IO-Link Master XZIOM8AM12EY

Ethernet/IP Adapter / 8 Port IO-Link Master V1.0

User manual

Original version

www.telemecaniquesensors.com

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Safety Information

Important Information

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result** in minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

Please Note

Our product should be installed, operated and maintained only by qualified personnel. Neither TMSS France nor any of its subsidiaries or other affiliated companies shall be responsible or liable for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

About the Book

Document Scope

This manual describes the features, installation, wiring, usage, and troubleshooting of the XZIOM8AM12EY IO-Link master device.

Validity Note

The technical characteristics of the device(s) described in this manual also appear online.

To access this information online:

Step	Action
1	Go to www.telemecaniquesensors.com.
2	In the **Search box**, type the model number of a product or the name of a product range.Do not include blank spaces in the model number/product range.
3	If more than one model number appears in the **Products** search results, click on the model number that interests you.
4	To save or print a data sheet as a .pdf file, click **Download product datasheet.**

The characteristics that are described in the present document should be the same as those characteristics that appear online. In line with our policy of constant improvement, we may revise content over time to improve clarity and accuracy. If you see a difference between the document and online information, use the online information as your reference.

Quick Response Code

A quick response code including the Telemecanique Sensors web address is present on the sensor label. Technical documents are available in various languages in this website.

User Comments

We welcome your comments about this document. You can reach us through the customer support page on your local TeSensors website.

Related Document

Title of documentation	Reference number
IO-Link master - Instruction Sheet	BQT8834801

Cybersecurity

Machines, controllers, and related equipment are usually integrated into networks. Unauthorized persons and malware may gain access to the machine as well as to other devices on the network/fieldbus of the machine and connected networks via insufficiently secure access to software and networks.

⚠ WARNING

UNAUTHORIZED ACCESS TO THE MACHINE VIA SOFTWARE AND NETWORKS

- In your hazard and risk analysis, consider all hazards that result from access to and operation on the network/fieldbus and develop an appropriate cybersecurity concept.
- Verify that the hardware infrastructure and the software infrastructure into which the machine is integrated as well as all organizational measures and rules covering access to this infrastructure consider the results of the hazard and risk analysis and are implemented according to best practices and standards covering IT security and cybersecurity (such as ISO/IEC 27000 series, ISO/ IEC 15408, IEC 62351, ISA/ IEC 62443, Common Criteria for Information Technology Security Evaluation, NIST Cybersecurity Framework, Information Security Forum - Standard of Good Practice for Information Security).
- Verify the effectiveness of your IT security and cyber security systems using appropriate, proven methods.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Consult the TMSS Cybersecurity Best Practices (www.telemecaniquesensors.com) for additional information.

Device Description

Function Description

The device is designed to be used within an Ethernet/IP network. The device enables you to use up to 8 IO-Link sensors/actuators and also serves to capture digital inputs and outputs.

Monitoring Functions

The device has several integrated sensors for measuring:

- Temperatures,
- Currents,
- Voltages.

The measurements are carried out for the device as well as for pin 1, pin 2 and pin 4 of each IO-Link port.

The measuring values are compared with limit values in the device. If the values exceed or fall below a limit value (for example: temperature limit value), an alarm is generated.

Web Server

The web server can display the measuring values.

Reaction if the Value Exceeds/Falls Below the Limit

If the value exceeds or falls below the limit, the device can send an event to the controller.

OPC UA Server

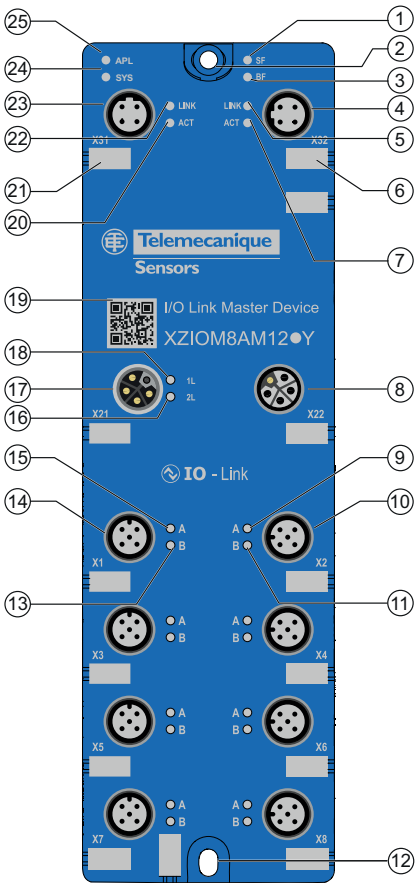
An OPC UA client can read and display the measuring values.

If the values exceed or fall below a limit value, the OPC UA server can send an event to the OPC UA client.

Overload Protection

The device has an internal current overload protection for the supply output for IO-Link devices or digital outputs. The output current is subject to permanent measurement and monitoring. If the measured output current exceeds the maximum value, the device reduces the current or switch off the corresponding loads.

Device Drawing XZIOM8AM12EY



Positions of the interfaces and LEDs:

Pos.	Name	Interface/LED	Pos.	Name	Interface/LED
1	MS	Module status LED	14	X1	IO-Link, port 1, M12, A-coded
2	-	Fixing hole	15	A	IO-Link status LED, port 1, channel A
3	NS	Network status LED	16	2L	+24 V DC power supply, 2L
4	X32	Ethernet interface, M12, D-coded	17	X21	Power In
5	LINK	Link LED X32	18	1L	+24 V DC power supply, 1L
6	-	Labeling field	19	-	QR code (part number, hardware revision, serial number, MAC ID, URL)
7	ACT	Activity LED X32	20	ACT	Activity LED X31
8	X22	Power Out	21	-	Labeling field
9	A	IO-Link status LED, port 2, channel A	22	LINK	Link LED X31
10	X2	IO-Link, port 2, M12, A-coded	23	X31	Ethernet interface, M12, D-coded
11	B	IO-Link status LED, port 2, channel B	24	APL	Application status LED
12	-	Fixing hole	25	SYS	System status LED
13	B	IO-Link status LED, port 1, channel B			

Identification

To identify the device, there is a dynamic 2D code on the front of the device housing:

The 2D code includes (sample data):

- Part number: 1913.120
- Hardware revision number: R1
- Serial number: 020000
- MAC-ID: 00-02-A2-2F-75-44 (individual for each device)

Revisions and Versions

The hardware revision listed below, as well as the software and firmware versions belong together functionally. If a hardware installation is available, for the firmware update these specifications are relevant.

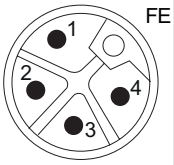
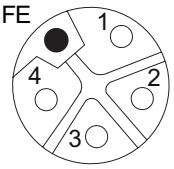
Model	Description	Part number	Hardware revision
XZIOM8AM12EY	IO-Link master class A Ethernet/IP Adapter	9388.021	4

Software	Name	Version
Web server	IO-Link master web server for Ethernet/IP Adapter	V1.1

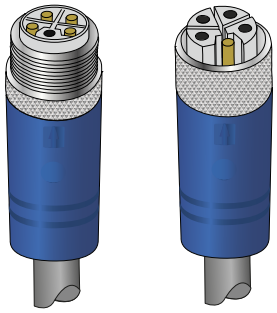
Protocol	File name	Version
Ethernet/IP Adapter	U197H000.nxi	V1.0

Connectors and Interfaces

Power supply

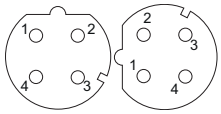
Supply voltage input	Supply voltage output	Pin	Signal	Color	Description
		1	1L+	Brown	24 V DC supply voltage U1L for system and sensor/ actuator
		2	2L-	White	Reference potential for 2L
		3	1L-	Blue	Reference potential for 1L
		4	2L+	Black	24 V DC auxiliary/control voltage U2L
		FE	FE	Pink	Functional earth

Available power cables:

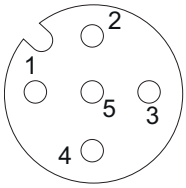


Reference	Description
XZCPK75DL2	IO-Link master single-ended pre-wired, L-Coded power cable, female, straight, 5 pin (4+FE), PUR, 1.5 mm², 2 m
XZCPK75DL5	IO-Link master single-ended pre-wired, L-Coded power cable, female, straight, 5 pin (4+FE), PUR, 1.5 mm², 5 m
XZCPK75CL2	IO-Link master single-ended pre-wired, L-Coded power cable, female, elbowed, 5 pin (4+FE), PUR, 1.5 mm², 2 m
XZCPK75CL5	IO-Link master single-ended pre-wired, L-Coded power cable, female, elbowed, 5 pin (4+FE), PUR, 1.5 mm², 5 m
XZCR25K25DL2	IO-Link master jumper power cable, male straight M12 5 pin, female straight M12 5 pin, PUR, 1.5 mm², 2 m
XZCR25K25DL5	IO-Link master jumper power cable, male straight M12 5 pin, female straight M12 5 pin, PUR, 1.5 mm², 5 m
XZCR26K26CL2	IO-Link master jumper power cable, male elbowed M12 5 pin, female elbowed M12 5 pin, PUR, 1.5 mm², 2 m
XZCR26K26CL5	IO-Link master jumper power cable, male elbowed M12 5 pin, female elbowed M12 5 pin, PUR, 1.5 mm², 5 m

Ethernet

Ethernet	Pin	Signal	Description
	1	TX+	Transmit data positive
	2	RX+	Receive data positive
	3	TX–	Transmit data negative
	4	RX–	Receive data negative

IO-Link ports (Class A)

IO-Link ports (Class A)	Pin	Signal	Description	Wire color
	1	1L+	24 V DC supply voltage U1L for system and sensor/actuator	Brown
	2	2L-	Reference potential for 2L	White
	3	1L-	Reference potential for 1L	Blue
	4	2L+	24 V DC auxiliary/control voltage U2L	Black
	FE	FE	Functional earth	–

Safety

Intended Use

The IO-Link master XZIOM8AM12EY serves to receive or send process data via IO-Link:

- The IO-Link master XZIOM8AM12EY receives process data from the connected sensor and sends this data to superordinated PLC (Ethernet/IP Scanner).
- The IO-Link master XZIOM8AM12EY receives process data from the superordinated PLC (Ethernet/IP Scanner) and sends this data to the connected actuator.

General Safety Regulations

⚠ CAUTION

ELECTRICAL HAZARD

- Only authorized expert electricians qualified in accordance with EN 50110-1/-2 and IEC 60364-1 are allowed to install and commission the device.
- Replace defective or damaged IO-Link masters (for example: deformed connections), otherwise malfunctions of the affected network stations or nodes may result.
- When installing, connecting, and using the IO-Link master, observe all relevant current regional, national, and international standards, mounting instructions, and accident prevention regulations.
- Observe the accident prevention regulations applicable to your plant during installation, commissioning, maintenance, and troubleshooting. For example: DGUV V3 (previously BGV A 3, «Electrical systems and equipment»). Using the device is allowed only in compliance with these regulations and the complete instructions manual. Any other use may endanger the safe use and result in the loss of the warranty or guarantee. Telemecanique Sensors is not liable for damage resulting from improper use.

Failure to follow these instructions can result in injury or equipment damage.

⚠ CAUTION

HAZARD OF INJURY OR EQUIPMENT DAMAGE

- This documentation is part of the product. Therefore, keep the documentation at hand the product is used. Pass the documentation on to any subsequent user of the product. In addition, make sure that any supplements received are included in the documentation, if need be added.
- Before installing, operating, or using the product, carefully read the complete information for use.
- The operating manuals of the IO-Link masters used must be kept at hand at the workplace.

Failure to follow these instructions can result in injury or equipment damage.

Electrical Safety

⚠ CAUTION

ELECTRICAL HAZARD

- Operate the device only with 24 V DC PELV (Protective Extra Low Voltage) or SELV (Safety Extra Low Voltage) voltage sources. Failure to do so may result in an electric shock.
- Connect the device and the plant to functional earth (FE).
- Lay the control/signal/data lines spatially separated from the supply lines.
- Use only conductors whose cross-sections are sufficient for the current carrying capacity.
- Protect the plant against an unintentional or unauthorized switching-on of the mains supply.
- Observe the relevant standards and guidelines for installations according to EMC.
- Disconnect the system to which you want to install the IO-Link masters class A.

Failure to follow these instructions can result in injury or equipment damage.

⚠ CAUTION

HAZARD OF INJURY OR EQUIPMENT DAMAGE

- Operating inadmissible voltage values or frequency values may destroy the device.
- Make sure that the pin assignment is correct.
- The current at a single IO-Link connector must not exceed the limit of 4 A, not even for a short period. With permanent operation, the admissible maximum per connector is 3 A. Otherwise you risk destruction or damage to the device or other devices connected to it. When the permissible maximum pass-through current is exceeded, you risk damage to the device and/or other connected devices.
- The electronic components integrated into the devices meet the ESD requirements of IEC 61000-6-2. Since, under unfavorable circumstances, higher voltages may occur in the field due to charging, discharge must be guaranteed before carrying out any work on the devices.
- The current limit in a load circuit must not exceed 16 A, never. Otherwise you risk destruction or damage to the device or other devices connected to it.
- SELV: Use the same phase or reference point.
- PELV: Limitation related to overvoltage category II.
- Keep sufficient distance to electromagnetic interference sources with all cables to achieve a high immunity of the IO-Link master against electromagnetic radiation. Where necessary, use shielded cables only. Observe the corresponding standards for installations according to EMC.

Failure to follow these instructions can result in injury or equipment damage.

Mechanical Safety

⚠ CAUTION

HAZARD OF INJURY OR EQUIPMENT DAMAGE

- Check the device for transport damage before commissioning. If damaged, the product must not be put into operation.
- When laying cables, make sure not to lay them in the shear zones of moving system parts.

Failure to follow these instructions can result in injury or equipment damage.

Thermal Safety

⚠ CAUTION

BURN AND ELECTRIC SHOCK HAZARD

- During operation, the housing surface and the metallic connection sockets heat up. The surface temperature of the device may rise above 40 °C. Under special conditions (for example in case of a fault or at an increased ambient temperature), touching the device may lead to burns. When the device was in operation, allow it to cool down before touching it, wear protective gloves or apply protective covers or a touch guard
- The cooling of the device must not be impaired. Make sure that the air supply is not obstructed.
- Do not mount the device on, at or near highly flammable materials.

Failure to follow these instructions can result in injury or equipment damage.

Information and Data Security

NOTICE

INFORMATION SECURITY MEASURES AND DATA SECURITY MEASURES

- Take all standard information measures and data security measures. Telemecanique explicitly points out that a device with access to a public network (Internet) has to be installed behind a firewall or should be accessible only via a secure connection such as an encrypted VPN connection. Otherwise, the integrity of the device, its data, or the application or system section is not guaranteed. Telemecanique disclaims all warranty or liability for damage caused by neglect of safety measures or incorrect installation.
- Change the password immediately after commissioning. The factory default setting is generally known and does not provide sufficient protection.

Failure to follow these instructions can result in equipment damage.

Indirect Security

⚠ WARNING

SAFE OPERATING STATE

If automation solutions are implemented that may cause personal injury or great property damage in case of a fault, you must take appropriate measures to implement a safe operating state of the plant even in case of a fault.

Take appropriate, external and independent measures to prevent personal injury or property damage in case of hazardous operations.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

NOTICE

CLEANING

For handling the device always use clean tools and materials.

Clean the device only with a dry or soft cloth moistened with water. Do not use any hard objects that might cause scratches or cleaning agents, for example: abrasives, diluents, alcohols, ketones (for example: acetone), and chlorinated hydrocarbons (for example: dichloromethane).

Failure to follow these instructions can result in equipment damage.

⚠ CAUTION

PERSONNEL QUALIFICATION FOR MAINTENANCE AND REPAIR WORK

The product does not contain any parts requiring maintenance by the user. Have maintenance, adaptation, service or repair work carried out only by expert personnel authorized by Telemecanique.

Failure to follow these instructions can result in injury or equipment damage.

NOTICE

PERSONNEL QUALIFICATION FOR THE USE OF NETWORK ANALYSIS TOOLS

Only trained and qualified specialists are allowed to use network analysis tools (for example: «Wireshark»).

Failure to follow these instructions can result in equipment damage.

NOTICE

INFORMATION PRINTED ON THE PRODUCT

In addition, observe the information printed on the product.

Failure to follow these instructions can result in equipment damage.

Safe Operation of the Flash Memory

There are two way to implement the safe operation of the internal Flash memory of the device.

Interruption of the Power Supply

Write and delete access operations (for example: updating firmware or saving configuration) in the FAT file system of the device may lead to the destruction of the FAT (File Allocation Table) if the access operations cannot be completed due to a voltage drop. If the FAT is corrupted, a firmware is possibly not be found and cannot be started.

Make sure that the power supply to the device is not interrupted during write and delete access operations in the file system (updating firmware, downloading configuration, and so on).

Maximum Number of Write and Delete Accesses

This device uses a serial flash chip to store remanent data such as firmware storage, configuration storage, and so on. This device allows a maximum of 100000 write/delete accesses that are sufficient for standard operation of the device. However, writing/deleting the chip excessively (for example: changing the configuration or changing the name of station) leads to the maximum number of permitted write/delete accesses being exceeded and to device damage. For example: if the configuration is changed once an hour, the maximum number is reached after 11.5 years. If the configuration is changed even more frequently, for example: once a minute, the maximum number is reached after approximately 69 days.

Avoid exceeding the maximum permitted write/delete accesses by writing too often.

Planning

Requirements

Hardware and System Requirements

To install your IO-Link master, you need the following hardware components:

- Power supply: 24 V DC SELV (Safety Extra Low Voltage) or PELV (Protective Extra Low Voltage),
- Power supply cable with L-coded M12 connector,
- Ethernet cable with D-coded M12 connector,
- Ethernet/IP Scanner (PLC),
- At least one IO-Link class A device,
- IO-Link cable with A-coded M12 connector.

Additional components:

- Ethernet network switch.

For commissioning:

- PC or notebook with at least one additional Ethernet port and Internet access.

Software Requirements

For commissioning and configuration:

- Web browser or Simply Config IO-Link application,
- DHCP server (required at least for the initial commissioning).

Mounting Guidelines and Standards

While mounting, observe the following relevant standards:

- DIN 60204 (Electrical equipment of machines),
- DIN EN 50178 (Electronic equipment for use in power installations),
- EN 61439 (Low-voltage switchgear and controlgear assemblies).

DIN 60204 and DIN EN 50178 also specify the requirements for power supplies according to PELV (Protective Extra Low Voltage) and SELV (Safety Extra Low Voltage) as well as the requirements for the isolation of the supply lines.

Supply Concept

Dimensioning the Supply

Basics

Supply of the Device and the Connected Sensors/Actuators

The 24 V supply voltages are supplied via supply input X21 (PWR IN).

The device has two galvanically isolated supply lines:

- Supply line 1 connects 1L+ (pin 1) with 1L- (pin 3).
- Supply line 2 connects 2L+ (pin 4) with 2L- (pin 2).

In case of IO-Link master class A, pin 4 and pin 2 are directly connected with each other.

The sensors, actuators or hubs connected to the device are supplied via port X1, X2, … . When dimensioning the supply, the required current of the connected sensors and actuators must be taken into account.

Further devices can be supplied via supply output X22 (PWR OUT). The current flowing at X22 is referred to below as the pass-through current and must be taken into account when dimensioning the supply. In contrast to the currents at the ports, the pass-through current cannot be measured by the sensors integrated in the device.

> **NOTE**: For more information on the pass-through current, see Rules 1 and 2 Supply Input X21 and Supply Output X22, page 20.

Protection Functions

The integrated protection functions of the device (see Overload Protection, page 9) prevent damage in overload situations (for example: overcurrent or short circuit), but they do not include the pass-through currents for supplying further devices via supply output (X22). Protective equipment is therefore required to limit the pass-through current via X21 and X22 (for example: safety fuse or automatic circuit breaker, see Technical Data, page 141).

Calculation of the Required Current

The required current of each supply line depends on the connected devices. The following branch currents are components of the total current and thus increase the required current.

Supply line 1:

- Logic supply (approximately 200 mA),
- Supply of all connected sensors/actuators and hubs via 1L,
- Supply of further devices via 1L.

Supply line 2:

- Supply of the further devices via 2L.

The 2L voltage of IO-Link master class A devices is not used for the separate power supply of actuators, it is only passed through.

Rules

The following rules must be observed to take the required current of the connected devices into account and to avoid damage to the device:

- Supply voltage input X21 (PWR IN) and supply voltage output X22 (PWR OUT)
  - Rule 1: Take the current carrying capacity of each pin of a connector into account.
  - Rule 2: Take the pass-through current 1L and 2L into account.
- Ports X1, X2, …
  - Rule 3: The current carrying capacity of pin 3 must not exceed 4 A because the sum of the currents of pins 1, 2, and 4 flows back via pin 3.

Rules 1 and 2 Supply Input X21 and Supply Output X22

The currents for the galvanically isolated supply lines 1 and 2 must be considered individually. The two supply lines are defined as follows:

- Supply line 1 corresponds to the way the current flows from pin 1 (signal 1L+) of power supply connection PWR IN (X21) through the device to pin 3 (signal 1L-) of PWR IN. The way of the current is shown in blue in chapter.
- Supply line 2 corresponds to the way the current flows from pin 4 (signal 2L+) of power supply connection PWR IN (X21) through the device to pin 2 (signal 2L-) of PWR IN. The way of the current is shown in red in chapter.

Rule 1 - Maximum Limit of 16 A for Current in the Entire Supply Line (1 or 2)

The following rule applies to both supply lines.

The upper limit of 16 A applies to the total current in a supply line. If you exceed this limit, you risk damaging or destroying the device. To avoid that, protect each supply line with a fuse or a circuit breaker; see Protection, page 23.

Also pay attention to the dependence of the permissible maximum current on the ambient temperature; see Derating, page 25.

The following branch currents are components of the total current in supply line 1:

1. Current I_{logic} for supplying the internal electronic system of the device (the device is supplied via supply line 1),
2. Currents I_{Xi_1L} for supplying the connected devices, sensors, and actuators (for each port Xi),
3. Current I_{X22_1L} that flows via supply voltage output PWR OUT (X22) to the other connected devices (pass-through current).

The following branch currents are components of the total current in supply line 2:

1. Currents I^{Xi_2L} for supplying the connected devices, sensors, and actuators (for each port Xi)
2. Current I^{X22_2L} that flows via supply voltage output PWR OUT (X22) to the other connected devices

Rule 2 – Limitation of the Pass-through Current

The following rule applies to both supply lines

The supply voltage for the devices of a supply line connected to output supply connector PWR OUT is passed through the device from the input supply connector. The current carrying capacity of the connector at the power supply input and the PCB is maximum 16 A and specifies the permissible maximum pass-through current for the respective supply line. The total current must not exceed this limit of 16 A.

Observe the following notes:

1. When using digital outputs, the permissible pass-through current must be reduced by the current that flows through these digital outputs.
2. In the worst case, the permissible pass-through current can reach the value 0 A.
3. The pass-through connection between supply voltage input and output has no internal protective device against overcurrent.

NOTE: For a description of the required safety measures, see Safety, page 13.

As an additional measure, Telemecanique recommends that the values measured by the sensors integrated in the device be monitored by a monitoring application, see Monitoring Functions, page 9.

Rule 3 Ports X1, X2

Rule 3 - Upper Limits for the Current at the Individual Pins of the Connectors

The following rules apply to each pin of the connectors.

The currents at the individual pins of the connectors (IO-Link ports) must not exceed the following upper limits:

Upper limits for the current at the pins of the IO-Link ports:

Pin	Operation under standard	Operation under overload conditions
1	4A	
2	2A	2.4 A
3	4A	
4	2A	2.4 A

The design of the device allows an unlimited operation under overload conditions. Valid for all pins:

Exceeding the maximum load capacity (upper limit of overload operation) of a pin may damage or destroy the printed circuit board or connector of the device.

NOTE: The sum of the currents of pins 1, 2, and 4 flows at pin 3.

Device-dependent Information - IO-Link devices

Pay attention to the currents explained in the following table for supply line 1 of the IO-Link device:

Current	Description
I_{X21_1L}	Current at connector PWR IN (X21): Current 1L+/reverse current 1L-
I_{X22_1L}	Current at PWR OUT (X22): Current 1L+/reverse current 1L-
I_{Logic}	Logic supply
I_{X1_1L}, I_{X2_1L}, … , I_{X8_1L}	Total current for supply line 1 at port Xi (i.e. port X1, X2, …, X8) corresponds to the current $I_{Xi\_Pin3\_1L}$ at pin 3 (ground). This current is the sum of the currents on pins 1, 2, and 4 of port Xi: $I_{Xi\_1L} = I_{Xi\_Pin3\_1L} = I_{Xi\_Pin1\_1L} + I_{Xi\_Pin2\_1L} + I_{Xi\_Pin4\_1L}$
I_{Device_1L}	Device current $I_{Device\_1L} = I_{X1\_Pin3\_1L} + I_{X2\_Pin3\_1L} + … + I_{X8\_Pin3\_1L}$

Pay attention to the currents explained in the following table for supply line 2 of the IO-Link device:

Current	Description
I_{X21_2L}	Current at connector PWR IN (X21): Current 2L+/reverse current 2L
I_{X22_2L}	Current at connector PWR OUT (X22): Current 2L+/reverse current 2L
I_{Device_2L}	Device current $I_{Device\_2L} = 0$

In this device, supply line 2 is used only for connecting PWR IN (X21) and PWR OUT (X22).

When operating the device, always observe the following rules for the currents in supply lines 1 and 2:

Current	Supply line 1	Supply line 2
Total current for supply line (rule 1)	$I_{X21\_1L} \leq 16$ A $I_{X21\_1L} = I_{Logic} + I_{X22\_1L} + I_{Device\_1L}$	$I_{X21\_2L} \leq 16$ A $I_{X21\_2L} = I_{X22\_2L}$
Permissible pass-through current (rule 2)	$I_{X22\_1L} \leq 16$ A - ILogic - I_{Device_1L}	$I_{X22\_2L} \leq 16$ A
Ports	Port X1, … , X8 (below referred to as port Xi with $1 \leq i \leq 8$)	-
Supply current at pin 1 (rule 3)	$I_{Xi\_Pin1\_1L} \leq 4$ A	-
Signal current at pin 2/4 during operation under standard conditions (rule 3)	$I_{Xi\_Pin2\_1L} \leq 2$ A $I_{Xi\_Pin4\_1L} \leq 2$ A	-
Signal current at pin 2/4 during operation under overload conditions (rule 3)	$I_{Xi\_Pin2\_1L} \leq 2{,}4$ A $I_{Xi\_Pin4\_1L} \leq 2{,}4$ A	-
Reverse current at pin 3 (ground) (rule 3)	$I_{Xi\_Pin3\_1L} \leq 4$ A	-

⚠ CAUTION

DEVICE DAMAGE WHEN THE PERMISSIBLE PASS-THROUGH CURRENT IS EXCEEDED

If you exceed the permissible maximum value for the pass-through current, you risk damage to the device and/or other connected devices.

Failure to follow these instructions can result in injury or equipment damage.

Requirements on the Power Supply

Power Supply

⚠ WARNING

PELV OR SELV POWER SUPPLY REQUIRED

Operate the device only with 24 V DC voltage supply PELV (Protective Extra Low Voltage) or SELV (Safety Extra Low Voltage). If you fail to do so, you risk an electric shock.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Protection

Always protect the supply cable from the power supply unit to the first device with a device circuit breaker or a fuse. For that purpose use a fuse or an automatic circuit breaker 24 V DC/maximum 16 A with type B tripping characteristic.

⚠ CAUTION

DEVICE DAMAGE

Do not exceed the maximum supply current, otherwise you risk damage to the printed circuit board and the connector of the device.

Failure to follow these instructions can result in injury or equipment damage.

Additional Measures

The chip used in the IO-Link masters can measure the current values of all currents on pins 1, 2, and 4 of all connectors. The chip can also calculate the current sum currents of the two supply lines from several measured values. The current at pin 3 (ground pin) of a connector corresponds to the sum of the currents at pins 1, 2, and 4 of that connector. The measured values enable you to implement a monitoring application with an integrated power management. The application can access the measured values via the OPC UA server. Design the monitoring application in such a way that it meets your individual demands and regularly checks compliance with the monitioring functions using the measured current, temperature and voltage values.

Examples of Supply Types

The device can be supplied with its operating voltage individually, or it can be part of a supply group consisting of several devices.

You have two possibilities of forming supply groups of several devices:

- Via PWR OUT: One or more additional devices can be supplied with power via supply voltage output PWR OUT (X32) and thus form a supply group together with the device.
- Via an IO-Link hub device: A device forms a common supply group with IO-Link hub devices being connected via IO-Link.

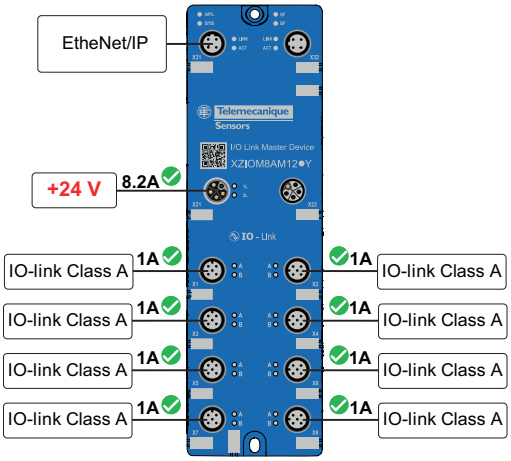
One example of single supply and one of group supply is explained below:

- Single supply,
- Supply group via PWR OUT (with a calculation of the permissible pass through current).

Example of a Single Supply

This example shows an individual XZIOM8AM12EY device whose PWR OUT connector (X22) does not supply any other device with power.

"Single supply" connection example XZIOM8AM12EY:



One IO-Link class A device each requiring maximum 1 A current is connected to the ports X1 to X8 of XZIOM8AM12EY. XZIOM8AM12EY requires 0.2 A current.

The total current required in supply line 1 thus is: 8 * 1 A + 0.2 A = 8.2 A.
This value does not exceed the maximum value of 16 A per supply line and is thus permissible.

Example of a Supply Group via PWR OUT

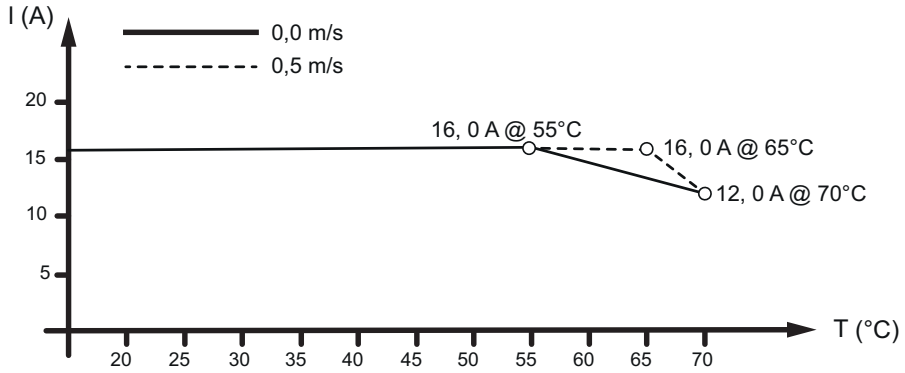
By connecting an additional device to supply voltage output PWR OUT (X22), you form a supply group. The permissible maximum pass-through current of this device is 16 A – 8.2 A = 7.8 A.

Derating

Pay attention to the derating when using the device. Ambient temperature and current influence the heating of the device.

The derating curve was created under the operating conditions "without air flow or with 0.5 m/s air flow" as well as "installation on a wall of poor thermal conductivity". The actual operating conditions may improve the heat dissipation of the device, for example by a higher air flow or a better heat dissipation to the mounting wall. The device provides measured temperature and current values that you can display via the web server or read out via the OPC UA protocol.

The following diagram shows the permissible maximum value of current (I) that may flow into the device depending on the ambient temperature (T):



Mounting

Tools Required for Mounting

For mounting you need the following tools:

- Allen key for the M4 fixing screws with hexagon socket.

Additionally required only for mounting when there is no threaded hole:

- M4 thread tap (ready-made or set of taps),
- Drilling machine (to pre-drill the holes for mounting the device on the system).

Moreover, you need 2 M4 hexagon socket cylinder head screws of suitable length according to DIN 912/ISO 4762.

Before Mounting

Always observe the following notes:

- Only authorized expert electricians qualified in accordance with EN 50110-1/-2 and IEC 60364-1 are allowed to install and commission the device,
- Observe the safety instructions of chapter,
- Before mounting the device, check it for damage, for example transport damage. Damaged devices must not be commissioned.

Mounting Instructions

Observe the following points when selecting the mounting location:

- Mount the device in such a way that it is protected from weathering (no direct sunlight, no salt water or salt spray) and the effects of UV light.
- Only screw the device onto flat contact surfaces to protect it from mechanical tension.
- To protect the device from tensile forces that may occur, do not use it to bridge any gaps.
- To prevent damage to the device, do not mount it in shearing zones of moving system parts. Lay the cables in such a way that they cannot get caught by moving system parts in the shearing zones.
- Leave sufficient space for easy replacement of the device and for connecting the plug connections.
- Make sure that the requirements of the device on vibration and shock resistance are fulfilled at the installation site.
- Mount the device in such a way that its diagnosis LEDs remain visible.

Notes on Protection Against the Heat Generated by the Device

The device can get hot during operation. For that reason, always observe the following notes:

- Do not mount the device in close proximity to objects or equipment that may become hot. In case of a high utilization of the devices, the temperature-dependent working area can be extended by mounting the devices in ventilated areas, on metal surfaces, metal profiles or the like. For optimization you can use the internal temperature measurement of the device.
- Do not mount the device on or near highly flammable materials.
- The cooling of the device must not be impaired.
- Check that the air supply is unobstructed.

Mounting

The devices is mounted with two M4 screws in the cabinet. Note, that the device has to be connected via a screw to FE (Function earth).

Installation

General Information on Installation

Lay the cables in accordance with local conditions and regulations.

Keep the min. distances between the cabling and possible sources of interference (including machines, welding equipment, power lines) to avoid data loss and corruption. Observe the applicable standards and regulations for planning and installing a system.

Mechanical Stress

Observe the following information to protect the cables from mechanical stress:

- Select the correct line type for your application. Make sure that the wires have a sufficient cross-section,
- Consider the min. bending radius,
- Make sure that lines do not enter the shear area of moving machine parts,
- Do not lay the cables crosswise to travel paths and machine movements,
- Use cable channels or cable bridges.

Interference

Follow these instructions to reduce interference:

- Lay network cables (for example Ethernet cables) in separate cable channels.
- Do not lay network cables parallel to supply lines that are used for high power.
- When installing shielded connectors (screws, union nuts), implement the best possible contact between shielding and ground. Check the connection of the grounding or shielding of the cables for low impedance passage before the first commissioning.

Protective Caps

Use protective caps for currently unused connectors to protect the connectors and to make IP67 protection effective. Protective caps are included within the scope of delivery.

Connecting Lines

Telemecanique Sensors recommends the use of factory-made connection lines for the IO-Link master class A devices. The tightening torques specified in section Technical data apply to the connectors of the connecting cables.

Mounting Distances

No specific distances are prescribed between two devices of the "IO-Link master" product family or between a device and a cabinet door or cover. The mounting distances depend only on the connectors, cables, and their bending radii. A factory-made connector can project beyond the edge of the respective housing.

The distance between one IO-Link Master and one IO-Link sensor / actuator is

limited to 20 m *(65.61 ft).*

In case of high ambient temperatures and high current loads at the same time, the devices of the product family "IO-Link master" should not be mounted directly next to each other, so that they do not heat up each other and have a large surface area for heat dissipation to the ambient air.

Grounding

Basically, you have two options for grounding the device:

- Via cable
- Via the housing

You can apply both options individually or together.

The IO-Link master class A operates in the low voltage range (SELV/PELV). With

these devices, functional earth (FE) is only used to dissipate interference, not as a touch protection for people.

> **NOTE**: Functional grounding is essential for trouble-free operation of the device. Use conductive fixing screws at the mounting holes and make sure that they have good contact.

Connecting Power Supplies

For the devices of the "IO-Link master" product family, two voltages are distinguished:

- 1L to supply logic and sensors/actuators
- 2L to supply actuators (separate actuator supply)

All supply voltages are connected via L-coded M12 connectors.

The 2L voltage of IO-Link master class A devices is not used for the separate power supply of actuators, it is only passed through.

⚠ CAUTION

DAMAGE TO THE ELECTRONIC SYSTEM

Connect each of the supply voltages separately with +24 V and 0 V. Connecting several supply voltages via a common 0 V connection is not permitted because this exceeds the current carrying capacity of the contacts.

Failure to follow these instructions can result in injury or equipment damage.

Power Supplies 1L and 2L

The voltages 1L and 2L are galvanically separated in the device and fed in at connection X21.

The 1L power supply serves to supply the electronic system of the device and the connected sensors/actuators. Connect these to connector X21. If you want to supply additional devices via this current path, connect the supply voltage output (connection X22) of your IO-Link Master to the supply voltage input of the next device to be supplied. If this device has a pass-through possibility for the supply voltage, you can also set up a cascaded power supply.

⚠ CAUTION

DAMAGE TO THE ELECTRONIC SYSTEM

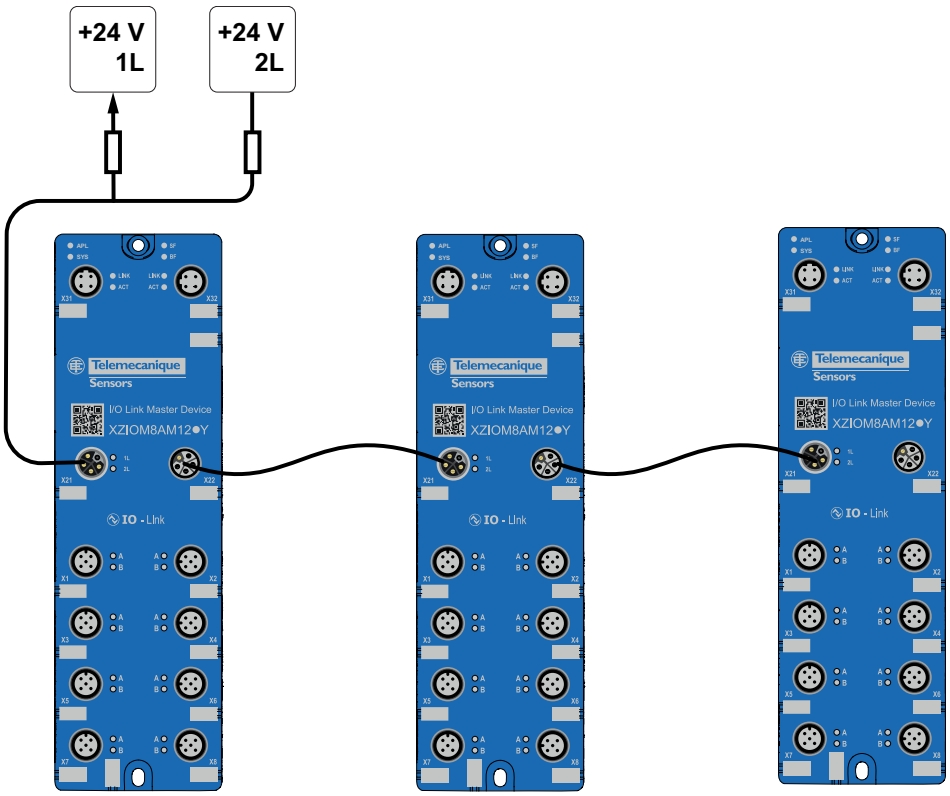
The maximum current carrying capacity of the L-coded M12 connectors of a current path (1L or 2L) is 16 A. Protect both current paths independently of each other so that the sum of all currents in the respective current path never exceeds the limit value of 16 A. To calculate the permissible maximum value of the pass-through current, see Device-dependent Information - IO-Link devices, page 22. Note that connection X22 (supply voltage output) is not monitored for overload. Exceeding the permissible current carrying capacity may damage the connectors.

Failure to follow these instructions can result in injury or equipment damage.

NOTE: For a description of the supply voltage connections (M12, L-coded), see Connectors and Interfaces, page 12.

Telemecanique Sensors recommends using factory-made connection cables.

The following figure shows an example of supplying and passing through voltages:



Load Capacity of the Supply Line (M12)

Consider the permissible current carrying capacities, see section Device-dependent Information - IO-Link devices, page 22.

⚠ CAUTION

DAMAGE TO THE ELECTRONIC SYSTEM

When passing through the supply voltage, observe the following upper limit:

Maximum total current at 1L: 16 A.

Maximum total current at 2L: 16 A.

The ambient temperature also influences the permissible total current. The above information is valid for room temperature. To consider the influence of higher temperatures, observe the notes on temperature-related derating, see Derating, page 25.

Failure to follow these instructions can result in injury or equipment damage.

Examples of Calculation

For examples of calculation of the permissible maximum pass-trough, see Device-dependent Information - IO-Link devices, page 22.

Calculation of Cable Loss

You can calculate the cable loss per wire as follows:

U = 2 x I x RL

Parameters for calculating the cable loss per wire:

U	Voltage drop
2	Factor for the feed and return cable
I	Current
RL	Cable resistance

The line resistance R_L (per wire) of a supply line of 4 x 1.5 mm^2 is:

$R_L \leq 13.7\ \Omega/KM$

Example of the voltage drop per wire at a current of 8 A on a supply line of 4 x 1.5 mm^2:

U = 2 x 8 A x 13.7 Ω/km = 219.2 V/km

This corresponds to a voltage drop of 2.19 V per 10 m cable length.

For the supply line of 4 x 2.5 mm^2 (fine-wire, class 6), the line resistance R_L per wire is:

$R_L \leq 8.22\ \Omega/km$

Example of the voltage drop per wire at a current of 16 A on a supply line of 4 x 2.5 mm^2:

U = 2 x 16 A x 8.22 Ω/km = 263 V/km

This corresponds to a voltage drop of 2.63 V per 10 m cable length.

Suggestion:

If you do not know the resistance of the cable used, you can calculate it with the following formula:

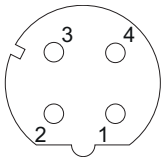
$R_L = l/(K \times A)$

Parameters for calculating the resistance:

RL	Cable resistance
l	Cable length
K	Specific resistance of the conductor material (mostly copper) according to the manufacturer's specification
A	Wire cross section (refers to the cross section of a single wire)

Connecting Ethernet/IP

To establish a connection with an Ethernet/IP Scanner, connect the device to an Ethernet network.

Ethernet	Pin	Signal	Description
	1	TX+	Send data positive
	2	RX+	Receive data positive
	3	TX-	Send data negative
	4	RX-	Receive data negative
	Housing	Shielding	Shield connection, housing is connected to functional earth.

If the Ethernet cable (with RJ45 connector) used is ready-made at one end, a shielded M12 connector with a degree of protection IP 67 must be installed at its other end.

The assignment between the signals, the colors of the individual wires and the contacts on the M12 and RJ45 connectors is as follows:

Contact	Contact	Color	RJ45 connector contact
1	TX+	Yellow	1
2	RX+	White	2
3	TX-	Orange	3
4	RX-	Blue	6

A crossover cable is not required. Since the Auto-MDI(X) function is enabled for the respective Ethernet port and automatically detects the send and receive data direction, it does not matter whether you use a crossed or an uncrossed cable.

Connecting a Single Device to an Ethernet Network

To connect the device to the Ethernet network, proceed as follows:

Step	Action
1	Disconnect that part of the plant from the power supply to which you have mounted the device.
2	Connect the device to the Ethernet network by plugging the Ethernet cable into connector X31.
3	Thereafter, tighten the connector with the knurled screw.

Connecting Several Devices to an Ethernet Network

Line topology/star topology

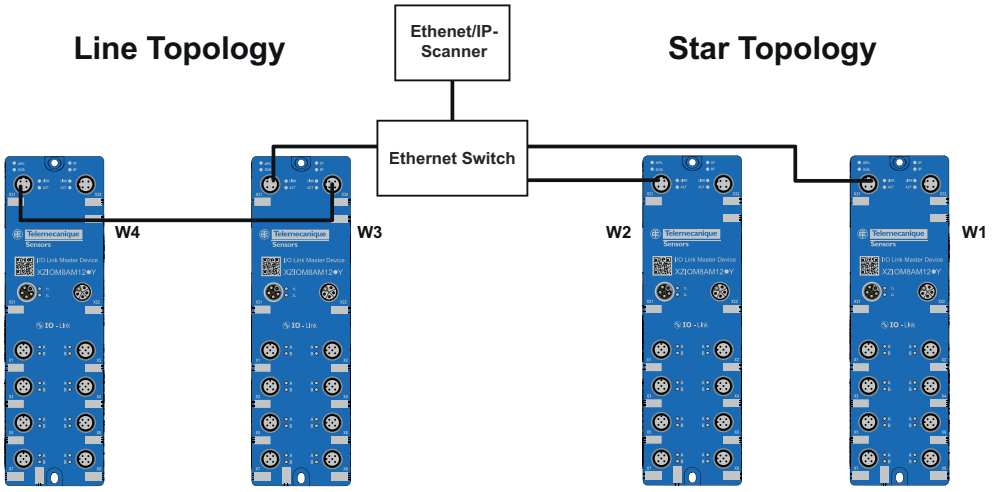
The IO-Link master XZIOM8AM12EY has two ports with an integrated switch so that a line topology can be wired.

The network topology shown in the figure below consists of a mixed star and line topology. To set up a star topology or a mixed topology, you need an Ethernet switch. Only the Ethernet specification IEEE 802.3 limits the number of devices of a star topology.

To connect several devices to the Ethernet network, proceed as follows:

Step	Action
1	Disconnect that part of the plant from the power supply to which you want to mount the device.
2	For a star topology, connect the Ethernet cables (W1, W2) to connector X31 of one device each of series XZIOM8AM12EYand an Ethernet switch, as shown in the figure below. Then tighten the connectors of the Ethernet cable.
3	For a line topology, connect the Ethernet cables (W3, W4) to connectors X31 and X32 on the device as shown in the figure below. Then tighten the connectors of the Ethernet cable.

The following figure shows how to set up a Ethernet/IP network with a mixed star and line topology:



Device Level Ring (DLR) Topology

This section gives a brief overview about the basics and concepts of the Device Level Ring (DLR) networking technology supported by EtherNet/IP Adapter protocol stack.

DLR is a technology for creating a single ring topology with media redundancy. It is based on Layer 2 (Data link) of the ISO/OSI model of networking and thus transparent for higher layers (except the existence of the DLR object providing configuration and diagnosis).

In general, there are two kinds of nodes in the network:

- Ring supervisors
- Ring nodes

DLR requires all nodes to be equipped with two Ethernet ports and internal switching technology. Each sent frame propagates on both ports, in both directions through the ring.

On reception, each module within the DLR network checks the target address of the received frame whether it matches its own MAC address.

- If the frame is targeting the node's MAC address, it consumes and processes the frame. Thus, the frame will not propagate any further through the ring.
- If the frame targets another MAC, the node propagates the packet to the next ring node by sending it on its other port.

The active ring supervisor uses to disable one of its ports in order to, technically, achieve a line topology and prevent looping packets.

1. Ring Supervisors

There are two kinds of supervisors defined:

- Active supervisors
- Back-up supervisors

NOTE: The EtherNet/IP stack does not support the ring supervisor mode.

1.1. Active supervisors

The active supervisor has the following duties:

- It periodically sends beacon and announce frames.
- It permanently verifies the ring integrity.
- It reconfigures the ring in order to ensure operation in case of single faults.
- It collects diagnostic information from the ring.

Exactly one active ring supervisor is required within a DLR network.

1.2. Back-up supervisors

It is recommended but not necessary that each DLR network has at least one back-up supervisor. If the active supervisor of the network fails, the back-up supervisor will take over and become the active ring supervisor. Therefore, each supervisor is assigned a precedence value. The supervisor with the highest precendence becomes the active ring supervisor, whereas all others stay passive in the role of back-up supervisors.

2. Beacon and Announce Frames

Beacon frames and announce frames are both used to inform the devices within the ring about the transition (i.e. the topology change) from linear operation to ring operation of the network.

They differ in the following:

Direction

- Beacon frames are sent in both directions.
- Announce frames are sent only in one direction of the ring.

Frequency

- Beacon frames are sent periodically every beacon interval, with a typical interval of 400 microseconds. Announce frames are sent once per second.

Support for Precedence Number

- Only Beacon frames contain the internal precedence number of the supervisor which sent them

Support for Network Fault Detection

- Loss of beacon frames allows the active supervisor to detect and discriminate various types of network faults in the ring.

3. Ring Nodes

This subsection deals with modules in the ring, which do not have supervisor capabilities. These are denominated as (normal) ring nodes.

There are two types of normal ring nodes within the network:

- Beacon-based
- Announce-based

A DLR network may contain an arbitrary number of normal nodes.Nodes of type beacon-based have the following capabilities

- They implement the DLR protocol, but without the ring supervisor capability
- They must be able to process beacon frames with hardware assistance

Nodes of type announce-based have the following capabilities

- They implement the DLR protocol, but without the ring supervisor capability
- They do not process beacon frames, they just forward beacon frames
- They must be able to process announce frames
- This type is often only a software solution

NOTE: Devices running an EtherNet/IP firmware always run as a beacon-based ring node.

4. Normal Network Operation

In normal operation, the supervisor sends beacon and announce frames in order to monitor the state of the network. Usual ring nodes and back-up supervisors receive these frames and react. The supervisor sends announce frames once per second and additionally, if an error is detected.

5. Rapid Fault/Restore Cycles

Sometimes a series of rapid fault and restore cycles may occur in the DLR network for instance if a connector is faulty. If the supervisor detects 5 faults within a time period of 30 seconds, it sets a flag (Rapid Fault/Restore Cycles) which must explicitly be reset by the user then. This can be accomplished via the "Clear Rapid Faults" service.

Connecting Sensors and Actuators

The sensor/actuator cables serve to supply connected sensors or actuators and to transmit the sensor and actuator signals.

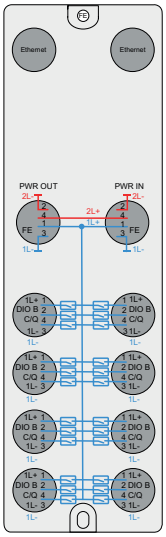
Observe the highest current carrying capacity of the supply contacts, see Rule 3 Ports X1, X2, page 21.

If a port is operated in IO-Link mode, a maximum of 1 A may flow via pin 1 and pin 3 without additional measures. The use of standard cables allows lengths of up to 20 m as long as the current remains below 1 A.

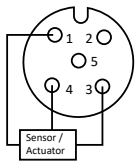
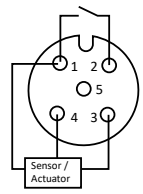
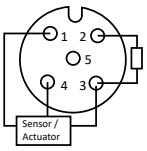
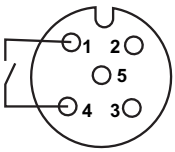
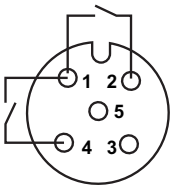
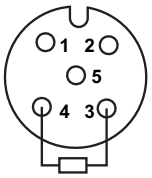
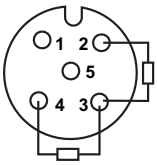
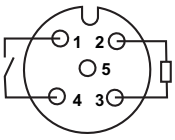
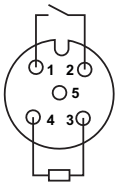
Higher currents are possible, but require a higher conductor cross-section or a shorter cable length to keep the voltage drop below 1.2 V along the return path of the current.

The following figure shows the potential routing of the two load circuits within the device.

Schematic diagram of the supply:



The following table shows the connection options for IO-Link devices (class A), digital inputs and outputs:

Connection	Description
	Connection of an IO-Link device. Required port configuration: IO-Link master and pin 2 deactivated.
	Connection of an IO-Link device and a digital input to channel B. Required port configuration: IO-Link master and pin 2 as a digital input.
	Connection of an IO-Link device and a digital output to channel B. Required port configuration: IO-Link master and pin 2 as a digital output.
	Connection of a digital input to channel A. Required port configuration: Pin 4 as a digital input and pin 2 deactivated.
	Connection of two digital inputs to channel A and B. Required port configuration: Pin 4 and pin 2 as a digital input.
	Connection of a digital output to channel A. Required port configuration: Pin 4 as a digital output and pin 2 deactivated.
	Connection of two digital outputs to channel A and B. Required port configuration: Pin 4 and pin 2 as a digital output.
	Connection of a digital input to channel A and a digital output to channel B. Required port configuration: Pin 4 as a digital input and pin 2 as a digital output.
	Connection of a digital output to channel A and a digital input to channel B. Required port configuration: Pin 4 as a digital output and pin 2 as a digital input.

Commissioning

Getting an IP Address from a DHCP Server

Overview

The device needs an IP address so that it can be addressed via the Ethernet network. In the state of delivery, the device does not have an IP address, and, once started, the device sends requests to a DHCP server in order to get an IP address.

If a DHCP server is already available in the network, ask your network administrator for the IP address assigned to the device and use its MAC address for identification.

Using a DHCP Server on your PC

If no DHCP server exists in the network or if you wish to use a DHCP server in the local network for test purposes, you can use for example the Open DHCP server.

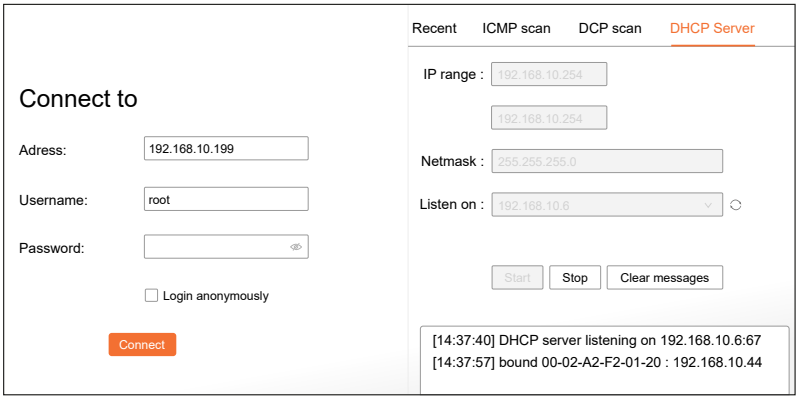
Observe the following notes:

- Never connect your PC to a global network, if a DHCP server is installed on your PC. Since larger networks usually have a DHCP server, collisions might occur causing a collapse of the network.
- Use a DHCP server on your PC only if no DHCP server is available in the network.

Using the DHCP Server in Simply Config IO-Link Software

A DHCP server installed during the installation of the Simply Config IO-Link Configuration software.

To use this in-built DHCP through the software, connect the IO-Link master to your PC and proceed as follows :

Step	Action
1	Select the DHCP Server tab.
2	Enter the start and end address of the IP range which includes at least 10 consecutive IP addresses.
3	Enter the Netmask for the DHCP server. Typical values are `255.255.255.0` or `255.255.0.0`.
4	Use the Listen on drop-down list to select the Ethernet interface the DHCP server has to use to wait for requests. Value 0.0.0.0 means to use all available Ethernet interfaces.
5	Click Start. • The DHCP server waits for DHCP requests. • The DHCP server displays messages with a time stamp. • As soon as the DHCP server has assigned an IP address to a device, it displays bound, the MAC address of the requesting device, and the assigned IP address. • 
6	If necessary, use **Clear messages**.
7	To stop the DHCP server, click **Stop**.

Configuration Tools

Overview

There are several ways to set the parameters of the IO-Link master. The following table provides an overview of the tools:

Tool	Description
PLC with Ethernet/IP Scanner	The Ethernet/IP Scanner must be configured to exchange process data with XZIOM8AM12EY.. The EDS file “TESENSORS_XZIOM8AM12EY_V1.1_IOLMA.EDS” describes the device. The configuration software of the Ethernet/IP Scanner can import this EDS file. The user can configure and parameterize XZIOM8AM12EY. The user loads the configuration into the Ethernet/IP Scanner. The Ethernet/IP Scanner configures the XZIOM8AM12EY via Ethernet/IP. Whether or not the scanner sends parameters (port configuration) depends on the selected connection. If, for example, connection 1 is selected, the Ethernet/IP Scanner transmits parameters to XZIOM8AM12EY. If, for example, connection 2 is used, the Ethernet/IP Scanner does not transmit any parameters to XZIOM8AM12EY and the ports must be configured with another tool. Chapter Selecting the Connection, page 44 describes the connection with which the Ethernet/IP Scanner transmits parameters and with which it does not.
IO-Link master web server	The IO-Link master web server is a web server integrated in XZIOM8AM12EY. With a web browser, the user can open the web pages to display and change parameters.
Simply Config IO-Link application	Simply Config IO-Link is a software for configuring the IO-Link master and the IO-Link devices.

Configuration and parameterization are subdivided in three sections:

- **Ethernet/IP configuration**: Select the Ethernet/IP connection.
- **Port configuration**: IO-Link master, digital input or output.
- **IO-Link device configuration.**

The following table shows which tool can influence which section:

Tool	Ethernet/IP connection	Port configuration	IO-Link device configuration
Ethernet/IP Scanner	The Ethernet/IP Scanner configures the Ethernet/IP connection of XZIOM8AM12EY.	Depending on which connection is used, the Ethernet/IP Scanner transmits parameters or not. Connection with parameterization: The scanner uses the parameters in the EDS file to set parameters selected by the user. These parameters configure each individual port and determine whether the port is used as an IO-Link master, as a digital input or as a digital output (or whether it is deactivated). Connection without parameterization: The port must be configured with another tool. Chapter Selecting the Connection, page 44 describes the connection with which the Ethernet/IP Scanner transmits parameters and with which it does not.	-

Tool	Ethernet/IP connection	Port configuration	IO-Link device configuration
IO-Link master web server	-	Yes	Objects of the IO-Link device can be read and written. For this purpose, the IO-Link master web server uses ISDU (Indexed Service Data Unit) services. This requires expert knowledge and the object description of the IO-Link device used. The IO-Link master web server does not evaluate IODD.
Simply Config IO-Link application	-	Yes	Yes The Simply Config IO-Link application can use IODD to parameterize an IO-Link device.

NOTE: If a connection is used with which the Ethernet/IP Scanner scanner transfers these parameters to the device each time the Ethernet/IP communication is started. Port configuration parameters set by the IO-Link master web server, Simply Config IO-Link application, or the OPC UA client are overwritten. Parameters set via Ethernet/IP have priority.

If you have changed port configuration parameters via the IO-Link master web server, the Simply Config IO-Link application, or the OPC UA client for XZIOM8AM12EY, note that the device initially accepts these changes, but the Ethernet/IP Scanner overwrites them as soon as it starts again. If you want to change the port configuration parameters, change them in the configuration software of the Ethernet/IP Scanner.

IO-Link Master Web Server

The IO-Link master web server is a web server integrated in the device.

You need a browser to access the IO-Link master web server in order to:

- Display and change device settings,
- Display port-specific information for ports X1, X2, …,
- Log user administration, user setup as well as users on and off,
- Reset the device to factory settings and reload firmware.

Port-specific information includes, for example:

- Display of the current measuring values of the ports (temperature, voltage, current of each pin) and information on the connected IO-Link device,
- Display of status information of the port,
- Port configuration: for example setting the operating mode,
- Read and write access to the connected IO-Link devices,
- Display of process data.

Simply Config IO-Link

The Simply Config IO-Link application enables the configuration of the IO-Link master, the IO-Link ports, and the connected IO-Link devices.

Moreover, Simply Config IO-Link enables access to diagnosis data, events, and the indices/subindices of the connected IO-Link devices.

Simply Config IO-Link can be used with the operating systems Windows, Apple MacOS, and Linux.

> **NOTE**: The document "Configuring Simply Config IO-Link, IO-Link Master, and IO-Link devices" describes the Simply Config IO-Link application.

Configuring Ethernet/IP

To make Ethernet/IP Scanner and Ethernet/IP Adapter exchange process data, the Ethernet/IP Scanner requires configuring. For this purpose, you need the device description file (EDS file) of the device used:

`TESENSORS_XZIOM8AM12EY_V1.1_IOLMA.EDS`

Perform the following steps in the configuration software of the Ethernet/IP Scanner used:

Step	Action
1	Import the EDS file.
2	Select the device " XZIOM8AM12EY" from the device catalog and insert it into the configuration project.
3	Select a connection: Connection 1, connection 2, …
4	Set the parameters.

The following sections describe the steps in detail.

Selecting the Device

In the device catalog of the configuration software of the Ethernet/IP Scanner, you can select the device "XZIOM8AM12EY" and insert it into the configuration project.

Selecting the Connection

Overview

The module offers several connections. Select one connection for your use case. By selecting a connection, you determine:

- The type of connection: "Exclusive owner", "Input only" or "Listen only",
- Whether the Ethernet/IP scanner transfers the IO-Link port parameters to the adapter or not,
- The maximum number of IO-Link process data of all connected IO-Link devices: 4, 16 or 32 bytes.

The Scanner Sends the IO-Link Port Parameters to the Device (Adapter)

The scanner does not transfer any IO-Link port parameters in case of connections with the suffix "… without Config". Section shows an overview of the tools you can use for setting the IO-Link port parameters.

With all other connections, the scanner transfers IO-Link port parameters, that you have previously set with the scanner configuration software, to the adapter. The scanner sends these parameters to the device each time a connection is established.

Maximum Number of IO-Link Process Data

By selecting the connection, you specify the maximum number of bytes of the IO-Link process data that applies to all connected IO-Link devices: 4, 16 or 32 bytes. By selecting the connection, you also specify the process data memory required in the PLC.

Select a connection with "… 32 bytes per IO-Link port" if you use one or more IO-Link devices with IO-Link process data of more than 16 bytes. This connection requires 276 input and 276 output data bytes in the PLC.

If you use only IO-Link devices with IO-Link process data of 16 bytes or less and if you want to use less process data memory in the PLC, select a connection with "… 16 bytes per IO-Link port". This connection requires 148 input and 148 output data bytes in the PLC.

If you use only IO-Link devices with IO-Link process data of 4 bytes or less and if you want to use as little process data memory as possible in the PLC, select a connection with "… 4 bytes per IO-Link port". This connection requires 52 input and 52 output data bytes in the PLC.

Connection	Name	Description
Connection 1	Exclusive Owner - 32 bytes per IO-Link Port	• Standard connection. • The port parameters are set with the scanner configuration software and transmitted to the device via this connection. • The scanner can read the input data of the device and write the output data. • IO-Link devices with IO-Link input and output data of up to 32 bytes can be used.
Connection 2	Exclusive Owner - 32 bytes per IO-Link Port without Config	• No port parameters are transmitted to the device via this connection. • The scanner can read the input data of the device and write the output data. • IO-Link devices with IO-Link input and output data of up to 32 bytes can be used.
Connection 3	Listen Only - 32 bytes per IO-Link port	• No port parameters are transmitted to the device via this connection. • The scanner can read the input data of the device. • An additional scanner is required which communicates with the device via an "Exclusive Owner" connection. • IO-Link devices with IO-Link input and output data of up to 32 bytes can be used.
Connection 4	Input Only - 32 bytes per IO-Link Port	• The port parameters are set with the scanner configuration software and transmitted to the device via this connection. • The scanner can read only the input data of the device. • IO-Link devices with IO-Link input data of up to 32 bytes each can be used.
Connection 5	Exclusive Owner - 16 bytes per IO-Link Port ·	• The port parameters are set with the scanner configuration software and transmitted to the device via this connection. • The scanner can read the input data of the device and write the output data. • IO-Link devices with a IO-Link input and output data of maximum 16 bytes can be used.
Connection 6	Exclusive Owner - 16 bytes per IO-Link Port without Config	• No port parameters are transmitted to the device via this connection. • The scanner can read the input data of the device and write the output data. • IO-Link devices with a IO-Link input and output data of maximum 16 bytes can be used.

Connection	Name	Description
Connection 7	Listen Only - 16 bytes per IO-Link Port	• No port parameters are transmitted to the device via this connection. • The scanner can read the input data of the device.An additional scanner is required which communicates with the device via an "Exclusive Owner" connection. • IO-Link devices with a IO-Link input and output data of maximum 16 bytes can be used.
Connection 8	Input Only - 16 bytes per IO-Link Port	• The port parameters are set with the scanner configuration software and transmitted to the device via this connection. • The scanner can read only the input data of the device. • IO-Link devices with IO-Link input data of maximum 16 bytes can be used.
Connection 9	Exclusive Owner - 4 bytes per IO-Link port	Same as connection 5, but IO-Link devices with IO-Link input and output data of maximum 4 bytes.
Connection 10	Exclusive Owner - 4 bytes per IO-Link Port without Config	Same as connection 6, but IO-Link devices with IO-Link input and output data of maximum 4 bytes.
Connection 11	Listen Only - 4 bytes per IO-Link Port	Same as connection 7, but IO-Link devices with IO-Link input and output data of maximum 4 bytes.
Connection 12	Input Only - 4 bytes per IO-Link Port	As connection 8, but IO-Link devices with IO-Link input data of maximum 4 bytes.

Setting Parameters

The "Exclusive Owner" connections 1, 5, and 9 as well as the "Input Only" connections 4, 8, and 12 require the following parameters and settings. The scanner transmits these parameters to the device when the connection is established.

Parameters 10 to 85

Parameters 10 to 15 configure IO-Link port X1,

parameters 20 to 25 configure IO-Link port X2

, …,

parameters 80 to 85 configure IO-Link port X8.

No.	Parameter name	Value range	Default	Description
10, 20, …	IO-Link Port X1/X2/… - Port mode	0 … 4	2	Port mode (configuration of pin 4)
		0: Deactivated		Pin 4 is deactivated.
		1: IOL Manual		Pin 4 is operated as an IO-Link port with manual configuration.
		2: IOL Autostart		Pin 4 is operated as an IO-Link port with an automatic (plug and play) configuration.
		3: Digital Input		Pin 4 is a digital input.
		4: Digital Output		Pin 4 is a digital output.
11, 21, …	IO-Link Port X1/X2/… - Validation and backup	0 … 4	0	Validierung and Backup-Einstellung
		0: No device check		The IO-Link master does not check the compatibility of the connected IO-Link device.
		1: Type-compatible to device V1.0		The IO-Link master uses the Vendor ID and device ID to check whether the connected IO-Link device is compatible and whether it supports specification V1.0.
		2: Type-compatible to device V1.1		The IO-Link master uses the Vendor ID and device ID to check whether the connected IO-Link device is compatible and whether it supports specification V1.1.
		3: Typecompatible to device V1.1, Backup and Restore		The IO-Link master uses the Vendor ID and device ID to check whether the connected IO-Link device is compatible and whether it supports specification V1.1. The IO-Link master uses backup and restore to back up the parameters of the IO-Link device and to load them into the IO-Link device after a device change.
		4: Type-compatible to device V1.1, Restore only		The IO-Link master uses the Vendor ID and device ID to check whether the connected IO-Link device is compatible and whether it supports specification V1.1. The IO-Link master uses Restore to load saved parameters to the IO-Link device after a device change.
12, 22, …	IO-Link Port X1/X2/… - IQ behavior	0 … 2	0	Configuration of pin 2
		0: Not supported		Pin 2 is not used.
		1: Digital input		Pin 2 is a digital input.
		2: Digital Output		Pin 2 is a digital output.
13, 23, …	IO-Link Port X1/X2/… - Port cycle time	0, 4 … 191	0	Port cycle time 0: Calculated by IO-Link master 4 … 191: See table Calculation of the port cycle time, page 49
14, 24, …	IO-Link Port X1/X2/… - Vendor ID	0, 1 … 65535	0	Vendor IDIf validation is used: Expected manufacturer ID of the connected IO-Link device. Vendor ID: See documentation of the IO-Link device used.Value 0 if no validation is used.
15, 25, …	IO-Link Port X1/X2/… - Device ID	0, 1 … 16777215	0	Device IDIf validation is used: Expected device ID of the connected IO-Link device. Device ID: See the documentation of the IO-Link device used.Value 0 if no validation is used.

Parameters 90 and 91

Parameters 90 and 91 configure the device.

No.	Parameter name	Value range	Default	Description
90	DIO process data layout	0: Port-based	0	Sequence of the process data of the digital inputs and digital outputs: Bit 0 = port X1 pin 4, bit 1 = port X1 pin 2, bit 2 = port X2 pin 4, bit 3 = port X2 pin 2, …
		1: Pin-based		Sequence of the process data of the digital inputs and digital outputs: Bit 0 = port X1 pin 4, bit 1 = port X2 pin 4, bit 2 = port X3 pin 4, bit 3 = port X4 pin 4, … bit 8 = port X1 pin 2, bit 9 = port X2 pin 2, …
91	DO substitute mode	0: Set to low	0	In case of an error, set all digital outputs to low level.
		2: Hold last state		In case of an error, keep the digital outputs at their last value.

Parameters 100 to 147

Parameters 100 to 103, 132 and 140 configure IO-Link port X1,

parameters 104 to 107, 133 and 141 configure IO-Link port X2

, …,

parameters 128 to 131, 139 and 147 configure IO-Link port X8.

No.	Parameter name	Value range	Default	Description
100, 104, …	DI port X1/X2/… - CQ pin polarity	0: Normally open	0	Pin 4 is a digital input. The input signal is not inverted.
		1: Normally closed		Pin 4 is a digital input. The input signal is inverted.
101, 105, …	DI port X1/X2/… - CQ pin signal filter	0: Deactivated	0	No filter active for detecting a signal change of the digital input signal pin 4.
		3: 3ms filter time		Setting the filter time for detecting a signal change of the digital input signal pin 4. Filter time is the period for which a signal has to be applied to detect a signal change.
		15: 15ms filter		
		20: 20ms filter time		
102, 106, …	DI port X1/X2/… - IQ pin polarity	0: Normally open	0	Pin 2 is a digital input. The input signal is not inverted.
		1: Normally closed		Pin 2 is a digital input. The input signal is inverted.
103, 107, …	DI port X1/X2/… - IQ pin signal filter	0: Deactivated	0	No filter active for detecting a signal change of the digital input signal pin 2.
		3: 3ms filter time		Setting the filter time for detecting a signal change of the digital input signal pin 2. Filter time is the period for which a signal has to be applied to detect a signal change.
		15: 15ms filter time		
		20: 20ms filter time		
132, 133, …	DO port X1/X2/… - IQ pin mode	0: Normal	0	Pin 2 is a digital output.
		1: Static on		Pin 2 is a digital output and switched on (+24 V DC).
140, 141, …	DO port X1/X2/… - CQ pin mode	0: Normal	0	Pin 4 is a digital output.
		1: Static on		Pin 4 is a digital output and switched on (+24 V DC).

Parameter Port Cycle Time

The parameter Port cycle time contains a factor (bits 0-5) and a time base (bits 6+7).

The following table describes how the port cycle time is calculated from the factor and the time base:

Value range	Time base (bits 6+7)	Factor (bits 0–5)	Port cycle time (formula)	Examples
0	–	0	As fast as possible.	0
1 … 3	–	–	This value range is reserved.	–
4 … 63	0,1 ms (00)	4 … 63	0.1 MS * factor	4: 400 µs 16: 1.6 ms 32: 3.2 ms 48: 4.8 ms
64 … 127	0.4 ms (01)	0 … 63	6.4 MS + 0.4 MS * factor	68: 8.0 ms 93: 18.0 ms 100: 20.8 ms
128 … 191	1.6 ms (10)	0 … 63	32 MS + 1.6 MS * factor	133: 40.0 ms 158: 80.0 ms 183: 120.0 ms
192 … 255	Reserved (11)	0 … 63	This value range is reserved.	–

Configuring via IO-Link Master Web Server

With the help of a standard browser, you can obtain detailed information on the current operating status of the device, make settings and thus influence the device behavior.

Functional Overview

The following overview shows the functions of the IO-Link master web server that is integrated into the device and the menu or tabs of the user interface via which you can activate these functions:

Menu	Tab	Description	Section
Dashboard	–	Display of device-specific information	Dashboard, page 51
Port X1, X2 …	(all)	Port-specific information and settings for the selected IO-Link ports (X1, X2 …)	Displaying Port Status Information, page 55
	Information	Display of current port-specific measuring values (temperature, voltage, current and status at pins 1, 2 and 4) and information on the IO-Link device connected to the selected port	Displaying Measuring Values and IO-Link Device Information, page 53
	Status	Display of port-specific status information for the selected port	Displaying Port Status Information, page 55
	Configuration	Performing port-specific settings (for example operating mode or device check for Validation & Backup)	Configuring the Port, page 59
	IOL	Access to an IO-Link device connected to the selected port	Accessing a Connected IO-Link Device, page 63
	Process data	Display of the configured process data (input/output)	Displaying the Process Data, page 58
Settings	(all)	Device settings	-
	Device configuration	Configuring parameters for IP-connection	
	Maintenance information	Storing maintenance information in the device	
	Factory reset	Resetting the device to the factory setting	Resetting the Device to the Factory Settings, page 71
	Firmware update	Firmware update	Firmware Update, page 69
User administration	–	Managing users	Signing Users In/Out and Managing Users, page 72
Sign-in, Sign-out	–	Signing users in and out	Signing Users In/Out and Managing Users, page 72

Open the IO-Link Master Web Server

Prerequisite: For opening the user interface of the IO-Link master web server, the IP address of the device must be configured and known.

For this purpose, proceed as follows:

- To address the device, enter the following text in the address line of your web browser:
  http://<Configurable IP-Address>
  http://192.168.10.2
- Upon opening the user interface of the IO-Link master web server, first the page **Dashboard** appears with the following device-specific information.

Dashboard

When you open the user interface of the IO-Link master web server, the register page **Dashboard** is displayed first.

This page displays the following device-specific information:

Area	Displayed information
Vendor information	Contact data of the device manufacturer
Device information	Device data
Device version	Version data of the device: • Hardware version number • Software version number • Version number of the web page
Maintenance information	Maintenance information in text form
IOL device information	IO-Link device information (measuring data concerning the current status of the device)

The maintenance information include indications in text form to be determined by the user, for example concerning device name, installation place, installation date, contact information, description, date of the last and next service of the device. You can edit these texts via tab **Maintenance information** of menu **Device settings** (see Configuring via IO-Link Master Web Server, page 50).

The extended information on devices and ports include the following data measured by the sensors integrated in the device:

- Device temperature,
- Supply voltage (for supply lines 1L and 2L),
- Sum of all currents (for supply lines 1L and 2L).

Displaying Port Information

By means of the tabs Information, Status, Configuration, IOL and Process data, you can display information on every single IO-Link port of the device (port X1, portX…).

The tab **Configuration** also enables you to make port-specific settings, see Configuring the Port, page 59.

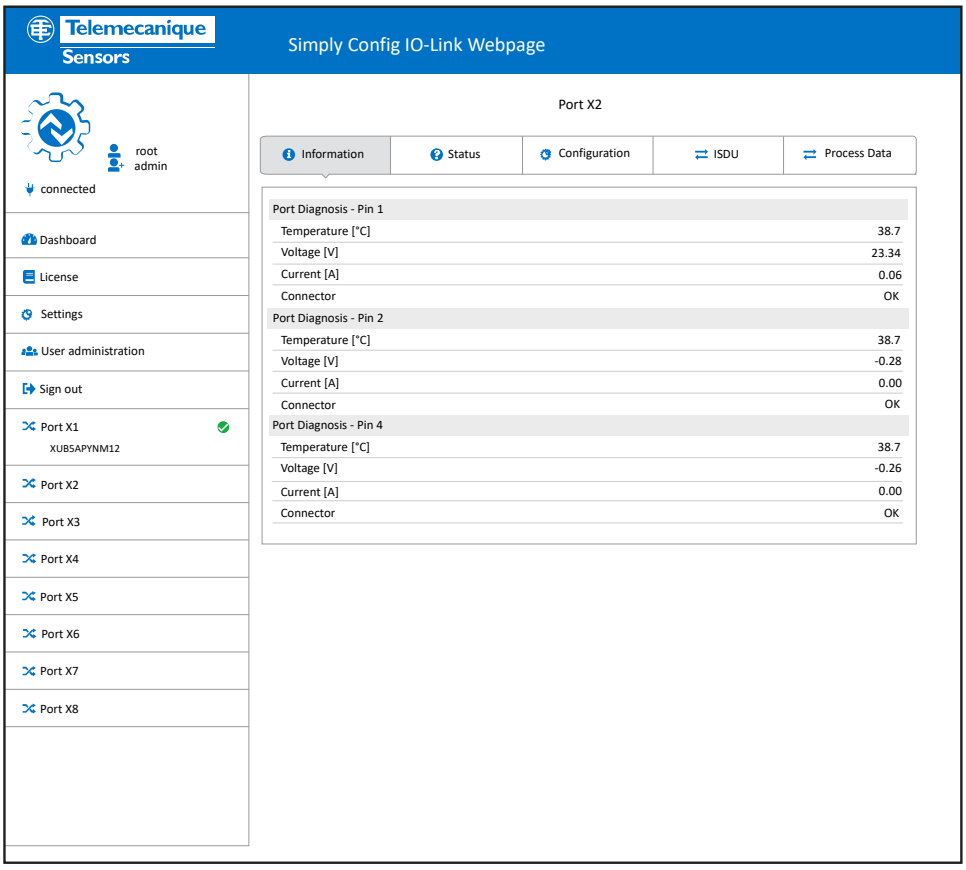
To access the port-specific information, proceed as follows:

Step	Action
1	Click the port in question (X1, X2 …) in the left column to display the information you need.
2	The tab **Information** is displayed.
3	Click the desired tab.
4	This enables you to access the information on the desired port.

The following five tabs are available for each port:

Tab	Description
Information	Display of the current measuring values: Temperature, voltage, current, and port status (individually for pin 1, 2 and 4). If an IO-Link device is connected to the port via pin 4, its device data is also displayed. This tab is preset.
Status	Display of port-specific status information
Configuration	Display and setting of port parameters, for example operating mode or port cycle time, see Setting Parameters, page 46.
IOL	Read/write access to the data of an IO-Link device connected to the port.
Process data	Display of the current process data

Displaying Measuring Values and IO-Link Device Information



For the selected port, the tab **Information** shows:

- The measuring values and statuses of the port diagnosis.
- The information on the connected IO-Link device.

Displaying Pin and Port-Specific Measuring Values and Statuses

The tab **Information** shows the following current measuring values individually for pin 1, 2 and 4 of the selected port:

- Temperature of the pin, measured in °C
- Voltage at the pin, measured in Volt
- Current flowing through the pin, measured in Ampere
- Status of the connecting pin

Statuses of the Connecting Pin

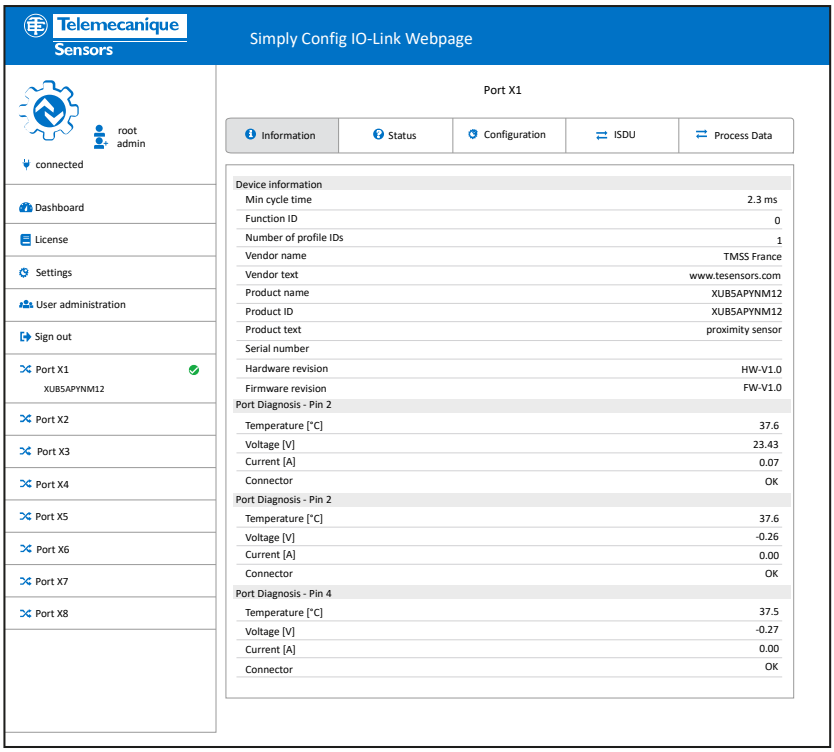
Possible statuses of the connecting pin:

- OK
- Short circuit
- Reaction of the device-internal overload protection
- Reaction of the device-internal overtemperature protection
- Reaction of the device-internal overvoltage protection
- Overcurrent
- Undercurrent
- Overtemperature
- Undertemperature
- Overvoltage
- Undervoltage
- Expiration of the device-internal watchdog timer

Displaying Information on the Connected IO-Link Device

If an IO-Link device is connected to the selected IO-Link port and if the firmware of the IO-Link master has identified this device, the block **Device information** is displayed additionally.

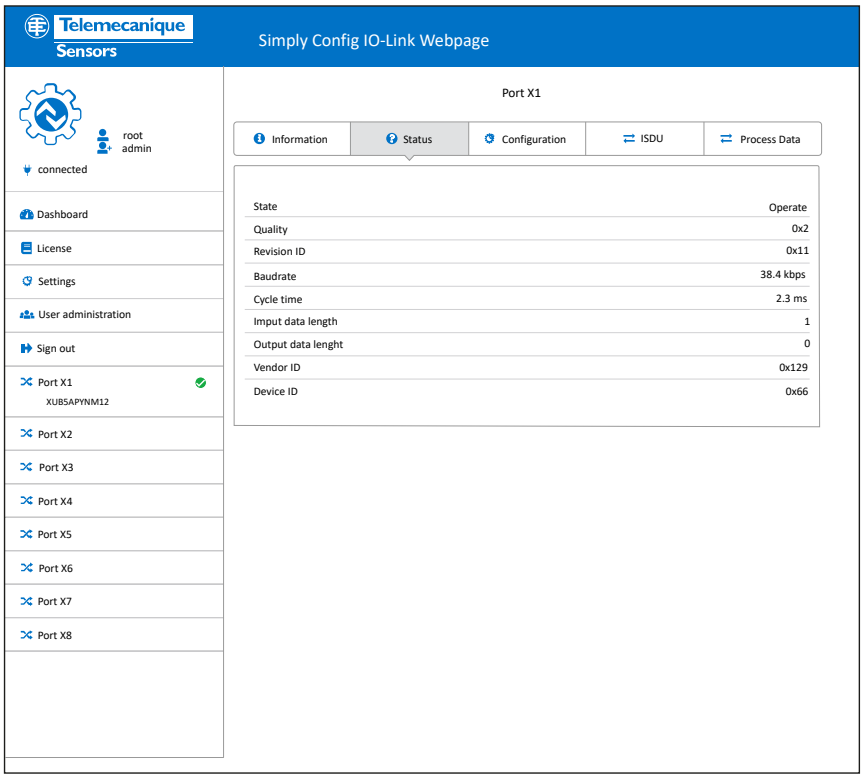
IO-Link master - port X1, X2… - Additional device information in the tab **Information**:.



The block **Device information** displays the following device-specific information on this IO-Link device:

Indication	Indication
Min. cycle time	Min. cycle time supported by the connected device in units of 0.1 milliseconds. Coding, see Master Cycle Time, page 171
Function ID	Function-ID of the connected device
Number of profile IDs	Number of profile IDs in the profile characteristic (Index 0x000D) of the connected device
Vendor name	Name of the manufacturer/vendor of the connected device in detail (up to 64 characters)
Vendor text	Additional descriptive text about the manufacturer/vendor (up to 64 characters)
Product name	Complete product name of the connected device (up to 64 characters)
Product ID	Vendor-specific information on the product o type of the connected device (up to 64 characters)
Product text	Additional descriptive text about the connected device (up to 64 characters)
Serial number	Individual, vendor-specifically unique serial number of the connected device (up to 16 characters)
Hardware revision	Vendor-specific information on the hardware revision (up to 64 characters)
Firmware revision	Vendor-specific information on the firmware revision (up to 64 characters)

Displaying Port Status Information



The tab **Status** displays status information on the selected port.

The tab answers to the following questions about the selected port:

- Which status has the current port?
- Are the process data valid for input or output?
- Is a device connected to the selected port? If yes, what is the revision ID of that device?
- How high is the data transmission rate between the port and the connected device?
- How long is the cyle time of the communication in the operating mode "Operate"?
- What length does the input/output data of the connected device have in Bytes?
- What is the name of the Vendor-ID or Device-ID of the device connected to the IO-Link port?

To display the status data of a certain port:

Step	Action
1	Select the port in the menu on the left.
2	Open the tab **Status**. The tab **Status** is opened. The current values of the port status data are displayed.

State

The current port status information of the selected IO-Link port is displayed here. The following table contains different values concerning the status of the IO-Link port:

Value	Port status	Description
0	No device	No device connected to the port or no communication with the connected device
1	Deactivated	The port is inactive
2	Incorrect device	Failure of revision check or compatibility check
3	Preoperate	The device is ready for communication
4	Operate	The device is communicating
5	DI CQ	The port is in the digital input mode
6	DO CQ	The port is in the digital output mode
7	Reserved	Reserved
8	Reserved	Reserved
9	Faulty cycle time	The configured cycle time does not match the connected device
254	Port Power Off	The port voltage is disconnected
255	Not available	The port is not available

Quality

The port quality information is displayed here. The information on the validity of the process data is separated for input and output. The contents is binary-coded.

Bits of Port Quality Info	Description
Bit 0	0 = Input process data valid1 = Input process data invalid
Bit 1	0 = Output process data valid1 = Output process data invalid
Bit 2 to 7	Reserved

Revision ID

The revision ID of the connected device is displayed here.

A value of 0 means: No device connected.

All other values have to be interpreted as the revision ID of the connected device.

Baud Rate

If an IO-Link device is connected to the port, its data transmission rate is displayed here. With IO-Link, the transmission rate of the communication between the port and a connected device may have the following values:

- 4.8 kbit/s (COM1)
- 38.4 kbit/s (COM2)
- 230.4 kbit/s (COM3)

If no IO-Link device is connected to the port, the text “Not connected” is displayed here.

Cycle Time

The cycle time of the master is bit-coded as follows:

- Bit 0…5 defines an integral multiplier between 0 and 63.
- Bit 6…7 defines the calculation formula to be used according to the following table:

Bit 6 - 7	Calculation formula
0	Multiplier * 0.1 ms
1	6.4 ms + multiplier * 0.4 ms
2	32.0 ms + multiplier * 1.6 ms
3	Reserved

Input Data Length

The real input data length of the connected device is displayed in Bytes here.

Output Data Length

The real output data length of the connected device is displayed in Bytes here.

Vendor ID

This value is the Vendor-ID of the connected device.

Device ID

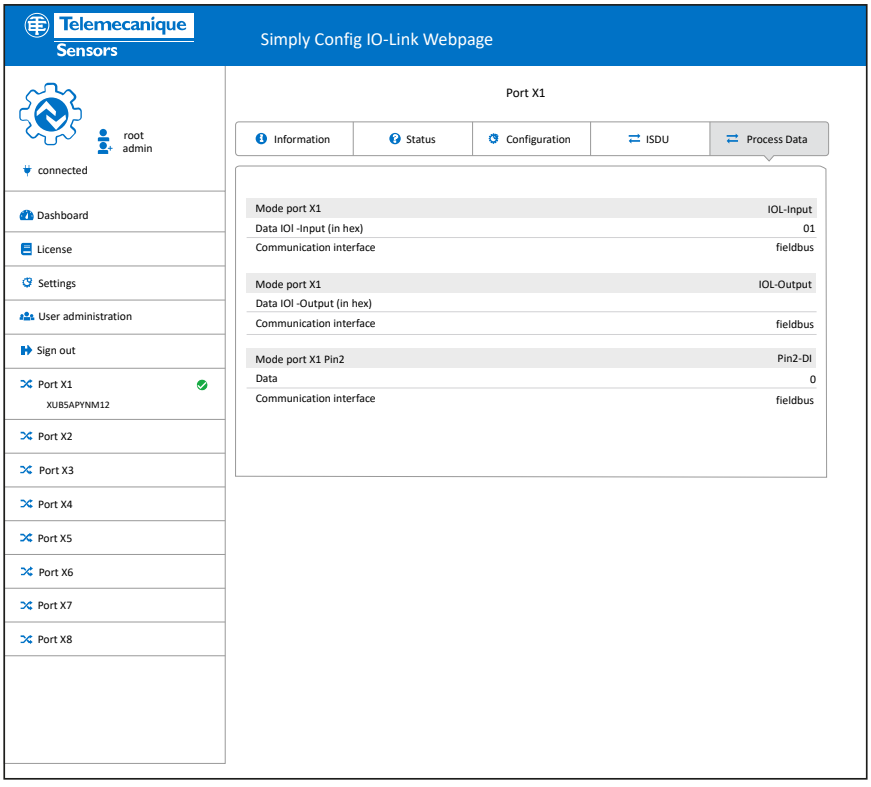
This value is the Device-ID of the connected device.

Displaying the Process Data

With the tab **Process data,** you can display the process data of a certain port.

To display the process data of a certain port:

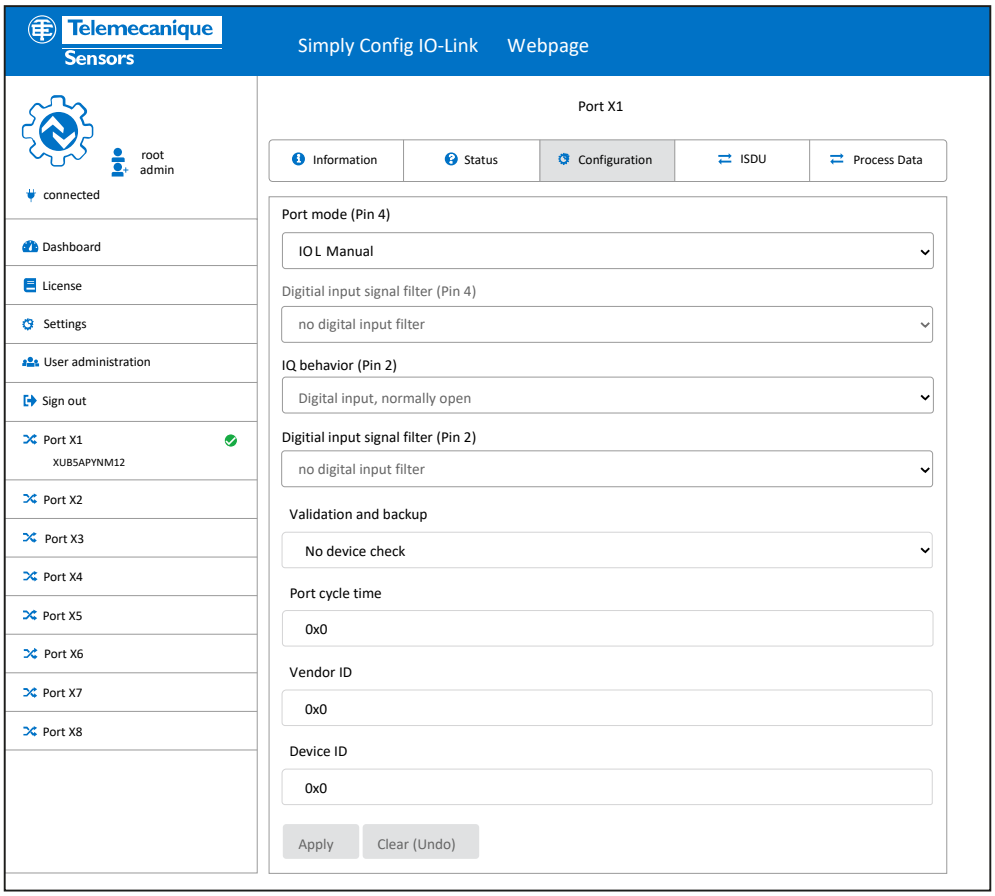
Step	Action
1	Select the port in the menu on the left.
2	Open the tab **Process data**. The tab **Process data** opens and shows the current values of the process data configured for input or output in hexadecimal format. If no process data has been configured for input or output, the corresponding field remains empty.



Making Settings at the Device

Via the web server you can make the following settings at the device:

Configuring the Port



With tab **Configuration** you can display and change the following settings of the selected port individually:

Name	Type	Meaning
Port mode (pin 4)	Selection list	Port operating mode (configuration of pin 4)
Digital input signal filter (pin 4)	Selection list	Filter time for digital input signals at pin 4
IQ behavior (pin 2)	Selection list	Configuration of pin 2 (Digital Input, Digital Output, Off)
Validation and Backup	Selection list	Setting for Validation and backup for a device check when the device is exchanged
PortCycleTime	Input field	Expected port cycle time
Vendor ID	Input field	Expected Vendor ID of the connected device
Device ID	Input field	Expected Vendor ID of the connected device

Modifications to settings require operator or admin rights. If you do not have these rights, the tab is grayed out and the displayed values are not editable.

As long as PLC and device are exchanging process data, the port configuration is not possible and the following message appears:

NOTE:
`Changing configuration not allowed because interface state is "communicating".`

In that case, terminate the exchange of process data.

To modify the configuration of a port:

Step	Action
1	Select the desired port (port X1, port X2 …) in the menu.
2	Open the tab **Configuration**.
3	Set the port operating mode for pin 4 , see Making Settings at the Device, page 59.
4	If required, configure the filter time for the signals of the digital inputs
5	If required, configure the device check in case of Validation and Backup, see Configuring the Port, page 59.
6	If required, set the I/Q behavior for pin 2, see **Configuring pin 2 (I/Q)** in Configuring the Port, page 59.
7	If required, set the expected Vendor ID, see **Input field “Vendor ID”** in Accessing a Connected IO-Link Device, page 63.
8	If required, set the expected Device ID, see **Input field “Device ID”** in Accessing a Connected IO-Link Device, page 63.
9	If required, set the expected cycle time, see **Selection list “PortCycleTime”** in Accessing a Connected IO-Link Device, page 63
10	Click Apply.Your changes takes effect now.

Configuring the Port Operating Mode for Pin 4

Via the selection list Port mode, you can set the port operating mode for pin 4 of the selected IO-Link port. You can select between the following operating modes:

Option	Meaning
Deactivated	The port is deactivated. L+ is switched off. The process data (input and output) is set to 0. The master no longer performs any activities concerning this port.
IOL Manual	The port is used as an IO-Link port with a manual (user defined) configuration. Vendor ID, Device ID, and Revision ID are validated.
IOL Autostart	The port is used as an IO-Link port with an automatic start. No configuration and no device validation.
Digital Input, normally open	The port is used as a digital input. All elements of the port configuration is ignored except the input and output data length.
Digital Input, normally closed	The port is used as a digital input. The signals at the port are inverted. All elements of the port configuration are ignored except the input and output data length.
Digital Output	The port is used as a digital output. All elements of the port configuration are ignored except the input and output data length.

Setting the Filter Time for Digital Inputs

If the operating mode for pin 4 is set to **Digital Input, normally open** or **Digital Input, normally closed,** the filter time for the signals can be set at the digital inputs via the selection list **Digital Input Signal Filter**.

If filtering is active, a change to the digital input (0 →1 or 1→0) is transferred to the process image only after the set filter time has expired and the changed value is still applied. If the value has changed again during the filter time, the filter time restarts from the beginning.

You can select between the following filter time values:

- No digital input filter
- 3 ms
- 15 ms
- 20 ms

When the option **No digital input filter** is selected, the signals at the digital inputs are not filtered.

With all other operating modes for pin 4, the selection list **Digital Input Signal Filter** is deactivated.

Configuring Pin 2 (I/Q)

Via the selection list **IQ behavior**, you can set the behavior of pin 2. You have the following possibilities of configuration:

Option	Description
Not supported	Pin 2 is not used.
Digital Input, normally open	Pin 2 is a digital input.
Digital Input, normally closed	Pin 2 is a digital input. The signal is inverted.
Digital Output	Pin 2 is a digital output.

NOTE: In the operating mode IOL Autostart (see above), your device check setting has no effect on the behavior of the device.

Via the selection list **Validation and backup**, you can set whether - and at which inspection level - a validation (device check) takes place while a connected device is exchanged and whether the stored operating parameters of the old device are transferred to the new device or not.

The following table explains the possible values of the parameter Inspection Level:

Inspection Level	Meaning
NO_CHECK	A device check does not take place.
TYPE_COMP	The device is checked for type compatibility. For a device check, the real Vendor ID is compared with the configured one, and the real Device ID is compared with the configured one.
IDENTICAL	The device is checked for device identity. For this purpose, the device is checked for type compatibility and the real serial number is compared with the configured one.

The parameter "Backup Level" determines the behavior of the system in case of an exchange of the device connected to the port concerning the continued operation of the system with identical device parameters.

This parameter can take three different values:

Backup Level	Meaning
Commissioning ("Disable")	No device parameter data is stored on the IO-Link master. In case of a device exchange, the master does not restore the device parameters.
Production ("Restore")	Changed parameter data is not automatically stored on the master. The master restores the parameter data stored in the master on the IO-Link device. For this purpose, the IO-Link device must support the data storage.
Production ("Backup/Restore")	Changed device parameter data is automatically stored on the master. For this purpose, the IO-Link device must support the data storage and report a parameter change. In case of a device exchange, the stored parameters are loaded onto the new device.

The selection list **Validation and Backup** offers the following possibilities of setting the parameters "Inspection Level" and "Backup Level":

Option	Inspection Level	Backup Level	Meaning
no Device check	NO_CHECK	Disable	A device check does not take place.
type-compatible device (V1.0)	TYPE_COMP	Disable	Device check for a type-compatible device according to IO-Link specification 1.0
type-compatible device (V1.1)	TYPE_COMP	Disable	Device check for a type-compatible device according to IO-Link specification 1.1
type-compatible device (V1.1) with Backup + Restore	TYPE_COMP	Backup + Restore	Device check for a type-compatible device according to IO-Link specification 1.1 with Backup & Restore functionality
type-compatible device (V1.1) with Restore	TYPE_COMP	Restore	Device check for a type-compatible device according to IO-Link specification 1.1 with Restore functionality

Selection List "PortCycleTime"

In the selection list **PortCycleTime**, the expected cycle time of the port is displayed or set depending on the selected operating mode. The coding corresponds to that in the port status, see Master Cycle Time, page 171.

Input Field "VendorID"

This element contains the expected Vendor ID (VendorID, 2 Bytes) of the selected device. Admissible value range: 1 to 0xFFFF.

The indication of the expected Vendor ID is required for checking the device for type compatibility. The selection of “no Device check” requires no input.

Input Field "DeviceID"

This element contains the expected Device ID (DeviceID, 3 Bytes) of the connected device. Admissible value range: 1 to 0xFFFFFF.

The indication of the expected Device ID is required for checking the device for type compatibility. The selection of “no Device check” requires no input.

Accessing a Connected IO-Link Device

The tab **IOL** allows read and write access to the IO-Link device connected to an IO-Link port. The device data is addressed via the ISDU message format (ISDU = Indexed Service Data Unit) by means of Index and Subindex.

> **NOTE**: For a description of the index and subindex values, see the documentation of the connected IO-Link device. For a description of the ISDU-message format, refer to the IO-Link specification.

Required Rights

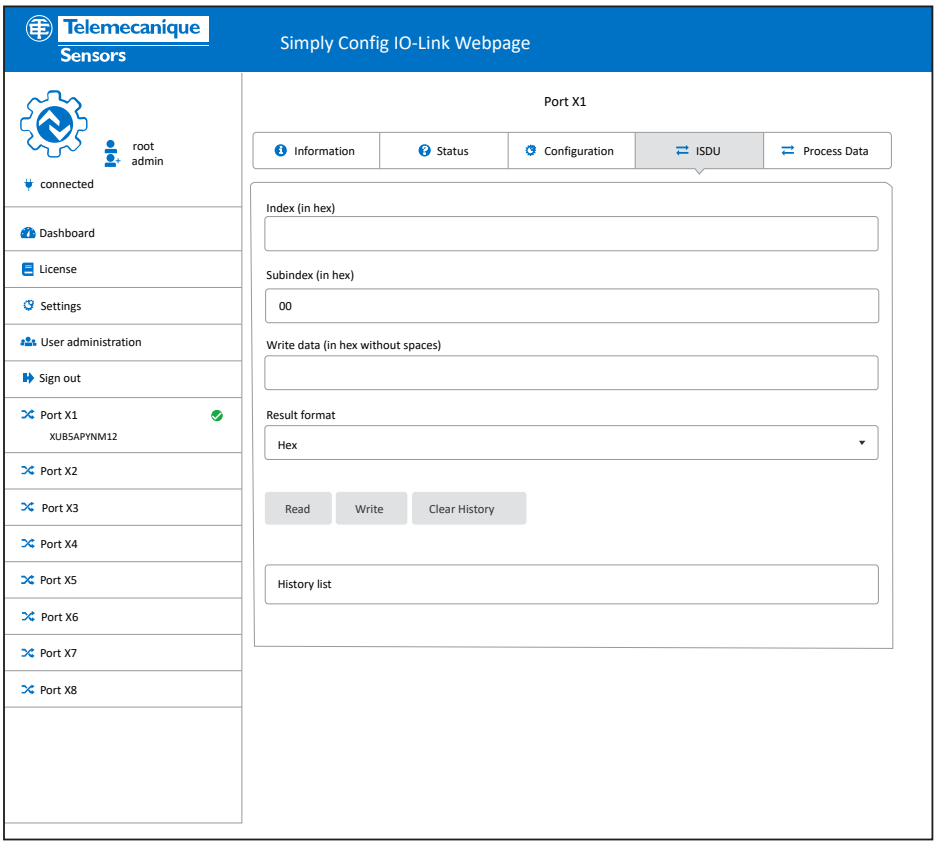
Modifications to settings require operator or admin rights. If you do not have these rights, the tab is grayed out and the displayed values are not editable.

Access to the IO-Link Device

To be able to access the data of an IO-Link device connected to a selected IO-Link port via index und subindex (ISDU message format):

Step	Action
1	In the menu on the left, select the port to which the IO-Link device is connected.
2	Open the tab IOL. The tab IOL is displayed.

Read Access

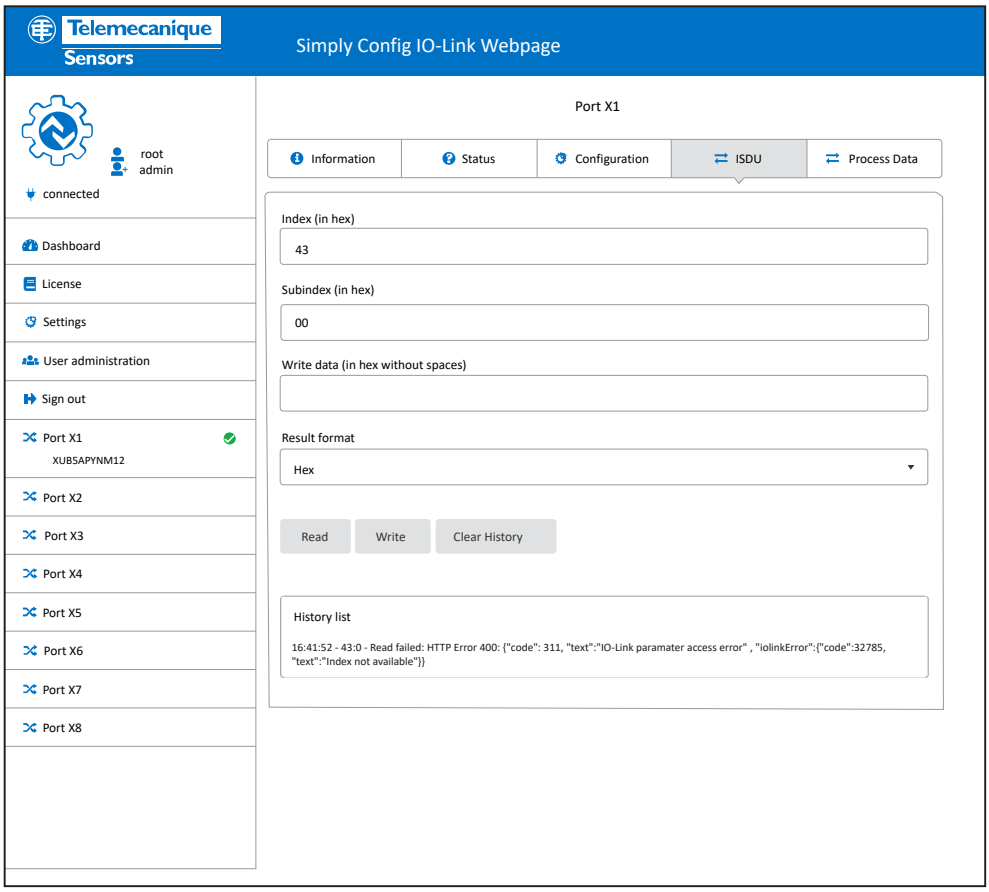


To read data from the connected IO-Link device, proceed as follows:

Step	Action
1	Enter the desired index of the connected IO-Link device as a hexadecimal value in the input field **Index** of tab **IOL**.
2	Enter the desired subindex of the connected IO-Link device as a hexadecimal value in the input field **Subindex** of **tabIOL**. Default is “00”.
3	Click **Read**. The read access is performed and protocolled with the current time in the history (at the bottom of the tab).

If the access is successful, the text Read ok: and the result is displayed in the history. History entries have the following structure:

```
Time – Index:Subindex – Read ok: <Result>
```



If the access is unsuccessful, the history displays an error message with error codes of IO-Link master and IO-Link device.

In this case, the history entries have the following structure:

```
Time – Index:Subindex – Read failed:
IOLMErrorCode(<error code of IO-Link master>):
IOLDErrorCode(<error code of IO-Link device>)
```

NOTE: For information on the meaning of the error codes of the IO-Link master (IOLMErrorCode) and IO-Link device (IOLDErrorCode), refer to the IO-Link specification.

In both cases:

- The time is displayed in the format HH:MM:SSt.
- Index and Subindex are displayed hexadecimally.

Write Access

To write data from the connected IO-Link device, proceed as follows:

Step	Action
1	Enter the desired index of the connected IO-Link device as a hexadecimal value in the input field **Index** of tab **IOL**.
2	Enter the desired subindex of the connected IO-Link device as a hexadecimal value in the input field **Subindex** of tab **IOL**. Default is “00”.
3	Enter the data to be written into the input field **Input data** of tab **IOL**.
4	Click **Write**.The write access is performed and protocolled with the current time in the history (at the bottom of the tab).

If the access is successful, the text Write ok: and the result is displayed in the history. History entries have the following structure:

```
Time – Index:Subindex – Write ok: <Result>
```

If the access is unsuccessful, the history displays an error message with error codes of IO-Link master and IO-Link device. History entries have the following structure:

```
Time – Index:Subindex – Write failed:
IOLMErrorCode(<error code of IO-Link master>):
IOLDErrorCode(<error code of IO-Link device>)
```

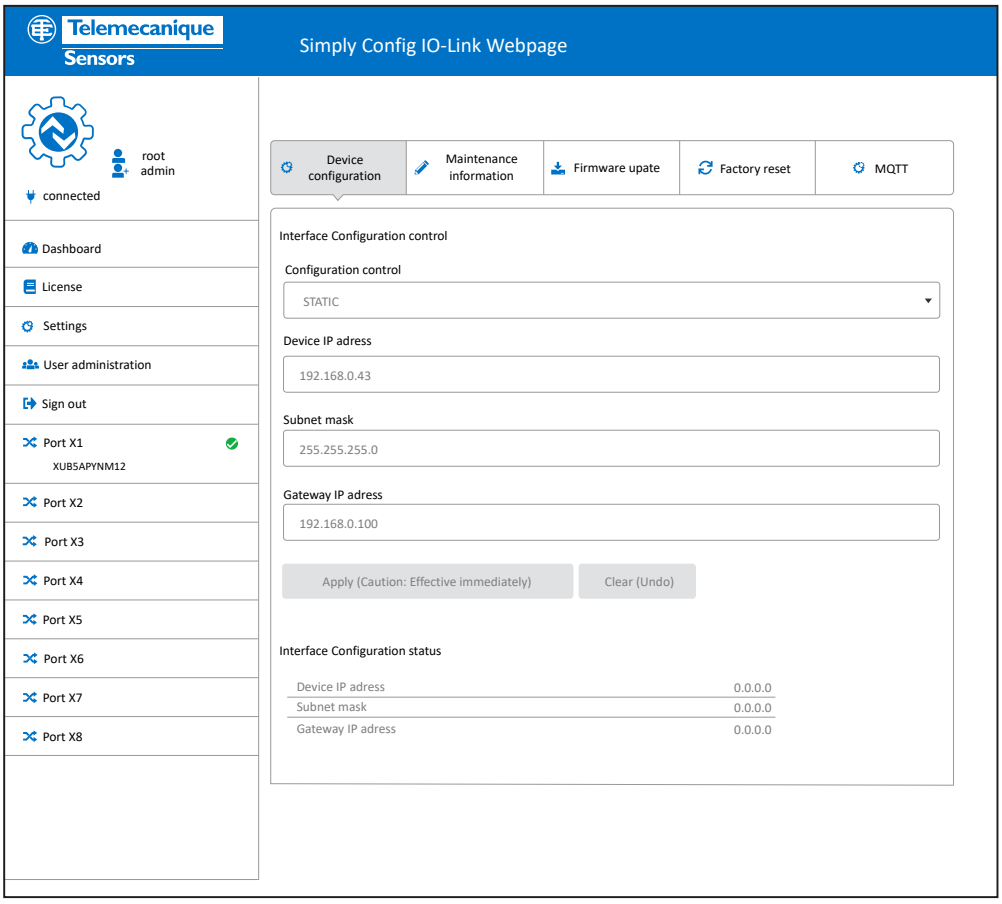
Deleting the history of the read and write access operations

To delete the history of the read and write access operations:

- Click **Clear History.**
- The history of the read and write access operations is cleared.

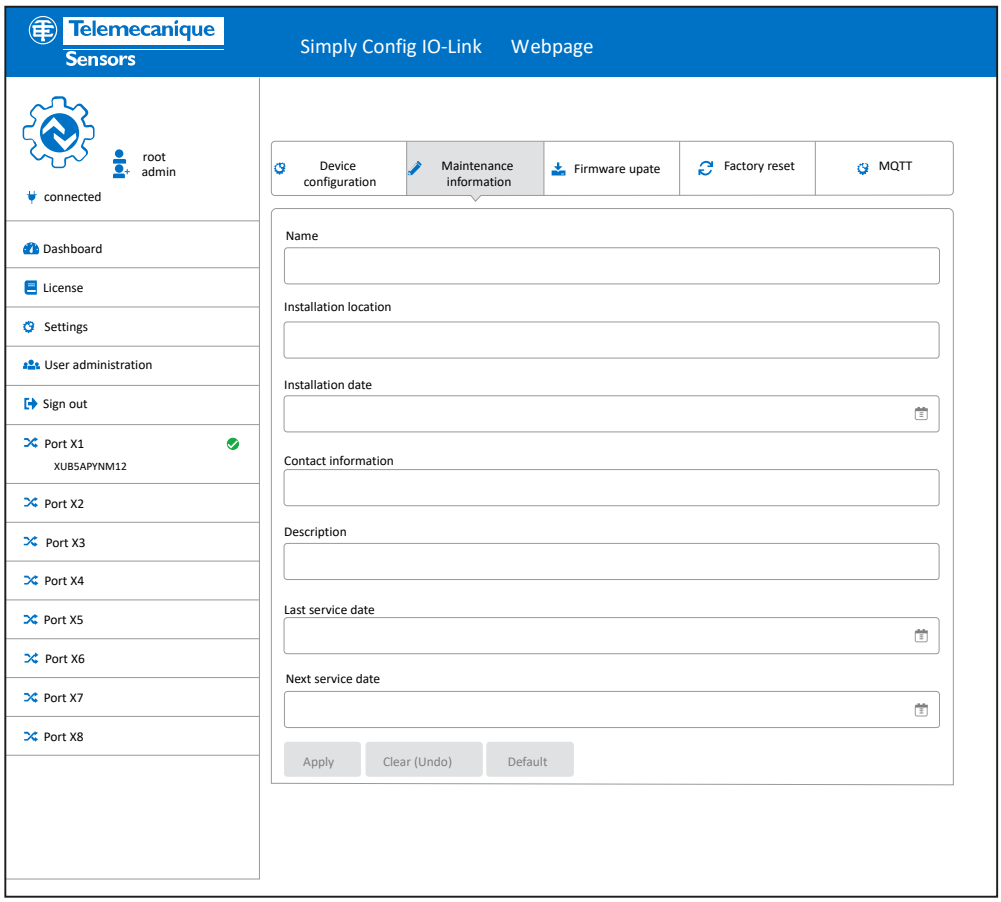
Configuring IP Parameters

With the tab **Device Configuration**, you can select your Configuration control and change the IP adresses.



Entering Maintenance Information

With the tab **Maintenance information**, you can enter maintenance information into the device, for example information on device name, installation location, installation date, contact information, description, date of the last and next service of the device.



Admin rights, the rights of a specialist, or the rights to carry out maintenance are required to modify settings. If you do not have these rights, the tab is grayed out and the displayed values are not editable. In his case, the following error message is displayed:

NOTE: For user role "Observer", editing maintenance data is not allowed.

The maintenance information include:

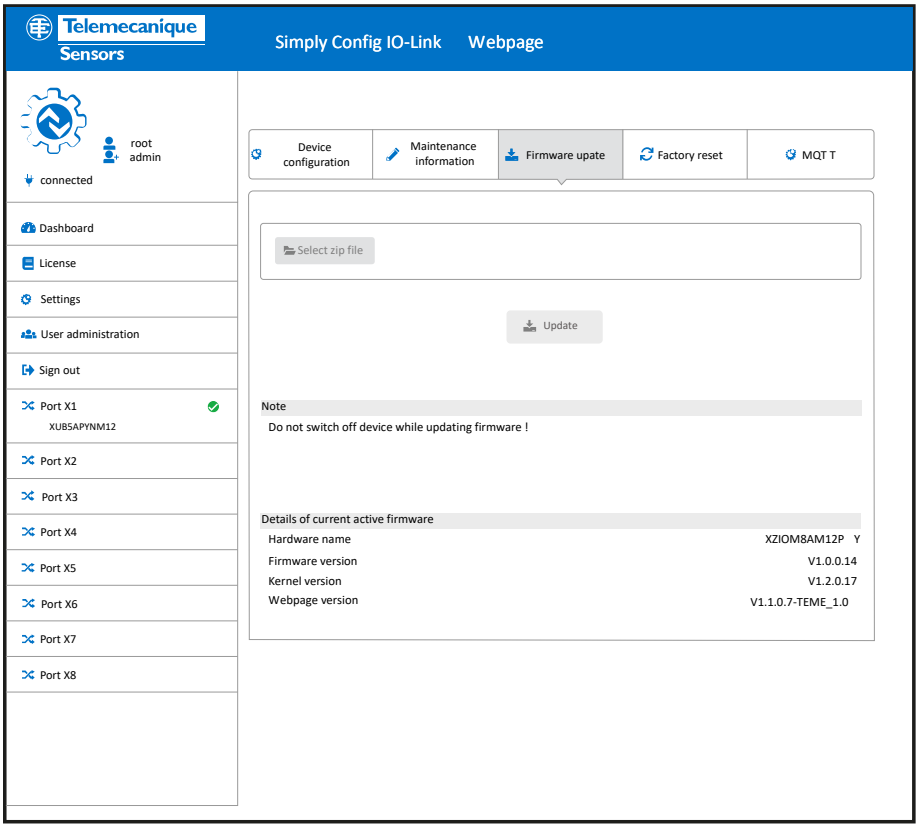
Name	Data format and data length	Description
Name	Printable ASCII-string, maximum 64 characters	Uniform label (string) in the plant for the function of this device
Installation Location	Printable ASCII-string, maximum 32 characters	Uniform label (string) in the plant for the position where the device is mounted.
Installation Date	ASCII time indication, maximum 32 characters (date format YYYY-MM-DD)	Date of installation or commissioning of this device
Contact Information	Printable ASCII-string, maximum 32 characters	Textual identification of a contact person for this managed node of the plant, together with the information on how to contact this person.
Description	Printable ASCII-string, maximum 64 characters	User-readable comment field for storing individual status information and remarks
Signature	Printable ASCII-string, maximum 128 characters	Signature
Change count	ASCII decimal digit, maximum 32 characters	Counter for changes to the hardware or device parameters. Requires counting up only if the data really have changed.
Last Service Date	ASCII time indication, maximum 32 characters (date format YYYY-MM-DD)	Date/time of the last service, for example firmware update.
Next Service Date	ASCII time indication, maximum 32 characters (date format YYYY-MM-DD)	Date/time of the next service, for example firmware update.

To modify the Maintenance information:

Step	Action
1	Click the menu item **Settings** in the left column.
2	The tab **Device** configuration is displayed.
3	Select the tab **Maintenance information**.
4	Change the fields in question.
5	Click **Apply**. Your changes thus takes effect.

Firmware Update

Via tab **Firmware update** the IO-Link master web server enables you to update the device firmware.



Observe the following notes:

NOTICE

BRINGING THE PLANT INTO A SAFE OPERATING STATE BEFORE THE FIRMWARE UPDATE

Never update the firmware while the plant in which the device is installed is running. Before each firmware update, the plant first must be shut down properly or brought into a safe operating state.

Failure to follow these instructions can result in equipment damage.

NOTE: If you update the firmware of your device, you become unable to re-construct its state before the update or the firmware used so far, unless you have a backup of the firmware and the configuration data.

Admin rights, the rights of a specialist or the rights to carry out maintenance are required to modify settings. If you do not have these rights, the tab is grayed out and the displayed values are not editable.

You can download the firmware container file FWUPDATE.ZIP, that you need for the firmware update, from the device manufacturer's or vendor's website.

Proceed as follows:

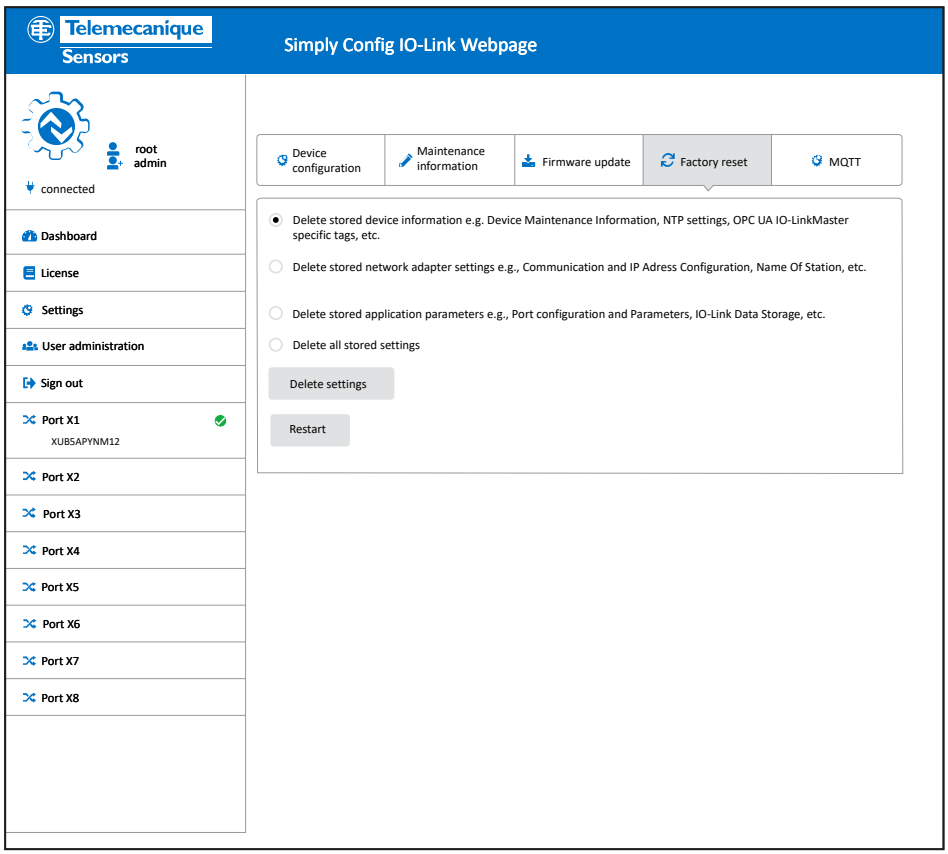
Step	Action
1	Click the menu item **Settings** in the left column.
2	Tab **Device** configuration is displayed.
3	Select the tab **Firmware update.**
4	Click **Select ZIP file.** A file selection dialog is displayed.
5	In this dialog, select the firmware container file “FWUPDATE.ZIP”. The display field **File** shows the name of the selected firmware container file.
6	Click **OK**. The firmware is updated. Thereafter, all ports used must be configured.

The firmware update procedure is as follows:

1. The firmware of the firmware container file “FWUPDATE.ZIP” is stored in the Flash Memory of the device.
2. An internal reset is triggered.
3. The device maintenance firmware, which processes the firmware container file and installs the new firmware including the configuration files of the device, is then started.
4. You are informed as soon as the installation procedure is finished.
5. Thereafter, the device performs again a reset.
6. The new firmware is started.

Resetting the Device to the Factory Settings

If required, you can reset the device or individual groups of settings to the factory settings (see table below) in the menu **Settings** of the tab **Factory reset.**



Admin rights, the rights of a specialist, or the rights to carry out maintenance are required to modify settings. If you do not have these rights, the tab is grayed out and the displayed values are not editable. In this case, the following error message are displayed:

```
Note: For user role "Observer", editing maintenance data is
not allowed.
```

You can reset three different groups of settings to their factory settings:

Options	Reset settings	Examples of concerned settings
Delete stored device information	Device settings	Maintenance information, system time settings, and IO-Link master settings within OPC UA
Delete stored network adapter settings	Settings of the network adapter	Communication settings, configuration of the IP-address, name of station
Delete stored application parameters	Application-specific data	Port configuration and port parameters, remanent parameters
Delete all stored settings	All settings	-

To reset the device to the factory settings, proceed as follows:

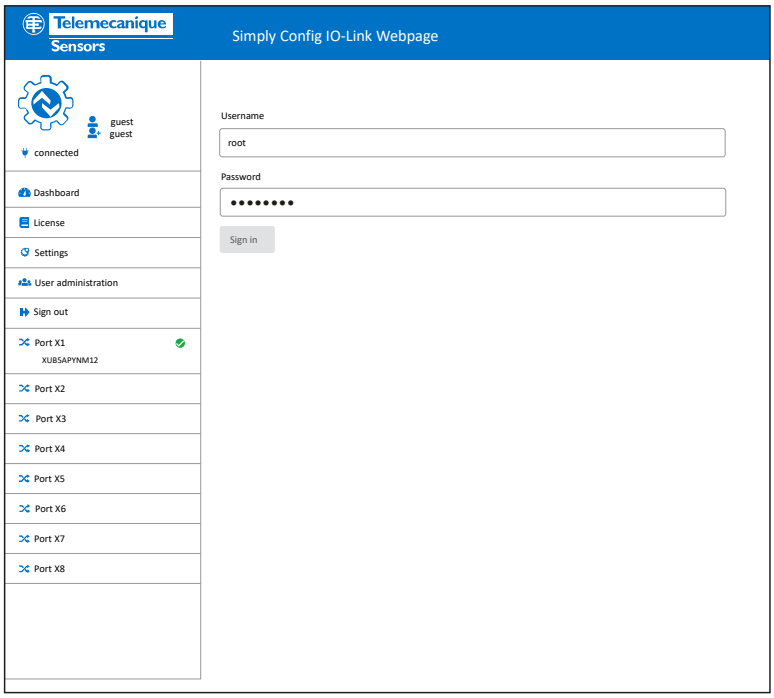
Step	Action
1	Click the menu item **Settings** in the left column. Tab **Device configuration** is displayed.
2	Select the tab **Factory reset.**
3	Use the buttons to select which group(s) of settings are to be reset to the factory settings.
4	Click **Delete Settings**. The selected settings is reset to the factory settings.

If you wish to restart the device after the reset, click **Restart**.

Signing Users In/Out and Managing Users

Signing Users In

To sign in as a user:

Step	Action
1	Select the menu point **Sign in** on the left side of the main menu of the web server. The input mask for user name and password are displayed: 
2	Enter your user name and your password into the corresponding input fields of the screen mask.
3	Click the button **Sign in**. User name and password are checked for matching and correctness. If the IO-Link master web server knows the user name and the password check is successful, you can work with the IO-Link master web server. The rights defined for the user name used apply. The user name used is displayed in the upper left corner of the input mask. The previous menu entry **Sign in** now changes to **Sign out**.

NOTE: For the first commissioning or a guest user access, you can use special combinations of user name and password, which you can find in the corresponding sections of this chapter.

Signing Users Out

To sign out a signed-in user:

- Click the menu item **Sign out** of the main menu of the device web server (left side).
- Thereafter, you no longer have the rights of the user signed in so far to work with the IO-Link master web server. Only the rights of the guest user access are still available. The user name used for signing in is no longer displayed in the upper left corner. Instead of the previous menu entry **Sign out,** the menu entry **Sign in** is now displayed again.

Guest User Access

As standard, the web server knows a user guest without password.

As standard, the IO-Link master web server knows a user guest without password that was created to realize a first-time or guest user access. The guest user access offers only limited display possibilities and no setting possibilities.

Signing-in as an Administrator for the First Time

In the state of delivery or after a reset to the factory settings, the web server can be addressed via the user name root and the password.

This combination also offers administrator rights.

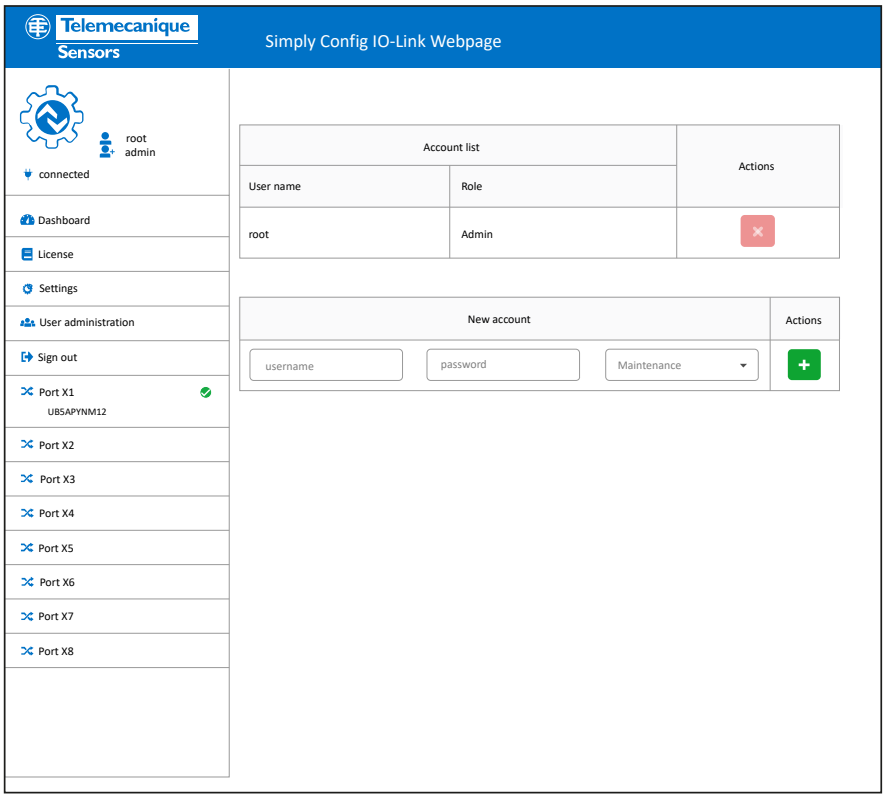
> **NOTE**: Change the administrator password immediately after the commissioning. The factory setting is generally known and does not provide any sufficient protection against misuse.

The tab **Administration** offers a role-based user administration. This tab enables you to create users, delete users, and assign them roles on which user rights depend. Users can be divided into three roles:

- Maintenance
- Operator
- Administrator

Creating a New User

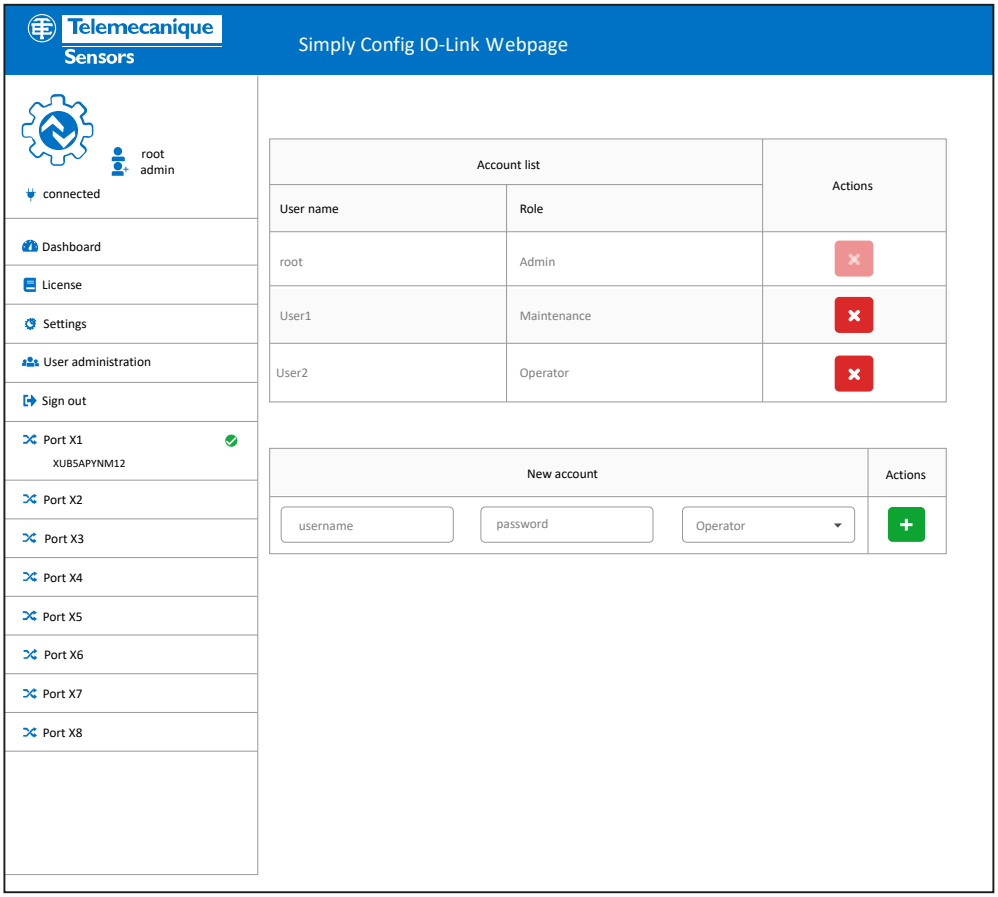
When you open the **User administration**, the following screen mask is displayed:



As standard, the user `root` is defined with the preset password `password`, see first line.

One further user can be defined in the second line. For this purpose, proceed as follows:

Step	Action
1	Enter a new user name in the input field **User name.** User names that are already in use are inadmissible.
2	Enter the password for this user name in the input field **Password**.
3	Via the selection list on the right, select the role for the new user to be created (three roles are available: Maintenance, Operator or Administrator).
4	To confirm the selection, click the green field. The new user is created and assigned to the selected role.



To remove an existing user from the user administration of the device, proceed as follows:

- Click the red button with a white cross to the right of the user you want to remove.
- The user is deleted.

The user `root` cannot be deleted, that is why the red button for deletion is grayed-out.

Communication

Process Data (Ethernet/IP)

This chapter describes the process data. The process data structure depends on the connection used (connection 1, connection 2, …) between the Ethernet/IP Scanner and the device. The device offers several connections, one of which was selected when configuring the Ethernet/IP Scanner.

List of connections:

- Connection 1: Exclusive Owner - 32 bytes per IO-Link port
- Connection 2: Exclusive Owner - 32 bytes per IO-Link port without config
- Connection 3: Listen Only - 32 bytes per IO-Link port
- Connection 4: Input Only - 32 bytes per IO-Link port
- Connection 5: Exclusive Owner - 16 bytes per IO-Link port
- Connection 6: Exclusive Owner - 16 bytes per IO-Link port without config
- Connection 7: Listen Only - 16 bytes per IO-Link port
- Connection 8: Input Only - 16 bytes per IO-Link port
- Connection 9: Exclusive Owner - 4 bytes per IO-Link port
- Connection 10: Exclusive Owner - 4 bytes per IO-Link port without config
- Connection 11: Listen Only - 4 bytes per IO-Link port
- Connection 12: Input Only - 4 bytes per IO-Link port

The following sections describe the process data for each connection.

Input Process Data of Connections 1 to 4

The following table describes the structure of the input process data of connections 1 to 4:

Byte offset	Number of bytes	Input process data	Description
0	1 byte	DI status	0: DI data invalid. 1-255: DI data valid.
1	1 byte	Fill byte	Reserved, 0
2 … 3	2 byte	DI data	The process data assigment to port and pin depends on the setting of the process data layout: pin-based or port-based. See the following tables.
4	1 byte	Port X1: IO-Link PQI	See table Port Qualifier Information, page 98.
5	1 byte	Fill byte	Reserved, 0
6 … 37	32 byte	Port X1 (pin 4) operates as an IO-Link master: IO-Link input data	IO-Link input data of the IO-Link device on port X1. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X1 (pin 4) operates as a digital input: Input value	Byte 6: Bit 0 = 0: Input off. Bit 0 = 1: Input on. Bits 1 … 7: Always 0. Byte 7 … 37: Reserved.
		Port X1 (pin 4) operates as a digital output: Output value	Byte 6: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 7 … 37: Reserved.
38	1 byte	Port X2: IO-Link PQI	See table Port Qualifier Information, page 98.
39	1 byte	Fill byte	Reserved, 0
40 … 71	32 byte	Port X2 (pin 4) operates as an IO-Link master: IO-Link input data	IO-Link input data of the IO-Link device on port X2. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X2 (pin 4) operates as a digital input: Input value	Byte 40: Bit 0 = 0: Input off. Bit 0 = 1: Input on. Bits 1 … 7: Always 0. Byte 41 … 71: Reserved.
		Port X2 (pin 4) operates as a digital output: Output value	Byte 40: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 41 … 71: Reserved.
72	1 byte	Port X3: IO-Link PQI	See table Port Qualifier Information, page 98.
73	1 byte	Fill byte	Reserved, 0
74 … 105	32 byte	Port X3 (pin 4) operates as an IO-Link master: IO-Link input data	IO-Link input data of the IO-Link device on port X3. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X3 (pin 4) operates as a digital input: Input value	Byte 74: Bit 0 = 0: Input off. Bit 0 = 1: Input on. Bits 1 … 7: Always 0. Byte 75 … 105: Reserved.
		Port X3 (pin 4) operates as a digital output: Output value	Byte 74: Bit 0 = 0: Output off. Bit 0 = 1: Output on.Bits 1 … 7: Always 0. Byte 75 … 105: Reserved.
106	1 byte	Port X4: IO-Link PQI	See table .

Byte offset	Number of bytes	Input process data	Description
107	1 byte	Fill byte	Reserved, 0
108 … 139	32 byte	Port X4 (pin 4) operates as an IO-Link master: IO-Link input data	IO-Link input data of the IO-Link device on port X4. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X4 (pin 4) operates as a digital input: Input value	Byte 108: Bit 0 = 0: Input off. Bit 0 = 1: Input on. Bits 1 … 7: Always 0. Byte 109 … 139: Reserved.
		Port X4 (pin 4) operates as a digital output: Output value	Byte 108: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 109 … 139: Reserved.
140	1 byte	Port X5: IO-Link PQI	See table Port Qualifier Information, page 98.
141	1 byte	Fill byte	Reserved, 0
142 … 173	32 byte	Port X5 (pin 4) operates as an IO-Link master: IO-Link input data	IO-Link input data of the IO-Link device on port X5. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X5 (pin 4) operates as a digital input: Input value	Byte 142: Bit 0 = 0: Input off. Bit 0 = 1: Input on. Bits 1 … 7: Always 0. Byte 143 … 173: Reserved.
		Port X5 (pin 4) operates as a digital output: Output value	Byte 142: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 143 … 173: Reserved.
174	1 byte	Port X6: IO-Link PQI	See table Port Qualifier Information, page 98.
175	1 byte	Fill byte	Reserved, 0
176 … 207	32 byte	Port X6 (pin 4) operates as an IO-Link master: IO-Link input data	IO-Link input data of the IO-Link device on port X6. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X6 (pin 4) operates as a digital input: Input value	Byte 176: Bit 0 = 0: Input off. Bit 0 = 1: Input on. Bits 1 … 7: Always 0. Byte 177 … 207: Reserved.
		Port X6 (pin 4) operates as a digital output: Output value	Byte 176: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 177 … 207: Reserved.
208	1 byte	Port X7: IO-Link PQI	See table Port Qualifier Information, page 98.
209	1 byte	Fill byte	Reserved, 0
210 … 241	32 byte	Port X7 (pin 4) operates as an IO-Link master: IO-Link input data	IO-Link input data of the IO-Link device on port X7. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X7 (pin 4) operates as a digital input: Input value	Byte 210: Bit 0 = 0: Input off. Bit 0 = 1: Input on. Bits 1 … 7: Always 0. Byte 211 … 241: Reserved.
		Port X7 (pin 4) operates as a digital output: Output value	Byte 210: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 211 … 241: Reserved.

Byte offset	Number of bytes	Input process data	Description
242	1 byte	Port X8: IO-Link PQI	See table Port Qualifier Information, page 98.
243	1 byte	Fill byte	Reserved, 0
244 … 275	32 byte	Port X8 (pin 4) operates as an IO-Link master: IO-Link input data	IO-Link input data of the IO-Link device on port X8. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X8 (pin 4) operates as a digital input: Input value	Byte 244: Bit 0 = 0: Input off. Bit 0 = 1: Input on. Bits 1 … 7: Always 0. Byte 245 … 275: Reserved.
		Port X8 (pin 4) operates as a digital output: Output value	Byte 244:Bit 0 = 0: Output off. Bit 0 = 1: Output on.Bits 1 … 7: Always 0.Byte 245 … 275: Reserved.

The process data of the digital inputs can be transmitted "portbased" (default) or "pin-based". The following tables show the assignment of port and pin.

Input process data (port-based assignment):

Byte offset	Bit	Input process data
2	0	Port X1, pin 4: DI A or DO A
	1	Port X1, pin 2: DI B or DO B
	…	…
	6	Port X4, pin 4: DI A or DO A
	7	Port X4, pin 2: DI B or DO B
3	0	Port X5, pin 4: DI A or DO A
	1	Port X5, pin 2: DI B or DO B
	…	…
	6	Port X8, pin 4: DI A or DO A
	7	Port X8, pin 2: DI B or DO B

Input process data (pin-based assignment):

Byte offset	Bit	Input process data
2	0	Port X1, pin 4: DI A or DO A
	1	Port X2, pin 4: DI A or DO A
	…	…
	6	Port X7, pin 4: DI A or DO A
	7	Port X8, pin 4: DI A or DO A
3	0	Port X1, pin 2: DI B or DO B
	1	Port X2, pin 2: DI B or DO B
	…	…
	6	Port X7, pin 2: DI B or DO B
	7	Port X8, pin 2: DI B or DO B

Input Process Data of Connections 5 to 8

The following table describes the structure of the input process data of connections 5 to 8:

Byte offset	Number of bytes	Input process data	Description
0	1 byte	DI status	0: DI data invalid. 1-255: DI data valid.
1	1 byte	Fill byte	Reserved, 0
2 … 3	2 byte	DI data	The process data assigment to port and pin depends on the setting of the process data layout: pin-based or port-based. See the following tables.
4	1 byte	Port X1: IO-Link PQI	See table .
5	1 byte	Fill byte	Reserved, 0
6 … 21	16 byte	Port X1 (pin 4) operates as an IO-Link master: IO-Link input data	IO-Link input data of the IO-Link device on port X1. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X1 (pin 4) operates as a digital input: Input value	Byte 6:Bit 0 = 0: Input off. Bit 0 = 1: Input on.Bits 1 … 7: Always 0.Byte 7 … 21: Reserved.
		Port X1 (pin 4) operates as a digital output: Output value	Byte 6:Bit 0 = 0: Output off. Bit 0 = 1: Output on.Bits 1 … 7: Always 0.Byte 7 … 21: Reserved.
22	1 byte	Port X2: IO-Link PQI	See table Port Qualifier Information, page 98.
23	1 byte	Fill byte	Reserved, 0
24 … 39	16 byte	Port X2 (pin 4) operates as an IO-Link master: IO-Link input data	IO-Link input data of the IO-Link device on port X2. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X2 (pin 4) operates as a digital input: Input value	Byte 24: Bit 0 = 0: Input off. Bit 0 = 1: Input on. Bits 1 … 7: Always 0. Byte 25 … 39: Reserved.
		Port X2 (pin 4) operates as a digital output: Output value	Byte 25: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 26 … 40: Reserved.
40	1 byte	Port X3: IO-Link PQI	See table Port Qualifier Information, page 98.
41	1 byte	Fill byte	Reserved, 0
42 … 57	16 byte	Port X3 (pin 4) operates as an IO-Link master: IO-Link input data	IO-Link input data of the IO-Link device on port X3. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X3 (pin 4) operates as a digital input: Input value	Byte 42: Bit 0 = 0: Input off. Bit 0 = 1: Input on. Bits 1 … 7: Always 0. Byte 43 … 57: Reserved.
		Port X3 (pin 4) operates as a digital output: Output value	Byte 42: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 43 … 57: Reserved.
58	1 byte	Port X4: IO-Link PQI	See table Port Qualifier Information, page 98.
59	1 byte	Fill byte	Reserved, 0

Byte offset	Number of bytes	Input process data	Description
60 … 75	16 byte	Port X4 (pin 4) operates as an IO-Linkmaster: IO-Link input data	IO-Link input data of the IO-Link device on port X4.For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X4 (pin 4) operates as a digitalinput: Input value	Byte 60: Bit 0 = 0: Input off. Bit 0 = 1: Input on. Bits 1 … 7: Always 0. Byte 61 … 75: Reserved.
		Port X4 (pin 4) operates as a digitaloutput: Output value	Byte 60: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 61 … 75: Reserved.
76	1 byte	Port X5: IO-Link PQI	See table Port Qualifier Information, page 98.
77	1 byte	Fill byte	Reserved, 0
78 … 93	16 byte	Port X5 (pin 4) operates as an IO-Link master: IO-Link input data	IO-Link input data of the IO-Link device on port X5. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X5 (pin 4) operates as a digital input: Input value	Byte 78: Bit 0 = 0: Input off. Bit 0 = 1: Input on. Bits 1 … 7: Always 0. Byte 79 … 93: Reserved.
		Port X5 (pin 4) operates as a digital output: Output value	Byte 79: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 79 … 93: Reserved.
94	1 byte	Port X6: IO-Link PQI	See table Port Qualifier Information, page 98.
95	1 byte	Fill byte	Reserved, 0
96 … 111	16 byte	Port X6 (pin 4) operates as an IO-Link master: IO-Link input data	IO-Link input data of the IO-Link device on port X6. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X6 (pin 4) operates as a digital input: Input value	Byte 96: Bit 0 = 0: Input off. Bit 0 = 1: Input on. Bits 1 … 7: Always 0. Byte 177 … 207: Reserved.
		Port X6 (pin 4) operates as a digital output: Output value	Byte 97: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 178 … 208: Reserved.
112	1 byte	Port X7: IO-Link PQI	See table Port Qualifier Information, page 98.
113	1 byte	Fill byte	Reserved, 0
114 … 129	16 byte	Port X7 (pin 4) operates as an IO-Link master: IO-Link input data	IO-Link input data of the IO-Link device on port X7. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X7 (pin 4) operates as a digital input: Input value	Byte 114: Bit 0 = 0: Input off. Bit 0 = 1: Input on. Bits 1 … 7: Always 0. Byte 116 … 130: Reserved.
		Port X7 (pin 4) operates as a digital output: Output value	Byte 115: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 116 … 130: Reserved.
130	1 byte	Port X8: IO-Link PQI	See table Port Qualifier Information, page 98.

Byte offset	Number of bytes	Input process data	Description
131	1 byte	Fill byte	Reserved, 0
132 … 147	16 byte	Port X8 (pin 4) operates as an IO-Link master: IO-Link input data	IO-Link input data of the IO-Link device on port X8. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X8 (pin 4) operates as a digital input: Input value	Byte 132: Bit 0 = 0: Input off. Bit 0 = 1: Input on. Bits 1 … 7: Always 0. Byte 133 … 147: Reserved.
		Port X8 (pin 4) operates as a digital output: Output value	Byte 132: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 133 … 147: Reserved.

The process data of the digital inputs can be transmitted "portbased" (default) or "pin-based". The following tables show the assignment of port and pin.

Input process data (port-based assignment):

Byte offset	Bit	Input process data
2	0	Port X1, pin 4: DI A or DO A
	1	Port X1, pin 2: DI B or DO B
	…	…
	6	Port X4, pin 4: DI A or DO A
	7	Port X4, pin 2: DI B or DO B
3	0	Port X5, pin 4: DI A or DO A
	1	Port X5, pin 2: DI B or DO B
	…	…
	6	Port X8, pin 4: DI A or DO A
	7	Port X8, pin 2: DI B or DO B

Input process data (pin-based assignment):

Byte offset	Bit	Input process data
2	0	Port X1, pin 4: DI A or DO A
	1	Port X2, pin 4: DI A or DO A
	…	…
	6	Port X7, pin 4: DI A or DO A
	7	Port X8, pin 4: DI A or DO A
3	0	Port X1, pin 2: DI B or DO B
	1	Port X2, pin 2: DI B or DO B
	…	…
	6	Port X7, pin 2: DI B or DO B
	7	Port X8, pin 2: DI B or DO B

Input Process Data of Connections 9 to 12

The following table describes the structure of the input process data of connections 9 to 12:

Byte offset	Number of bytes	Input process data	Description
0	1 byte	DI status	0: DI data invalid. 1-255: DI data valid.
1	1 byte	Fill byte	Reserved, 0
2 … 3	2 byte	DI data	The process data assigment to port and pin depends on the setting of the process data layout: pin-based or port-based. See the following tables.
4	1 byte	Port X1: IO-Link PQI	See table Port Qualifier Information, page 98.
5	1 byte	Fill byte	Reserved, 0
6 … 9	4 byte	Port X1 (pin 4) operates as an IO-Link master: IO-Link input data	IO-Link input data of the IO-Link device on port X1. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X1 (pin 4) operates as a digital input: Input value	Byte 6: Bit 0 = 0: Input off. Bit 0 = 1: Input on. Bits 1 … 7: Always 0. Byte 7 … 9: Reserved.
		Port X1 (pin 4) operates as a digital output: Output value	Byte 6: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 7 … 9: Reserved.
10	1 byte	Port X2: IO-Link PQI	See table Port Qualifier Information, page 98.
11	1 byte	Fill byte	Reserved, 0
12 … 15	4 byte	Port X2 (pin 4) operates as an IO-Link master: IO-Link input data	IO-Link input data of the IO-Link device on port X2. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X2 (pin 4) operates as a digital input: Input value	Byte 12: Bit 0 = 0: Input off. Bit 0 = 1: Input on. Bits 1 … 7: Always 0. Byte 13 … 15: Reserved.
		Port X2 (pin 4) operates as a digital output: Output value	Byte 12: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 13 … 15: Reserved.
16	1 byte	Port X3: IO-Link PQI	See table Port Qualifier Information, page 98.
17	1 byte	Fill byte	Reserved, 0
18 … 21	4 byte	Port X3 (pin 4) operates as an IO-Link master: IO-Link input data	IO-Link input data of the IO-Link device on port X3. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X3 (pin 4) operates as a digital input: Input value	Byte 18: Bit 0 = 0: Input off. Bit 0 = 1: Input on. Bits 1 … 7: Always 0. Byte 19 … 21: Reserved.
		Port X3 (pin 4) operates as a digital output: Output value	Byte 18: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 19 … 21: Reserved.
22	1 byte	Port X4: IO-Link PQI	See table Port Qualifier Information, page 98.
23	1 byte	Fill byte	Reserved, 0

Byte offset	Number of bytes	Input process data	Description
24 … 27	4 byte	Port X4 (pin 4) operates as an IO-Link master: IO-Link input data	IO-Link input data of the IO-Link device on port X4. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X4 (pin 4) operates as a digital input: Input value	Byte 24: Bit 0 = 0: Input off. Bit 0 = 1: Input on. Bits 1 … 7: Always 0. Byte 25 … 27: Reserved.
		Port X4 (pin 4) operates as a digital output: Output value	Byte 24: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 25 … 27: Reserved.
28	1 byte	Port X5: IO-Link PQI	See table Port Qualifier Information, page 98.
29	1 byte	Fill byte	Reserved, 0
30 … 33	4 byte	Port X5 (pin 4) operates as an IO-Linkmaster: IO-Link input data	IO-Link input data of the IO-Link device on port X5. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X5 (pin 4) operates as a digitalinput: Input value	Byte 30: Bit 0 = 0: Input off. Bit 0 = 1: Input on. Bits 1 … 7: Always 0. Byte 31 … 33: Reserved.
		Port X5 (pin 4) operates as a digitaloutput: Output value	Byte 30: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 31 … 33: Reserved.
34	1 byte	Port X6: IO-Link PQI	See table Port Qualifier Information, page 98.
35	1 byte	Fill byte	Reserved, 0
36 … 39	4 byte	Port X6 (pin 4) operates as an IO-Link master: IO-Link input data	IO-Link input data of the IO-Link device on port X6. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X6 (pin 4) operates as a digital input: Input value	Byte 36: Bit 0 = 0: Input off. Bit 0 = 1: Input on. Bits 1 … 7: Always 0. Byte 37 … 39: Reserved.
		Port X6 (pin 4) operates as a digital output: Output value	Byte 36: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 37 … 39: Reserved.
40	1 byte	Port X7: IO-Link PQI	See table Port Qualifier Information, page 98.
41	1 byte	Fill byte	Reserved, 0
42 … 45	4 byte	Port X7 (pin 4) operates as an IO-Link master: IO-Link input data	IO-Link input data of the IO-Link device on port X7. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X7 (pin 4) operates as a digital input: Input value	Byte 42: Bit 0 = 0: Input off. Bit 0 = 1: Input on. Bits 1 … 7: Always 0. Byte 44 … 46: Reserved.
		Port X7 (pin 4) operates as a digital output: Output value	Byte 43: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 43 … 45: Reserved.
46	1 byte	Port X8: IO-Link PQI	See table Port Qualifier Information, page 98.

Byte offset	Number of bytes	Input process data	Description
47	1 byte	Fill byte	Reserved, 0
48 … 51	4 byte	Port X8 (pin 4) operates as an IO-Link master: IO-Link input data	IO-Link input data of the IO-Link device on port X8. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X8 (pin 4) operates as a digital input: Input value	Byte 48: Bit 0 = 0: Input off. Bit 0 = 1: Input on. Bits 1 … 7: Always 0. Byte 49 … 51: Reserved.
		Port X8 (pin 4) operates as a digital output: Output value	Byte 48: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 49 … 51: Reserved.

The process data of the digital inputs can be transmitted "portbased" (default) or "pin-based". The following tables show the assignment of port and pin.

Input process data (port-based assignment):

Byte offset	Bit	Input process data
2	0	Port X1, pin 4: DI A or DO A
	1	Port X1, pin 2: DI B or DO B
	…	…
	6	Port X4, pin 4: DI A or DO A
	7	Port X4, pin 2: DI B or DO B
3	0	Port X5, pin 4: DI A or DO A
	1	Port X5, pin 2: DI B or DO B
	…	…
	6	Port X8, pin 4: DI A or DO A
	7	Port X8, pin 2: DI B or DO B

Input process data (pin-based assignment):

Byte offset	Bit	Input process data
2	0	Port X1, pin 4: DI A or DO A
	1	Port X2, pin 4: DI A or DO A
	…	…
	6	Port X7, pin 4: DI A or DO A
	7	Port X8, pin 4: DI A or DO A
3	0	Port X1, pin 2: DI B or DO B
	1	Port X2, pin 2: DI B or DO B
	…	…
	6	Port X7, pin 2: DI B or DO B
	7	Port X8, pin 2: DI B or DO B

Output Process Data of Connections 1 and 2

The following table describes the structure of the output process data of connections 1 and 2:

Byte offset	Number of bytes	Output process data	Description
0	1 byte	DO status	0: DO data invalid. Substitute values are used. 1-255: DO data valid (pin 2).
1	1 byte	Fill byte	Reserved, 0
2 … 3	2 byte	DO data	The process data assignment to port and pin depends on the setting of the process data layout: pin-based or port-based. See the following tables.
4	1 byte	Port X1 operates as an IO-Link master: IO-Link enable of output values	0: IO-Link port X1 output data invalid. 1-255: IO-Link port X1 output data valid.
		Port X1 (pin 4) operates as a digital output: Output enable	0: Port X1 pin 4 output value invalid. Substitute value is used. 1-255: Port X1 pin 4 output value valid.
		Port X1 (pin 4) operates as a digital input	Reserved, 0
5	1 byte	Fill byte	Reserved, 0
6 … 37	32 byte	Port X1 operates as an IO-Link master: IO-Link output data	IO-Link output data of the IO-Link device on port X1. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X1 (pin 4) operates as a digital output: Output value	Byte 6: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 7 … 37: Reserved.
		Port X1 (pin 4) operates as a digital input	Reserved, 0
38	1 byte	Port X2 operates as an IO-Link master: IO-Link enable of output values	0: IO-Link port X2 output data invalid. 1-255: IO-Link port X2 output data valid.
		Port X2 (pin 4) operates as a digital output: Output enable	0: Port X2 pin 4 output value invalid. Substitute value is used.1-255: Port X2 pin 4 output value valid.
		Port X2 (pin 4) operates as a digital input	Reserved, 0
39	1 byte	Fill byte	Reserved, 0
40 … 71	32 byte	Port X2 operates as an IO-Link master: IO-Link output data	IO-Link output data of the IO-Link device on port X2. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X2 (pin 4) operates as a digital output: Output value	Byte 40: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 41 … 71: Reserved.
		Port X2 (pin 4) operates as a digital input	Reserved, 0
72	1 byte	Port X3 operates as an IO-Link master: IO-Link enable of output values	0: IO-Link port X3 output data invalid. 1-255: IO-Link port X3 output data valid.
		Port X3 (pin 4) operates as a digital output: Output enable	0: Port X3 pin 4 output value invalid. Substitute value is used. 1-255: Port X3 pin 4 output value valid.
		Port X3 (pin 4) operates as a digital input	Reserved, 0
73	1 byte	Fill byte	Reserved, 0

Byte offset	Number of bytes	Output process data	Description
74 … 105	32 byte	Port X3 operates as an IO-Link master: IO-Link output data	IO-Link output data of the IO-Link device on port X3. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X3 (pin 4) operates as a digital output: Output value	Byte 74: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 75 … 105: Reserved.
		Port X3 (pin 4) operates as a digital input	Reserved, 0
106	1 byte	Port X4 operates as an IO-Link master: IO-Link enable of output values	0: IO-Link port X4 output data invalid. 1-255: IO-Link port X4 output data valid.
		Port X4 (pin 4) operates as a digital output: Output enable	0: Port X4 pin 4 output value invalid. Substitute value is used. 1-255: Port X4 pin 4 output value valid.
		Port X4 (pin 4) operates as a digital input	Reserved, 0
107	1 byte	Fill byte	Reserved, 0
108 … 139	32 byte	Port X4 operates as an IO-Link master: IO-Link output data	IO-Link output data of the IO-Link device on port X4. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X4 (pin 4) operates as a digital output: Output value	Byte 108: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 109 … 139: Reserved.
		Port X4 (pin 4) operates as a digital input	Reserved, 0
140	1 byte	Port X5 operates as an IO-Link master: IO-Link enable of output values	0: IO-Link port X5 output data invalid. 1-255: IO-Link port X5 output data valid.
		Port X5 (pin 4) operates as a digital output: Output enable	0: Port X5 pin 4 output value invalid. Substitute value is used. 1-255: Port X5 pin 4 output value valid.
		Port X5 (pin 4) operates as a digital input	Reserved, 0
141	1 byte	Fill byte	Reserved, 0
142 … 173	32 byte	Port X5 operates as an IO-Link master: IO-Link output data	IO-Link output data of the IO-Link device on port X5. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X5 (pin 4) operates as a digital output: Output value	Byte 142: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 143 … 173: Reserved.
		Port X5 (pin 4) operates as a digital input	Reserved, 0
174	1 byte	Port X6 operates as an IO-Link master: IO-Link enable of output values	0: IO-Link port X6 output data invalid. 1-255: IO-Link port X6 output data valid.
		Port X6 (pin 4) operates as a digital output: Output enable	0: Port X6 pin 4 output value invalid. Substitute value is used. 1-255: Port X6 pin 4 output value valid.
		Port X6 (pin 4) operates as a digital input	Reserved, 0
175	1 byte	Fill byte	Reserved, 0

Byte offset	Number of bytes	Output process data	Description
176 … 207	32 byte	Port X6 operates as an IO-Link master: IO-Link output data	IO-Link output data of the IO-Link device on port X6. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X6 (pin 4) operates as a digital output: Output value	Byte 176: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 177 … 207: Reserved.
		Port X6 (pin 4) operates as a digital input	Reserved, 0
208	1 byte	Port X7 operates as an IO-Link master: IO-Link enable of output values	0: IO-Link port X7 output data invalid. 1-255: IO-Link port X7 output data valid.
		Port X7 (pin 4) operates as a digital output: Output enable	0: Port X7 pin 4 output value invalid. Substitute value is used. 1-255: Port X7 pin 4 output value valid.
		Port X7 (pin 4) operates as a digital input	Reserved, 0
209	1 byte	Fill byte	Reserved, 0
210 … 241	32 byte	Port X7 operates as an IO-Link master: IO-Link output data	IO-Link output data of the IO-Link device on port X7. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X7 (pin 4) operates as a digital output: Output value	Byte 210: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 211 … 241: Reserved.
		Port X7 (pin 4) operates as a digital input	Reserved, 0
242	1 byte	Port X8 operates as an IO-Link master: IO-Link enable of output values	0: IO-Link port X8 output data invalid. 1-255: IO-Link port X8 output data valid.
		Port X8 (pin 4) operates as a digital output: Output enable	0: Port X8 pin 4 output value invalid. Substitute value is used. 1-255: Port X8 pin 4 output value valid.
		Port X8 (pin 4) operates as a digital input	Reserved, 0
243	1 byte	Fill byte	Reserved, 0
244 … 275	32 byte	Port X8 operates as an IO-Link master: IO-Link output data	IO-Link output data of the IO-Link device on port X8. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X8 (pin 4) operates as a digital output: Output value	Byte 244: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 245 … 275: Reserved.
		Port X8 (pin 4) operates as a digital input	Reserved, 0

The process data of the digital outputs can be transmitted "port-based" (default) or "pin-based". The following tables show the assignment of port and pin.

Output process data (port-based assignment):

Byte offset	Bit	Output process data
2	0	0
	1	Port X1, pin 2: DO B
	…	…
	6	0
	7	Port X4, pin 2: DO B
3	0	0
	1	Port X5, pin 2: DO B
	…	…
	6	0
	7	Port X8, pin 2: DO B

Output process data (pin-based assignment):

Byte offset	Bit	Output process data
2	0	0
	1	0
	…	…
	6	0
	7	0
3	0	Port X1, pin 2: DO B
	1	Port X2, pin 2: DO B
	…	…
	6	Port X7, pin 2: DO B
	7	Port X8, pin 2: DO B

Output Process Data of Connections 3 and 4

Connections 3 and 4 have no output process data.

Output Process Data of Connections 5 and 6

The following table describes the structure of the output process data of connections 5 and 6:

Byte offset	Number of bytes	Output process data	Description
0	1 byte	DO status	0: DO data invalid. Substitute values are used. 1-255: DO data valid (pin 2).
1	1 byte	Fill byte	Reserved, 0
2 … 3	2 byte	DO data	The process data assignment to port and pin depends on the setting of the process data layout: pin-based or port-based. See the following tables.
4	1 byte	Port X1 operates as an IO-Link master: IO-Link enable of output values	0: IO-Link port X1 output data invalid. 1-255: IO-Link port X1 output data valid.
		Port X1 (pin 4) operates as a digital output: Output enable	0: Port X1 pin 4 output value invalid. Substitute value is used. 1-255: Port X1 pin 4 output value valid.
		Port X1 (pin 4) operates as a digital input	Reserved, 0
5	1 byte	Fill byte	Reserved, 0
6 … 21	16 byte	Port X1 operates as an IO-Link master: IO-Link output data	IO-Link output data of the IO-Link device on port X1. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X1 (pin 4) operates as a digital output: Output value	Byte 6: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 7 … 21: Reserved.
		Port X1 (pin 4) operates as a digital input	Reserved, 0
22	1 byte	Port X2 operates as an IO-Link master: IO-Link enable of output values	0: IO-Link port X2 output data invalid. 1-255: IO-Link port X2 output data valid.
		Port X2 (pin 4) operates as a digital output: Output enable	0: Port X2 pin 4 output value invalid. Substitute value is used. 1-255: Port X2 pin 4 output value valid.
		Port X2 (pin 4) operates as a digital input	Reserved, 0
23	1 byte	Fill byte	Reserved, 0
24 … 39	16 byte	Port X2 operates as an IO-Link master: IO-Link output data	IO-Link output data of the IO-Link device on port X2. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X2 (pin 4) operates as a digital output: Output value	Byte 24: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 25 … 39: Reserved.
		Port X2 (pin 4) operates as a digital input	Reserved, 0
40	1 byte	Port X3 operates as an IO-Link master: IO-Link enable of output values	0: IO-Link port X3 output data invalid. 1-255: IO-Link port X3 output data valid.
		Port X3 (pin 4) operates as a digital output: Output enable	0: Port X3 pin 4 output value invalid. Substitute value is used. 1-255: Port X3 pin 4 output value valid.
		Port X3 (pin 4) operates as a digital input	Reserved, 0
41	1 byte	Fill byte	Reserved, 0

Byte offset	Number of bytes	Output process data	Description
42 … 57	16 byte	Port X3 operates as an IO-Link master: IO-Link output data	IO-Link output data of the IO-Link device on port X3. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X3 (pin 4) operates as a digital output: Output value	Byte 42: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 43 … 57: Reserved.
		Port X3 (pin 4) operates as a digital input	Reserved, 0
58	1 byte	Port X4 operates as an IO-Link master: IO-Link enable of output values	0: IO-Link port X4 output data invalid. 1-255: IO-Link port X4 output data valid.
		Port X4 (pin 4) operates as a digital output: Output enable	0: Port X4 pin 4 output value invalid. Substitute value is used. 1-255: Port X4 pin 4 output value valid.
		Port X4 (pin 4) operates as a digital input	Reserved, 0
59	1 byte	Fill byte	Reserved, 0
60 … 75	16 byte	Port X4 operates as an IO-Link master: IO-Link output data	IO-Link output data of the IO-Link device on port X4.For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X4 (pin 4) operates as a digital output: Output value	Byte 60: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 61 … 75: Reserved.
		Port X4 (pin 4) operates as a digital input	Reserved, 0
76	1 byte	Port X5 operates as an IO-Link master: IO-Link enable of output values	0: IO-Link port X5 output data invalid. 1-255: IO-Link port X5 output data valid.
		Port X5 (pin 4) operates as a digital output: Output enable	0: Port X5 pin 4 output value invalid. Substitute value is used.1-255: Port X5 pin 4 output value valid.
		Port X5 (pin 4) operates as a digital input	Reserved, 0
77	1 byte	Fill byte	Reserved, 0
78 … 93	16 byte	Port X5 operates as an IO-Link master: IO-Link output data	IO-Link output data of the IO-Link device on port X5. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X5 (pin 4) operates as a digital output: Output value	Byte 78: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 79 … 93: Reserved.
		Port X5 (pin 4) operates as a digital input	Reserved, 0
94	1 byte	Port X6 operates as an IO-Link master: IO-Link enable of output values	0: IO-Link port X6 output data invalid. 1-255: IO-Link port X6 output data valid.
		Port X6 (pin 4) operates as a digital output: Output enable	0: Port X6 pin 4 output value invalid. Substitute value is used. 1-255: Port X6 pin 4 output value valid.
		Port X6 (pin 4) operates as a digital input	Reserved, 0
95	1 byte	Fill byte	Reserved, 0

Byte offset	Number of bytes	Output process data	Description
96 … 111	16 byte	Port X6 operates as an IO-Link master: IO-Link output data	IO-Link output data of the IO-Link device on port X6. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X6 (pin 4) operates as a digital output: Output value	Byte 96: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 97 … 111: Reserved.
		Port X6 (pin 4) operates as a digital input	Reserved, 0
112	1 byte	Port X7 operates as an IO-Link master: IO-Link enable of output values	0: IO-Link port X7 output data invalid. 1-255: IO-Link port X7 output data valid.
		Port X7 (pin 4) operates as a digital output: Output enable	0: Port X7 pin 4 output value invalid. Substitute value is used. 1-255: Port X7 pin 4 output value valid.
		Port X7 (pin 4) operates as a digital input	Reserved, 0
113	1 byte	Fill byte	Reserved, 0
114 … 129	16 byte	Port X7 operates as an IO-Link master: IO-Link output data	IO-Link output data of the IO-Link device on port X7. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X7 (pin 4) operates as a digital output: Output value	Byte 114: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 115 … 129: Reserved.
		Port X7 (pin 4) operates as a digital input	Reserved, 0
130	1 byte	Port X8 operates as an IO-Link master: IO-Link enable of output values	0: IO-Link port X8 output data invalid. 1-255: IO-Link port X8 output data valid.
		Port X8 (pin 4) operates as a digital output: Output enable	0: Port X8 pin 4 output value invalid. Substitute value is used. 1-255: Port X8 pin 4 output value valid.
		Port X8 (pin 4) operates as a digital input	Reserved, 0
131	1 byte	Fill byte	Reserved, 0
132 … 147	16 byte	Port X8 operates as an IO-Link master: IO-Link output data	IO-Link output data of the IO-Link device on port X8. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X8 (pin 4) operates as a digital output: Output value	Byte 132: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 133 … 147: Reserved.
		Port X8 (pin 4) operates as a digital input	Reserved, 0

The process data of the digital outputs can be transmitted "port-based" (default) or "pin-based". The following tables show the assignment of port and pin.

Output process data (port-based assignment):

Byte offset	Bit	Output process data
2	0	0
	1	Port X1, pin 2: DO B
	…	…
	6	0
	7	Port X4, pin 2: DO B
3	0	0
	1	Port X5, pin 2: DO B
	…	…
	6	0
	7	Port X8, pin 2: DO B

Output process data (pin-based assignment):

Byte offset	Bit	Output process data
2	0	0
	1	0
	…	…
	6	0
	7	0
3	0	Port X1, pin 2: DO B
	1	Port X2, pin 2: DO B
	…	…
	6	Port X7, pin 2: DO B
	7	Port X8, pin 2: DO B

Output Process Data of Connections 7 and 8

Connections 7 and 8 have no output process data.

Output Process Data of Connections 9 and 10

The following table describes the structure of the output process data of connections 9 and 10:

Byte offset	Number of bytes	Output process data	Description
0	1 byte	DO status	0: DO data invalid. Substitute values are used.1-255: DO data valid (pin 2).
1	1 byte	Fill byte	Reserved, 0
2 … 3	2 byte	DO data	The process data assignment to port and pin depends on the setting of the process data layout: pin-based or port-based. See the following tables.
4	1 byte	Port X1 operates as an IO-Link master: IO-Link enable of output values	0: IO-Link port X1 output data invalid. 1-255: IO-Link port X1 output data valid.
		Port X1 (pin 4) operates as a digital output: Output enable	0: Port X1 pin 4 output value invalid. Substitute value is used. 1-255: Port X1 pin 4 output value valid.
		Port X1 (pin 4) operates as a digital input	Reserved, 0
5	1 byte	Fill byte	Reserved, 0
6 … 9	4 byte	Port X1 operates as an IO-Link master: IO-Link output data	IO-Link output data of the IO-Link device on port X1. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X1 (pin 4) operates as a digital output: Output value	Byte 6: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 7 … 9: Reserved.
		Port X1 (pin 4) operates as a digital input	Reserved, 0
10	1 byte	Port X2 operates as an IO-Link master: IO-Link enable of output values	0: IO-Link port X2 output data invalid. 1-255: IO-Link port X2 output data valid.
		Port X2 (pin 4) operates as a digital output: Output enable	0: Port X2 pin 4 output value invalid. Substitute value is used. 1-255: Port X2 pin 4 output value valid.
		Port X2 (pin 4) operates as a digital input	Reserved, 0
11	1 byte	Fill byte	Reserved, 0
12 … 15	4 byte	Port X2 operates as an IO-Link master: IO-Link output data	IO-Link output data of the IO-Link device on port X2. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X2 (pin 4) operates as a digital output: Output value	Byte 12: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 13 … 15: Reserved.
		Port X2 (pin 4) operates as a digital input	Reserved, 0
16	1 byte	Port X3 operates as an IO-Link master: IO-Link enable of output values	0: IO-Link port X3 output data invalid. 1-255: IO-Link port X3 output data valid.
		Port X3 (pin 4) operates as a digital output: Output enable	0: Port X3 pin 4 output value invalid. Substitute value is used. 1-255: Port X3 pin 4 output value valid.
		Port X3 (pin 4) operates as a digital input	Reserved, 0
17	1 byte	Fill byte	Reserved, 0

Byte offset	Number of bytes	Output process data	Description
18 … 21	4 byte	Port X3 operates as an IO-Link master: IO-Link output data	IO-Link output data of the IO-Link device on port X3. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X3 (pin 4) operates as a digital output: Output value	Byte 18: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 19 … 21: Reserved.
		Port X3 (pin 4) operates as a digital input	Reserved, 0
22	1 byte	Port X4 operates as an IO-Link master: IO-Link enable of output values	0: IO-Link port X4 output data invalid. 1-255: IO-Link port X4 output data valid.
		Port X4 (pin 4) operates as a digital output: Output enable	0: Port X4 pin 4 output value invalid. Substitute value is used. 1-255: Port X4 pin 4 output value valid. 1-255: Port X4 pin 4 output value valid.
		Port X4 (pin 4) operates as a digital input	Reserved, 0
23	1 byte	Fill byte	Reserved, 0
24 … 27	4 byte	Port X4 operates as an IO-Link master: IO-Link output data	IO-Link output data of the IO-Link device on port X4. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X4 (pin 4) operates as a digital output: Output value	Byte 24: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 25 … 27: Reserved.
		Port X4 (pin 4) operates as a digital input	Reserved, 0
28	1 byte	Port X5 operates as an IO-Link master: IO-Link enable of output values	0: IO-Link port X5 output data invalid. 1-255: IO-Link port X5 output data valid.
		Port X5 (pin 4) operates as a digital output: Output enable	0: Port X5 pin 4 output value invalid. Substitute valueis used. 1-255: Port X5 pin 4 output value valid.
		Port X5 (pin 4) operates as a digital input	Reserved, 0
29	1 byte	Fill byte	Reserved, 0
30 … 33	4 byte	Port X5 operates as an IO-Link master: IO-Link output data	IO-Link output data of the IO-Link device on port X5. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X5 (pin 4) operates as a digital output: Output value	Byte 30: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 31 … 33: Reserved.
		Port X5 (pin 4) operates as a digital input	Reserved, 0
34	1 byte	Port X6 operates as an IO-Link master: IO-Link enable of output values	0: IO-Link port X6 output data invalid. 1-255: IO-Link port X6 output data valid.
		Port X6 (pin 4) operates as a digital output: Output enable	0: Port X6 pin 4 output value invalid. Substitute value is used. 1-255: Port X6 pin 4 output value valid.
		Port X6 (pin 4) operates as a digital input	Reserved, 0
35	1 byte	Fill byte	Reserved, 0

Byte offset	Number of bytes	Output process data	Description
36 … 39	4 byte	Port X6 operates as an IO-Link master: IO-Link output data	IO-Link output data of the IO-Link device on port X6. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X6 (pin 4) operates as a digital output: Output value	Byte 36: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 37 … 39: Reserved.
		Port X6 (pin 4) operates as a digital input	Reserved, 0
40	1 byte	Port X7 operates as an IO-Link master: IO-Link enable of output values	0: IO-Link port X7 output data invalid. 1-255: IO-Link port X7 output data valid.
		Port X7 (pin 4) operates as a digital output: Output enable	0: Port X7 pin 4 output value invalid. Substitute value is used. 1-255: Port X7 pin 4 output value valid.
		Port X7 (pin 4) operates as a digital input	Reserved, 0
41	1 byte	Fill byte	Reserved, 0
42 … 45	4 byte	Port X7 operates as an IO-Link master: IO-Link output data	IO-Link output data of the IO-Link device on port X7. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X7 (pin 4) operates as a digital output: Output value	Byte 42: Bit 0 = 0: Output off. Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 43 … 45: Reserved.
		Port X7 (pin 4) operates as a digital input	Reserved, 0
46	1 byte	Port X8 operates as an IO-Link master: IO-Link enable of output values	0: IO-Link port X8 output data invalid. 1-255: IO-Link port X8 output data valid.
		Port X8 (pin 4) operates as a digital output: Output enable	0: Port X8 pin 4 output value invalid. Substitute value is used. 1-255: Port X8 pin 4 output value valid.
		Port X8 (pin 4) operates as a digital input	Reserved, 0
47	1 byte	Fill byte	Reserved, 0
48 … 51	4 byte	Port X8 operates as an IO-Link master: IO-Link output data	IO-Link output data of the IO-Link device on port X8. For a description of the data, see the manual of the manufacturer of the IO-Link device used.
		Port X8 (pin 4) operates as a digital output: Output value	Byte 48: Bit 0 = 0: Output off.Bit 0 = 1: Output on. Bits 1 … 7: Always 0. Byte 49 … 51: Reserved.
		Port X8 (pin 4) operates as a digital input	Reserved, 0

The process data of the digital outputs can be transmitted "port-based" (default) or "pin-based". The following tables show the assignment of port and pin.

Output process data (port-based assignment):

Byte offset	Bit	Output process data
2	0	0
	1	Port X1, pin 2: DO B
	…	…
	6	0
	7	Port X4, pin 2: DO B
3	0	0
	1	Port X5, pin 2: DO B
	…	…
	6	0
	7	Port X8, pin 2: DO B

Output process data (pin-based assignment):

Byte offset	Bit	Output process data
2	0	0
	1	0
	…	…
	6	0
	7	0
3	0	Port X1, pin 2: DO B
	1	Port X2, pin 2: DO B
	…	…
	6	Port X7, pin 2: DO B
	7	Port X8, pin 2: DO B

Output Process Data of Connections 11 and 12

Connections 11 and 12 have no output process data.

Port Qualifier Information

The PQI (Port Qualifier Information) provides status information on IO-Link port and IO-Link device.

Port Qualifier Information:

Bit	Flag	Description
0	-	Reserved, 0
1	-	Reserved, 0
2	-	Reserved, 0
3	Event	IO-Link event The value corresponds to attribute 20 of event log object 65 (0x41). 0: Port has no IO-Link event. 1: Port has an IO-Link event. The event can be read out via event log object 65 (0x41).
4	-	Reserved, 0
5	DevCom	IO-Link device communication 0: No IO-Link device available. 1: IO-Link device detected that is in the state PREOPERATE or OPERATE.
6	DevErr	Port/Device error 0: No error/warning occurred. 1: Error/warning occurred on the port or IO-Link device.
7	PQ	Validity of the device process data 0: Invalid I/O process data from the IO-Link device. 1: Valid I/O process data from the IO-Link device.

Reading and Writing the Parameters of an IO-Link Device

The IO-Link master offers services for the Ethernet/IP Scanner to read or write parameters of an IO-Link device. For this purpose, an acyclic Ethernet/IP service is mapped to the ISDU service of the IO-Link communication. Using the ISDU service (Indexed Service Data Unit), the IO-Link master can read or write parameters of the IO-Link device.

IO-Link parameter object 131 (0x83) maps CIP services to ISDU services of the IO-Link communication. Chapter IO-Link Device Parameter - Object 131 (0x83), page 174 describes the object and the structures of the read and write services.

Reading the Parameters of an IO-Link Device

The Ethernet/IP Scanner uses the Read ISDU service to read the IO-Link device parameter object. In the request, the service contains the values for the port (to which the IO-Link device is connected), the object index, and the object subindex of the IO-Link parameter.

In the positive case, the response to the Ethernet/IP Scanner contains the value of the parameter read. In the negative case, the answer contains information on the error.

Writing Parameters of an IO-Link Device

The Ethernet/IP Scanner uses the Write ISDU service to write the IO-Link device parameter object. In the request, the service contains the values for the port (to which the IO-Link device is connected), the object index, the object subindex of the parameter, and the value of the parameter to be written.

In the positive case, the response to the Ethernet/IP Scanner contains the CIP status with the value 0. In the negative case, the answer contains information on the error.

MQTT Topics

General Parts of a Topic

The description of a topic contains parts that are substituted:

Bit	Description
{prefix}	Prefix of each topic. The prefix is a text used to identify a device. Configurable in the IO-Link master Web Server.
[MASTER_NUMBER]	Number for each master in the gateway. Typically, the gateway has one master and MASTER_NUMBER is 1.
[PORT_NUMBER]	Number for each port of a master. If the master has 8 ports for example, PORT_NUMBER is 1 … 8.
[DEVICE_ALIAS]	String to identify a device connected to a port of a master:-masterXportY. Example: master1port3.

Gateway Topics

Overview

Topic	Description
{prefix}/IO-Link/v1/gateway/identification	Identification of the gateway: MAC address, serial number, product ID, vendor name, product name, hardware revision, firmware revision For an example, see Gateway Identification, page 100.
{prefix}/IO-Link/v1/gateway/capabilities	Capabilities of the gateway: IODD supported, MQTT supported For an example, see Gateway Capabilities, page 101.
{prefix}/IO-Link/v1/gateway/configuration	Network configuration of the gateway: IP configuration, IP address, subnet mask, standard gateway For an example, see Gateway Configuration, page 101.

You can find examples of and details about the transferred JSON objects below.

Gateway Identification

Example of the gateway identification JSON object:

```
{
"macAddress": "01:02:03:04:05:06",
"serialNumber": "12345678",
"productID": "TMP34Z",
"vendorName": "SensorCompany",
"productName": "FlowSensor34",
"hardwareRevision": "V2.34",
"firmwareRevision": "V1.23"
}
```

Gateway Capabilities

JSON key	Description
ioddSupported	"ioddSupported": true: IODD is available"ioddSupported": false: IODD is not available
mqttSupported	"mqttSupported": true: MQTT is available"mqttSupported": false: MQTT is not available

Example of the gateway capabilities JSON object:

```
{
"ioddSupported": true,
"mqttSupported": false
}
```

Gateway Configuration

JSON key	Description
"ipConfiguration"	Possible values for "ipConfiguration": “MANUAL”: Assignment of the IP address by other device-specific means. “DHCP”: RFC 2131 defines the “Dynamic Host Configuration Protocol” that allows automatic assignment of IP addresses. “DCP”: PROFINET defines the “Discovery and Configuration Protocol”, a link-layer protocol that allows the manual assignment of IP addresses.

Example of the gateway configuration JSON object:

```
{
"ethIpv4":
[
{
"ipConfiguration": "MANUAL",
"ipAddress": "192.168.1.13",
"subnetMask: "255.255.255.0",
"standardGateway": "192.168.1.1"
}
]
}
```

Master Topics

Overview

Topic	Description
{prefix}/IO-Link/v1/masters	Available master number keys and identification information: Master number, serial number, location tag For an example, see Master List, page 103.
{prefix}/IO-Link/v1/masters/[MASTER_NUMBER]/identification	Identification of the master: Vendor name, vendor ID, master ID, master type, serial number, application-specific tag, location tag, function tag Example: {prefix}/IO-Link/v1/masters/1/identification For an example, see Master Identification, page 104.
{prefix}/IO-Link/v1/masters/[MASTER_NUMBER]/capabilities	Capabilities of the master: Number of ports, maximum power supply (of the device) Example: {prefix}/IO-Link/v1/masters/1/capabilities For an example, see Master Capabilities, page 104.
{prefix}/IO-Link/v1/masters/[MASTER_NUMBER]/ports	Available port number keys: Port number, status info, device alias Example: {prefix}/IO-Link/v1/masters/1/ports For an example, see Port List, page 105.
{prefix}/IO-Link/v1/masters/[MASTER_NUMBER]/ports/[PORT_NUMBER]/capabilities	Capability information of the port: Max power supply (of the port), port type Example: {prefix}/IO-Link/v1/masters/1/ports/4/capabilities For an example, see Port Capabilities, page 105.
{prefix}/IO-Link/v1/masters/[MASTER_NUMBER]/ports/[PORT_NUMBER]/status	Current status of the port: Status Info, IO-Link revision, transmission rate, master cycle time Example: {prefix}/IO-Link/v1/masters/1/ports/4/status For an example, see Port Status, page 106.
{prefix}/IO-Link/v1/masters/[MASTER_NUMBER]/ports/[PORT_NUMBER]/configuration	Configuration of the port: Mode, validation and backup, iq configuration, cycle time, device alias Example: {prefix}/IO-Link/v1/masters/1/ports/4/configuration For an example, see Port Configuration, page 106.
{prefix}/IO-Link/v1/masters/[MASTER_NUMBER]/ports/[PORT_NUMBER]/diagnostics/configuration	Diagnostics/configuration of the port: overcurrent pin 1, undercurrent pin 1, overcurrent pin 2, undercurrent pin 2, overcurrent pin 4, undercurrent pin 4 Example: {prefix}/IO-Link/v1/masters/1/ports/4/diagnostics/configuration For an example, see Port Diagnostics Configuration, page 107
{prefix}/IO-Link/v1/masters/[MASTER_NUMBER]/ports/[PORT_NUMBER]/diagnostics/current	Diagnostics/current of the port: current pin 1, current pin 2, current pin 4 Example: {prefix}/IO-Link/v1/masters/1/ports/4/diagnostics/current For an example, see Port Diagnostics Current, page 107
{prefix}/IO-Link/v1/masters/[MASTER_NUMBER]/ports/[PORT_NUMBER]/diagnostics/voltage	Diagnostics/voltage of the port: voltage pin 1, voltage pin 2, voltage pin 4 Example: {prefix}/IO-Link/v1/masters/1/ports/4/diagnostics/voltage For an example, see Port Diagnostics Voltage, page 107
{prefix}/IO-Link/v1/masters/[MASTER_NUMBER]/ports/[PORT_NUMBER]/diagnostics/temperature	Diagnostics/temperature of the port: temperature pin 1, temperature pin 2, temperature pin 4 Example: {prefix}/IO-Link/v1/masters/1/ports/4/diagnostics/temperature For an example, see Port Diagnostics Temperature, page 108
{prefix}/IO-Link/v1/masters/[MASTER_NUMBER]/ports/[PORT_NUMBER]/statistics/current	Statistics/current of the port: minimum current pin 1, maximum current pin 1, minimum current pin 2, maximum current pin 2, minimum current pin 4, maximum current pin 4 Example: {prefix}/IO-Link/v1/masters/1/ports/4/statistics/current For an example, see Port Diagnostics Current, page 107

Topic	Description
{prefix}/IO-Link/v1/masters/[MASTER_NUMBER]/ports/[PORT_NUMBER]/statistics/voltage	Statistics/voltage of the port: minimum voltage pin 1, maximum voltage pin 1, minimum voltage pin 2, maximum voltage pin 2, minimum voltage pin 4, maximum voltage pin 4 Example: {prefix}/IO-Link/v1/masters/1/ports/4/statistics/voltage For an example, see Port Diagnostics Voltage, page 107
{prefix}/IO-Link/v1/masters/[MASTER_NUMBER]/ports/[PORT_NUMBER]/statistics/temperature	Statistics/temperature of the port: minimum temperature pin 1, maximum temperature pin 1, minimum temperature pin 2, maximum temperature pin 2, minimum temperature pin 4, maximum temperature pin 4 Example: {prefix}/IO-Link/v1/masters/1/ports/4/statistics/temperature For an example, see Port Statistics Temperature, page 109
{prefix}/IO-Link/v1/masters/[MASTER_NUMBER]/diagnostics/configuration	Diagnostics/configuration: over temperature, temperature hysteresis, overvoltage low, undervoltage low, overvoltage low2, undervoltage low2, voltage hysteresis, current hysteresis Example: {prefix}/IO-Link/v1/masters/1/diagnostics/configuration For an example, see Diagnostics Configuration, page 110
{prefix}/IO-Link/v1/masters/[MASTER_NUMBER]/diagnostics/value	Diagnostics/value: mean temperature, mean voltage low, mean voltage low2, sum current low, sum current low2 Example: {prefix}/IO-Link/v1/masters/1/diagnostics/value For an example, see Diagnostics Value, page 110
{prefix}/IO-Link/v1/masters/[MASTER_NUMBER]/ports/[PORT_NUMBER]/datastorage	Data storage content of the port: Vendor ID, device ID, IO-Link revision Example: {prefix}/IO-Link/v1/masters/1/ports/4/datastorage For an example, see Port Data Storage, page 111.

You can find examples of and details about the transferred JSON objects below.

Master List

Example of the master list JSON object:

```
{
{
"masterNumber": 1,
"serialNumber": "A0A1A2A3A4",
"locationTag": "slot 2"
},
{
"masterNumber": 2,
"serialNumber": "B0B1B2B3B4",
"locationTag": "slot 3"
}
```

Master Identification

Example of the master identification JSON object:


```
{
"vendorName": "Vendor GmbH",
"vendorId": 26,
"masterId": 42,
"masterType":
"Master acc. V1.0",
"serialNumber": "IOLM123456",
"applicationSpecificTag": "Fallback reader",
"locationTag": "Down under",
"functionTag": "Code reading"
}
```


Master Capabilities

Example of the master capabilities JSON object:


```
{
"numberOfPorts": 8,
"maxPowerSupply": {
"value": 0.3,
"unit": "A"
}
}
```

Port List

JSON key	Description
statusInfo	Activated: "statusInfo": "DEVICE_ONLINE" Deactivated: "statusInfo": “DEACTIVATED”
deviceAlias	Possible values for "deviceAlias": "Distance_sensor" "Pressure_sensor" "Switching_sensor” "Empty_port"

Example of the port list JSON object:

```
[
{
"portNumber": 1,
"statusInfo": "DEVICE_ONLINE",
"deviceAlias": "Distance_sensor"
},
{
"portNumber": 2,
"statusInfo": "DEVICE_ONLINE",
"deviceAlias": "Pressure_sensor"
},
{
"portNumber": 3,
"statusInfo": "DEVICE_ONLINE",
"deviceAlias": "Switching_sensor"
},
{
"portNumber": 4, "statusInfo":
"DEACTIVATED",
"deviceAlias": "Empty_port"
}
]
```

Port Capabilities

JSON key	Description
portType	Value for “portType” for IO-Link master: “CLASS_A”

Example of the port capabilities JSON object:

```
{
"maxPowerSupply":
{
"value": 0.3,
"unit": "A"
},
"portType": "CLASS_A"
}
```

Port Status

JSON key	Description
statusInfo	Activated: "statusInfo": "DEVICE_ONLINE" Deactivated: "statusInfo": “Deactivated”

Example of the IO-Link port status JSON object:

```
{
"statusInfo": "DEVICE_ONLINE",
"IO-LinkRevision": "1.1",
"transmissionRate": "COM2",
"masterCycleTime": {
"value": "5.0",
"unit": "ms"
}
}
```

Port Configuration

JSON key	Values
mode	• "DEACTIVATED" • "IO-Link_CYCLIC" • "IO-Link_ROAMING"
validationAndBackup	• "NO_DEVICE_CHECK" • "TYPE_COMPATIBLE" • "TYPE_COMPATIBLE_RESTORE_ONLY" • "TYPE_COMPATIBLE_BACKUP_AND_RESTORE"

Example of the IO-Link configuration JSON object:

```
{
"mode": "IO-Link_MANUAL",
"validationAndBackup": "TYPE COMPATIBLE",
"iqConfiguration":"DIGITAL_INPUT"
"cycleTime": {
"value": "5.0",
"unit": "ms"
},
"deviceAlias": "Distance_sensor_1"
}
```

Example of the cycle time object JSON object:

```
{
"value": "5.0",
"unit": "ms"
}
```

Port Diagnostics Configuration

Example of the port diagnostics configuration JSON object:


```
{
"overCurrentPin1": {
"value": "0.0",
"unit": "A"
},
"underCurrentPin1": {
"value": "0.0",
"unit": "A"
},
"overCurrentPin2": {
"value": "0.0",
"unit": "A"
},
"underCurrentPin2": {
"value": "0.0",
"unit": "A"
},
"overCurrentPin4": {
"value": "0.0",
"unit": "A"
},
"underCurrentPin4": {
"value": "0.0",
"unit": "A"
}
}
```


Port Diagnostics Current

Example of the port diagnostics current JSON object:


```
{
"currentPin1": {
"value": "60.0",
"unit": "mA"
},
"currentPin2": {
"value": "0.0",
"unit": "mA"
},
"currentPin4": {
"value": "0.0",
"unit": "mA"
}
}
```


Port Diagnostics Voltage

Example of the port diagnostics voltage JSON object:


```
{
"voltagetPin1": {
"value": "23.2",
"unit": "V"
},
"voltagePin2": {
"value": "0.2",
"unit": "V"
},
"voltagePin4": {
"value": "18.3",
"unit": "V"
}
}
```

Port Diagnostics Temperature

Example of the port diagnostics temperature JSON object:


```
{
"temperaturePin1": {
"value": "39.3",
"unit": "C"
},
"temperaturePin2": {
"value": "39.3",
"unit": "C"
},
"temperaturePin4": {
"value": "39.3",
"unit": "C"
}
}
```


Port Statistics Current

Example of the port statistics current JSON object:


```
{
"minCurrentPin1": {
"value": "55.0",
"unit": "mA"
},
"maxCurrentPin1": {
"value": "72.0",
"unit": "mA"
},
"minCurrentPin2": {
"value": "0.0",
"unit": "mA"
},
"maxCurrentPin2": {
"value": "0.0",
"unit": "mA"
},
"minCurrentPin4": {
"value": "0.0",
"unit": "mA"
},
"maxCurrentPin4": {
"value": "0.0",
"unit": "mA"
}
}
```

Port Statistics Voltage

Example of the port statistics voltage JSON object:


```
{
"minVoltagePin1": {
"value": "23.3",
"unit": "V"
},
"maxVoltagePin1": {
"value": "23.3",
"unit": "V"
},
"minVoltagePin2": {
"value": "-0.2",
"unit": "V"
},
"maxVoltagePin2": {
"value": "-0.2",
"unit": "V"
},
"minVoltagePin4": {
"value": "-0.2",
"unit": "V"
},
"maxVoltagePin4": {
"value": "22.4",
"unit": "V"
}
}
```


Port Statistics Temperature

Example of the port statistics temperature JSON object:


```
{
"minTemperaturePin1": {
"value": "38.9",
"unit": "C"
},
"maxTemperaturePin1": {
"value": "39.5",
"unit": "C"
},
"minTemperaturePin2": {
"value": "38.9",
"unit": "C"
},
"maxTemperaturePin2": {
"value": "39.5",
"unit": "C"
},
"minTemperaturePin4": {
"value": "38.9",
"unit": "C"
},
"maxTemperaturePin4": {
"value": "39.5",
"unit": "C"
}
}
```

Diagnostics Configuration

Example of the diagnostics configuration JSON object:


```
{
"overTemperature": {
"value":70.0,
"unit":"C"
},
"temperatureHysteresis": {
"value":2.0,
"unit":"C"
},
"overVoltageL": {
"value":30.0,
"unit":"V"
},
"underVoltageL": {
"value":18.0,
"unit":"V"
},
"overVoltageL2": {
"value":30.0,
"unit":"V"
},
"underVoltageL2": {
"value":18.0,
"unit":"V"
},
"voltageHysteresis": {
"value":0.3,
"unit":"V"
},
"currentHysteresis": {
"value":0.0,
"unit":"A"
}
}
```


Diagnostics Value

Example of the diagnostics value JSON object:


```
{
"meanTemperature":{
"value":37.6,
"unit":"C"
},
"meanVoltageL":{
"value":23.2,
"unit":"V"
},
"meanVoltageL2":{
"value":0.0,
"unit":"V"
},
"sumCurrentL":{
"value":0.5,
"unit":"A"
},
"sumCurrentL2":{
"value":0.0,
"unit":"A"
}
}
```

Port Data Storage

Example of the port data storage JSON object:

```
"header": {
"vendorId": 15,
"deviceId": 65253,
"IO-LinkRevision": "1.1"},
"content": "YmFzZTY0IGVuY3J5cHRlZCBjb250ZW50"
}
}
```

Device Topics

Overview

Topic	Description
{prefix}/IO-Link/v1/devices	Address all devices of all masters: Device alias, master number, port number. For an example, see Device List, page 112
{prefix}/IO-Link/v1/devices/[DEVICE_ALIAS]/process-data/value	Process data value of the device: Get data (IO-Link, IQ value), set data (IO-Link) Example: {prefix}/IO-Link/v1/devices/master1port4/process-data/value For an example, see Device Process Data, page 112.
{prefix}/IO-Link/v1/devices/[DEVICE_ALIAS]/process-data/getdata/value	Process data input value of the device: Get Data (IO-Link, IQ value) Example: {prefix}/IO-Link/v1/devices/master1port4]/process-data/getdata/value For an example, see Device Process Data Input, page 113.
{prefix}/IO-Link/v1/devices/[DEVICE_ALIAS]/process-data/setdata/value	Process data output value of the device: Set Data (IO-Link) Example: {prefix}/IO-Link/v1/devices/master1port4]/process-data/setdata/value For an example, see Device Process Data Output, page 113.
IO-Link/v1/devices/[DEVICE_ALIAS]/events	Event log of the device: Time, severity, origin, message Example: {prefix}/IO-Link/v1/devices/master1port4/events For an example, see Device Events, page 113.

Device List (JSON Object)

Example of the device list JSON object:

JSON key	Description
deviceAlias	Device alias
masterNumber	Master number
portNumber	Port number

Example of the device list JSON object:

```
[
{
"deviceAlias": "DT35",
"masterNumber": 1,
"portNumber": 1,
},
{
"deviceAlias": "DT36",
"masterNumber": 1,
"portNumber": 2,
},
{
"deviceAlias": "DT37",
"masterNumber": 1,
"portNumber": 3,
},
{
"deviceAlias": "DT38",
"masterNumber": 1,
"portNumber": 4,
},
]
```

Device Process Data (JSON Object)

Example of the device process data JSON object:

JSON key	Description
getData	Get Data
IO-Link	IO-Link
iqValue	IQ value
setData	Set Data
IO-Link	IO-Link

Example of the device process data JSON object for an IO-Link device:

```
{
"getData": {
"IO-Link": {
"valid": true,
"value": [12,22,216]
},
"iqValue": false
},
"setData": {
"IO-Link": {
"valid": true,
"value": [128,221,134]
}
}
```

Device Process Data Input (JSON Object)

Example of the device process data input JSON object:

JSON key	Description
getData	Get Data
IO-Link	IO-Link
iqValue	IQ value

Example of the device process data input JSON object for an IO-Link device:

```
{
"getData": {
"IO-Link": {
"valid": true,
"value": [12,22,216]
},
"iqValue": false
}
}
```

Device Process Data Output (JSON Object)

Example of the device process data output JSON object:

JSON key	Description
setData	Set Data
IO-Link	IO-Link

Example of the device process data output JSON object for an IO-Link device:

```
{
"getData": {},
"setData": {
"IO-Link": {
"valid": true,
"value": [128,221,134]
}
}
}
```

Device Events (JSON Object)

Example of the device events JSON object:

JSON key	Description
time	Time
severity	Severity
origin	Origin
message	Message

Example of the device events JSON object:

```
[
{
"time": "2018-05-18T07:31:54.123z",
"severity": "WARNING",
"origin": {
"master": 1,
"port": 1,
"device": "Temp sensor 1",
},
"message": {
"code": 16912,
"mode": "APPEARS",
"text": "Device temperature over-run - Clear source of heat"
}
}
]
```

MQTT Topics

Overview

Topic	Description
{prefix}/IO-Link/v1/mqtt/configuration	Configuration of MQTT client: Client mode, server address, user name, password, last will, keep alive time For an example, see MQTT Configuration, page 114.
{prefix}/IO-Link/v1/mqtt/connectionstatus	Configuration of MQTT client: Connection status, server address, up time For an example, see MQTT Connection Status, page 114.

You can find examples of and details about the transferred JSON objects below.

MQTT Configuration

JSON key	Description
clientMode	Activated: "clientMode": "ACTIVE"Deactivated: "clientMode": "INACTIVE"

Example of the MQTT configuration JSON object:

```
{
"clientMode": "ACTIVE",
"serverAddress": "192.168.2.1./mqttserver",
"username": "IO-Link_json",
"password": "123456",
"lastWill": {"topic": "my temperature sensor",
"message": "Process data transfer stopped",
"qoS": "0_ONLY_ONCE",
"retain": true
},
"keepAliveTime": 0
}
```

MQTT Connection Status

JSON key	Description
connectionStatus	Possible values for "connectionStatus":CONNECTINGCONNECTION_ACCEPTEDCLIENT_INACTIVE

Example of the MQTT connection status JSON object:

```
{
"connectionStatus": "CONNECTION_ACCEPTED",
"serverAddress": "192.168.2.1./mqttserver",
"upTime": 123
}
```

OPC UA

The device has an OPC UA server. An OPC UA client can establish a connection to the device and access the following parameters:

- Device identification,
- Configuration parameters,
- Process data,
- Measuring values,
- Information on diagnosis,
- Information on statistics, and so on.

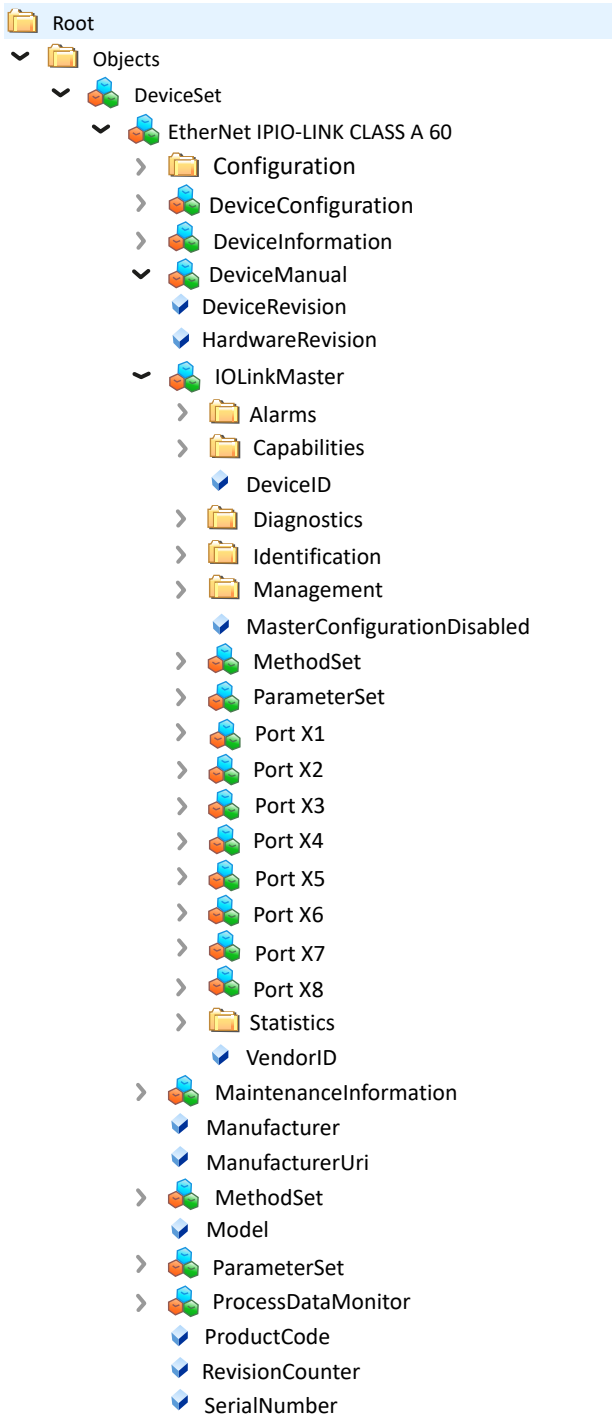
The OPC UA client establishes a connection via the following URL:

```
opc.tcp://IP address:4840
```

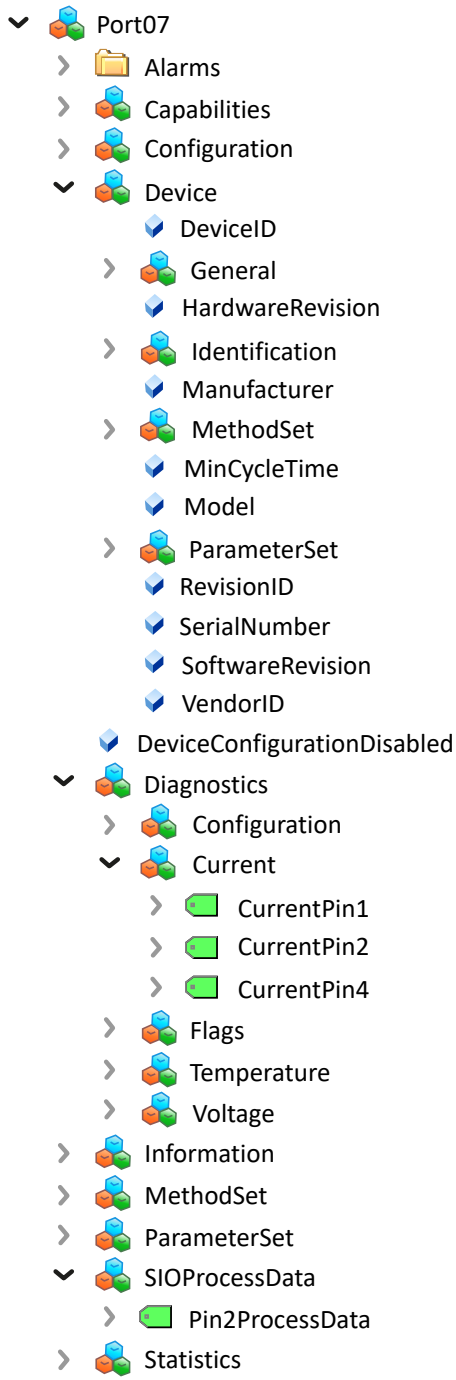
For IP address use the IP address of the device.

The client can access the device parameters anonymously (reading only) or via user name/password (reading and writing). Use the web server to set user name and password.

The following figure shows a part of the information model of the device:



The following figure shows a part of the information model of the IO-Link port:



Device Identifiation

The device provides nodes for the device identification. In the node SoftwareRevision, for example, the OPC UA client can read the version of the device firmware used.

The path to these nodes is:

Root > Object > DeviceSet > [device name]

Device identification:

Node name	Node class	Access	Description
Manufacturer	Variable	read	Device manufacturer
ManufacturerUri	Variable	read	URL of the device manufacturer
Model	Variable	read	Model name of the device
ProductCode	Variable	read	Product code of the device
RevisionCounter	Variable	read	Hardware revision of the device
SerialNumber	Variable	read	Serial number of the device
SoftwareRevision	Variable	read	Revision/version of the firmware

Configuration Parameter

The OPC UA server provides nodes with configuration parameters of the device. In the node OverTemperature , for example, the OPC UA client can read the upper temperature limit value.

The path to these nodes is:

Root > Object > DeviceSet > [device name] > IO-LinkMaster > Diagnostics > Configuration

Device-related configuration parameter:

Node name	Node class	Access	Default	Description
CurrentHysteresis	Variable	read	10 mA	Current hysteresis, unit: mA In case the current exceeds the limit, then the current has to lower by the hysteresis value below the limit in order to remove the diagnosis.
OverTemperature	Variable	read	70 °C	Higher limit value for the temperature of a port, unit: 0,1°C
OverVoltageL1	Variable	read	30 V	Upper voltage limit of power line 1, monitoring possible for pins with function L+, DI, DO, DIO, IO-Link, unit: mV
OverVoltageL2	Variable	read	30 V	Higher limit of the voltage of power line 2, unit: mV
TemperatureHysteresis	Variable	read	2 °C	Temperature hysteresis, unit: 0.1 °C In case the the temperature exceeds the limit, then the temperature has to lower by the hysteresis value below the limit in order to remove the diagnosis.
UnderTemperature	Variable	read	-25 °C	Lower temperature limit of a port, unit: 0.1 °C
UnderVoltageL1	Variable	read	18 V	Lower limit of the voltage of power line 1, monitoring possible for pins with function L+, DI, DO, DIO, IO-Link, unit: mV

Node name	Node class	Access	Default	Description
UnderVoltageL2	Variable	read	18 V	Lower limit of the voltage of power line 2, unit: mV
VoltageHyste-resis	Variable	read	300 mV	Voltage hysteresis, unit: mV In case the the voltage exceeds the limit, then the voltage has to lower by the hysteresis value below the limit in order to remove the diagnosis.

The OPC UA server provides nodes with configuration parameters for each port. The path to these nodes is:

Root > Object > DeviceSet > [device name] > IO-LinkMaster > Diagnostics > PortXX > Configuration

The following table lists port-related configuration parameters:

Node name	Node class	Access	Default	Description
OverCurrent-Pin1	Variable	read	0	Warning level for upper current limit at pin 1, unit: 1 mA 0: Monitoring not activated
OverCurrent-Pin2	Variable	read	0	Warning level for upper current limit at pin 2, unit: 1 mA 0: Monitoring not activated
OverCurrent-Pin4	Variable	read	0	Warning level for upper current limit at pin 4, unit: 1 mA 0: Monitoring not activated
UnderCurrent-Pin1	Variable	read	0	Warning level for lower current limit at pin 1, unit: 1 mA 0: Monitoring not activated
UnderCurrent-Pin2	Variable	read	0	Warning level for lower current limit at pin 2, unit: 1 mA 0: Monitoring not activated
UnderCurrent-Pin4	Variable	read	0	Warning level for lower current limit at pin 4, unit: 1 mA 0: Monitoring not activated

Process Data

The OPC UA server provides nodes with configuration parameters for each port. For example, the OPC UA client can read the value at pin 4 of a port in the Pin4ProcessData node.

The OPC UA server provides nodes with configuration parameters for each port. The path to these nodes is:

Root > Objects > DeviceSet > [Device name] > IO-LinkMaster > Port XX > Device > ParameterSet

The following table lists port-related IO-Link process data:

Node name	Node class	Access	Description
ProcessDataInput	Variable	read	Process data (inputs)
PDDescriptor	Variable	read	Coding according to "IO-Link Companion Specification"
ProcessDataLength	Variable	read	Length of input process data
ProcessDataOutput	Variable	read	Process data (outputs)
PDDescriptor	Variable	read	Coding according to "IO-Link Companion Specification"
ProcessDataLength	Variable	read	Length of input process data

Read Device-related Measured Values

The OPC UA server provides nodes with calculated measured values. For example, the OPC UA client can read the calculated sum current of supply line 1 in the SumCurrentL node.

The path to these nodes is:

Root > Object > DeviceSet > [device name] > IO-LinkMaster > Diagnostics > Current

The following table lists device-related (calculated) current measured values:

Node name	Node class	Access	Description
SumCurrentL1	Variable	read	Total current calculated from individual measurements in supply line 1, unit: mA

Node name	Node class	Access	Description
SumCurrentL2	Variable	read	Total current calculated from individual measurements in supply line 2, unit: mA

The path to the node of the temperature measured value is:

Root > Object > DeviceSet > [device name] > IO-LinkMaster > Diagnostics > Temperature

The following table lists device-related (calculated) temperature measured values:

Node name	Node class	Access	Description
MeanTemperature	Variable	read	Mean value for the temperature of the module, calculated from the temperature values measured individually on the three chips, unit:°C

The path to the nodes of the voltage measured values is:

Root > Object > DeviceSet > [device name] > IO-LinkMaster > Diagnostics > Voltage

The following table lists device-related (calculated) voltage measured values:

Node name	Node class	Access	Description
MeanVoltageL1	Variable	read	Mean voltage of power line 1, unit: mV
MeanVoltageL2	Variable	read	Mean voltage of power line 2, unit: mV

Read Port Measured Values and Diagnostics

The OPC UA server provides nodes with measured values for each port and each pin.

The path to the nodes with port-related current measured values is:

Root > Object > DeviceSet > [device name] > IO-LinkMaster > Diagnostics > PortXX > Current

The following table lists port-related current measured values:

Node name	Node class	Access	Description
CurrentPin1	Variable	read	Current measured at pin 1, unit: mA
CurrentPin2	Variable	read	Current measured at pin 2, unit: mA
CurrentPin4	Variable	read	Current measured at pin 4, unit: mA

The path to the nodes with port-related temperature measured values is:

Root > Object > DeviceSet > [device name] > IO-LinkMaster > Diagnostics > PortXX > Temperature

The following table lists port-related temperature measured values:

Node name	Node class	Access	Description
TemperaturePin1	Variable	read	Temperature measured at pin 1, unit: °C
TemperaturePin2 C	Variable	read	Temperature measured at pin 2, unit: °
TemperaturePin4	Variable	read	Temperature measured at pin 4, unit: °C

The path to the nodes with port-related voltage measured values is:

Root > Object > DeviceSet > [device name] > IO-LinkMaster > Diagnostics > PortXX > Voltage

The following table lists port-related voltage measured values:

Node name	Node class	Access	Description
VoltagePin1	Variable	read	Voltage measured at pin 1, unit: mV
VoltagePin1	Variable	read	Voltage measured at pin 1, unit: mV
VoltagePin4	Variablev	read	Voltage measured at pin 4, unit: mV

Diagnosis OPC UA

The OPC UA server provides nodes with information on diagnosis. In node DiagnosticsPin1, the OPC UA client can read whether the device has detected, for example, an overcurrent at pin 1 of a port.

Node name	Node class	Access	Description
DiagnosticsPin1, DiagnosticsPin2, DiagnosticsPin4	Variable	read	Diagnosis on pin 1, pin 2 or pin 4. The numeric value contains bitcoded information: • Bit 0: Short circuit • Bit 1: Overload protection • Bit 2: Overtemperature protection • Bit 3: Overvoltage protection • Bit 4: Overcurrent • Bit 5: Undercurrent • Bit 6: Overtemperature • Bit 7: Undertemperature • Bit 8: Overvoltage • Bit 9: Undervoltage • Bit 10: Watchdog 0: Diagnosis not active 1: Diagnosis active

Statistics

The OPC UA server provides nodes with statistical data. In the node MaxCurrentPin1, for example, the OPC UA client can read the measured maximum current at pin 1 of a port.

The path to these nodes is:

Root > Object > DeviceSet > [device name] > IO-LinkMaster > PortXX > Statistics > Current/Temperatur/Voltage

The following table lists port-related statistic information:

Measurement	Node name	Node class	Access	Description
Current	MaxCurrentPin1	Variable	read	Maximum current at pin 1 since last reset, unit: mA
	MaxCurrentPin2	Variable	read	Maximum current at pin 2 since last reset, unit: mA
	MaxCurrentPin4	Variable	read	Maximum current at pin 4 since last reset, unit: mA
	MinCurrentPin1	Variable	read	Maximum current at pin 1 since last reset, unit: mA
	MinCurrentPin2	Variable	read	Maximum current at pin 2 since last reset, unit: mA
	MinCurrentPin4	Variable	read	Maximum current at pin 4 since last reset, unit: mA
Temperature	MaxTemperaturePin1	Variable	read	Maximum temperature at pin 1 since last reset, unit: °C
	MaxTemperaturePin2	Variable	read	Maximum temperature at pin 2 since last reset, unit: °C
	MaxTemperaturePin4	Variable	read	Maximum temperature at pin 4 since last reset, unit: °C
	MinTemperaturePin1	Variable	read	Maximum temperature at pin 1 since last reset, unit: °C
	MinTemperaturePin2	Variable	read	Maximum temperature at pin 2 since last reset, unit: °C
	MinTemperaturePin4	Variable	read	Maximum temperature at pin 4 since last reset, unit: °C
Voltage	MaxVoltagePin1	Variable	read	Maximum voltage at pin 1 since last reset, unit: mV
	MaxVoltagePin2	Variable	read	Maximum voltage at pin 2 since last reset, unit: mV
	MaxVoltagePin4	Variable	read	Maximum voltage at pin 4 since last reset, unit: mV
Voltage	MinVoltagePin1	Variable	read	Maximum voltage at pin 1 since last reset, unit: mV
	MinVoltagePin2	Variable	read	Maximum voltage at pin 2 since last reset, unit: mV
	MinVoltagePin4	Variable	read	Maximum voltage at pin 4 since last reset, unit: mV

NTP Client Configuration

The OPC UA server provides nodes for configuring the NTP client.

The path to these nodes is:

Root > Object > DeviceSet > [Device Name] > Configuration > NtpClient > Configuration > CurrentConfiguration

Node name	Node class	Access	Default	Description
NtpClientServerIpAddress	Variable	read/write	0	IP address of the NTP server. The NTP client uses the set IP address to getthe date and time from an NTP server. The IP address must be converted into a decimal number. The calculation is explained below the table. The value 0 disables the function.
NtpClientServerIpAddressFallback .	Variable	read/write	0	IP address of the NTP server (fallback) Optional additional IP address if the NTP server cannot be reached via the IP address in theNtpClientServerIpAddress node. The IP address must be converted into adecimal number. The calculation is explained below the table. The value 0 disables the function.
NtpClientUpdateConfiguration	Method	write	-	Method for writing the nodes NtpClientServerIpAddress and NtpClientServerIpAddressFallback.

To convert the IP address to a decimal number, use the following formula. Starting from an IP address in the format A.B.C.D:

((A * 256 + B) * 256 + C) * 256 + D = IP address as a decimal number

Example of IP address 192.53.103.108

((192 * 256 + 53) * 256 + 103) * 256 + 108 = 3224725356

Using OPC UA client

The IO-Link master has an integrated OPC UA server. You can communicate with the IO-Link master using an OPC UA client.

For test purposes, you can use for example the UaExpert from Unified Automation GmbH:

http://www.unifiedautomation.com

An OPC UA client has read access to the IO-Link master with the authentication "anonymous".

An OPC UA client has read and write access to the IO-Link master with the authentication "User name and password" if the user used has write permissions.

Connecting to IO-Link Master Device

Requirements:

- You have an OPC UA client.
- If you want write access to the IO-Link master:You know the user name and password and have write permissions.
- You know the IP address of the IO-Link master.

Without user name and password, you can access the IO-Link master "anonymously" and read data:

Step	Action
1	Start UaExpert.
2	Use **File > New** to create a new project.
3	Use **Server > Add** to add a new server.
4	Enter a name for your configuration, in the field **Configuration name**. For example: “Test”.
5	Select the tab **Advanced**.
6	In the area **Server Information** of the tab **Advanced**, enter the following text in the data field **Endpoint Url:** `opc.tcp://<IP address>:4840` For <IP address> enter the IP address of your device.
7	In the area **Authentication Settings**, select the option **Username/Password** if you want to execute a write access to the device or select **Anonymous** if a read access is sufficient.
8	If you have selected the option **Username/Password**, enter your user name and, if necessary, your password.
9	Click **OK**. In the project window, under **Project > Servers**, the UaExpert enters the server. for example Test.
10	Open the context menu of the server (“Test”) and select **Connect**. The connection is established.

Setting Date and Time of the Device via OPC UA

Requirements

- You have an OPC UA client.
- You know the username and password, and you have the permission to write.
- You know the IP address of an NTP server.
- You have converted the IP address of the NTP server into a decimal number, as described below.
- You have already established a connection to the IO-Link master.

Example of an NTP Server

NTP server ptbtime1.ptb.de of the German Federal Institute of the Physikalisch-Technische Bundesanstalt in Braunschweig with the IP address 192.53.103.108

Substitude NTP server (optional) of the NTP server ptbtime2.ptb.de of the Physikalisch-Technische Bundesanstalt in Braunschweig with the IP address 192.53.103.104

Converting an IP Address into a Decimal Number

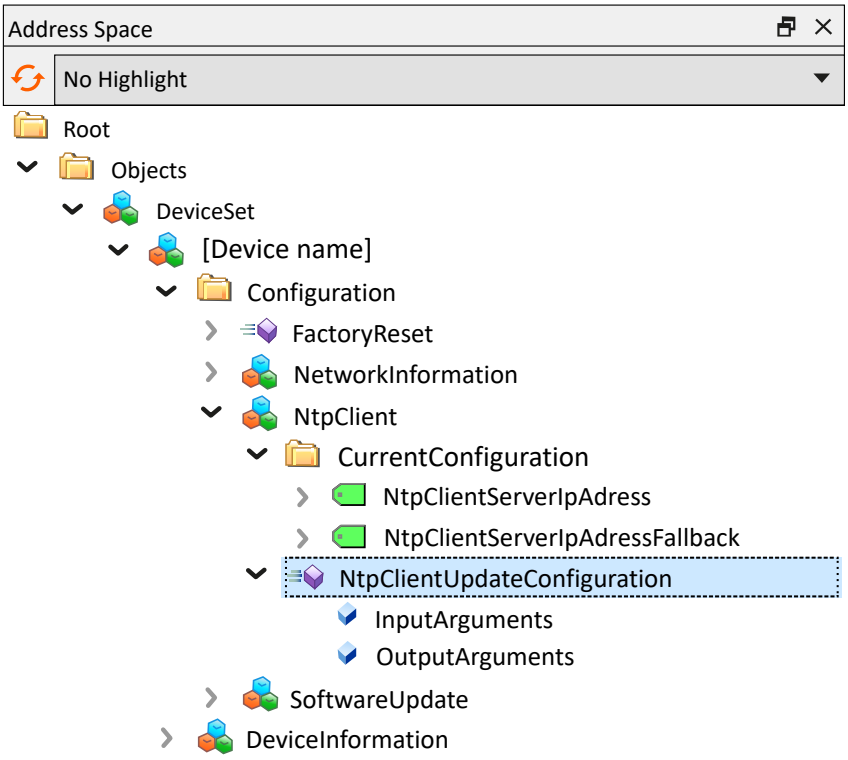
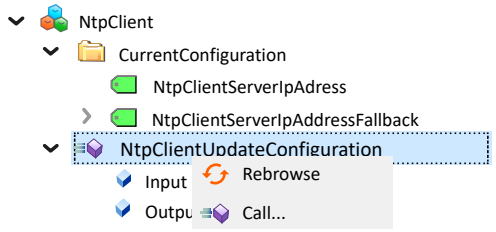
To convert the IP address to a decimal number, use the following formula.

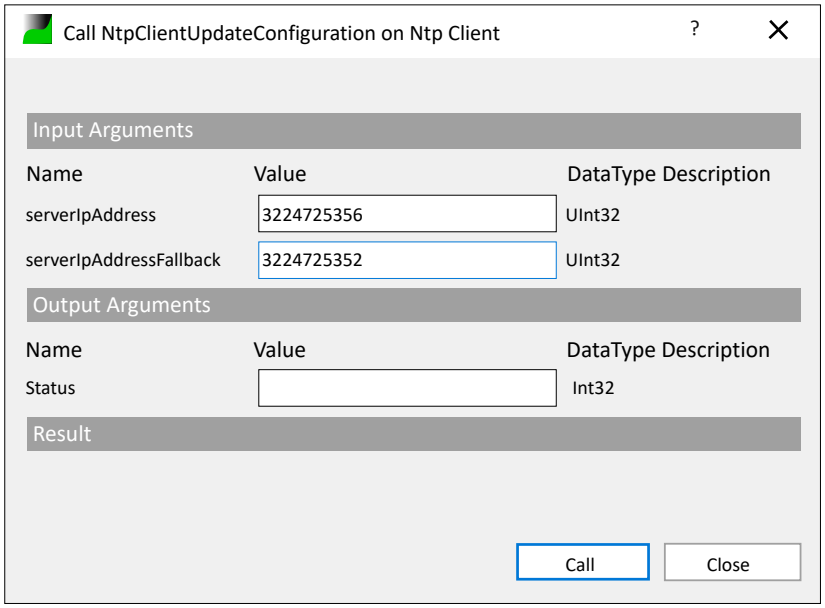
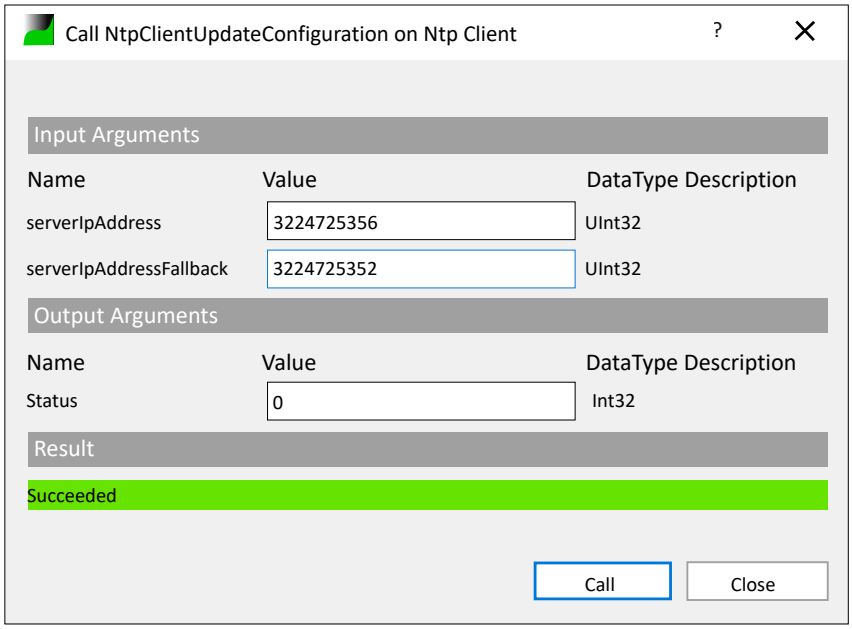
Starting from an IP address in the format A.B.C.D:

((A x 256 + B) x 256 + C) x 256 + D = IP address as a decimal number

Example of IP address 192.53.103.108

((192 x 256 + 53) x 256 + 103) x 256 + 108 = 3224725356

Step	Action
1	In the window **Address Space**, open the context menu: **Root > Objects > DeviceSet > [Device name] > Configuration > NtpClient > NtpClient > Update > Configuration** 
2	In the context menu select **Call**.  The dialog Call NtpClientUpdateConfiguration on NtpClient is displayed:

Step	Action
2	
3	In the area Input **Arguments**, in the input field **ServerIpAddress**, enter the value “3224725356” for the IP address of the NTP server.
4	In the area **Input Arguments**, in the input field **ServerIpAddressFallback**, enter “3224725352” for the IP address of the replacement NTP server.
5	Click **Call**. If the function call was successful, the output field to the right of Status in the area **Output Arguments** displays “0”. A green bar with the text "succeeded" appears in the area **Result**. The two variables ServerIpAddress and ServerIpAddressFallback are now set. The device obtains the current time of the time server via NTP and synchronizes its internal time. 

Diagnosis

Diagnosis via LEDs

Supply Voltage Status

Supply voltage 1L correspond to (18) and 2L to (16) in Positions of the interfaces and LEDs (see Device Drawing XZIOM8AM12EY, page 10).

The following table describes the LED status of the supply voltages 1L and 2L:

LED	Color	State	Meaning
1L	**Duo-LED red/green**		
	 (green)	On	1L supply voltage OK (18…30V)
	 (red)	On	1L undervoltage (11…18V)
	 (red)	Flashing (4 Hz)	1L overvoltage (> 30V)
	 (off)	Off	No 1L supply voltage (< 11V)
2L	**Duo-LED red/green**		
	 (green)	On	2L supply voltage OK (18…30V)
	 (red)	On	2L undervoltage (11…18V)
	 (red)	Flashing (4 Hz)	2L overvoltage (> 30V)
	 (off)	Off	No 2L supply voltage (< 11V)

System Status

SYS corresponds to (24) in Positions of the interfaces and LEDs (see Device Drawing XZIOM8AM12EY, page 10).

The following table describes the LED status of the system LED SYS:

LED	Color	State	Meaning
SYS	**Duo-LED yellow/green**		
	(green)	On	Firmware is running. System status: OK
	(yellow)	On	Error
	(yellow) / (green)	Flashing (4 Hz)	Firmware update active
	(off)	Off	No power supply

Application Status

APL corresponds to (23) in Positions of the interfaces and LEDs (see Device Drawing XZIOM8AM12EY, page 10).

The following table describes the LED status of the application LED APL:

LED	Color	State	Meaning
APL	**Duo-LED red/green/yellow (yellow = red and green simultaneously)**		
	(green)	On	Firmware is running, normal operating state
	(green)	Flashing (4 Hz)	Used for device identification (via web server or OPC UA connection)
	(yellow)	On	Initialization error (for example hardware error, missing valid configuration, no COM firmware found)
	(red)	On	Critical operating state: Overtemperature or self-protection is active
	(off)	Off	Firmware is not running

Ethernet/IP Adapter Status

MS corresponds to (1), NS to (3), LINK channel 0 to (21), ACT channel 0 to (19), LINK channel 1 (5), ACT channel 1 (7) in interface and LED positions (see Device Drawing XZIOM8AM12EY, page 10).

Communication Status Ethernet/IP Adapter

The following table describes the LED status for the communication status of the Ethernet/IP Adapter:

LED	Color	State	Description
MS (Module status)	**Duo-LED red/green**		
	(green)	On	Device operational: The device is operating correctly.
	(green)	Flashing (1 Hz)	Standby: The device has not been configured.
	(red) / (green)	Flashing (1 Hz) red/green	Self-test: The device performs a self-test after power-on.
	(red)	Flashing (1 Hz)	Major recoverable fault: The device has detected a major recoverable fault. for example, an incorrect or inconsistent configuration can be considered a major recoverable fault.
	(red)	On	Major unrecoverable fault: The device has detected a major unrecoverable fault.
	(off)	Off	No power: The device is powered off.
NS (Network status)	**Duo-LED red/green**		
	(green)	On	Connected: An IP address is configured, at least one CIP connection is established.
	(green)	Flashing (1 Hz)	No connection: An IPaddress is configured, but no CIP connections have been established.
	(red) / (green)	Flashing fast red/off	Self-test: The device performs a self-test after power-on.
	(red)	Flashing (1 Hz)	Connection timeout: One or more of the connections that this device is the target have timed out.
	(red)	On	Duplicate IP: The device has detected that its IP address isalready in use.
	(off)	Off	Not powered, no IP address: The device does not have anIP address (or is powered off).

Definition of LED status of the communication status:

LED status	Definition
Blinking (1 Hz)	The LED turns on and off with a frequency of 1 Hz: “On” for 500 ms, followed by “Off” for 500 ms.
Flashing fast green/red	The MS LED or NS LED turns on green "On" for 250 ms, then red "On" for 250 ms, then green "On" (until the test is completed).

Ethernet Status Ethernet/IP Adapter

The following table describes the LED status for the communication status of the Ethernet/IP Adapter:

LED	Color	State	Description
LINK (channel 0, channel 1)	**LED green**		
	(green)	On	The device is linked to the Ethernet.
	(off)	Off	The device has no link to the Ethernet.
ACT (channel 0, channel 1)	**LED yellow**		
	(yellow)	Flickering (load dependent)	The device sends/receives Ethernet frames.
	(off)	Off	The device does not send/receive Ethernet frames.

LED status	Definition
Flickering (load dependent)	The LED turns on and off with a frequency of approximately 10 Hz to indicate high Ethernet activity: "On" for approximately 50 ms, followed by Off" for 50 ms. The LED turns on and off in irregular intervals to indicate low Ethernet activity.

IO-Link Port Status

IO-Link, channel A correspond to (15) for port 1 and (9) for port 2 in Positions of the interfaces and LEDs (see Device Drawing XZIOM8AM12EY, page 10), channel B correspond to (13) for port 1 and (11) for port 2.

The following table describes the LED status of the IO-Link channels A and B:

LED	Color	State	Description
IO-Link, channel A Status pin 4 IO-Link	**Duo-LED yellow/red/green (yellow by red and green simultaneously)**		
	(yellow)	On	Status of digital input pin 4: On
	(off)	Off	Status of digital input pin 4: Off
	(green)	On	IO-Link communication active
	(green)	Blinking 1 Hz	No IO-Link device connected to the port or no IO-Link communication to the connected IO-Link device
	(green)	Blinking 4 Hz	IO-Link device ready for communication but IO-Link communication not yet active or check of revision or compatibility of the IO-Link device failed
	(red)	On	Overload, short circuit (pin 4 and pin 3)
	(red)	Blinking 1 Hz	Overload, short circuit sensor supply 1L+, 1L- (pin 1 and pin 3)

LED	Color	State	Description
IO-Link, channel B Status pin 2 DIO	**Duo-LED yellow/red (yellow by red and green simultaneously)**		
	(yellow)	On	Status of digital input pin 2: On
	 (off)	Off	Status of digital input pin 2: Off
	 (red)	On	Overload, short circuit (pin 2 and pin 3)
	 (red)	Blinking 1 Hz	Overload, short circuit sensor supply 1L+, 1L- (pin 1 and pin 3)

Diagnosis via Ethernet/IP

The device contains the event log object with information about IO-Link events. The PLC can read attributes of the event log object in order to obtain the "Event Qualifier" and "Event Code" of an IO-Link event. Each IO-Link port is assigned to an object instance.

Chapter Event Log Object 65 (0x41) describes the attributes of the object.

Error Codes (CIP Status)

Error codes (CIP status):

CIP status	Description
0 (0x00)	Success The addressed object has successfully performed the service.
1 (0x01)	Connection failure A connection-related service failed. The error may have occurred anywhere along the connection path.
2 (0x02)	Resource not available Some resources the object needs to perform the service are not available.
3 (0x03)	Invalid parameter value See CIP status 32 (0x20).
4 (0x04)	Path segment error A path segment error has occurred. The path information could not be evaluated.
5 (0x05)	Path destination unknown The addressed CIP class or CIP instance is unknown.
6 (0x06)	Partial transfer Only a part of the data could be transferred.
7 (0x07)	Connection lost The connection for messaging has been lost.
8 (0x08)	Service not supported The required service has not been defined or implemented for this object class or instance.
9 (0x09)	Invalid attribute value Detection of invalid attribute data.
10 (0x0A)	Attribute list error An attribute in the response “Get_Attribute_List” or “Set_Attribute_List” has a status not equal to 0.
11 (0x0B)	Already in requested mode/state The object is already in the mode or state requested by the service.
12 (0x0C)	Object state conflict The object is not able to perform the requested service in the current mode or state.
13 (0x0D)	Object exists already It has been tried to create an instance of an existing object.
14 (0x0E)	Attribute not settable It has been tried to change a non-modifiable attribute.
15 (0x0F)	Violation of rights The check of authorizations or rights failed.
16 (0x10)	Device state conflict The current mode or state of the device prevents the execution of the requested service.
17 (0x11)	Reply data too large The data to be transmitted requires more space than the allocated response buffer has.
18 (0x12)	Fragmentation of a primitive value The service specifies a function to fragment a primitive data value (for example to halve a REAL data type) and can thus not be executed.

CIP status	Description
19 (0x13)	Not enough data The service did not supply all required data to perform the specified operation.
20 (0x14)	Attribute not supported An unsupported attribute has been specified in the request.
21 (0x15)	Too much data The service supplied more data than expected.
22 (0x16)	Object does not exist The specified object does not exist in the device.
23 (0x17)	Service fragmentation sequence not in progress The fragmentation sequence for this service is currently not active for this data.
24 (0x18)	No stored attribute data The attribute data for this object has not been saved before requesting the service.
25 (0x19)	Saving attempt failed The attribute data of the object could not be saved because an error occurred during the attempt to save the data.
26 (0x1A)	Routing failure, request packet too large The routing device had to abort the service because the request packet of this service was too large for the transmission in the network on the path to the destination.
27 (0x1B)	Routing failure, response packet too large The routing device had to abort the service because the response packet of this service was too large for the transmission in the network on the path from the destination.
28 (0x1C)	Missing entry data in attribute list The service could not supply an attribute of an attribute list that it needs to perform the requested behavior.
29 (0x1D)	Invalid attribute value list The service returns a list of attributes containing the status information “invalid attributes”.
30 (0x1E)	Embedded service error If the embedded service is an IO-Link service: The IO-Link-specific error codes within the CIP data provide further information of the IO-Link master or IO-Link-Device.
31 (0x1F)	Vendor-specific error A Vendor-specific error has occurred. This Vendor-specific error occurs if none of the general error codes can be used.
32 (0x20)	Invalid parameter A parameter of the request is invalid because it does not meet the requirements of the CIP specification and/or the requirements defined in the specification of an application object.
33 (0x21)	Write-once value or medium already written An attempt was made to modify the values of a medium that have already been written and cannot be written a second time.
34 (0x22)	Invalid reply received An invalid reply has been received because, for example, a reply service code does not match the request service code or because the reply is shorter than the expected minimum size.
35 (0x23) – 36 (0x24)	Reserved Reserved for future extensions of the CIP standard.
37 (0x25)	Error in the key segment The key segment (the first segment in the path) does not match the destination module. More information about which part of the key check failed, see object status.
38 (0x26)	Path size invalid The path to an object cannot be routed due to lacking information or too much routing data.
39 (0x27)	Unexpected attribute in list The attempt has been made to set an attribute that must not be set in the current situation.
40 (0x28)	Invalid member ID The member ID specified in the request is not available in the class/instance or attribute.

CIP status	Description
41 (0x29)	Member cannot be modified A request has occurred to modify a member that cannot be modified.
42 (0x2A)	General error in "Group 2 only server" This DeviceNet-specific error cannot occur in Ethernet/IP.
43 (0x2B) – 207(0xCF)	Reserved Reserved for future extensions of the CIP standard.
208 (0xD0) – 255 (0xFF)	Reserved for object class and service errors An object-class-specific error has occurred.

Diagnosis via IO-Link

An IO-Link event contains an "Event Qualifier" and an "Event Code". The "Event Qualifier" indicates whether the IO-Link event has been reported by the master or by the device.

Event Qualifier

The Event Qualifier is a bit-coded information about the event.

Mode		Type		Source	Instance		
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit	Name	Description
Bit 6-7	Mode	0: reserved 1: Event single shot 2: Event disappears 3: Event appears
Bit 4-5	Type	0: reserved 1: Notification 2: Warning 3: Error
Bit 3	Source	0: Device (remote) 1: Master/Port
Bit 0-2	Instance	0: unknown 1-3: reserved 4: Application 5-7: reserved

IO-Link Master Event Codes

The IO-Link master reports events on the IO-Link master or its ports to the Ethernet/IP Adapter which forwards that as a diagnosis to the Ethernet/IP Scanner.

The following values are set in the "Event Qualifier":

TYPE = 2 (Warning) or 3 (Error)

MODE = 2 (Event disappears) or 3 (Event appears)

SOURCE = 1 (Master/local)

The following table lists the IO-Link event codes that belong to IO-Link master events and provides information on how to remedy problems:

Event code	Description	Type	Remedy
0x0000	No malfunction	Message	No action required
0x17FF	Process data error	Error	Check the submodule configuration
0x1800	No IO-Link device (communication), communication with IO-Link device lost	Error	Check whether the IO-Link device is connected
0x1801	Startup parameter error	Error	Check the parameters
0x1802	Validation inconsistency: Incorrect vendor ID	Error	Use the correct IO-Link device type
0x1803	Validation inconsistency: Incorrect device ID	Error	Use the correct IO-Link device type
0x1804	Short circuit at pin C/Q (pin 4)	Error	Check the installation
0x1805	Overtemperature (at the port)	Error	Check temperature and load
0x1806	Short circuit at pin 1 (1L+ supply)	Error	Check the installation
0x1807	Overcurrent at pin 1 (1L+ supply)	Error	Check the supply
0x1808	IO-Link device event overflow	Error	Check the IO-Link device
0x1809	Backup inconsistency: Insufficient storage (2048 octets)	Error	Delete data storage by reconfiguring the port
0x180A	Backup inconsistency: Identity error	Error	Delete data storage by reconfiguring the port
0x180B	Backup inconsistency: Data storage, nonspecific error	Error	Delete data storage by reconfiguring the port
0x180C	Backup inconsistency: Upload error	Error	Check IO-Link master, check connection to IO-Link device
0x180D	Parameter inconsistency: Download error	Error	Check IO-Link device, check connection to IO-Link master
0x180E	Class B: Undervoltage at pin 2 (2L+ supply)	Error	Check the supply
0x180F	Class B: Short circuit at pin 2 (2L+ supply)	Error	Check installation and load
0x1810	Short circuit at pin 2 (DIO)	Error	Check installation and load
0x1811	Short circuit at pin 4 (DIO)	Error	Check installation and load
0x1812	Overcurrent at pin 2 (DIO)	Error	Check load and installation
0x1813	Overcurrent at pin 4 (DIO)	Error	Check load and installation
0x6000	Invalid cycle time	Error	Check the port configuration parameters
0x6001	Revision error (incompatible protocol version)	Error	Check the port configuration parameters
0x6002	Failure of ISDU batch	Error	Eliminate parameter inconsistency

IO-Link Device Event Codes (Common)

An IO-Link device connected to the IO-Link master via a port can also trigger events. An IO-Link device sends the "event code" and the "event qualifier" of the event to the IO-Link master. The following values are set in the event qualifier:

TYPE = 1 (Notification)

MODE = 1 (Single shot)

SOURCE = 0 (Device/remote)

The IO-Link master sends this event to the Ethernet/IP Adapter which can report that as an emergency to the Ethernet/IP Scanner. The IODD of the IO-Link device contains manufacturer-specific events with message text.

The following table lists standard IO-Link device Event Codes (for device specific Event Codes or remedy, use the manual of the used IO-Link device):

Event code	Description	Type	Remedy (common)
0x0000	No malfunction	Notification	No action required
0x1000	General malfunction (unknown error)	Error	See manual of the used IO-Link device
0x1800 - 0x18FF	Vendor-specific	-	See manual of the used IO-Link device
0x4000	Temperature fault - overload	Error	Check temperature, find source for overload
0x4210	Device temperature overrun	Warning	Clear source of heat
0x4220	Device temperature underrun	Warning	Insulate IO-Link device
0x5000	Device hardware fault	Error	Exchange IO-Link device
0x5010	Component malfunction	Error	Repair or exchange
0x5011	Non-volatile memory loss	Error	Check batteries
0x5012	Batteries low	Warning	Exchange batteries
0x5013	HMI button pressed	Notification	-
0x5100	General power supply fault	Error	Check availability of power supply
0x5101	Fuse blown/open	Error	Exchange fuse
0x5110	Primary supply voltage overrun	Warning	Check tolerance of 1L+ voltage
0x5111	Primary supply voltage underrun	Warning	Check tolerance of 1L+ voltage
0x5112	Secondary supply voltage fault (Port Class B)	Warning	Check tolerance of 2L+ voltage
0x6000	Device software fault	Error	Check firmware revision
0x6320	Parameter error	Error	Check data sheet and values
0x6321	Parameter missing	Error	Check data sheet
0x6350	Parameter changed	Error	Check configuration
0x7700	Wire break of a subordinate device	Error	Check installation
0x7701 - 0x770F	Wire break of subordinate device 1 … device 15	Error	Check installation
0x7710	Short circuit	Error	Check installation
0x7711	Ground fault	Error	Check installation
0x8C00	Technology-specific application fault	Error	Reset Device
0x8C01	Simulation active	Warning	Check operational mode
0x8C10	Process variable range overrun - Process Data uncertain	Warning	Check configuration of device
0x8C20	Measurement range exceeded	Error	Check application
0x8C30	Process variable range underrun - Process Data uncertain	Warning	Check configuration of device
0x8C40	Maintenance required	Warning	Clean
0x8C41	Maintenance required	Warning	Refill

Event code	Description	Type	Remedy (common)
0x8C42	Maintenance required	Warning	Exchange wear and tear parts
0x8CA0 - 0x8DFF	Vendor-specific	-	See manual of the used IO-Link device
0xB000 - 0xB0FF	Safety extensions	-	See manual of the used IO-Link device
0xB100 - 0xBFFF	Profile-specific	-	See manual of the used IO-Link device
0xFF91	Internal Data Storage upload request	Notification (single shot)	See manual of the used IO-Link device
0xFFB9	Retry error	Error	See manual of the used IO-Link device
Any other code	Reserved	-	See manual of the used IO-Link device

Decommissioning

Decommissioning the Device

⚠ CAUTION

RISK OF UNSAFE PLANT OPERATION

To prevent possible personal injury or property damage, do not remove this device from a production plant without ensuring a safe operation of the plant during or after the removal of the device.

Failure to follow these instructions can result in injury, or equipment damage.

To decommission the IO-Link master you have to switch off its power supply, but if you do that, you must be aware that in doing so you also switch off the connected IO-Link devices, which depend on the power supply by the IO-Link master.

So, before switching off the power supply, consider the consequences of a switching-off of the connected devices for your plant and, if necessary, consider appropriate precautions and countermeasures.

Do not switch off the power supply of the IO-Link master before you have taken all necessary precautions, observing the above note.

Dismounting

Tools Required for Dismounting

For dismounting, you need an Allen key to loosen the M4 cylinder head screws with hexagon socket according to DIN 912 or ISO 4762.

Before Dismounting

⚠ CAUTION

HAZARD OF BURN

During operation, high surface temperatures can occur on the metal housing and on the metal connection sockets. If the device has been in use, let it cool down before you touch it or use gloves.

Failure to follow these instructions can result in injury, or equipment damage.

Prepare the dismounting:

Step	Action
1	Disconnect that part of the plant from the power supply to which you have mounted the device.
2	Should the device be dirty, clean it first. It is of utmost importance to clean dirty screw connections.
3	Before dismounting, loosen all screw connections and pull off the cables.

Dismounting

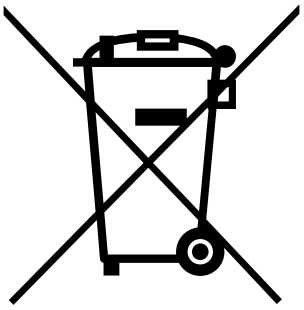
To dismount the device, for example for replacing it, proceed as follows:

Step	Action
1	Make sure that the part of the plant to which you have mounted the device is disconnected from the power supply.
2	Use the Allen key to loosen the two M4 cylinder head screws.
3	Remove the device.

After Dismounting

If the removed device is defective, mark it as such to prevent its reuse.

Disposal of Waste Electronic Equipment



Important notes from the European Directive 2002/96/EU “Waste Electrical and Electronic Equipment (WEEE)”

Waste electronic equipmentThis product must not be treated as household waste.This product must be disposed of at a designated waste electronic equipment collecting point.

Waste electronic equipment may not be disposed of as household waste. As a consumer, you are legally obliged to dispose of all waste electronic equipment according to national and local regulations.

Technical Data

XZIOM8AM12EY

Category	Parameter	Value
Product	Part number	9388.021
	Name	XZIOM8AM12EY
	Function	Ethernet/IP Adapter/8 Port IO-Link Master
Power supply 1L, 2L	Supply voltage 1L, 2L	24 V DC, –25%/+30% (18 V DC … 31.2 V DC)Voltages higher than 34 V can damage the device permanently.Voltages below approximately 11 V result in a device reset.
	Low voltage warning 1L	18.0 V (± 5% at 25 °C) notification on,18.3 V (± 5% at 25 °C) notification off
	Overvoltage warning 1L	30.0 V (± 5% at 25 °C) notification on,29.7 V (± 5% at 25 °C) notification off
	Current consumption	1L: 0.1 A … 16 A (at 24 V DC)2L: 0.01 A … 16 A (at 24 V DC)
	Current consumption of supply port	Maximum 16 A, consider external limitation or use fuse in the supply line.Maximum total current including transit between the current connector pins may not exceed 16 A for each 1L and 2L. If additional devices are connected to X32 (PWR OUT), then the maximum total current if necessary has to be monitored by an external power management. Maximum current: Observe the derating depending on the ambient temperature.
	Conductor cross-section	0.5 mm2 … 2.5 mm2Observe the current carrying capacity and cable length.
	Connector	PWR IN: M12 L-coded, 5-pin, plugPWR OUT: M12 L-coded, 5-pin, socket
	Torque	1.0 Nm
	Reverse polarity protection	Yes
	Power supply	24 V DC PELV (Protective Extra Low voltage) or SELV (Safety Extra Low voltage) power supply
Total load	Maximum total load current (total of all currents of ports X1 - X8)	15.7 A
Device	Dimensions (L x W x H)	200 mm x 60 mm x 32 mm
	Weight	404 g
	Housing	Plastic
	Potting	Solvent-free electro-casting resin system based on 2 K polyurethane
	Degree of protection	IP65/IP67(EN 60529)
	Protection class	III (EN 61140)
	Mounting	Screw mounting on carrier, 2x M4
Environmental conditions	Location of operation	Indoor
	Ambient temperature (operation)	–25 °C … +70 °C
	Ambient temperature (storage)	–40 °C … +80 °C
	Maximum temperature change	3 K/min
	Relative humidity	5% … 95%
	Degree of pollution	3 (EN 60664-1)
	Altitude	0 … 2000 m
	Overvoltage category	II (EN 60664-1)
	Degree of protection	IP67 (EN 60529)
	Protection class	III (EN 61140)

Category	Parameter	Value
Electrical safety	Insulation resistance	60 V DC
	Test voltage	550 V AC RMS
	Min. creepage distance	0.7 mm
Ethernet connector	Communication interface	Ethernet
	Autonegotiation, autocrossover	Yes
	Connector	2x M12, D coded, socket, 4-pin
	Torque	1.0 Nm
IO-Link connector	Connector	8x M12, A coded, plug, 5-pin
	Torque	1.0 Nm
	Operating modes	Pin 2: DI or DOPin 4: IO-Link Master, DI or DO
Displays	SYS	System status, green/yellow
	APL	Application status, red/green
	MS	Module status (Ethernet/IP), red/green
	NS	Network status (Ethernet/IP), red/green
	LINK	Link status, green
	ACT	Activity status, yellow
	1L, 2L	Supply voltage status, red/green
	A, B	Port status: red/green/yellow (yellow by simultaneous red and green)
Compliance	RoHS	Yes
Compliance with EMC guidelines	CE sign	Yes
	UKCA sign	Yes
	Emission	EN 61000-6-4/BS EN 61000-6-4
	Immunity	EN 61000-6-2/BS EN 61000-6-2

IO-Link Port

Category	Parameter	Value
IO-Link Master (Class A)	Quantity	Maximum 8 (configurable)
	Specification	V1.1
	Port modes	Pin 4: IO-Link: autoconfig, manual, tool-based, DI, DO
		Pin 2: DI, DO
	Transmission mode	COM 1, COM 2, COM 3
	Min. cycle time	400 µs (IO-Link Frame Type_2_1 at transmission mode COM 3)
Digital input	Quantity	Maximum 16 (configurable)
	Characteristic	Type 3 (IEC 61131-2)
	Switching level high	> 11 V
	Switching level low	< 5 V
	Permitted input voltage	-3 V … 31.2 V
	Circuit	Digital input has no reverse current protection. Input voltage may not be higher than the supply voltage.
	Parameter	Digital software input filter: None, 3 ms … 20 ms The input signal may have a maximum frequence of 2.5 kHz in order to detect signal changes correctly in the device. Note, that the transfer and the processing of the process data (in the device and in the PLC) requires time and reduce the maximum change of the input signal.
	Capture cycle	200 µs
	Display	Status LED for on/off

Category	Parameter	Value
Digital output	Quantity	Maximum 16 (configurable)
	Output voltage	24 V DC, 1L supplied
	Current	Nominal: Maximum 2.0 A per channelOverload mode: Maximum 2.4 A per channel, according to IEC 61131-2
	Residual current	below 1 mA
	Circuit	High side driver, digital output has no reverse current protection. Input voltage may not be higher than the supply voltage.
	Voltage drop by high side path	Below 250 mV
	Self-protection	Overcurrent, overload, overtemperature, and overvoltage
	Short-circuit proof	Yes
	Maximum capacitive load	100 µF parallel to 12 Ohm; 10 Hz
	Maximum inductive load	1.15 H/2 A; 0.2 Hz; DC13 UL: 1.15 H/2 A; 1 Hz; DC13; Pilot Duty
	Display	Status LED for on/off
	Diagnosis	Events: Overcurrent, overload and overtemperature
Electrical safety	Insulation resistance	60 V DC
	Test voltage	550 V AC RMS
	Min. creepage distance	0.7 mm
Actuator/Sensor supply	Output voltage	24 V DC, 1L supplied
	Current 1L	Maximum 4.0 A per channel
	Current 1L for IO-Link operating mode	Maximum 1 A for wire cross-section AWG22 or 0.34 mm² and up to 20 m cable length (according to IO-Link specification) Maximum 4.0 A with increased wire cross-section or reduced cable length (voltage drop maximum 1.2 V per outgoing or return line)
	Circuit	High side driver, 1L+ output has no reverse current protection. Input voltage may not be higher than the supply voltage.
	Self-protection	Overcurrent, overload, overtemperature, and overvoltage
	Voltage drop by high side path	Below 200 mV
	Maximum capacitive load	1000 µF parallel to 24 Ohm; 0.1 Hz 470 µF parallel to 12 Ohm; 0.1 Hz 220 µF parallel to 6 Ohm; 0.1 Hz
	Maximum inductive load	1.15 H/2 A; 0.2 Hz; DC13 UL: 1.15 H/2 A; 1 Hz; DC13; Pilot Duty
	Diagnosis (1L+)	Events: Overcurrent, overload, overtemperature, and overvoltage

Ethernet/IP Adapter

Parameters	Value
Connection 1: Exclusive Owner - 32 bytes per IO-Link port	Input data: 276 bytes, output data: 276 bytes
Connection 2: Exclusive Owner - 32 bytes per IO-Link port without config	
Connection 3: Listen Only - 32 bytes per IO-Link port	Input data: 276 bytes, output data: 0 bytes
Connection 4: Input Only - 32 bytes per IO-Link port	
Connection 5: Exclusive Owner - 16 bytes per IO-Link port	Input data: 148 bytes, output data: 148 bytes
Connection 6: Exclusive Owner - 16 bytes per IO-Link port without config	
Connection 7: Listen Only - 16 bytes per IO-Link port	Input data: 148 bytes, output data: 0 bytes
Connection 8: Input Only - 16 bytes per IO-Link port	
Connection 9: Exclusive Owner - 4 bytes per IO-Link port	Input data: 52 bytes, output data: 52 bytes
Connection 10: Exclusive Owner - 4 bytes per IO-Link port without config	
Connection 11: Listen Only - 4 bytes per IO-Link port	Input data: 52 bytes, output data: 0 bytes
Connection 12: Input Only - 4 bytes per IO-Link port	
I/O connection types (implicit)	• Exclusive Owne • rInput Only • Listen Only
I/O connection trigger types	Cyclic
DHCP	Supported (factory setting)
BOOTP	Supported
Fixed IP address	Supported
Duplex mode	Half-duplex, full-duplex, auto-negotiation
MDI mode	MDI, MDI-X, Auto-MDIX
ACD (Address Conflict Detection)	Supported
Integrated switch	Supported
Reset services	CIP Reset Services: Identity Object, Reset services type 0 and type 1
Data transport layerr	Ethernet II, IEEE 802.3
Interface type	10BASE-T/100BASE-TX, isolated

OPC UA Server

Parameter	Value
OPC UA Server:	According to "IO-Link Companion Specification":http://opcfoundation.org/UA/IO-Link/
Server profile	Micro Embedded Device
Protocol	OPC UA TCP
User access	Anonymous (Read access only)User name/password (Read and write access)
Number of sessions	2
Number subscriptions per session	2
Number „Monitored Items“ per session	20
Data coding	UA binary

MQTT Client

Parameter	Description
MQTT	Client
Client services	Publish
Protocols	MQTT over TCP
Topic size	Maximum 256 bytes individually per MQTT publication and up to 256 bytes of common topic prefix of the associated MQTT connection
Topics	Topic: Printable UTF-8 string, NUL-terminated, multibyte encoding (MBCS)Payload: JSON
Will Topic	Maximum 256 bytes
Quality of Service	QoS 0, QoS 1, and QoS 2
IP standard	IPv4
Port	1883 (default), MQTT unencrypted
MQTT standard	V3.1.1
Restriction	The Subscribe service is not supported.

Web Server

Parameter	Value
HTTP	HTTP/1.1
Port	80
Connections	Maximum 8 simultaneous connectionsOne connection is being processed.
JavaScript	Required
HTTPS	Not supported

Appendix

Objects

Identity Object (Class code: 0x01)

The Identity Object provides identification and general information about the device. The EtherNet/IP protocol stack implements the Identity object at class level and a single instance with Instance ID 1.

Class attributes

Attr ID	Name	Access		Description	Default Value	Supported by default
		from Network	from Host			
1	Revision	Get	Get	Revision of this object	(2)	The attribute is supported and activated per default.
2	Max. Instance	Get	Get	Maximum instance number of an object currently created in this class level of the device	(1)	The attribute is supported and activated per default.
3	Number of Instances	Get	Get	The number of Instances currently created in this class	(1)	The attribute is supported and activated per default.
6	Maximum ID Number Class Attributes	Get	Get	The attribute ID number of the last class attribute of the class definition implemented in the device.	(7)	The attribute is supported and activated per default.
7	Maximum ID Number Instance Attributes	Get	Get	The attribute ID number of the last instance attribute of the class definition implemented in the device.	(19)	The attribute is supported and activated per default.

Instance attributes

Attr ID	Name	Access		Description	Default Value	Supported by default
		from Network	from Host			
1	Vendor ID	Get	Get/Set	Vendor Identification	(0x011B) TMSS France	The attribute is supported and activated per default.
2	Device Type	Get	Get/Set	Indication of general type of product	(1)	The attribute is supported and activated per default.
3	Product Code	Get	Get/Set	Identification of a particular product of an individual vendor	(1)	The attribute is supported and activated per default.

Attr ID	Name	Access		Description	Default Value	Supported by default
		from Network	from Host			
4	Revision	Get	Get/Set	Revision of the product	(1.1)	The attribute is supported and activated per default.
5	Status	Get	Get	Summary status of device	-	The attribute is supported and activated per default.
6	Serial Number	Get	Get	Serial number of device	-	The attribute is supported and activated per default.
7	Product Name	Get	Get/Set	Human readable identification	"netX"	The attribute is supported and activated per default.
8	State	Get	Get	Present state of the device	-	The attribute is supported and activated per default.
9	Conf. Consist. Value	Get	Get	Configuration Consistency Value	0	The attribute is supported and deactivated per default. The host can activate it.
19	Protection Mode	Get	Get/Set	Current protection mode of the device	0	The attribute is supported and activated per default.

Common services

These services are available to the host application and remote EtherNet/IP clients.

Service Code	Name	Addressing the object's		Description
		Class Lavel	Instance Level	
0x01	Get Attribute All	The stack supports this service at object class level (Instance ID 0).	The stack supports this service at object instance level (instance 1-n).	Retrieve all attribute values
x05	Reset1	The stack supports this service at object class level (Instance ID 0).	The stack supports this service at object instance level (instance 1-n).	Reset the device
0x4B	Flash LEDs	The stack does not support this service at class level.	The stack supports this service at object instance level (instance 1-n).	Flash the device's LEDs for identification
0x0E	Get Attribute Single	The stack supports this service at object class level (Instance ID 0).	The stack supports this service at object instance level (instance 1-n).	Retrieve attribute value
0x10	Set Attribute Single	The stack supports this service at object class level (Instance ID 0).	The stack supports this service at object instance level (instance 1-n).	Modify attribute value

1 In case the Safety Network Number is activated (see Instance Attributes of TCP/IP Interface Object (Class Code: 0xF5), page 159), the reset service will not be support for any instance. In that case the service will be reject with general status code 0x08 "Service not supported".

Message Router Object (Class Code: 0x02)

The Message Router Object is responsible for dispatching service requests toward the addressed object class or object class instance. The EtherNet/IP protocol stack implements the Message Router object exclusively at class level.

Class attributes

Attr ID	Name	Access		Description	Default Value	Supported by default
		from Network	from Host			
1	Revision	Get	Get	Revision of this object	(1)	The attribute is supported and activated per default.
2	Max. Instance	Get	Get	Maximum instance number of an object currently created in this class level of the device	(1)	The attribute is supported and activated per default.
3	Number of Instances	Get	Get	The number of Instances currently created in this class	(1)	The attribute is supported and activated per default.
6	Maximum ID Number Class Attributes	Get	Get	The attribute ID number of the last class attribute of the class definition implemented in the device.	(7)	The attribute is supported and activated per default.
7	Maximum ID Number Instance Attributes	Get	Get	The attribute ID number of the last instance attribute of the class definition implemented in the device.	(0)	The attribute is supported and activated per default.

Instance attributes

The EtherNet/IP protocol stack implements the Message Router object exclusively at class level. It does not provide any instances.

Common services

These services are available to the host application and remote EtherNet/IP clients.

Service Code	Name	Addressing the object's		Description
		Class Lavel	Instance Level	
0x0E	Get Attribute Single	The stack supports this service at object class level (Instance ID 0).	The stack supports this service at object instance level (instance 1-n).	Retrieve attribute value
0x10	Set Attribute Single	The stack does not support this service at class level.	The stack supports this service at object instance level (instance 1-n).	Modify attribute value

Assembly Object (Class Code: 0x04)

The Assembly object stores process data for exchange with other EtherNet/IP devices over the network and with the host application.

Class attributes

Attr ID	Name	Access		Description	Default Value	Supported by default
		from Network	from Host			
1	Revision	Get	Get	Revision of this object	(2)	The attribute is supported and activated per default.
2	Max. Instance	Get	Get	Maximum instance number of an object currently created in this class level of the device	(1)	The attribute is supported and activated per default.
3	Number of Instances	Get	Get	The number of Instances currently created in this class	(0)	The attribute is supported and activated per default.
6	Maximum ID Number Class Attributes	Get	Get	The attribute ID number of the last class attribute of the class definition implemented in the device.	(7)	The attribute is supported and activated per default.
7	Maximum ID Number Instance Attributes	Get	Get	The attribute ID number of the last instance attribute of the class definition implemented in the device.	(4)	The attribute is supported and activated per default.

Instance attributes

Attr ID	Name	Access		Description	Default Value	Supported by default
		from Network	from Host			
1	Number of Member	Get	Get	Number of members in List	n.a.	The attribute is supported and activated per default. / The attribute is supported and deactivated per default. The host can activate it. [1]
2	Member	Get	Get	Member list	n.a.	The attribute is supported and activated per default. / The attribute is supported and deactivated per default. The host can activate it. [1]
3	Data	Get/Set	Get/Set	Current process data snapshot	n.a.	The attribute is supported and activated per default.
4	Size	Get	Get/Set	Process data size in number of bytes	n.a.	The attribute is supported and activated per default.

Attr ID	Name	Access		Description	Default Value	Supported by default
		from Network	from Host			
768	Member data list	None	None	Data of assembly members	n.a.	The attribute is supported and deactivated per default. The host can activate it.
769	Parameter	None	Get	Assembly parameter	n.a.	The attribute is supported and deactivated per default. The host can activate it.
770	Status	None	Get	Status of the assembly	n.a.	The attribute is supported and deactivated per default. The host can activate it.
1 Attributes 1 and 2 are not available for configuration assembly instances. Configuration assembly instances are added by using the flag EIP_AS_TYPE_CONFIG.						

Common services

These services are available to the host application and remote EtherNet/IP clients.

Service Code	Name	Addressing the object's		Description
		Class Lavel	Instance Level	
0x0E	Get Attribute Single	The stack supports this service at object class level (Instance ID 0).	The stack supports this service at object instance level (instance 1-n).	Retrieve attribute value
0x10	Set Attribute Single	The stack does not support this service at class level.	The stack supports this service at object instance level (instance 1-n).	Modify attribute value
0x18	Get Member	The stack does not support this service at class level.	The stack supports this service at object instance level (instance 1-n).	Get a member of instance attribute 2

Connection Manager Object (Class Code: 0x06)

The Connection Manager Class manages class 1 implicit I/O and class 3 explicit connections.

Class attributes

Attr ID	Name	Access		Description	Default Value	Supported by default
		from Network	from Host			
1	Revision	Get	Get	Revision of this object	(1)	The attribute is supported and activated per default.
2	Max. Instance	Get	Get	Maximum instance number of an object currently created in this class level of the device	(1)	The attribute is supported and activated per default.
3	Number of Instances	Get	Get	The number of Instances currently created in this class	(1)	The attribute is supported and activated per default.
6	Maximum ID Number Class Attributes	Get	Get	The attribute ID number of the last class attribute of the class definition implemented in the device.	(7)	The attribute is supported and activated per default.
7	Maximum ID Number Instance Attributes	Get	Get	The attribute ID number of the last instance attribute of the class definition implemented in the device.	(4)	The attribute is supported and activated per default.

Instance attributes

The EtherNet/IP protocol stack does not provide any instance attributes for the connection manager object.

Common services

These services are available to the host application and remote EtherNet/IP clients.

Service Code	Name	Addressing the object's		Description
		Class Lavel	Instance Level	
0x0E	Get Attribute Single	The stack supports this service at object class level (Instance ID 0).	The stack supports this service at object instance level (instance 1-n).	Retrieve attribute value
0x10	Set Attribute Single	The stack does not support this service at class level.	The stack supports this service at object instance level (instance 1-n).	Modify attribute value
0x54	Forward Open[1]	The stack does not support this service at class level.	The stack supports this service at object instance level (instance 1-n).	Open new connection
0x4E	Forward Close[1]	The stack does not support this service at class level.	The stack supports this service at object instance level (instance 1-n).	Close connection
1 This service is only available to remote EtherNet/IP clients. Initiated from the host application, the service will be rejected with an appropriate error code.				

Time Sync Object (Class Code: 0x43)

The Time Sync Object (used for CIP SYNC) provides a CIP interface to the IEEE 1588 (IEC 61588) Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems, commonly referred to as the Precision Time Protocol (PTP). When starting the stack, this object is not available right away. The host application has to activate the TimeSync object using the packet EIP_OBJECT_MR_REGISTER_REQ (0x1A02).

NOTE: The TimeSync object has to be registered during the stack configuration sequence, before the EIP_APS_CONFIG_DONE_REQ or HIL_CHANNEL_INIT_REQ packets. Registration during runtime leads to undefined behavior.

For further information regarding CIP Sync and its use with the EtherNet/IP protocol stack and your host application, please refer to the corresponding Application Note [4].

Class attributes

Attr ID	Name	Access		Description	Default Value	Supported by default
		from Network	from Host			
1	Revision	Get	Get	Revision of this object	(3)	The attribute is supported and activated per default.
2	Max. Instance	Get	Get	Maximum instance number of an object currently created in this class level of the device	(1)	The attribute is supported and activated per default.
3	Number of Instances	Get	Get	The number of Instances currently created in this class	(1)	The attribute is supported and activated per default.
6	Maximum ID Number Class Attributes	Get	Get	The attribute ID number of the last class attribute of the class definition implemented in the device.	(7)	The attribute is supported and activated per default.
7	Maximum ID Number Instance Attributes	Get	Get	The attribute ID number of the last instance attribute of the class definition implemented in the device.	(768)	The attribute is supported and activated per default.

Instance attributes

Attr ID	Name	Access		Description	Default Value	Supported by default
		from Network	from Host			
1	PTPEnable	Get/Set	Get/Set	PTP Enable	0 (Disabled)	The attribute is supported and activated per default.
2	IsSynchronized	Get	Get	Local clock is synchronized with master	0	The attribute is supported and activated per default.
3	SystemTimeMicroseconds	Get	Get	Current value of system_time in microseconds	unsynchronized clock counts from zero	The attribute is supported and activated per default.
4	SystemTimeNanoseconds	Get	Get	Current value of system_time in nanoseconds	unsynchronized clock counts from zero	The attribute is supported and activated per default.

Attr ID	Name	Access		Description	Default Value	Supported by default
		from Network	from Host			
5	OffsetFrom-Master	Get	Get	Offset between local clock and master clock	0	The attribute is supported and activated per default.
6	MaxOffset-FromMaster	Get/Set	Get/Set	Maximum offset between local clock and master clock since last reset of this value.	0	The attribute is supported and activated per default.
7	MeanPathDelayToMaster	Get	Get	Mean path delay to master	0	The attribute is supported and activated per default.
8	GrandMaster-ClockInfo	Get	Get	Grandmaster Clock Info	all 0	The attribute is supported and activated per default.
9	ParentClockInfo	Get	Get	Parent Clock Info	all 0	The attribute is supported and activated per default.
10	LocalClockIno	Get	Get	Local Clock Info	all 0	The attribute is supported and activated per default.
11	NumberOfPorts	Get	Get	Number of ports	1	The attribute is supported and activated per default.
12	PortStateInfo	Get	Get	Port state info	disabled	The attribute is supported and activated per default.
13	PortEnableCfg	Get/Set	Get/Set	Port enable cfg	enabled	The attribute is supported and activated per default.
14	PortLogAnnounceIntervalCfg	Get/Set	Get/Set	Port log announce interval cfg	0	The attribute is supported and activated per default.
15	ortLogSyncIntervalCfg	Get/Set	Get/Set	Port log sync interval cfg	0	The attribute is supported and activated per default.
16	Priority1	-	-	Priority 1	n.a.	The attribute is not supported. The host cannot activate it.
17	Priority2	-	-	Priority 2	n.a.	The attribute is not supported. The host cannot activate it.
18	DomainNumber	Get/Set	Get/Set	Domain number	0	The attribute is supported and activated per default.
19	ClockType	Get	Get	Clock type	0	The attribute is supported and activated per default.
20	ManufactureIdentity	Get	Get	Manufacture identity	all 0	The attribute is supported and activated per default.
21	ProductDescription	Get	Get	Product description	""	The attribute is supported and activated per default.
22	RevisionData	Get	Get	Revision data	""	The attribute is supported and activated per default.
23	UserDescription	Get	Get	User description	""	The attribute is supported and activated per default.
24	PortProfileIdentityInfo	Get	Get	Port profile identity info	00-21-6C-00-01-00	The attribute is supported and activated per default.

Attr ID	Name	Access		Description	Default Value	Supported by default
		from Network	from Host			
25	PortPhysicalAddressInfo	Get	Get	Port physical address info	Filled in automatically according to device's MAC address	The attribute is supported and activated per default.
26	PortProtocolAddressInfo	Get	Get	Port protocol address info	Filled in automatically according to device's IP address	The attribute is supported and activated per default.
27	StepsRemoved	Get	Get	Steps removed	0	The attribute is supported and activated per default.
28	SystemTimeAndOffset	Get	Get	System time and offset	all 0	The attribute is supported and activated per default.
29	AssociatedInterfaceObjects	Get	Get	Objects associated with PTP ports	CIP path to Ethernet Link object	The attribute is supported and activated per default.
768	SyncParameters	Get/Set1	Get/Set[1]	Synchronization Parameters	See below	The attribute is supported and activated per default.
1 The time sync parameter attribute (attribute 768) is not available through the GetAttributesList and SetAttributesList services						

Common services

These services are available to the host application and remote EtherNet/IP clients.

Service Code	Name	Addressing the object's		Description
		Class Lavel	Instance Level	
0x03	Get Attributes List	The stack does not support this service at class level.	The stack supports this service at object instance level (instance 1-n).	The Get_Attribute_List service returns the contents of the selected attributes of the specified object class or instance
0x04	Set Attributes List	The stack does not support this service at class level.	The stack supports this service at object instance level (instance 1-n).	The Set_Attribute_List service sets the contents of selected attributes of the specified object class or instance
0x0E	Get Attribute Single	The stack supports this service at object class level (Instance ID 0).	The stack supports this service at object instance level (instance 1-n).	Retrieve attribute value
0x10	Set Attribute Single	The stack does not support this service at class level.	The stack supports this service at object instance level (instance 1-n).	Modify attribute value

Instance Attribute 768 (0x300) - Sync Parameters

Attribute 768 of the Time Sync object controls synchronization-related parameters. These are used to adjust intervals and offsets of the hardware synchronization signals Sync 0 and Sync 1.

The Sync 0 signal is the interrupt that the host application will receive in order to retrieve the current system time. On each event, the EtherNet/IP stack writes the current system time into the extended data area of the Dual Port Memory interface (for further information see CIP Sync Application Note [4]).

NOTE: Currently, only Sync 0 can be used.

The following table describes "Time Sync Object- Attribute 768 (0x300)".

Variable	Type	Value/Range	Description
`ulSync0Interval`	UINT32	0, 10000 … 999999999 Default: 500000000	Sync0 Interval in nanoseconds This parameter specifies the interval of the Sync 0 signal in nanoseconds. The value 0 means the signal is deactivated. The starting point of the Sync0 signal is dependent on the Sync0 Offset (see parameter “ulSync0Offset” below).
`ulSync0Offset`	UINT32	smaller than `ulSync0Interval` Default: 0	Sync 0 Offset in nanoseconds This parameter specifies a nanosecond offset for the Sync 0 signal relative to the system time (Time of the Sync Master).
`ulSync1Interval`	UINT32	0, 10000 … 999999999 Default: 500000000	Sync1 Interval in nanoseconds This parameter specifies the interval of the Sync 1 signal in nanoseconds. The value 0 means the signal is deactivated. The starting point of the Sync1 signal is dependent on the Sync1 Offset (see parameter ulSync1Offset).
`ulSync1Offset`	UINT32	smaller than `ulSync1Interval` Default: 150	Sync 1 Offset in nanoseconds This parameter specifies a nanosecond offset for the Sync 1 signal relative to the system time (Time of the Sync Master).

`ulPulseLength`	UINT32	1 … 500
		AND
		smaller than the minimum of the values
		`ulSync0Interval`
		and
		`ulSync1Interval`
		, when converted to microseconds.
		Default: 4
			Pulse length of the trigger signals in microseconds

Device Level Ring Object (Class Code: 0x47)

The Device Level Ring (DLR) Object provides the configuration of the DLR protocol. DLR is used for Ethernet Ring topology.

Class attributes

Attr ID	Name	Access		Description	Default Value	Supported by default
		from Network	from Host			
1	Revision	Get	Get	Revision of this object	(3)	The attribute is supported and activated per default.
2	Max. Instance	Get	Get	Maximum instance number of an object currently created in this class level of the device	(1)	The attribute is supported and activated per default.
3	Number of Instances	Get	Get	The number of Instances currently created in this class	(1)	The attribute is supported and activated per default.
6	Maximum ID Number Class Attributes	Get	Get	The attribute ID number of the last class attribute of the class definition implemented in the device.	(7)	The attribute is supported and activated per default.
7	Maximum ID Number Instance Attributes	Get	Get	The attribute ID number of the last instance attribute of the class definition implemented in the device.	(12)	The attribute is supported and activated per default.

Instance attributes

Attr ID	Name	Access		Description	Default Value	Supported by default
		from Network	from Host			
1	Network Topology	Get	Get	Current network topology	0 – Linear	The attribute is supported and activated per default.
2	Network Status	Get	Get	Current network status	0 – Normal	The attribute is supported and activated per default.
10	Active Supervisor	Get	Get	Active Supervisor Address	(0)	The attribute is supported and activated per default.
12	Capability Flags	Get	Get	DLR capability of the device	0x82 (Beacon based Ring Node, Flush Table frame support)	The attribute is supported and activated per default.

Common services

Service Code	Name	Adressing the object's		Description
		Class Level	Instance Level	
0x01	Get Attribute All	The stack supports this service at object class level (Instance ID 0).	The stack supports this service at object instance level (instance 1-n).	Returns content of instance or class attributes
0x0E	Get Attribute Single	The stack does not support this service at class level.	The stack supports this service at object instance level (instance 1-n).	Retrieve attribute value

Quality of Service Object (Class Code: 0x48)

The Quality of Service (QoS) Object provides the configuration of frame priorities. Ethernet frame priorities are set at the Differentiate Service Code Points (DSCP) or at the 802.1Q Tag.

Class attributes

Attr ID	Name	Access		Description	Default Value	Supported by default
		from Network	from Host			
1	Revision	Get	Get	Revision of this object	(1)	The attribute is supported and activated per default.
2	Max. Instance	Get	Get	Maximum instance number of an object currently created in this class level of the device	(1)	The attribute is supported and activated per default.
3	Number of Instances	Get	Get	The number of Instances currently created in this class	(1)	The attribute is supported and activated per default.
6	Maximum ID Number Class Attributes	Get	Get	The attribute ID number of the last class attribute of the class definition implemented in the device.	(7)	The attribute is supported and activated per default.
7	Maximum ID Number Instance Attributes	Get	Get	The attribute ID number of the last instance attribute of the class definition implemented in the device.	(8)	The attribute is supported and activated per default.

Instance attributes

Attr ID	Name	Access		Description	Default Value	Supported by default
		from Network	from Host			
1	Tag Enable	Get/Set	Get/Set	Enables or disables sending 802.1Q frames on CIP and IEEE 1588 messages	(0)	The attribute is not supported. The host cannot activate it.
2	DSCP PTP Event	Get/Set	Get/Set	DSCP value for PTP Event frames	(59)	The attribute is supported and activated per default.

Attr ID	Name	Access		Description	Default Value	Supported by default
		from Network	from Host			
3	DSCP PTP General	Get/Set	Get/Set	DSCP value for PTP general frames	(47)	The attribute is supported and activated per default.
4	DSCP Urgent	Get/Set	Get/Set	DSCP value for implicit messages with urgent priority	(55)	The attribute is supported and activated per default.
5	DSCP Scheduled	Get/Set	Get/Set	DSCP value for implicit messages with scheduled priority	(47)	The attribute is supported and activated per default.
6	DSCP High	Get/Set	Get/Set	DSCP value for implicit messages with high priority	(43)	The attribute is supported and activated per default.
7	DSCP Low	Get/Set	Get/Set	DSCP value for implicit messages with low priority	(31)	The attribute is supported and activated per default.
8	DSCP Explicit	Get/Set	Get/Set	DSCP value for explicit messages	(27)	The attribute is supported and activated per default.

Common services

Service Code	Name	Addressing the object's		Description
		Class Lavel	Instance Level	
0x0E	Get Attribute Single	The stack supports this service at object class level (Instance ID 0).	The stack supports this service at object instance level (instance 1-n).	Retrieve attribute value
0x10	Set Attribute Single	The stack does not support this service at class level.	The stack supports this service at object instance level (instance 1-n).	Modify attribute value

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

The TCP/IP Interface Object provides an interface to control a device's TCP/IPv4 network configuration, most importantly the device's IP Address, Network Mask, and Gateway Address.

The EtherNet/IP Adapter stack supports exactly one instance of the TCP/IP Interface Object.

Class attributes

Attr ID	Name	Access		Description	Default Value	Supported by default
		from Network	from Host			
1	Revision	Get	Get	Revision of this object	(7)	The attribute is supported and activated per default.
2	Max. Instance	Get	Get	Maximum instance number of an object currently created in this class level of the device	(1)	The attribute is supported and activated per default.
3	Number of Instances	Get	Get	The number of Instances currently created in this class	(1)	The attribute is supported and activated per default.
6	Maximum ID Number Class Attributes	Get	Get	The attribute ID number of the last class attribute of the class definition implemented in the device.	(7)	The attribute is supported and activated per default.
7	Maximum ID Number Instance Attributes	Get	Get	The attribute ID number of the last instance attribute of the class definition implemented in the device.	(14)	The attribute is supported and activated per default.

Instance attributes

Attr ID	Name	Access		Description	Default Value	Supported by default
		from Network	from Host			
1	Status	Get	Get/Set	Interface status	-	The attribute is supported and activated per default.
2	Configura-tion Capa-bility	Get	Get/Set	Interface capability flags	(0x95)	The attribute is supported and activated per default.
3	Configura-tion Control	Set	Get/Set	Interface control flags	(0)	The attribute is supported and activated per default.
4	Physical Link Object	Get	Get	Path to physical link object	(0x20 0xF6 0x24 0x01)	The attribute is supported and activated per default.
5	Interface Configura-tion	Get/Set	Get/Set	Interface Configuration (IP address, subnet mask, gateway address etc.)	(0)	The attribute is supported and activated per default.
6	Host Name	Get/Set	Get/Set	The Host Name attribute contains the device's host name, which can be used for informational purposes.	("")	The attribute is supported and activated per default.

Attr ID	Name	Access		Description	Default Value	Supported by default
		from Network	from Host			
7	Safety Network Number[1]	Get	Get/Set	See CIP Safety Specification, Volume 5, Chapter 3	(0xFF 0xFF 0xFF 0xFF 0xFF 0xFF)	The attribute is supported and deactivated per default. The host can activate it.
8	TTL Value	Get/Set	Get/Set	TTL value for EtherNet/IP multicast packets	(1)	The attribute is supported and activated per default.
9	Mcast Config	Get/Set	Get/Set	IP multicast address Configuration	(0)	The attribute is supported and activated per default.
10	SelectAcd	Get/Set	Get/Set	Activates the use of ACD	(1)	The attribute is supported and activated per default.
11	LastConflict-Detected	Get/Set	Get/Set	Structure containing information related to the last conflict detected	(0)	The attribute is supported and activated per default.
12	EtherNet/IP Quick Connect	Get/Set	Get/Set	Enable/Disable of Quick Connect feature	(0)	The attribute is supported and deactivated per default. The host can activate it.
13	Encapsulation Inactivity Timeout	Get/Set	Get/Set	Number of seconds till TCP connection is closed on encapsulation inactivity	(120)	The attribute is supported and activated per default.
14	IANA Port Admin	Get	Get/Set	IANA port admin configuration	tcp: 44818 udp: 44818 udp: 2222	The attribute is supported and activated per default.
1 Activating the Safety Network Number will automatically switch off the support of the Identity object's reset service. The reset service will be reject with general status 0x08 "Service not supported"						

Common services

These services are available to the host application and remote EtherNet/IP clients.

Service Code	Name	Addressing the object's		Description
		Class Lavel	Instance Level	
0x01	Get Attribute All	The stack does not support this service at class level.	The stack supports this service at object instance level (instance 1-n).	Returns content of instance or class attributes
0x0E	Get Attribute Single	The stack supports this service at object class level (Instance ID 0).	The stack supports this service at object instance level (instance 1-n).	Retrieve attribute value
0x10	Set Attribute Single	The stack does not support this service at class level.	The stack supports this service at object instance level (instance 1-n).	Modify attribute value
1This service is only available to remote EtherNet/IP clients. Initiated from the host application, the service will be rejected with an appropriate error code.				

Ethernet Link Object (Class Code: 0xF6)

The Ethernet Link Object maintains link-specific status information for the Ethernet communications interface. If the device is a multi-port device, it holds more than one instance of this object. Usually, when using the Dual-Port Virtual Ethernet Switch, instance 1 refers to Ethernet port 0 and instance 2 to Ethernet port 1.

Class attributes

Attr ID	Name	Access		Description	Default Value	Supported by default
		from Network	from Host			
1	Revision	Get	Get	Revision of this object	(4)	The attribute is supported and activated per default.
2	Max. Instance	Get	Get	Maximum instance number of an object currently created in this class level of the device	(2)	The attribute is supported and activated per default.
3	Number of Instances	Get	Get	The number of Instances currently created in this class	(2)	The attribute is supported and activated per default.
6	Maximum ID Number Class Attributes	Get	Get	The attribute ID number of the last class attribute of the class definition implemented in the device.	(7)	The attribute is supported and activated per default.
7	Maximum ID Number Instance Attributes	Get	Get	The attribute ID number of the last instance attribute of the class definition implemented in the device.	(768)	The attribute is supported and activated per default.

Instance attributes

Attr ID	Name	Access		Description	Default Value	Supported by default
		from Network	from Host			
1	Interface Speed	Get	Get	Interface speed currently in use	(100)	The attribute is supported and activated per default.
2	Interface Flags	Get	Get	Interface status flags	(0x20)	The attribute is supported and activated per default.
3	Physical Address	Get	Get	MAC layer address	Filled in automatically according to device's MAC address	The attribute is supported and activated per default.
4	Interface Counters	Get	Get	Interface specific counters		The attribute is supported and activated per default.
5	Media Counters	Get	Get	Media specific counters		The attribute is supported and activated per default.
6	Interface Control	Get/Set	Get/Set	Configuration for physical interface	(0)	The attribute is supported and activated per default.
7	Interface Type	Get	Get/Set	Type of interface: twisted pair, fiber	(0x02)	The attribute is supported and activated per default.
8	Interface State	Get	Get	Current state of interface	(0)	The attribute is supported and activated per default.

Attr ID	Name	Access		Description	Default Value	Supported by default
		from Network	from Host			
9	Admin State	Get/Set	Get/Set	Administrative state: 1 EIP_EN_INTF_STATE_ENABLE Enable interface 2 EIP_EN_INTF_STATE_DISABLE Disable Interface	(disable)	The attribute is supported and activated per default.
10	Interface Label	Get	Get/Set	Human readable identification	("port1","port2")	The attribute is supported and activated per default.
11	Interface Capability	Get	Get/Set	Indication of capabilities of the interface	10 / HD, 10 / FD, 100 / HD 100 / FD	The attribute is supported and activated per default.
768	MDIX	Get/Set	Get/Set	MDIX configuration Format: uint8_t, range [1 .. 3] 1 EIP_EN_INTF_MDIX_AUTO Auto detect 2 EIP_EN_INTF_MDIX_MDI Explicit MDI 3 EIP_EN_INTF_MDIX_MDIX Explicit MDIX	1	The attribute is supported and activated per default.

Common services

These services are available to the host application and remote EtherNet/IP clients.

Service Code	Name	Addressing the object's		Description
		Class Lavel	Instance Level	
0x01	Get Attribute All	The stack does not support this service at class level.	The stack supports this service at object instance level (instance 1-n).	Returns content of instance or class attributes
0x0E	Get Attribute Single	The stack supports this service at object class level (Instance ID 0).	The stack supports this service at object instance level (instance 1-n).	Retrieve attribute value
0x10	Set Attribute Single	The stack does not support this service at class level.	The stack supports this service at object instance level (instance 1-n).	Modify attribute value

Class-specific services

Class-specific services

Service Code	Name	Addressing the object's		Description
		Class Lavel	Instance Level	
0x4C	Get and Clear	The stack does not support this service at class level.	The stack supports this service at object instance level (instance 1-n).	Retrieves attribute value and subsequently sets the attribute value to zero (only for attributes Interface-Counters and Media-Counters).

LLDP Management Object (Class Code: 0x109)

The LLDP Management Object function as an interface to configure aspects of the LLDP protocol that is running in the device.

All information about neighboring devices that is stored in the data tables of the LLDP protocol stack can be accessed via the SNMP LLDP MIB (OID 1.0.8802.1.1.2.1).

Class attributes

Attr ID	Name	Access		Description	Default Value	Supported by default
		from Network	from Host			
1	Revision	Get	Get	Revision of this object	(1)	The attribute is supported and activated per default.
2	Max. Instance	Get	Get	Maximum instance number of an object currently created in this class level of the device	(1)	The attribute is supported and activated per default.
3	Number of Instances	Get	Get	The number of Instances currently created in this class	(1)	The attribute is supported and activated per default.
6	Maximum ID Number Class Attributes	Get	Get	The attribute ID number of the last class attribute of the class definition implemented in the device.	(7)	The attribute is supported and activated per default.
7	Maximum ID Number Instance Attributes	Get	Get	The attribute ID number of the last instance attribute of the class definition implemented in the device.	(5)	The attribute is supported and activated per default.

Instance attributes

Attr ID	Name	Access		Description	Default Value	Supported by default
		from Network	from Host			
1	LLDP Enable	Get/Set	Get/Set	Enables/Disables LLDP global or per port.	All ports enabled	The attribute is supported and activated per default.
2	msgTxInterval	Get/Set	Get/Set	From 802.1AB-2016. The interval in seconds for transmitting LLDP frames from this device.	(30)	The attribute is supported and activated per default.
3	msgTxHold	Get/Set	Get/Set	From 802.1AB-2016. A multiplier of msgTxInterval to determine the value of the TTL TLV sent to neighboring devices.	(4)	The attribute is supported and activated per default.
4	LLDP Datastore	Get	Get	An indication of the retrieval methods for the LLDP database supported by the device.	(0x02) (SNMP)	The attribute is supported and activated per default.
5	Last Change	Get	Get	The value of sysUpTime taken the last time any entry in the local LLDP database changed.	(0)	The attribute is supported and activated per default.

Common services

These services are available to the host application and remote EtherNet/IP clients.

Service Code	Name	Addressing the object's		Description
		Class Lavel	Instance Level	
0x0E	Get Attribute Single	The stack supports this service at object class level (Instance ID 0).	The stack supports this service at object instance level (instance 1-n).	Retrieve attribute value
0x10	Set Attribute Single	The stack does not support this service at class level.	The stack supports this service at object instance level (instance 1-n).	Modify attribute value

Quality of Service (QoS)

Introduction

Quality of Service, abbreviated as QoS, denotes a mechanism treating data streams according to their delivery characteristics, of which the by far most important one is the priority of the data stream. Therefore, in the context of EtherNet/IP, QoS means priority-dependent control of Ethernet data streams. QoS is of special importance for advanced time-critical applications such as CIP Sync and CIP Motion and is mandatory for DLR (see Device Level Ring (DLR) topology).

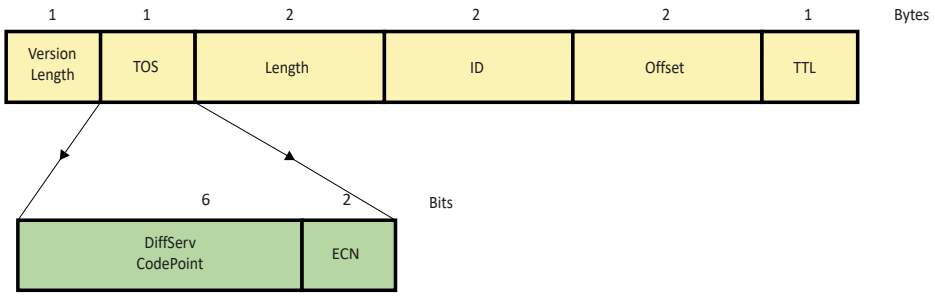
In TCP/IP-based protocols, there are two standard mechanisms available for implementing QoS, which are described in more detail below:

- Differentiated Services (abbreviated as DiffServ)
- The 802.1D/Q Protocols

Introducing QoS means providing network infrastructure devices such as switches and hubs with means to differentiate between frames of different priority. Therefore, these devices write priority information into the frames. This technique is called priority tagging.

DiffServ

In the definition of an IP v4 frame, the second byte is denominated as TOS. See figure below:



DiffServ is a schematic model for the priority-based classification of IP frames based on an alternative interpretation of the TOS byte. It has been specified in RFC2474.

The idea of DiffServ consists in redefining 6 bits (i.e. the bits 8 to 13 of the whole IP v4 frame) and to use them as codepoint. Thus, these 6 bits are denominated as DSCP (*Differentiated Services Codepoint*) in the context of DiffServ. These 6 bits allow to address 63 predefined routing behaviors, which can be applied for routing the frame at the next router, and specifies exactly how to process the frame there. These routing behaviors are called PHBs (Per-hop behavior). Many PHBs have been predefined and the IANA has assigned DSCPs to these PHBs. For a list of these DSCPs and the assigned PHBs, see http://www.iana.org/assignments/dscp-registry/dscp-registry.xhtml.

Mapping of DSCP to EtherNet/IP

The following table shows the default assignment of DSCPs to different kinds of data traffic in EtherNet/IP which is defined in the CIP specification.

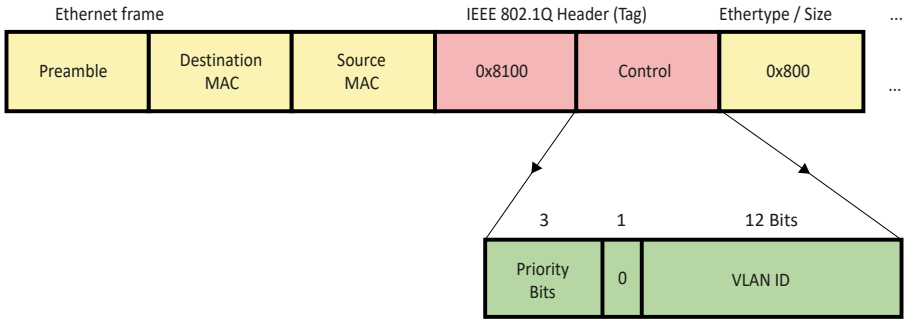
Traffic Type	CIP Priority	DSCP (numeric)	DSCP (bin)
CIP Class 0 and 1	Urgent (3)	55	110111
	Scheduled (2)	47	101111
	High (1)	43	101011
	Low (0)	31	011111
CIP Class 3 CIP UCMM All other encapsulation messages	All	27	011011

802.1D/Q Protocol

Another possibility is used by 802.1Q. IEEE 802.1Q is a standard for defining virtual LANs (VLANs) on an Ethernet network. It introduces an additional header, the IEEE 802.1Q header, which is located between Source MAC and Ethertype and Size in the standard Ethernet frame.

The IEEE 802.1Q header has the Ethertype 0x8100. It allows to specify

- The ID of the Virtual LAN (VLAN ID, 12 bits wide)
- And the priority (defined in 802.1D)



As the header definition reserves only 3 bits for the priority, only 8 priorities (levels from 0 to 7) can be used here.

Mapping of 802.1D/Q to EtherNet/IP

The following table shows the default assignment of 802.1D priorities to different kinds of data traffic in EtherNet/IP which is defined in the CIP specification.

Traffic Type	CIP Priority	802.1D priority
CIP Class 0 and 1	Urgent (3)	6
	Scheduled (2)	5
	High (1)	5
	Low (0)	3
CIP Class 3 CIP UCMM All other encapsulation messages	All	3

The QoS Object

Within the EtherNet/IP implementation of QoS, the DiffServ mechanism is usually always present and does not need to be activated explicitly. In contrast to this, 802.1Q must explicitly be activated on all participating devices. The main capabilities of the QoS object are therefore:

- To enable 802.1Q (VLAN tagging)
- To enable setting parameters related to DiffServ (DSCP parameters)

For more information on the QoS object in the EtherNet/IP adapter protocol stack see Quality of Service Object (Class Code: 0x48), page 157.

Enable 802.1Q (VLAN tagging)

The 802.1Q VLAN tagging mechanism can be turned on and off by setting attribute 1 (802.1Q Tag Enable) of the QoS object to value 1.

Event Log Object 65 (0x41)

The Event Log Object contains information on IO-Link events.

Instance 0 (Class Attributes)

Attribute	Name	NV	Access	Data type	Description	Default
1 (0x01)	Revision	NV	Get	UINT	Revision of this object	1
2 (0x02)	Maximum instance	NV	Get	UINT	Number of IO-Link ports	Number of available IO-Link ports
32 (0x20)	Time Format	NV	Get	USINT	Data type identifier of the time format Only THE STIME data type is supported.	204 (0xCC) =STIME
33 (0x21)	Present Time	NV	Get	STIME	Default for time value Applies to all instances.	0

Instances 100, 101, … (Instance Attributes)

The following table shows the assignment of the CIP instances to the IO-Link ports:

IO-Link port	CIP instance
1	100
2	101
3	102
…	…

The following table describes the attributes of instances 100, 101, …:

Attribute	Name	NV	Access	Data type	Description	Default
2 (0x02)	State	V	Get	USINT	State of this instance 0: Does not exist 1: Stopped 2: Empty 3: Available 4: Full/Override 5: Full/Stopped 6 - 255: Reserved	-
9 (0x09)	Logged Data Configuration	NV	Get/Set	BYTE	Configures which data is stored in the event log. Bit 0 = 0: Enter event without time value Bit 0 = 1: Enter event with time value Bits 1 – 7: Reserved (always 0).	0
10 (0x0A)	Log Full Action	NV	Get/Set	USINT	Configures what to do when a new event is detected and the log is full. 0: Stop1: Scrol l2 - 255: Reserved	1
11 (0x0B)	Duplicate Event Action	NV	Get/Set	USINT	Configures what to do when a double event is detected. 0: Ignore 1: Add 2 - 255: Reserved	1

Attribute	Name	NV	Access	Data type	Description	Default
12 (0x0C)	Event/Data Log Maximum Size	V	Get	UDINT	Maximum Number of allowed entries in the event log.	8
13 (0x0D)	Event/Data Log Size	V	Get	UDINT	The current number of entries in the event log. Values: 0 to maximum (= value of the attribute 12).	0
14 (0x0E)	Event/Data Log	V	Get Get Member Remove Member	ARRAY of STRUCT	List of all registered events. An entry contains the IO-Link Event Qualifier (USINT) and the IO-Link Event Code (UINT). Attribute 9 specifies whether a time stamp (STIME) is also entered. The structure of an entry is described below.	0
19 (0x13)	Log Full	V	Get	BOOL	Log full? Incorrect: Log not full True: Log full	Wrong
20 (0x14)	Log Contains Entries	V	Get	BOOL	Log contains entries? False: Log is empty. True-Log contains events.	Wrong
21 (0x15)	Log Overrun	V	Get	BOOL	Log Overflow? False: No Log Overflow True - Log Overflow	Wrong
22 (0x16)	Sequential Event/Data Access	V	Get	STRUCT	Easy read access to event entries. If there are one or more entries in the event log, get_attribute_Single reads the first entry, which is then removed from the event log. If there is no entry in the event log, get_attribute_Single does not return any data.	-
24 (0x18)	Event Identifier Format	NV	Get/Set	USINT	Format of a log entry 0 - 3: Reserved 4: 24 bits in the format USINT + UINT 5 - 255: Reserved	4

Attribute 14: Structure of an Entry

The value of attribute 9 defines the structure of an entry:

Structure of an entry	Description
USINT	IO-Link event qualifier, always available.
UINT	IO-Link event code, always available.
STIME	System time The system time is available only if attribute 9 bit 0 = 1.

Services

Service code	Service name	Class level	Instance level	Description
5 (0x05)	Reset	-	Yes	Reset
14 (0x0E)	Get Attribute Single	Yes	Yes	Read an attribute
16 (0x10)	Set Attribute Single	-	Yes	Write an attribute value
24 (0x18)	Get Member	-	Yes	Read the entry
27 (0x1B)	Remove Member	-	Yes	Delete entry

IO-Link Port Configuration - Object 128 (0x80)

The IO-Link port configuration object contains the configuration of an IO-Link port. Each IO-Link port is assigned to an object instance.

Instance 0 (Class Attributes)

Attribute	Name	NV	Access	Data type	Description	Default
1 (0x01)	Revision	NV	Get	UINT	Revision of this object	1
2 (0x02)	Maximum instance	NV	Get	UINT	Number of IO-Link ports	Number of available IO-Link ports

Instances 1, 2, … (Instance Attributes)

The following table shows the assignment of the CIP instances to the IO-Link ports:

IO-Link port parameter	CIP instance
1 (0x01)	1 (0x01)
2 (0x02)	2 (0x02)
3 (0x03)	3 (0x03)
…	…

The following table describes the attributes of the instances 1, 2, …:

Attribute	Name	NV	Access	Data type	Description	Default
1 (0x01)	Port mode	NV	Get/Set	USINT	Port operating mode (configuration of pin 4) 0: The port is deactivated. L+ is switched off. The process data (input and output) is set to 0. The IO-Link master no longer performs any activities for this port. 1: The port is used as an IO-Link port with a manual (user-defined) configuration. Vendor ID, Device ID, and Revision ID is validated. 2: The port is used as an IO-Link port with an automatic start. The IO-Link-Device is neither configured nor validated. 3: Digital input. 4: Digital output.	2
2 (0x02)	Validation and Backup	NV	Get/Set	USINT	Validation and backup settings to identify the IO-Link-Device while it is changed. 0: No identification of the IO-Link device. 1: The IO-Link device is identified and checked for type compatibility according to IO-Link specification 1.0 2: The IO-Link device is identified and checked for type compatibility according to IO-Link specification 1.1 3: The IO-Link device is identified and checked for type compatibility (with backup and restore functionality) according to IO-Link specification 1.1 4: The IO-Link device is identified and checked for type compatibility (with restore functionality) according to IO-Link specification 1.1	0

Attribute	Name	NV	Access	Data type	Description	Default
3 (0x03)	IQ behavior	NV	Get/Set	USINT	IQ-behavior of the port (configuration of pin 2) 0: Pin 2 cannot be used. 1: Digital input 2: Digital output 3 - 4: Reserved 5: Voltage supply 2L (for IO-Link Class B only): This option is intended only for IO-Link devices class B. Do not select this option with IO-Link devices class A.	0
4 (0x04)	Port cycle time	NV	Get/Set	USINT	Cycle time of the port For a description of the values, see table Calculation of the port cycle time, page 49	0
5 (0x05)	Vendor ID	NV	Get/Set	UINT	Vendor ID 0 … 65535 The Vendor ID is used to check whether an IO-Link device of the correct manufacturer is connected. For the value of the Vendor ID, see the documentation of the IO-Link device used. If the value is 0, no check takes place.	0
6 (0x06)	Device ID	NV	Get/Set	UDINT	Device ID 0 … 4294967295 The Device ID is used to check whether the correct IO-Link Device is connected. For the value of the Device ID, see the documentation of the IO-Link device used. If the value is 0, no check takes place.	0

Services

Service code	Service name	Class level	Instance level	Description
14 (0x0E)	Get Attribute Single	Yes	Yes	Read an attribute
16 (0x10)	Set Attribute Single	-	Yes	Write an attribute value
1 (0x01)	Get Attributes All	-	Yes	Read all attributes
2 (0x02)	Set Attributes All	-	Yes	Write all attributes

IO-Link Port Status - Object 129 (0x81)

Object with status information of the IO-Link master port. Each IO-Link port is assigned to an object instance.

Instance 0 (Class Attributes)

Attribute	Name	NV	Access	Data type	Description	Default
1 (0x01)	Revision	NV	Get	UINT	Revision of this object	1
2 (0x02)	Maximum instance	NV	Get	UINT	Number of IO-Link ports	Number of available IO-Link ports

Instances 1, 2, … (Instance Attributes)

The following table shows the assignment of the CIP instances to the IO-Link ports:

IO-Link port parameter	CIP instance
1 (0x01)	1 (0x01)
2 (0x02)	2 (0x02)
3 (0x03)	3 (0x03)
…	…

Attribute	Name	NV	Access	Data type	Description	Default
1 (0x01)	Port State Info	V	Get	USINT	Current port status information of the IO-Link port 0: No IO-Link device: No IO-Link device is connected to the port or there is no communication with the connected IO-Link device. 1: Deactivated: The port is inactive. 2: Wrong device: The check of the revision or compatibility shows that the wrong IO-Link device is connected. 3: Preoperate: The IO-Link device is ready for communication. 4: Operate: The IO-Link device is communicating. 5: DI CQ: The port is in the digital input mode. 6: DO CQ: The port is in the digital output mode. 7 - 8: Reserved 9: Incorrect cycle time: The configured cycle time does not match the connected IO-Link device. 254: Port Power Off: The port voltage is disconnected. 255: Not available: The port is not available.	0
2 (0x02)	Port Quality Info	V	Get	USINT	Information on port quality and validity of process data for input and output. The contents is bit-coded. Bit 0: 0: Process input data valid 1: Process input data invalid Bit 1: 0: Process output data valid 1: Process output data invalid Bit 2 - 7: Reserved	0

Attribute	Name	NV	Access	Data type	Description	Default
3 (0x03)	Revision	V	Get	USINT	Revision ID of the connected IO-Link device 0: No IO-Link device connected. All other values: Revision ID of the connected IO-Link device.	0
4 (0x04)	Transmis-sion Rate	V	Get	USINT	Data transmission rate 0: No IO-Link device connected. 1: 4.8 kbit/s (COM1) 2: 38.4 kbit/s (COM2)3 : 230.4 kbit/s (COM3) 4 – 255: Reserved	0
5 (0x05)	Master cycle time	V	Get	USINT	Cyle time of the communication in the operating mode "Operate".	0
6 (0x06)	Input data length	V	Get	USINT	Input data length of the connected IO-Link device in bytes: 0 … 32	0
7 (0x07)	Output data length	V	Get	USINT	Output data length of the connected IO-Link device in bytes: 0 … 32	0
8 (0x08)	Vendor ID	V	Get	UINT	Vendor ID of the connected IO-Link device	0
9 (0x09)	Device ID	V	Get	UDINT	Device ID of the connected IO-Link device	0

Services

Service code	Service name	Class level	Instance level	Description
14 (0x0E)	Get Attribute Single	Yes	Yes	Read an attribute
1 (0x01)	Get Attributes All	-	Yes	Read all attributes

IO-Link Port Identification - Object 130 (0x82)

The IO-Link port identification object contains information on IO-Link port types. Each IO-Link port is assigned to an object instance.

Instance 0 (Class Attributes)

Attribute	Name	NV	Access	Data type	Description	Default
1 (0x01)	Revision	NV	Get	UINT	Revision of this object	1
2 (0x02)	Maximum instance	NV	Get	UINT	Number of IO-Link ports	Number of available IO-Link ports

Instances 1 (Instance Attributes)

The following table shows the assignment of the CIP instances to the IO-Link ports:

IO-Link port parameter	CIP instance
1 (0x01)	1 (0x01)
2 (0x02)	2 (0x02)
3 (0x03)	3 (0x03)
…	…

Attribute	Name	NV	Access	Data type	Description	Default
1	Port type	V	Get	USINT	Port type 0: Class A 1: Class A with port supply voltage on-off-support 2: Class B 3 – 255: Reserved	-

Services

Service code	Service name	Class level	Instance level	Description
14 (0x0E)	Get Attribute Single	Yes	Yes	Read an attribute

IO-Link Device Parameter - Object 131 (0x83)

This object allows you to read and write parameters of an IO-Link device using the IO-Link service ISDU (indexed service data unit). This object maps CIP services on the IO-Link-services. An object instance addresses the IO-Link port to which the IO-Link device is connected.

Instance 0 (Class Attributes)

Attribute	Name	NV	Access	Data type	Description	Default
1 (0x01)	Revision	NV	Get	UINT	Revision of this object	1
2 (0x02)	Maximum instance	NV	Get	UINT	Number of IO-Link ports	Number of available IO-Link ports

Instances 1, 2, … (Instance Attributes)

The following table shows the assignment of the CIP instances to the IO-Link ports:

IO-Link port parameter	CIP instance
1 (0x01)	1 (0x01)
2 (0x02)	2 (0x02)
3 (0x03)	3 (0x03)
…	…

The instances do not have any attributes.

Services

Service code	Service name	Class level	Instance level	Description
14 (0x0E)	Get Attribute Single	Yes	-	Read an attribute
75 (0x4B)	Read ISDU (indexed service data unit)	-	Yes	Read data from IO-Link device
76 (0x4C)	Write ISDU (indexed service data unit)	-	Yes	Write data in IO-Link device

ISDU Read Service (Request)

This service reads the parameters of an IO-Link device that is connected to an IO-Link port. The CIP instance addresses the IO-Link port.

A CIP attribute need not be addressed. A CIP attribute contained in the request is not used.

The CIP data contains the value of the object index and object subindex. These values address the object in the IO-Link device.

Field	Type	Value	Description
CIP service	-	75 (0x4B)	ISDU read service
CIP class	-	131 (0x83)	IO-Link device parameter object
CIP instance	-	1 (0x01), 2 (0x02), …	Addresses the IO-Link port to which the IO-Link device is connected.
CIP data	UINT	Index	Object index of the IO-Link device
	USINT	Subindex	Object subindex of the IO-Link device

ISDU Read Service (Response)

In case of a successful execution of the request, the CIP status of the response has the value 0. The CIP data contains the data read from the object of the IO-Link device.

Field	Type	Value	Description
CIP service	-	75 (0x4B)	ISDU read service
CIP class	-	131 (0x83)	IO-Link device parameter object
CIP instance	-	1 (0x01), 2 (0x02), …	Addresses the IO-Link port to which the IO-Link device is connected.
CIP data	ARRAY of BYTE	ISDU data	Read IO-Link object data of the IO-Link Device. Length 0 … 232 bytes.

In case of an unsuccessful execution of the request, the CIP status of the response has a value that is not equal to 0. The CIP data contains error codes.

Field	Type	Value	Description
CIP service	-	75 (0x4B)	ISDU read service
CIP class	-	131 (0x83)	IO-Link device parameter object
CIP instance	-	1 (0x01), 2 (0x02), …	Addresses the IO-Link port to which the IO-Link device is connected.
CIP data	UINT	Error code	IO-Link master: Error code At the end of this section, you can find a cross reference to the list of error codes.
	USINT	Error code	IO-Link device: Error code At the end of this section, you can find a cross reference to the list of error codes.
	USINT	Error code	IO-Link device: Additional error code At the end of this section, you can find a cross reference to the list of error codes.

ISDU Write Service (Request)

This service writes the parameters of an IO-Link device that is connected to an IO-Link port. The CIP instance addresses the IO-Link port.

A CIP attribute need not be addressed. A CIP attribute contained in the request is not used.

The CIP data contains the value of the object index and object subindex.

These values address the object in the IO-Link device.

The CIP data also contains the data to be written into the object of the IO-Link Device.

Field	Type	Value	Description
CIP service	-	76 (0x4C)	ISDU write service
CIP class	-	131 (0x83)	IO-Link device parameter object
CIP instance	-	1 (0x01), 2 (0x02), …	Addresses the IO-Link port to which the IO-Link device is connected.
CIP data	UINT	Index	IO-Link object index
	USINT	Subindex	IO-Link object subindex
	ARRAY of BYTE	ISDU data	Data that is to be written into the IO-Link device. Length 0 … 232 bytes

ISDU Write Service (Response)

In case of a successful execution of the request, the CIP status of the response has the value 0.

Field	Type	Value	Description
CIP service	-	76 (0x4C)	ISDU write service
CIP class	-	131 (0x83)	IO-Link device parameter object
CIP instance	-	1 (0x01), 2 (0x02), …	Addresses the IO-Link port to which the IO-Link device is connected.

In case of an unsuccessful execution of the request, the CIP status of the response has a value that is not equal to 0. The CIP data contains error codes.

Field	Type	Value	Description
CIP service	-	76 (0x4C)	ISDU write service
CIP class	-	131 (0x83)	IO-Link device parameter object
CIP instance	-	1 (0x01), 2 (0x02), …	Addresses the IO-Link port to which the IO-Link device is connected.
CIP data	UINT	Error code	IO-Link master: Error code At the end of this section, you can find a cross reference to the list of error codes.
	USINT	Error code	IO-Link device: Error codeAt the end of this section, you can find a cross reference to the list of error codes.
	USINT	Error code	IO-Link device: Additional error code At the end of this section, you can find a cross reference to the list of error codes.

Glossary

B

Baud rate
Data transmission speed specified in the form of a number of bits transferred per second (baud rate = data rate).

BOOL
A *Boolean* type is the basic data type in computing. A `BOOL` variable can have one of these values: 0 (`FALSE`), 1 (`TRUE`). A bit that is extracted from a word is of type `BOOL`, for example: `%MW10.4` is the fifth bit of a memory word number 10.

BYTE
When 8 bits are grouped together, they are called a `BYTE`. You can enter a `BYTE` either in binary mode or in base 8. The `BYTE` type is encoded in an 8-bit format that ranges from `16#00` to `16#FF` (in hexadecimal format).

C

CIP
(Common Industrial Protocol) CIP is an industrial protocol for industrial automation applications. It encompasses a comprehensive suite of messages and services for the collection of manufacturing automation applications-control, safety , synchronization, motion, configuration and information.

Cycle time
Time to transmit an M-sequence between a master and its device including the following idle time.

D

DHCP
dynamic host configuration protocol. A TCP/IP protocol that allows a server to assign an IP address based on a device name (host name) to a network node.

DI
(Digital input)

DO
(Digital output)

DSCP
(Differentiated Services Code Point) DSCP is a computer networking architecture that specifies a mechanism for classifyingand managing network traffic and providing quality of service on modern IP networks.

E

EMI

(Electromagnetic Interference) It is unwanted noise or interference in an electrical path or circuit caused by an outside source. It is also called radio frequency interference.

Ethernet
A physical and data link layer technology for LANs, also known as IEE 802.3. Ethernet uses a bus or a star topology to connect different nodes on a network.

H

HMI
(Human Machine Interface) An operator interface, usually graphical, for industrial equipment.

I

IEC 61131-9
International standard that deals with the basics of programmable controllers. Part 9 describes IO-Link under the designation Singledrop digital communication interface for small sensors and actuators (IO-Link).

IODD
(IO Device Description) IODD serves as a digital description and identity of an IO-Link device, providing information about the characteristics, parameters, and communication capabilities of the device.

N

NTP
(Network Time Protocol) NTP is a networking protocol for clock synchronization between computer systems over packet-switched, variable-latency data networks.

O

OEM
(Original Equipment Manufacturer) It refers to any company that manufactures products or parts intended to be incorporated into a final product of another company.

OPC UA
(Open Platform Communications Unified Architecture) It is an omni-platform communication protocol for industrial automation. Regardless of their age, OPC-UA enables industrial robots, machine tools and PLCs to communicate with each other.

P

PELV
(Protective Extra Low Voltage) PELV describes a voltage that is set so low that in the event of indirect contact and small area direct contact there is no risk of electric shock. In the event of an insulation failure adequate protection must still be provided.

PLC
(Programmable Logic Controller) The PLC is the brain of an industrial manufacturing process. It automates a process as opposed to relay control systems. PLCs are computers suited to survive the harsh conditions of the industrial environment.

Port
Communication medium interface of the Master to one Device.

S

SCADA
(supervisory control and data acquisition) A system that monitors, manages, and controls industrial applications or processes, usually for entire sites or complexes of systems spread over large areas.

SELV
(safety extra low voltage) A system that follows IEC 61140 guidelines for power supplies is protected in such a way that voltage between any 2 accessible parts (or between 1 accessible part and the PE terminal for class 1 equipment) does not exceed a specified value under normal conditions or under inoperable conditions.

SIO
(Standard Input Output) Port operation mode in accordance with digital input and output defined in IEC 61131-2 that is established after power-up or fallback or unsuccessful communication attempts.

W

Wake-up
IO link procedure for causing a device to change its mode from SIO to IO-Link mode.

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