERATE state • state communication error: Device has communication error	ro
[applicationspecifictag]	Application-specific tag	***: *** (Default)	rw

Requirements:

✓ IoT Core Visualizer has been started.

✓ The [Processdata] menu is active.

▶ Select the [Iolinkmaster] > [port[x]] > [iolinkdevice] submenu (x: 1…4).

▷ 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.

9.1.4.6 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.

An IO-Link event message has the following structure:

Byte 0…1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
Event Code	Source	Validity	Type	Mode	Instance

Legend

• Instance	IO-Link Event Qualifier: Trigger	1 byte	• 0x00: unknown • 0x01: PL (Physical Layer) • 0x02: DL (Data Layer) • 0x03: AL (Application Layer) • 0x04: APPL (Application)
• Mode	IO-Link Event Qualifier: Event trigger	1 byte	• 0x40: One-time event or warning (single shot) • 0xC0: Error disappeared • 0x80: Error appeared
• Type	IO-Link Event Qualifier: Event category	1 byte	• 0x10: Notification • 0x20: Warning • 0x30: Error
• Validity	Validity of the process data	1 byte	• 0x00: Valid • 0x40: Invalid
• Source	IO-Link Event Qualifier: Event source	1 byte	• 0x00: IO-Link device • 0xFF: IO-Link master
• Event Code	IO-Link event code (bytes are swapped!)	2 bytes	→ IO-Link specification

Available parameters:

Name	Description	Value range	Access
[iolinkevent]	IO-Link event	See above	ro

Requirements:

✓ IoT Core Visualizer has been started.

✓ The [Processdata] menu is active.

▶ Select the [Iolinkmaster] > [port[x]] > [iolinkdevice] submenu (x: 1…4).

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

9.1.4.7 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	DeviceStatus: • 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 disabled • 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

Requirements:

✓ IoT Core Visualizer has been started.

✓ The [Processdata] menu is active.

▶ Select the [Iolinkmaster] > [port[x]] submenu (x: 1…4).

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

9.1.5 Update firmware

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

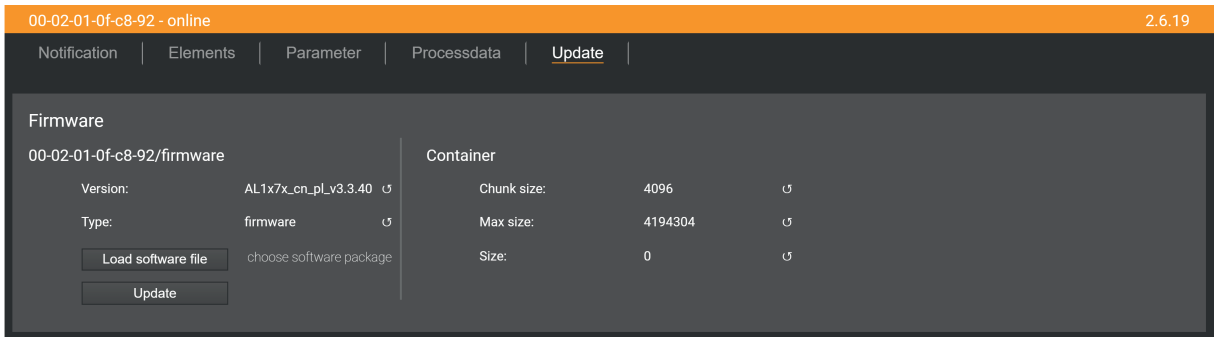
Requirements:

✓ 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 a 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.

9.2 EtherCAT

9.2.1 Installing the ESI file

For mapping of the device in an EtherCAT projection software, ifm electronic provides a device description file in ESI format (ESI - Electronic Slave Information). In the ESI file, all parameters, process data and their valid status and diagnostic information are defined.

The ESI file is available on ifm's website: www.ifm.com

Example:

To install the ESI file in the TwinCAT 3.1 EtherCAT projection software:

▶ Download the ESI file.

▶ Copy the file to the following subdirectory of the TwinCAT installation directory: `..\3.1\Config\Io\EtherCAT`

▶ Start TwinCAT.

▷ The device description is loaded into the device catalogue.

▷ TwinCAT can access data provided by the device.

9.2.2 Integrating the device into a project

The device is integrated into the automation project as an EtherCAT slave.

To integrate the device into a TwinCAT project:

Requirements:

✓ The ESI file of the device is installed in TwinCAT.

✓ The project contains an EtherCAT master to which the device is connected.

▶ In the [Solution Explorer]: Mark the EtherCAT master under the [I/O] node.

▶ Right-click the node of the EtherCAT master.

▷ The context menu appears.

▶ Click on [Add new item…].

▷ A dialogue window appears.

▶ Under [ifm electronic] > [ifm IO-Link Master], select the device.

▶ Click on [OK].

▷ The device has been added to the project.

▶ Save the project.

▷ The device has been integrated into the TwinCAT project.

9.2.2.1 Using Ethernet over EtherCAT (EoE)

The device supports the Ethernet over EtherCAT (EoE) protocol.

To use EoE, the following conditions must be met:

- The EtherCAT master supports the EoE protocol.
- EoE is activated and configured on the EtherCAT master and the EtherCAT slave.

The configuration differs depending on the network topology used. The following example shows the configuration steps for a direct connection between a PC with TwinCAT and the device. The EtherCAT master is assigned to the Ethernet interface of the PC.

Requirements:

✓ The device is integrated into the project.

✓ IP parameters of the Ethernet interface of the TwinCAT PC are set (e.g. IP address: 192.168.3.1, subnet mask: 255.255.255.0)

▶ In the [Solution Explorer]: Select the node of the EtherCAT master.

▷ The detail window shows device settings.

▶ Select the [EtherCAT] tab.

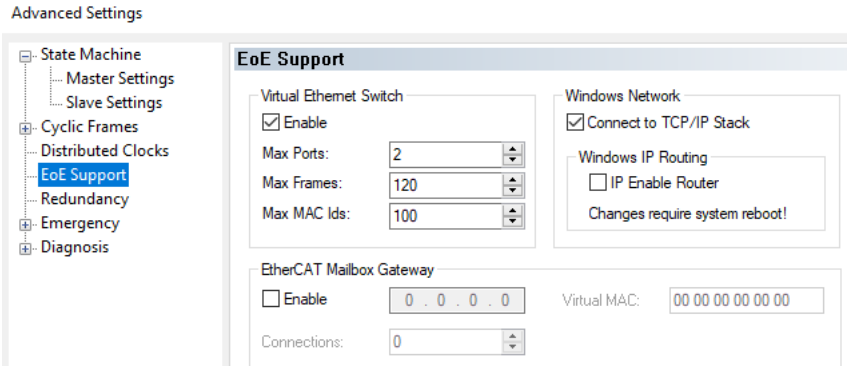
▷ The detail window shows EtherCAT settings.

▶ Click on [Advanced Settings…].

▷ A dialogue window appears.

▶ Select the [EoE Support] menu item.

▶ Set the parameters as follows:



▶ Click on [OK].

▷ The EoE protocol is activated and configured on the EtherCAT master.

▶ In the [Solution Explorer]: Select the node of the device.

▷ The detail window shows device settings.

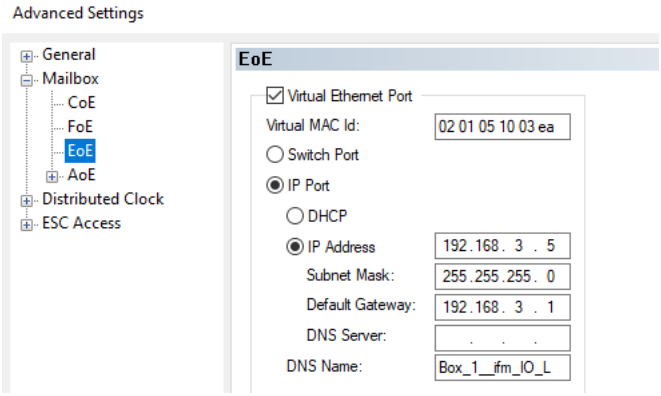
▶ Select the [EtherCAT] tab.

▷ The detail window shows EtherCAT settings.

▶ Click on [Advanced Settings…].

▷ A dialogue window appears.

▶ Select the [Mailbox] > [EOE] menu item.



▶ Activate the [Virtual Ethernet Port] parameters.

▶ Activate the [IP Port] parameters.

▶ Enter IP settings of the device in the Ethernet network.

▶ Click on [OK].

▷ The EoE protocol is activated and configured on the EtherCAT slave.

▷ The device can be reached from the TwinCAT PC via the set IP address.

9.2.3 Setting the startup parameters

In the factory settings, a set of preset parameters is defined as startup parameters. The parameters are transmitted to the device and activated when the EtherCAT connection is established.

In addition, the following parameters with user-specific values can be activated as startup parameters for each port of the device:

Parameter	Description	Reference
Process Data In Length	Length of the cyclic input data	Startup parameters (→ 🗋 48)
Process Data Out Length	Length of the cyclic output data	
Master Control	Operating modes of the port	

To set the startup parameters:

Requirements:

✓ The TwinCAT project has been created.

✓ The device is integrated into the project.

▶ In the [Solution Explorer]: Double-click on the device node.

▷ A detailed view of the device appears.

▶ Select the [Startup] tab.

▷ The detail window shows configuration options of the device.

▶ Configure the startup parameters.

▶ Save the project.

▷ The startup parameters are transmitted to the device and activated when an EtherCAT connection is established the next time.

9.2.4 Configuring the IO-Link master

The IO-Link master is configured via the Manufacturer Specific Area (0x2000) object area.

Access options:

- Using CANopen over EtherCAT (→ 🗋 45)

Available parameters:

Parameter	Description	Reference
Installation Location	Installation location can be set by the user	Manufacturer-Specific Area (0x2000 - 0x5FFF) (→ 🗋 56)
Equipment ID	Equipment ID can be set by the user	
Reset to Factory	Resetting the device	
Device Localization	Trigger the flashing of the status LEDs	
Current Use case	Access rights to the device	

9.2.5 Configuring the ports

The ports are configured via the Configuration Area (0x8000) object area.

Changes to the port configuration in online mode must be activated separately.

▶ Activate changes with the Reconfigure (0x80n8, subindex 0x02) parameter.

The device does not have a failsafe function for the outputs of the ports. If the EtherCAT connection is interrupted, the last output values present are written and marked as invalid.

A separate configuration area is available for each port.

Available parameters:

Parameter	Description	Reference
Device ID	Device ID validation	Configuration Area (0x8000 - 0x8FFF) (→ 62)
Vendor ID	Vendor ID validation	
IO-Link revision	IO-Link revision validation	
Cycle Time	Cycle time	
Process Data In Length	Length of the cyclic input data	
Process Data Out Length	Length of the cyclic output data	
Master Control	Operating mode (pin 4)	
Validation ID	Validation methods and data storage settings	
Reconfigure	Activate changes	
Byte Swap	Set arrangement of the bytes in the process data	
Mode UA	Operating mode (pin 2)	
Current Limit UA	Restriction of current UA	
Current Limit US	Restriction of current US	

9.2.6 Configuring process data

The cyclic input and output data at pin 4 of the IO-Link ports is configured via the EtherCAT slots. The user can assign a module to each slot. The assigned module defines which data is transmitted.

Available slots:

Slot	Description	Reference
IO-Link Ch.1	Process data IO-Link port 1	IO-Link Ch.1 (→ 🗋 49)
IO-Link Ch.2	Process data IO-Link port 2	IO-Link Ch.2 (→ 🗋 50)
IO-Link Ch.3	Process data IO-Link port 3	IO-Link Ch.3 (→ 🗋 51)
IO-Link Ch.4	Process data IO-Link port 4	IO-Link Ch.4 (→ 🗋 52)

Requirements:

✓ The TwinCAT project has been created.

✓ The device is integrated into the project.

▶ In the [Solution Explorer]: Double-click on the device node.

▷ A detailed view of the device appears.

▶ Select the [Slots] tab.

▷ The detail window shows slots and the modules available in each case.

▶ Assign the desired module to each slot.

▷ Cyclic input and output data has been configured.

The digital outputs at pin 2 of ports X1...X4 are activated via the port configuration (→ Configuring the ports 🗋 39).

▶ Set the [Mode UA] = [DO] parameter in the port configuration of the desired ports.

▷ Digital outputs at pin 2 of the ports can be switched.

9.2.7 Accessing the process data

The cyclic input and output data at pin 4 of the ports is stored in the Inputs (0x6000) and Outputs (0x7000) object areas.

▶ To check the validity of the cyclic process data, read and evaluate the Port Qualifier Information (PQI) of the port.

Even if the EtherCAT connection is interrupted, the PQI indicates that the process data is valid. This may have an unintended impact on the control process.

▶ Take suitable measures to detect an interruption of the EtherCAT connection.

Available parameters:

Parameter	Description	Reference
Input Process Data	Cyclic input data of the ports	Input Area (0x6000 - 0x6FFF) (→ 🗋 60)
Output Process Data	Cyclic output data of the ports	Output Area (0x7000 - 0x7FFF) (→ 🗋 61)

In the “IO-Link” operating mode, max. 32 bytes each are available for input data and output data for each port. The number of bytes transmitted is set when configuring the cyclic input and output data.

In the “Digital Input (DI)” operating mode, the process value of the port is mapped in the 1st byte of the input data (object 0x60n0, subindex 0x01).

In the “Digital Output (DO)” operating mode, the process value of the port is mapped in the 1st byte of the output data (object 0x70n0, subindex 0x01).

Valid values:

- 0x00: OFF
- 0x01: ON

The digital output data of pin 2 of ports X1...X4 is stored in the Device Area (0xF000).

Parameter	Description	Reference
Pin 2 Digital Output Control	Digital output data at pin 2 of ports X1...X4	Device Area (0xF000 - 0xFFFF) (→ 🗋 66)

9.2.7.1 TwinCAT-specific information

During the configuration of the slot, TwinCAT automatically creates variable nodes for the process data in the Solution Explorer:

Available objects:

- The cyclic input and output data at pin 4 of the port is grouped in the folders below the respective EtherCAT module.

Node group	Node	Description
TxPDO	• input byte 0 • input byte 1 … • input byte n [1]	Cyclic input data of the port (pin 4)
RxPDO	• output byte 0 • output byte 1 … • output byte m [2]	Cyclic output data of the port (pin 4)

[1] n: [3…31]; depending on the length of the configured input data of the port

[2] m: [3…31]; depending on the length of the configured output data of the port

- The digital output data at pin 2 of the ports is located as a subfolder below the device node:

Node group	Variables	Description
RxPDO Mapping of Pin 2 Outputs	• Pin 2 Digital Output Control	Digital output data of the port (pin 2)

9.2.8 Reading identification information

Identification information of the device is stored in the Communication Area (0x1000).

Access options:

- Using CANopen over EtherCAT (→ 🗋 45)

Available information:

Parameter	Description	Reference
Device Type	EtherCAT device profile	Communication Area (0x1000 - 0x1FFF) (→ 🗋 53)
Manufacturer Device Name	Device Name	
Manufacturer Hardware Version	Hardware version	
Manufacturer Software Version	Software version	
Vendor ID	Vendor identification	
Product Code	Article number	
Revision Number	Hardware version	
Serial number	Serial number	

9.2.9 Reading diagnostic and status information

The diagnostic and status information of the IO-Link master and the connected IO-Link devices is stored in different object areas.

Access options:

- Using CANopen over EtherCAT (→ 🗋 45)

Available information:

Parameter	Description	Reference
Diagnosis History	Reading IO-Link events (→ 🗋 44)	Communication Area (0x1000 - 0x1FFF) (→ 🗋 53)
Timestamp	Operating time of the device (time stamp)	
Device ID	Device ID of the IO-Link device	Information Area (0x9000 - 0x9FFF) (→ 🗋 64)
Vendor ID	Vendor ID of the IO-Link device	
IO-Link revision	IO-Link revision of the IO-Link device	
Frame Capability		
Cycle Time	Cycle time	
PD In Length	Length of the cyclic input data	
PD Out Length	Length of the cyclic output data	
Serial number IO-Link Device	Serial number of the IO-Link device	
Current UA (Pin 2/5)	Present current intensity of the voltage UA (pin 2/5)	
Current US (Pin 1/3)	Present current intensity of the voltage US (pin 1/3)	
IO-Link State	State of the IO-Link	Diagnosis Area (0xA000 - 0xAFFF) (→ 🗋 65)
Lost frames	Number of lost frames	
Device status	Diagnostic information of the IO-Link device	Device Area (0xF000 - 0xFFFF) (→ 🗋 66)

Parameter	Description	Reference
Port Qualifier Information (PQI)	Diagnostic information of the ports	Device Area (0xF000 - 0xFFFF) (→ 66)
Port Status UA/US	Status of the supply voltages UA/US at the ports	
Global Status UA/US	Status of the supply voltages UA/US of the device	
Global Voltage UA	Present voltage UA	
Global Current UA	Present current intensity UA	
Global Voltage US	Present voltage US	
Global Current US	Present current intensity US	

9.2.9.1 TwinCAT-specific information

When the device is integrated into an EtherCAT project, TwinCAT automatically creates variable nodes for diagnostic and status information in the Solution Explorer. The data is grouped in folders under the device node.

Available objects:

Node group	Node	Description
TxPDO IO-Link Device Status	• State of IO-Link Ch.1 • State of IO-Link Ch.2 … • State of IO-Link Ch.4	Status of the IO-Link ports X1...X4 Device Area (0xF000 - 0xFFFF) (→ 66)
TxPDO IO-Link Port Qualifier	• Qualifier of IO-Link Ch.1 • Qualifier of IO-Link Ch.2 … • Qualifier of IO-Link Ch.4	Port Qualifier Information (PQI) of the IO-Link port X1...X4 Device Area (0xF000 - 0xFFFF) (→ 66)
TxPDO New Diagnosis Message available	• New Message Available Flag	Display of a new IO-Link event Communication Area (0x1000 - 0x1FFF) (→ 53)
TxPDO Timestamp	• Timestamp	timestamp Communication Area (0x1000 - 0x1FFF) (→ 53)
TxPDO Power Supply Status	• Per port status UA/US • Global status UA/US • Global voltage UA • Global current UA • Global voltage US • Global current US	Status of the voltages UA/US of the ports X1...X4 Status of the voltages UA/US of the device Current values of the current intensities and voltages UA/US of the device Device Area (0xF000 - 0xFFFF) (→ 66)
TxPDO Vendor Specific IO Info Ch.1	• Current UA Ch.1 • Current US Ch.1	Current intensity of the voltages UA/US of port X1 Information Area (0x9000 - 0x9FFF) (→ 64)
TxPDO Vendor Specific IO Info Ch.2	• Current UA Ch.2 • Current US Ch.2	Current intensity of the voltages UA/US of port X2 Information Area (0x9000 - 0x9FFF) (→ 64)
TxPDO Vendor Specific IO Info Ch.3	• Current UA Ch.3 • Current US Ch.3	Current intensity of the voltages UA/US of port X3 Information Area (0x9000 - 0x9FFF) (→ 64)
TxPDO Vendor Specific IO Info Ch.4	• Current UA Ch.4 • Current US Ch.4	Current intensity of the voltages UA/US of port X4 Information Area (0x9000 - 0x9FFF) (→ 64)

9.2.10 Accessing IO-Link devices

The device supports the following ISDU communication mechanism. Via ISDU (Indexed Service Data Unit), the user can acyclically access parameters, process data as well as status and diagnostic information of the connected IO-Link devices.

Access takes place via index and subindex of the respective object.

A separate area for processing acyclic commands is available for each port.

Availability data of the IO-Link device: → IO Device Description (IODD) of the IO-Link device

The following methods are available for acyclic access to the objects of the IO-Link device:

- Using ADS over EtherCAT (→ 🗋 44)
- Using CANopen over EtherCAT (→ 🗋 45)

9.2.11 Reading IO-Link events

The device supports IO-Link events.

IO-Link events are stored in the diagnosis history (0x10F3): Communication Area (0x1000 - 0x1FFF) (→ 🗋 53)

The IO-Link master stores max. 32 events.

The individual events are stored in a ring buffer. The device supports the following operating modes for writing the buffer.

- Overwrite Mode: If the buffer is full, the oldest event is overwritten.
- Acknowledge Mode: Events are only overwritten when they have been read and acknowledged.

The operating mode is configured via the flags (0x10F3, subindex 0x05). The events are stored in the subindices 0x06…0x26.

9.2.12 Using acyclic services

The device supports the following mailbox services for acyclic read and write access:

- Using ADS over EtherCAT (→ 🗋 44)
- Using CANopen over EtherCAT (→ 🗋 45)

9.2.12.1 Using ADS over EtherCAT

The device supports mailbox communication via ADS over EtherCAT (AoE). The AoE protocol allows uninterrupted acyclic access to the connected IO-Link devices during normal operation. Access via AoE to the IO-Link master is not supported.

AoE uses the object area 0xF302 for read and write access.

▶ Observe the TwinCAT help!

The following function blocks are available for access:

- ADS read: Read access
- ADS write: Write access

With AoE, IO-Link parameters with a length of max. 80 bytes can be read or written.

Notes on the input assignment of the ADS function blocks:

Input	Description	Value range
PORT	ADS communication port = 0x1000 + port number	• 0x1001: Port 1 • 0x1002: Port 2 • 0x1003: Port 3 • 0x1004: Port 4
IDXGRP	AoE Index Group	0xF302
IDXOFFS	Index Offset • Bit 0…7: IO-Link Subindex • Bit 8…15: 0x00 • Bit 16…31: IO-Link Index	e.g. access to index 21, subindex 0: IDXOFFS = 0x00 21 00 00
ERRID	ADS Error Code • Bit 0…15: Error code of the IO-Link device • Bit 16…31: ADS device error = 0x0700	e.g. access to parameters of the IO-Link device refused: ERRID = 0x0700 8023

9.2.12.2 Using CANopen over EtherCAT

The device supports mailbox communication via CANopen over EtherCAT (CoE). The CoE protocol allows acyclic access to the IO-Link master and the connected IO-Link devices.

CoE uses the IO-Link Acyclic Command object area: Manufacturer-Specific Area (0x2000 - 0x5FFF) (→ 🗋 56)

A separate object area is available for each port.

▶ Observe the TwinCAT help!

In TwinCAT, access via CoE can be implemented via the following options:

1. [CoE – Online] tab in the device settings
2. Function blocks:
   – FB_EcCoESdoRead: Read SDO of an EtherCAT slave
   – FB_EcCoESdoWrite: Read SDO of an EtherCAT slave

   Notes on the input assignment of the CoE function blocks:

Input	Description	Value range
sNetId	AMS net ID of the EtherCAT master to which the device is connected	Depending on the project; e.g. 172.16.131.2.1
nSlaveAddr	EtherCAT address of the port on the IO-Link master: 0x1000 + port number	• 0x1001: Port 1 • 0x1002: Port 2 • 0x1003: Port 3 • 0x1004: Port 4
nSubIndex	IO-Link subindex of the date • Depending on the device; → IODD description of the IO-Link device	e.g. subindex 0: 0x00
nIndex	IO-Link index of the date • Depending on the device; → IODD description of the IO-Link device	e.g. subindex 21: 0x0015

Principle of acyclic command processing

General procedure of acyclic communication:

The IO-Link master can only process one CoE command request at a time. If another CoE request is started during an active request, the device responds with an error (SDO abort code: 0x06090030).

1. Writing a command request

▶ In the command buffer (object 0x310n, subindex 0x01): Write command data

▷ Request data is transmitted.

▷ Processing of the command is started.

▷ The request channel is blocked.

2. Checking the status of command processing

▶ In the status byte (object 031n, subindex 0x02): Read status

▷ Status == 0xFF: Request is still being processed, repeat step 2

▷ Status < 0xFF: Command processing finished, continue with step 3

3. Reading a command response

▶ In the response buffer (object 0x310n, subindex 0x03): Read and evaluate the response data

▷ Blocking of the request channel is cancelled.

▷ The next command can be executed.

10 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.

10.1 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!

10.2 Update firmware

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

- ifm IoT Core Visualizer: Update firmware (→ 🗋 34)
- ifm moneo: Update firmware

11 Appendix

11.1 EtherCAT

11.1.1 Startup parameters

Index	Subindex	Name	Possible values	Data type / access
0x8000		Port 1: Startup parameters		
	0x24	Process Data In Length	• 0x00: Output only, 0 bytes • 0x83: 4 bytes • 0x87: 8 bytes • 0x8F: 16 bytes • 0x9F: 32 bytes (Default)	UINT8 / rw
	0x25	Process Data Out Length	• 0x00: Input only, 0 bytes • 0x83: 4 bytes • 0x87: 8 bytes • 0x8F: 16 bytes • 0x9F: 32 bytes (Default)	UINT8 / rw
	0x28	Master Control	• 0x0000: Deactivated • 0x0001: Digital Input • 0x0002: Digital Output • 0x0003: IO-Link	UINT16 / rw
0x8010		Port 2: Startup parameters (structure: Index 0x8000)		
0x8020		Port 3: Startup parameters (structure: Index 0x8000)		
0x8030		Port 4: Startup parameters (structure: Index 0x8000)		

11.1.2 EtherCAT modules

11.1.2.1 IO-Link Ch.1

Slot	Description	Available modules	Length [bytes]
1	Port 1: Port configuration (pin 4)	• Deactivated: Port disabled	0
		• Digital_IN: “Digital input” operating mode	1 / 0
		• Digital_OUT: “Digital output” operating mode	0 / 1
		• IOL_In_4Byte: “IO-Link” operating mode – 4 byte input data	4 / 0
		• IOL_In_8Byte: “IO-Link” operating mode – 8 byte input data	8 / 0
		• IOL_In_16Byte: “IO-Link” operating mode – 16 byte input data	16 / 0
		• IOL_In_32Byte: “IO-Link” operating mode – 32 byte input data	32 / 0
		• IOL_Out_4Byte: “IO-Link” operating mode – 4 byte output data	0 / 4
		• IOL_Out_8Byte: “IO-Link” operating mode – 8 byte output data	0 / 8
		• IOL_Out_16Byte: “IO-Link” operating mode – 16 byte output data	0 / 16
		• IOL_Out_32Byte: “IO-Link” operating mode – 32 byte output data	0 / 32
		• IOL_4/4_I/O-Bytes: “IO-Link” operating mode – 4-byte input data / 4-byte output data (default)	4 / 4
		• IOL_8/8_I/O-Bytes: “IO-Link” operating mode – 8 byte input data / 8 byte output data	8 / 8
		• IOL_4/16_I/O-Bytes: “IO-Link” operating mode – 4 byte input data / 16 byte output data	4 / 16
		• IOL_16/4_I/O-Bytes: “IO-Link” operating mode – 16 byte input data / 4 byte output data	16 / 4
		• IOL_16/16_I/O-Bytes: “IO-Link” operating mode – 16 byte input data / 16 byte output data	16 / 16
		• IOL_32/32_I/O-Bytes: “IO-Link” operating mode – 32 byte input data / 32 byte output data	32 / 32

11.1.2.2 IO-Link Ch.2

Slot	Description	Available modules	Length [bytes]
2	Port 2: Port configuration (pin 4)	• Deactivated: Port disabled	0
		• Digital_IN: “Digital input” operating mode	1 / 0
		• Digital_OUT: “Digital output” operating mode	0 / 1
		• IOL_In_4Byte: “IO-Link” operating mode – 4 byte input data	4 / 0
		• IOL_In_8Byte: “IO-Link” operating mode – 8 byte input data	8 / 0
		• IOL_In_16Byte: “IO-Link” operating mode – 16 byte input data	16 / 0
		• IOL_In_32Byte: “IO-Link” operating mode – 32 byte input data	32 / 0
		• IOL_Out_4Byte: “IO-Link” operating mode – 4 byte output data	0 / 4
		• IOL_Out_8Byte: “IO-Link” operating mode – 8 byte output data	0 / 8
		• IOL_Out_16Byte: “IO-Link” operating mode – 16 byte output data	0 / 16
		• IOL_Out_32Byte: “IO-Link” operating mode – 32 byte output data	0 / 32
		• IOL_4/4_I/O-Bytes: “IO-Link” operating mode – 4-byte input data / 4-byte output data (default)	4 / 4
		• IOL_8/8_I/O-Bytes: “IO-Link” operating mode – 8 byte input data / 8 byte output data	8 / 8
		• IOL_4/16_I/O-Bytes: “IO-Link” operating mode – 4 byte input data / 16 byte output data	4 / 16
		• IOL_16/4_I/O-Bytes: “IO-Link” operating mode – 16 byte input data / 4 byte output data	16 / 4
		• IOL_16/16_I/O-Bytes: “IO-Link” operating mode – 16 byte input data / 16 byte output data	16 / 16
		• IOL_32/32_I/O-Bytes: “IO-Link” operating mode – 32 byte input data / 32 byte output data	32 / 32

11.1.2.3 IO-Link Ch.3

Slot	Description	Available modules	Length [bytes]
3	Port 3: Port configuration (pin 4)	• Deactivated: Port disabled	0
		• Digital_IN: “Digital input” operating mode	1 / 0
		• Digital_OUT: “Digital output” operating mode	0 / 1
		• IOL_In_4Byte: “IO-Link” operating mode – 4 byte input data	4 / 0
		• IOL_In_8Byte: “IO-Link” operating mode – 8 byte input data	8 / 0
		• IOL_In_16Byte: “IO-Link” operating mode – 16 byte input data	16 / 0
		• IOL_In_32Byte: “IO-Link” operating mode – 32 byte input data	32 / 0
		• IOL_Out_4Byte: “IO-Link” operating mode – 4 byte output data	0 / 4
		• IOL_Out_8Byte: “IO-Link” operating mode – 8 byte output data	0 / 8
		• IOL_Out_16Byte: “IO-Link” operating mode – 16 byte output data	0 / 16
		• IOL_Out_32Byte: “IO-Link” operating mode – 32 byte output data	0 / 32
		• IOL_4/4_I/O-Bytes: “IO-Link” operating mode – 4-byte input data / 4-byte output data (default)	4 / 4
		• IOL_8/8_I/O-Bytes: “IO-Link” operating mode – 8 byte input data / 8 byte output data	8 / 8
		• IOL_4/16_I/O-Bytes: “IO-Link” operating mode – 4 byte input data / 16 byte output data	4 / 16
		• IOL_16/4_I/O-Bytes: “IO-Link” operating mode – 16 byte input data / 4 byte output data	16 / 4
		• IOL_16/16_I/O-Bytes: “IO-Link” operating mode – 16 byte input data / 16 byte output data	16 / 16
		• IOL_32/32_I/O-Bytes: “IO-Link” operating mode – 32 byte input data / 32 byte output data	32 / 32

11.1.2.4 IO-Link Ch.4

Slot	Description	Available modules	Length [bytes]
4	Port 4: Port configuration (pin 4)	• Deactivated: Port disabled	0
		• Digital_IN: “Digital input” operating mode	1 / 0
		• Digital_OUT: “Digital output” operating mode	0 / 1
		• IOL_In_4Byte: “IO-Link” operating mode – 4 byte input data	4 / 0
		• IOL_In_8Byte: “IO-Link” operating mode – 8 byte input data	8 / 0
		• IOL_In_16Byte: “IO-Link” operating mode – 16 byte input data	16 / 0
		• IOL_In_32Byte: “IO-Link” operating mode – 32 byte input data	32 / 0
		• IOL_Out_4Byte: “IO-Link” operating mode – 4 byte output data	0 / 4
		• IOL_Out_8Byte: “IO-Link” operating mode – 8 byte output data	0 / 8
		• IOL_Out_16Byte: “IO-Link” operating mode – 16 byte output data	0 / 16
		• IOL_Out_32Byte: “IO-Link” operating mode – 32 byte output data	0 / 32
		• IOL_4/4_I/O-Bytes: “IO-Link” operating mode – 4-byte input data / 4-byte output data (default)	4 / 4
		• IOL_8/8_I/O-Bytes: “IO-Link” operating mode – 8 byte input data / 8 byte output data	8 / 8
		• IOL_4/16_I/O-Bytes: “IO-Link” operating mode – 4 byte input data / 16 byte output data	4 / 16
		• IOL_16/4_I/O-Bytes: “IO-Link” operating mode – 16 byte input data / 4 byte output data	16 / 4
		• IOL_16/16_I/O-Bytes: “IO-Link” operating mode – 16 byte input data / 16 byte output data	16 / 16
		• IOL_32/32_I/O-Bytes: “IO-Link” operating mode – 32 byte input data / 32 byte output data	32 / 32

11.1.3 Object directory

11.1.3.1 Communication Area (0x1000 - 0x1FFF)

Index	Subindex	Name	Possible values	Data type / access
0x1000	--	Device Type	• 0x184C1389: Modular Device Profile (MDP)	UINT32 / ro
0x1008	--	Manufacturer Device Name	"AL1431"	STRING / ro
0x1009	--	Manufacturer Hardware Version	e.g., "AA"	STRING / ro
0x100A	--	Manufacturer Software Version	e.g., "3.1.89"	STRING / ro
0x100B	--	Bootloader Version	e.g., "2.4.1"	STRING / ro
0x1018	--	Identity Object		
	• 0x1	Vendor ID	0x622: ifm electronic	UINT32 / ro
	• 0x2	Product Code	"0x00001431"	UINT32 / ro
	• 0x3	Revision Number	e.g., "0x00000001"	UINT32 / ro
	• 0x4	Serial number	e.g., "000045632787" (depending on device)	UINT32 / ro
0x10F3		Diagnosis History		
	• 0x01	Maximum Messages	• 0x00: 0 Messages … • 0x20: 32 Messages	UINT8 / ro
	• 0x02	Newest Message	• 0x01: Message 1 … • 0x20: Message 32	UINT8 / ro
	• 0x03	Newest Ack. Message	Override Mode: • 0x00: Reading: When the message queue will be overwritten, the slave shall set subindex 0x03 to 0 • 0x01…0x05: Writing: The slave shall return SDO-Abort with codes 0x06090030 (value range of parameter exceeded) or 0x0609003 • 0x06…0x46: Writing: Subindex 0x03 = Written value without checking • 0x47…0xFF: Writing: SDO-Abort with codes 0x06090030 or 0x06090031(value of parameter written too high) Acknowledge Mode: • 0x00: – Read: No messages have been acknowledged so far – Writing: All acknowledged messages will be deleted. • 0x01…0x05: Writing: The slave shall return SDO-Abort with codes 0x06090030 (value range of parameter exceeded) or 0x06090032 • 0x06…0x26: – Read: SubIndex of latest acknowledged diagnosis message – Writing: Messages are acknowledged • 0x27…0xFF: Writing: SDO-Abort with codes 0x06090030 or 0x06090031(value of parameter written too high)	UINT8 / rw

Index	Subindex	Name	Possible values	Data type / access
0x10F3	• 0x04	New Message Available	Override Mode: • 0x0: Newest message was read • 0x1: Newest message was not read Acknowledge Mode: • 0x0: No acknowledged message • 0x1: Diagnosis messages are available which can be acknowledged (Subindex 0x02 <> Subindex 0x03)	BOOL / ro
	• 0x05	Flags	Mapping: Flags (→ 🗋 55)	UINT16 / rw
	• 0x06	Diagnosis Message 01	Mapping: Diagnosis Message (→ 🗋 56)	OCTET STRING / ro
	…	…	…	…
	• 0x20	Diagnosis Message 32	Mapping: Diagnosis Message (→ 🗋 56)	OCTET STRING / ro
0x10F8	--	Timestamp (value in ns)		UINT64 / ro

Mapping: Flags

Word (Offset)	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
n	reserved										OI	MS	DE	DW	DI	EE

Legend:

• EE	Enable Emergency sending (acc. to ETG.1000-6)	1 BIT	• 0x0: Do not transmit diagnostic messages as emergency messages • 0x1: Transmit new diagnostic message as emergency message
• DI	Disable information messages	1 BIT	• 0x0: Information messages are stored in the message queue (default) • 0x1: Information messages are not stored in the message queue
• DW	Disable warning messages	1 BIT	• 0x0: Warning messages are stored in the message queue (default) • 0x1: Warning messages are not stored in the message queue
• DE	Disable error messages	1 bit	• 0x0: Error messages are stored in the message queue (default) • 0x1: Error messages are not stored in the message queue
• MS	Mode selection	1 bit	• 0x0: Override Mode • 0x1: Acknowledge Mode
• OI	Overwrite/discard information		Override Mode: • 0x0: no event • 0x1: Unacknowledged messages were overwritten (buffer overrun); Subindex 0x03 = 0 Acknowledge Mode: • 0x0: no event • 0x1: Buffer is full of unacknowledged messages and new messages are discarded

Mapping: Diagnosis Message

Parameter	Description	Value range	Data type / Access
Diag Code	Diagnostic code	Bits 0…15: • 0x0000…0xDFFF: unused • 0xE000…0xE7FF: Bit 16…31 vendor specific • 0xE800: Bit 16…31: Emergency Error Code from DS301 or DS4xxx • 0xE801…0xEDFF: reserved • 0xEE00…0xEFFF: Bit 16…31: profile specific • 0xF000…0xFF00: unused • 0xFF01: New IO-Link Event – Byte0: IO-Link Port – Byte 1: Event Qualifier – Byte 2+3: Event Code – Byte 4: unused • 0xFF02: Port configuration has failed – Byte 0…4: unused • 0xFF03: IO-Link Device Lost (disconnected) – Byte 0: IO-Link Port – Byte 1…4: unused • 0xFF04: IO-Link Device Fault (validation error or PD length mismatch) – Byte 0: IO-Link Port – Byte 1…4: unused • 0xFF05: IO-Link Device Operating – Byte 0: IO-Link Port – Byte 1: Old status code – Byte 2: Old info code – Byte 3: New status code – Byte 4: New info code • 0xFF06: Port UA/US Fault • 0xFF07: Global UA/US Fault	UINT32 / ro
Flags	Event qualifier type	• 0x0000: Notification • 0x0001: Warning • 0x0002: Error	UINT16 / ro
Text ID	Text ID as reference to diagnosis text as defined in ESI file	• 0x0000: not Text ID • 0x0001…0xFFFF: Text ID reference to ESI file	UINT16 / ro
Time Stamp	Time Stamp (value in ms)	0x0000000000000000…0xFFFFFFFFFFFFFFFF	UINT64 / to
Flags Parameter 1	Data type Parameter 1	• 0x0005: UINT8	UINT16 / ro
Flags Parameter 2	Data type Parameter 2	• 0x0006: UINT16	UINT16 / ro
Parameter 2	Event Code	Depending on the device: → IODD description of the IO-Link device	UINT16 / ro
Flags Parameter 3	Data type Parameter 3	• 0x0005: UINT8	UINT16 / ro
Parameter 3	Event Qualifier		UINT8 / ro

11.1.3.2 Manufacturer-Specific Area (0x2000 - 0x5FFF)

Index	Subindex	Name	Possible values	Data type / access
0x2001	--	Component Name	“EtherCAT IO-Link gateway”	STRING / ro
0x2002	--	Vendor Name	“ifm electronic”	STRING / ro
0x2003	--	Vendor URL	“www.ifm.com”	STRING / ro
0x2004	--	Order Number	"AL1431"	STRING / ro

Index	Subindex	Name	Possible values	Data type / access
0x2005	--	Manufacturing Date		STRING / ro
0x2006	--	QS Date		STRING / ro
0x2007	--	Installation Location	user-defined; max. 20 characters	STRING / rw
0x200A	--	Equipment ID	user-defined; max. 20 characters	STRING / rw
0x2F00	--	Reset to Factory	• 0xA500: Factory Reset of System + NVMEM • 0xA501: Factory Reset of System	UINT16 / wo
0x2F01	--	Device Localization	• 0x00: LED blinking for 5 s	UINT8 / wo
0x2F02	--	Current Use Case	• 0xA500: EtherCAT + IoT • 0xA501: EtherCAT + IoT (read only) • 0xA502: IoT (only)	UINT16 / rw
0x3100		Port 1: IO-Link Acyclic Command		
	• 0x01	Command Buffer	Mapping: Command Buffer (→ 🗋 58)	ARRAY_OF_BYTES / wo
	• 0x02	Status	• 0x00: Command completed: no error, no response data • 0x01: Command completed: no error, response data available • 0x02: Command completed: error, no response data • 0x03: Command completed: error, response data available • 0xFF: Command is executing (pending)	UINT16 / ro
	• 0x03	Response Buffer	Mapping: Response Buffer (→ 🗋 59)	ARRAY_OF_BYTES / ro
0x3101		Port 2: IO-Link Acyclic Command (structure: → Index 0x3100)		
0x3102		Port 3: IO-Link Acyclic Command (structure: → Index 0x3100)		
0x3103		Port 4: IO-Link Acyclic Command (structure: → Index 0x3100)		

Mapping: Command Buffer

Byte (offset)	Bit							
	7	6	5	4	3	2	1	0
0	Command							
1	Index (LSB)							
2	Index (MSB)							
3	Subindex							
4	Length							
5…5+m	Data							

Legend:

• Command	Command	1 BYTE	• 0x00: Read • 0x01: Write
• Index	Index of the ISDU object	2 BYTE	• 0x0000…0xFFFF
• Subindex	Subindex of the ISDU object	1 BYTE	• 0x00…0xFF
• Length	Number m of bytes with user data (write commands only)	1 BYTE	• 0x00: 0 Byte (Read) • 0x01: 1 Byte (Write) … • 0xE8: 232 Bytes (Write)
• Data	User data Data is transmitted to the ISDU object	m BYTE	Pro byte: • 0x00…0xFF

Mapping: Response Buffer

Byte (offset)	Bit							
	7	6	5	4	3	2	1	0
0	Status							
1	0x00							
2	Length							
3… 3+m	Data							

Legend:

• [Status]	Status of the command processing	1 BYTE	• 0x00: Command completed: no error, no response data • 0x01: Command completed: no error, response data available • 0x02: Command completed: error, no response data • 0x03: Command completed: error, response data available • 0xFF: Command is executing (pending)
• [Length]	Number m of bytes with user data (only if status == 0x01 or 0x03)	1 BYTE	• 0x00: 0 Byte (Read) • 0x01: 1 Byte (Write) … • 0xE8: 232 Bytes (Write)
• [Data]	User data If [Status] == 0x01: • 0…232 bytes with data from the ISDU object If [Status] == 0x03: • byte 3: IO-Link Error Code • byte 4: Additional Code	m BYTE	Pro byte: • 0x00…0xFF

11.1.3.3 Input Area (0x6000 - 0x6FFF)

Index	Subindex	Name	Possible values	Data type / access
0x6000		Port 1: Input Process Data		
	• 0x01	Byte 1	0x00…0xFF	UINT8 / rw
	…	…	…	…
	• 0x20	Byte 32	0x00…0xFF	UINT8 / rw
0x6010		Port 2: Input Process Data (structure: → Index 0x6000)		
0x6020		Port 3: Input Process Data (structure: → Index 0x6000)		
0x6030		Port 4: Input Process Data (structure: → Index 0x6000)		

11.1.3.4 Output Area (0x7000 - 0x7FFF)

Index	Subindex	Name	Possible values	Data type / access
0x7000		Port 1: Output Process Data		
	• 0x01	Byte 1	0x00…0xFF	UINT8 / rw
	…	…	…	…
	• 0x20	Byte 32	0x00…0xFF	UINT8 / rw
0x7010		Port 2: Output Process Data (structure: → Index 0x7000)		
0x7020		Port 3: Output Process Data (structure: → Index 0x7000)		
0x7030		Port 4: Output Process Data (structure: → Index 0x7000)		

11.1.3.5 Configuration Area (0x8000 - 0x8FFF)

Index	Subindex	Name	Possible values	Data type / access
0x8000		Port 1: Port Configuration		
	• 0x04	Device ID	0x000000…0xFFFFFF	UINT32 / rw
	• 0x05	Vendor ID	0x0000…0xFFFF	UINT32 / rw
	• 0x20	IO-Link revision	• 0x10: IO-Link Revision 1.0 • 0x11: IO-Link Revision 1.1	UINT8 / rw
	• 0x22	Cycle Time (value * 0.1 ms)	• 0x00: Best possible (Default) • 0x01: 0.1 ms … • 0xFF: 25.5 ms	UINT8 / rw
	• 0x24	Process Data In Length	• 0x00: Output only, 0 bytes • 0x83: 4 Bytes • 0x87: 8 bytes • 0x8F: 16 bytes • 0x9F: 32 bytes (default)	UINT8 / rw
	• 0x25	Process Data Out Length	• 0x00: Input only, 0 bytes • 0x83: 4 Bytes • 0x87: 8 bytes • 0x8F: 16 bytes • 0x9F: 32 bytes (default)	UINT8 / rw
	• 0x28	Master Control	• 0x0000: Deactivated • 0x0001: Digital Input • 0x0002: Digital Output • 0x0003: IO-Link (default)	UINT16 / rw
0x8008		Port 1: Vendor Specific Port Configuration		
	• 0x01	Validation ID	• 0x00: No check (default) • 0x01: V1.0 Device, no Datastorage • 0x02: V1.1 Device, no Datastorage • 0x03: V1.1 Device, Backup + Restore • 0x04: V1.1 Device, Restore	UINT8 / rw
	• 0x02	Reconfigure	• 0x00: No action (default) • 0xFF: Activate configuration	UINT8 / rw
	• 0x03	Byte Swap	• 0x00: No action (default) • 0x01: Byte swap	UINT8 / rw
	• 0x04	Mode UA	• 0x00: UA = OFF - IO-Link Port Class A (default) • 0x01: UA = ON - IO-Link Port Class B) • 0x02: Digital Output (DO)	UINT8 / rw
	• 0x05	Current Limit UA	• 0x0000: 0 mA … • 0x07D0: 2000 mA (default)	UINT16 / rw
	• 0x06	Current Limit US	• 0x0000: 0 mA … • 0x01C2: 450 mA … • 0x07D0: 2000 mA (default)	UINT16 / rw
0x8010		Port 2: Port Configuration (structure: → Index 0x8000)		
0x8018		Port 2: Vendor Specific Port Configuration (structure: → Index 0x8008)		
0x8020		Port 3: Port Configuration (structure: → Index 0x8000)		
0x8028		Port 3: Vendor Specific Port Configuration (structure: → Index 0x8008)		
0x8030		Port 4: Port Configuration (structure: → Index 0x8000)		

Index	Subindex	Name	Possible values	Data type / access
0x8038		Port 4: Vendor Specific Port Configuration (structure: → Index 0x8008)		

11.1.3.6 Information Area (0x9000 - 0x9FFF)

Index	Subindex	Name	Possible values	Data type / access
0x9000	--	Port 1: Port Mode Status		
	• 0x04	Device ID	0x000000…0xFFFFFF	UINT32 / ro
	• 0x05	Vendor ID	0x0000…0xFFFF	UINT32 / ro
	• 0x20	IO-Link revision	• 0x10: IO-Link Revision 1.0 • 0x11: IO-Link Revision 1.1	UINT8 / ro
	• 0x21	Frame Capability		UINT8 / ro
	• 0x22	Cycle Time	• 0x0000 0000: Best possible • 0x0000 0001: 1 µs … • 0x0002 06C0: 132800 µs	UINT8 / ro
	• 0x24	PD In Length	• 0x00: 0 byte • 0x01: 4 bytes • 0x02: 8 bytes • 0x03: 16 bytes • 0x04: 32 bytes	UINT8 / ro
	• 0x25	PD Out Length	• 0x00: 0 byte • 0x01: 4 bytes • 0x02: 8 bytes • 0x03: 16 bytes • 0x04: 32 bytes	UINT8 / ro
0x9001		Port 1: Serial number IO-Link Device		STRING / ro
0x9008		Port 1: Specific IO information		
	• 0x01	Current UA (Pin 2/5)	• 0x0000: 0 mA … • 0x07D0: 2000 mA	UINT16 / ro
	• 0x02	Current US (Pin 1/3)	• 0x0000: 0 mA … • 0x07D0: 2000 mA	UINT16 / ro
0x9010		Port 2: Port Mode (structure: → Index 0x9000)		
0x9011		Port 2: Serial number IO-Link Device		STRING / ro
0x9018		Port 2: Specific IO information (structure: → Index 0x9008)		
0x9020		Port 3: Port Mode (structure: → Index 0x9000)		
0x9021		Port 3: Serial number IO-Link Device		STRING / ro
0x9028		Port 3: Specific IO information (structure: → Index 0x9008)		
0x9030		Port 4: Port Mode (structure: → Index 0x9000)		
0x9031		Port 4: Serial number IO-Link Device		STRING / ro
0x9038		Port 4: Specific IO information (structure: → Index 0x9008)		

11.1.3.7 Diagnosis Area (0xA000 - 0xAFFF)

Index	Subindex	Name	Possible values	Data type / access
0xA0000		Port 1: Diagnostics Data		
	• 0x01	IO-Link State	• 0x00: INACTIVE - Deactivated • 0x01: DIGINPUT – Digital Input • 0x02: DIGOUTPUT – Digital Output • 0x08: OPERATE – IO-Link OPERATE state • 0x09: STOP – IO-Link STOP state (Error or no device)	UINT8 / ro
	• 0x02	Lost frames	0x00…0xFF	UINT8 / ro
0xA010		Port 2: Diagnostics Data (structure: → Index A000)		
0xA020		Port 3: Diagnostics Data (structure: → Index A000)		
0xA030		Port 4: Diagnostics Data (structure: → Index A000)		

11.1.3.8 Device Area (0xF000 - 0xFFFF)

Index	Subindex	Name	Possible values	Data type / access
0xF000		Module Device Profile		
	• 0x01	Module Index Distance	0x0010	UINT16 / ro
	• 0x02	Maximum Number of Modules	0x0004	UINT16 / ro
0xF100		Device status		
	• 0x01	Port 1: Device status	Mapping: Device status (→ 67)	UINT8 / ro
	• 0x02	Port 2: Device status	Mapping: Device status (→ 67)	UINT8 / ro
	• 0x03	Port 3: Device status	Mapping: Device status (→ 67)	UINT8 / ro
	• 0x04	Port 4: Device status	Mapping: Device status (→ 67)	UINT8 / ro
0xF101		IO-Link Port Qualifier Information (PQI)		
	• 0x01	Port 1: PQI	Mapping: Port Qualifier Information (→ 67)	UINT8 / ro
	• 0x02	Port 2: PQI	Mapping: Port Qualifier Information (→ 67)	UINT8 / ro
	• 0x03	Port 3: PQI	Mapping: Port Qualifier Information (→ 67)	UINT8 / ro
	• 0x04	Port 4: PQI	Mapping: Port Qualifier Information (→ 67)	UINT8 / ro
0xF102		Power Supply Status		
	• 0x01	Port Status UA/US	Mapping: Port Status UA/US (→ 68)	UINT16 / ro
	• 0x02	Global Status UA/US	Mapping: Global Status UA/US (→ 68)	UINT16 / ro
	• 0x03	Global Voltage UA (in mV)	• 0x4E20: 20 V … • 0x7530: 30 V	UINT16 / ro
	• 0x04	Global Current UA (in mA)	• 0x0000: 0 mA … • 0x1F40: 8000 mA	UINT16 / ro
	• 0x05	Global Voltage US (in mV)	• 0x4E20: 20 V … • 0x7530: 30 V	UINT16 / ro
	• 0x06	Global Current US (in mA)	• 0x0000: 0 mA … • 0x0E10: 3600 mA	UINT16 / ro
0xF200		Pin 2 Digital Output Control		
	• 0x01	Digital Outputs (Pin 2)	Mapping: Pin 2 Digital Output Control (→ 68)	UINT16 / rw

Mapping: Device status

Byte (offset)	Bit							
	7	6	5	4	3	2	1	0
n	Error Code				Port State			

Legend:

• Port State	Status of the IO-Link port	4 bit	• 0x0: deactivated • 0x1: Digital input • 0x2: Digital output • 0x3: IO-Link - OPERATE • 0x4: IO-Link – STOP (error or no device)
• Error Code	Error code of the IO-Link device Note: If several errors occur at the same time, only one error is displayed. The other error messages are suppressed.	4 bit	• 0x0: No error • 0x1: Watchdog error • 0x2: Buffer overflow • 0x3: Invalid device ID • 0x4: Invalid vendor ID • 0x5: Invalid IO-Link revision • 0x6: Invalid frame capability • 0x7: Invalid cycle time • 0x8: Invalid length of the input data (PD in) • 0x9: Invalid length of the output data (PD out) • 0xA: No device detected • 0xB: PREOPERATIONAL error • 0xC: Low voltage • 0xD: Unspecified error • 0xE: Short circuit

Mapping: Port Qualifier Information

Byte (offset)	Bit							
	7	6	5	4	3	2	1	0
n	PVI	DE	DO	DACT	PVO	res.	DI2	DI4

Legend:

• DI4	Status digital input - pin 4 (operating mode: DI)	1 bit	• 0x0: LOW • 0x1: HIGH
• DI2	Status digital input - pin 2 (if in use)	1 bit	• 0x0: LOW • 0x1: HIGH
• PVO	Port Validity Output: Validity of the output data of the IO-Link device	1 bit	• 0x0: Invalid • 0x1: Valid
• DACT	Device deactivated: Shows if the IO-Link port is configured and can be used	1 bit	• 0x0: Activated and can be used • 0x1: Deactivated or not available
• DO	Device Operational: Availability of the IO-Link device	1 bit	• 0x0: Not available • 0x1: Detected and in OPERATE state
• DE	Device Error: Error or warning occurred; Note: The user needs to determine the cause of the error separately via acyclic services	1 bit	• 0x0: No error • 0x1: Error (validation error, short circuit, etc.)
• PVI	Port Validity Output: Validity of the input data of the IO-Link device	1 bit	• 0x0: Invalid • 0x1: Valid

Mapping: Port Status UA/US

Word (Offset)	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
n	res.	res.	res.	res.	res.	res.	res.	res.	res.	res.	res.	res.	PWR Port 4	PWR Port 3	PWR Port 2	PWR Port 1

Legend:

- PWR Port n — Status of the voltage supply on port n — 1 bit
  - 0x0: No error
  - 0x1: Overcurrent detected at US and / or UA

Mapping: Global Status UA/US

Word (Offset)	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
n	res.	res.	res.	res.	res.	res.	res.	res.	res.	res.	res.	res.	res.	res.	UA	US

Legend:

- US — Status of the global supply voltage US — 1 bit
  - 0x0: No error
  - 0x1: Overvoltage detected (US > 3.6 V)
- UA — Status of the global supply voltage UA — 1 bit
  - 0x0: No error
  - 0x1: Supply voltage UA not connected

Mapping: Pin 2 Digital Output Control

Word (Offset)	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
n	res.	res.	res.	res.	res.	res.	res.	res.	res.	res.	res.	res.	DO2 Port 4	DO2 Port 3	DO2 Port 2	DO2 Port 1

Legend:

- DO2 Port n — Status digital output - pin 2 (operating mode: DO) — 1 bit
  - 0x0: LOW
  - 0x1: HIGH