Reference Manual
00809-0100-4118, Rev AB
September 2019

Rosemount™ IO-Link Master

with EtherNet/IP™ Interface

FB-5204, FB-5208

ROSEMOUNT™

EMERSON™

Safety messages

Note

The plant manufacturer is responsible for the safety of the plant in which the device is installed.

If the device is used in a way that is not intended by the manufacturer, the protection supported by the device may be impaired.

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

- Observe these operating instructions.
- Adhere to the warning notes on the product.

Required background knowledge

This document is intended for specialists. Specialists are people who, based on their relevant training and experience, are capable of identifying risks and avoiding potential hazards that may be caused during operation or maintenance of the product.

The document contains information about the correct handling of the product.

⚠ WARNING

Observe instructions in chapter "Electrical connection."

Tampering with the units can affect the safety of operators and machinery.

Tampering with the units is not allowed. In case of non-compliance our liability and warranty expire.

Do not open the devices.

Do not insert any objects into the devices.

Prevent metal foreign bodies from penetrating.

Physical access

Unauthorized personnel may potentially cause significant damage to and/or misconfiguration of end users' equipment. This could be intentional or unintentional and needs to be protected against.

Physical security is an important part of any security program and fundamental to protecting your system. Restrict physical access by unauthorized personnel to protect end users' assets. This is true for all systems used within the facility.

Contents

1 Overview

1.1 Legal and copyright information

All product names, pictures, companies or other brands used on our pages are the property of the respective rights owners:

- EtherNet/IP® is the property of ODVA
- IO-Link ™(www.io-link.com) is the property of the PROFIBUS Nutzerorganisation e.V., Germany
- Microsoft™ is the property of the Microsoft Corporation, USA (www.microsoft.com)
- PROFIBUS™ is the property of the PROFIBUS Nutzerorganisation e.V., Germany (www.profibus.com)
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1.2 Purpose of the document

This document is only for device types Rosemount IO-Link Master with EtherNet IP Interface, 4 port and 8 port (FB-5204 and FB-5208). It contains information about the correct handling of the product.

- Read this document before using the device.
- Keep this document during the service life of the device.

2 Intended use

Permitted use

The IO-Link master serves as a gateway between intelligent IO-Link devices and the fieldbus. The device is designed for use without a control cabinet in the food industry.

Prohibited use

The device may not be used beyond the limits of the technical data.

3 Function

3.1 Communication parameter setting evaluation

IO-Link

The device offers the following IO-Link functions:

- IO-Link master (IO-Link revision 1.0 and 1.1)
- FB-5204 offers 4 IO-Link ports for connection of IO-link devices. FB-5208 offers 8 IO-link ports for connection of IO-Link devices

EtherNet/IP

The device offers the following EtherNet/IP functions:

- Provision of the functions of an EtherNet/IP Device
- Two-port switch for access to the EtherNet/IP interface (X21/X22)
- Gateway for transmission of the process and parameter data between the connected IO-Link devices and the higher-level EtherNet/IP controller

Parameter setting

The device provides the following configuration options:

- Parameter setting of the IO-Link master with EtherNet/IP projection software.
- Parameter setting of the connected IO-Link devices (transmitters, sensors, actuators) with EtherNet/IP projection software.
- Storage of parameter sets of the connected IO-Link devices for automatic recovery (data storage.)

Visual indication

The device has the following visual indicators:

- Status and error indication of the gateway, of the EtherNet/IP connection and of the system
- Status display of the voltage supply
- Status and activity display of the Ethernet connection
- Status, error and short circuit/overload indication of the IO-Link ports

Digital inputs

The device has 4/8 additional digital inputs (type 2 according to EN 61131-2).

The digital inputs are on pin 2 of the IO-Link ports (X01...X04 for FB-5104, X01..X08 for FB-5108).

All inputs refer to the potential of the device supply (pin 3).

IO-Link supply

The device has 4 (FB-5204) or 8 (FB-5208) supplies for IO-Link devices.

The IO-Link ports X01…X04/X08 are ports class A.

All ports feature short circuit protection (3.6A)

The device ensures fire protection for the connected IO-Link devices by providing a power-restricted circuit at the IO-Link ports (according to IEC61010-1 and Class 2 according to UL1310).

4 Mounting

4.1 Mount the device

Note

Disconnect the system from power before installation.

For installation choose a flat mounting surface.

Please observe the maximum tightening torque.

1. Fix the unit to the mounting surface using two M5 mounting screws and washers (tightening torque: 15.9 inch-pound, 1.8 Nm).
2. Ground the unit via the upper mounting screw.

5 Electrical connection

5.1 Safety messages

⚠ CAUTION

A qualified electrician must connect the unit.

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

Device is only suitable for operation on SELV/PELV voltages.

Observe the information listed in section 5.3 Connect the device.

The device contains components that can be damaged or destroyed by electrostatic discharge (ESD).

Observe the required safety measures against electrostatic discharge.

The IP rating depends on the individual protection ratings of the unit, the applied connection elements and the corresponding protective covers.

For UL applications: For connecting the device and the IO-Link devices use UL certified cables of category CYJV or PVVA with a minimum temperature rating of 100°C.

Depending on the mounting conditions, cables must be provided with a strain relief to avoid unacceptable loads on the mounting points and M12 connections.

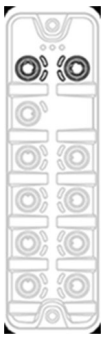
Make sure that the M12 connection parts are correctly seated and mounted correctly. The specified protection rating can not be guaranteed if this is not observed.

For information on wiring, see Technical data.

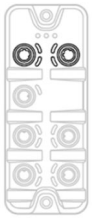
Note
The communication interfaces are seperated from the device supply according to EN61010-1 considering basis isolation as secondary circuit with maximum 30 V DC derived from the applied voltage up to 300 V of overvoltage category II. The communication interfaces are designed for a network environment 0 according to IEC TR62102.

5.2 Ethernet ports

8 ports FB-5208



4 ports FB-5204



Connect the unit via the M12 socket X21 and/or X22 with the EtherNet/IP network (e.g. EtherNet/IP PLC, additional EtherNet/IP device)

- Tightening torque: 5.3-7.1 in-lbs (0.6-0.8 Nm)

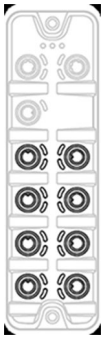
For the connection, use M12 connectors with protection rating IP 65 / IP 66 / IP 67 / IP 69K or higher.

Cover the unused sockets with M12 protective caps.

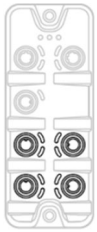
- Tightening torque: 5.3-7.1 in-lbs (0.6-0.8 Nm)

5.2.1 IO-Link ports

8 ports FB-5208



4 ports FB-5204



Ports X01...X04/X08: For use as IO-Link port class A:

Connect the connector of the IO-Link devices with the M12 sockets X01 ... X04/X08.

- Tightening torque: 5.3-7.1 in-lbs (0.6-0.8 Nm)
- Maximum cable length per IO-Link interface: 65.6 ft (20 m)

For the connection, use M12 connectors with protection rating IP 65 / IP 66 / IP 67 / IP 69K or higher.

Cover the unused sockets with M12 protective caps.

- Tightening torque 5.3-7.1 in-lbs (0.6-0.8 Nm)

Input circuit

The inputs of the ports X01...X04/X08 (pin 2) provide a type 2 behavior according to standard EN61131-2, the connected electronics must be rated for this electrically.

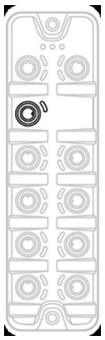
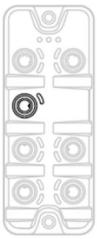
IO-Link circuits

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

Note
The power supply of the connected IO-Link devices may only be provided from the FB-520X IO-Link Master.
For more information, see Technical data.

5.3 Connect the device

Table 5-1: IO Link Ports

8 ports FB-5208	4 ports FB-5204
	

1. Disconnect the power.

2. Connect the device via M12 socket X31 to 24 V DC (20...28 V SELV/PELV; according to EN61010-1, secondary circuit with maximum 30 V DC derived from applied voltage up to 300 V of overvoltage category II).
   - Connect the device via M12 socket X31 to 24 V DC (20...28 V SELV/PELV; according to EN61010-1, secondary circuit with maximum 30 V DC derived from applied voltage up to 300 V of overvoltage category II).
   - Maximum cable length: 82 ft (25 m)

3. To connect the device, use M12 connectors with protection rating IP 65 / IP 66 / IP 67 / IP 69K or higher.

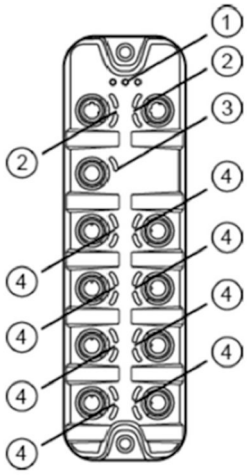
Note
When using cable length greater than 25 m keep in mind the voltage drop as well as the required minimum voltage supply of 20 V.

5.4 Display elements

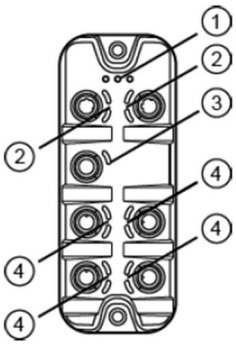
Figure 5-1 displays standard LED status ports.

Figure 5-1: LED Status Ports

8 ports FB-5208



4 ports FB-5204



1. Status LEDs RDY, NET and MOD. See Status LEDs.

2. Status LEDs LNK and ACT of the EtherNet/IP port 1 (X21) and 2 (X22). See Ethernet interface.

3. Status LED US of the power supply(X31). See Voltage supply.

4. Status LEDs IOL and DI of the IO-Link ports Class A (X01...X04/X08). See IO-Link port (Class A).

5.5 LED indicators

The device includes only the following status LED indicators:

- The RDY LED indicates the status of the Gateway.
- The NET LED (Network Status) indicates the status of the network.
- The MOD LED (Module Status) indicates the status of the EtherNet/IP module.

Table 5-2: Status LEDs

Status LED			Description
RDY	Green	On	Gateway functioning properly
		Flashes 1 Hz	Error
		Flashes 5 Hz	Firmware update running
		Off	Gateway not running or device booting

Table 5-2: Status LEDs *(continued)*

Status LED			Description
NET	Green	On	Connection with the EtherNet/IP PLC
		Off	No IP address
	Red	On	IP address is used twice
		Flashes	No connection with the EtherNet/IP PLC
MOD	Green	On	No error
		Off	Voltage too low
	Red	On	Module failed
		Flashes	Configuration of the module has been changed

Ethernet interface

Each Ethernet interface (X21, X22) has 2 LEDs (LNK and ACT). The LEDs indicate the status of the Ethernet connection.

Table 5-3: Ethernet Interface Status LEDs

Status LED			Description
LNK	Green	On	Ethernet connection established
		Off	No Ethernet connection
ACT	Yellow	Flashes	Data is transmitted via the Ethernet interface
		Off	No data transmission

Voltage supply

The interface for voltage supply (X31) has the LED that is marked as US. The LED indicates the status of the voltage supply.

Table 5-4: Voltage Supply Status LEDs

Status LED			Description
US	Green	On	The supply voltage US is applied
		Off	No supply voltage is applied or the applied supply voltage is too low

IO-Link port (Class A)

Each IO-Link port Class A (X01 ... X04/X08) has 2 LEDs marked as IOL and DI. The LEDs indicate the status of the IO-Link port.

Table 5-5: IO-Link Ports (Class A)

Status LED			Description
IOL	Yellow	On	Interface configured as DI/DO: pin 4 (C/Q) =ON
		Off	Interface configured as DI/DO: pin 4 (C/Q) = OFF
	Green	On	IO-Link transmission functions properly
		Flashes 1 Hz	Interface configured as IO-Link, but no IO-Link transmission
	Red	On	Short circuit or overload in supply voltage
		Flashes 1 Hz	Transmission error
DI	Yellow	On	Digital input: pin 2 (DI) = ON
		Off	Digital input : pin 2 (DI) = OFF

6 Configuration

6.1 Fieldbus: configure the EtherNet/IP port

The EtherNet/IP ports X21/X22 have to be configured via the EtherNet/IP for access to the device. To configure the fieldbus port:

Procedure

1. Select [Fieldbus] menu.
   a) The menu page shows the current settings.
2. Set the following parameters as required:

Table 6-1:

Name	Description	Possible values	
[DHCP]	Enable /disable the DHCP client of the IO-Link master	[Static IP]	The user sets the IP configuration
		[DHCP]	The network's DHCP server sets the IP configuration
		[BOOTP]	The Bootstrap Protocol (BOOTP) sets the IP configuration
[IP address]	IP address of the EtherNet/IP port	Factory setting: 192.168.1.250	
[Subnet mask]	Subnet mask of the IP network	Factory setting: 255.255.255.0	
[Default gateway IP address]	IP address of the gateway	Factory setting: 0.0.0.0	
[Host name]	Name of the device in the EtherNet/IP network	e.g. FB-520X	
[MAC address]	MAC address of the device	The value is firmly set.	
[Fieldbus firmware]		e.g. 3.4.04 (EtherNet/IP Adapter)	
[Configuration][(1)]	EtherNet/IP configuration mode	Independent mode off	Top down
		Independent mode on	Independent
[Process data length][(2)]	Process data length for each IO-Link port	2 Bytes Input 2 Bytes Output	2 bytes input data, 2 bytes output data

Table 6-1: ***(continued)***

Name	Description	Possible values	
		4 Bytes Input 4 Bytes Output	4 bytes input data, 4 bytes output data
		8 Bytes Input 8 Bytes Output	8 bytes input data, 8 bytes output data
		16 Bytes Input 16 Bytes Output	16 bytes input data, 16 bytes output data
		32 Bytes Input 32 Bytes Output	32 bytes input data, 32 bytes output data
[Swap](3)	Byte order in data word	Off	As Array of Bytes
		On	As Integer16 value; bytes will be swapped when updating the process data

(1) Parameter only changeable if connection to EtherNet/IP controller is closed
(2) Parameter only changeable if connection to EtherNet/IP controller is closed
(3) Parameter only changeable if connection to EtherNet/IP controller is closed

3. Save changed values on the device.

6.2 IO-Link ports configure operating mode

The IO-Link ports X01…X04/X08 of the device support the following operating modes:

- Digital input (DI): binary input signal at pin 4 (C/Q) of the IO-Link port
- Digital output (DO): binary output signal at pin 4 (C/Q) of the IO-Link port
- O-Link: IO-Link data transfer via pin 4 (C/Q) of the IO-Link port

Prerequisites

The user can set the operating mode separately for each IO-Link port. To set the operating mode of an IO-Link port:

Procedure

1. Select **[Port x] menu** (x = 1…4/8).
   a) The menu page shows the current settings.
2. Set the following parameters as required:

Table 6-2:

Name	Description	Possible values	
Mode	Operating mode of the IO-Link port	[Disabled]	Port deactivated
		[DI]	Operation as digital input
		[DO]	Operation as digital output
		[IO-Link]	Operation as IO-Link interface
[Cycle time actual](1)	Current cycle time of the data transfer between IO-Link master and IO-Link device on the port (value in microseconds)	Parameter can only be read	
[Cycle time preset](2)	Cycle time of the data transfer between the IO-Link master and the IO-Link device at the port (value in microseconds)	0	The device automatically sets the fastest possible cycle time.
		1 ... 132800	1 microsecond ... 132800 microseconds
[Bitrate](3)	Current transmission rate of the data transfer between the IO-Link master and the IO-Link device on the port	Parameter can only be read	

(1) Parameter only visible if the IO-Link device is connected to the IO-Link port.
(2) Parameter only available if [Mode] = [IO-Link]
(3) Parameter only visible if the IO-Link device is connected to the IO-Link port

3. Save changed values on the device.

6.3 IO-Link ports: set device validation and data storage

In the operating mode "IO-Link" the user can set the behaviour of the IO-Link port with regard to device validation and the storage / restoration of the parameter data of the connected IO-Link device.

Procedure

1. To configure the device validation and the data storage, select **[Port x]** menu (x = 1...4/8).

a) The menu page shows the current settings.

2. Set the following parameters as required:

Table 6-3:

Name	Description	Possible values	
[Validation / Data Storage]	Supported IO-Link standard and behaviour of the device during connection of a new IO-Link device on port x (x = 1...4/8)	[No check and clear]	• No verification of the vendor ID and device ID • No data storage
		[Type compatible V1.0 device]	• IO-Link device is compatible with the V1.0 IO-Link standard • Verification whether it is an IO-Link device of the same type (validation via vendor ID and device ID) • No data storage
		[Type compatible V1.1 device]	• IO-Link device is compatible with the V1.1 IO-Link standard • Verification whether it is an IO-Link device of the same type (validation via vendor ID and device ID) • No data storage
		[Type compatible V1.1 device with Restore]	• IO-Link device is compatible with the V1.1 IO-Link standard • Verification whether it is an IO-Link device of the same type (validation via vendor ID and device ID) • The IO-Link master saves the parameter values of the connected IO-Link device; modifications of the parameter values are also saved (observe the note) • When connecting an IO-Link device with factory settings, the parameter values stored in the IO-Link master are restored automatically on the IO-Link device.

Table 6-3: *(continued)*

Name	Description	Possible values	
		[Type compatible V1.1 device with Restore]	• IO-Link device is compatible with the V1.1 IO-Link standard • Verification whether it is an IO-Link device of the same type (validation via vendor ID and device ID) • The IO-Link master saves the parameter values of the connected IO-Link device once. • When connecting an IO-Link device with factory settings, the parameter values stored in the IO-Link master are restored automatically on the IO-Link device.
[Vendor ID]	ID of the manufacturer that is to be validated	0 ... 65535	Factory setting: 0 Rosemount: 38
[Device ID]	ID of the IO-Link device that is to be validated	0 ... 16777215	Factory setting: 0

3. Save changed values on the device.

6.4 IO-Link ports set fail-safe values

For the configuration mode "Independent" the user can set fail-safe values for the outputs of IO-Link ports X01...X04/X08. The fail-safe values will be activated in case of an interuption of the EtherNet/IP conection.

Procedure

1. To set the fail-safe values, select **[Port x]** menu (x = 1...4/8).
   a) The menu page shows the current settings.
2. Set the following parameters as required:

Table 6-4:

Name	Description	Possible values	
[Fail-safe digital out](1)	Fail-safe value of the output for operating	[Reset]	OFF
		[Old]	Old value

Table 6-4: ***(continued)***

Name	Description	Possible values	
	mode "Digital Output (DO)"	[Set]	ON
[Fail-safe IO-Link](2)	Fail-safe value of the output for operating mode "IO-Link"	[Off]	No fail-safe
		[Reset]	Fail-safe: OFF
		[Old]	Fail-safe: old value
		[Pattern]	Fail-safe: byte pattern

(1) Parameter only changeable if the connection to the EtherNet/IP controller is closed
(2) Parameter only changeable if the connection to the EtherNet/IP controller is closed

3. Save changed values on the device.

6.5 Info: show device information

Procedure

To read the general information of the Rosemount IO-Link Master, select **[Port] x menu** (x = 1...4/8).

a) The menu page shows the current settings.

Table 6-5:

Name	Description	Possible values
[Product code]	Article number of the IO-Link master	FB-5204 or FB-5208
[Device family]	Device family of the IO-Link master	IO-Link master
Vendor]	Vendor	Rosemount
[SW-Revision]	Firmware of the IO-Link master	
[HW revision]	Hardware version of the IO-Link master	
[Bootloader revision]	Bootloader version of the IO-Link master	
[Serial number]	Serial number	

6.6 Firmware: reset device to factory settings

When the IO-Link master is reset, all parameters are set to the factory settings: To reset the device to factory settings:

Procedure

1. Select **[Firmware]** menu.
    a) The menu page shows the current settings.
2. Click on **[Factory Reset]** to reset the device.

6.7 Firmware: reboot the device

When rebooting the device, all settings are kept. To restart the FB-510X:

Procedure

1. Select **[Firmware]** menu.
    a) The menu page shows the current settings.
2. Click on [Reboot] to reboot the device.

6.8 Configure IO-Link devices

To configure IO-Link devices connected to the Rosemount IO-Link parameter setting software:

Requirements

- IO-Link master is correctly installed and connected to the Rosemount IO-Link Software.
- The IO-Link device is correctly connected to the FB-520X.
- Operating mode of the IO-Link port is "IO-Link" (see IO-Link ports configure operating mode).
- IoT has write access rights to the IO-Link master (see IoT: Configure access rights).

Procedure

1. Select IO-Link master.
    a) Start Rosemount IO-Link Software.
    b) Import IODD file of the IO-Link device
2. Add IO-Link device.
    a) Under [ONLINE]: Click on the required IO-Link master. Rosemount IO-Link Software automatically detects the IO-Link devices connected to the IO-Link master.
3. Configure IO-Link device.

a) Mouse click on the port to which the IO-Link device is connected. Rosemount IO-Link Software reads and shows the current parameter values of the IO-Link device.

b) Configure IO-Link device.

Note
For information about the available parameters of the IO-Link device, see IO Device Description (IODD) of the IO-Link device.

c) Save the changed configuration on the IO-Link device.

6.9 EtherNet/IP: programmers notes

The programmer can access the following data from the PLC application:

- Read cyclic input and output data of the IO-Link devices
- Read diagnostic and status information
- Change parameters of the IO-Link port of the FB-520X
- Read and change parameters of the connected IO-Link devices

The following sections show the available options.

Supported EtherNet/IP configuration modes

The FB-520X supports the following EtherNet/IP configuration modes.

Top down

- Configuration of the EtherNet/IP slave with the EtherNet/IP projection software (Configuration Assembly)
- EtherNet/IP PLC transmits the created configuration to the EtherNet/IP slave, where it is stored

Independent

- Configuration of the EtherNet/IP slave with IoT core
- Confiuration Assembly in EtherNet/IP project is not evaluated

Use acyclic services

The FB-520X offers the following options to execute acyclic commands.

Command channels in cyclic process data

Within the cyclic input and output data, special areas are available for the acyclic data transmission. Both read and write access can be implemented via the areas.

Principle of the command channels

General process of an acyclic communcation:

1. Write command request: In the request channel, write requested command data (without [Trigger] bit).

2. Set [Trigger] = 1. Change of [Trigger] = 1 indicates a new command. In the response channel: all bytes are set to 0.
3. Command processing is started.
4. Check status: In the response channel, check [Handshake] bit. If [Handshake] is greater or less than 0: command processing completed, continue with the next step. If [Handshake] equals 0: command is processed, repeat this step.
5. Read command response: In the response channel, read responsed user data. In the request channel: set [Trigger] = 0.

Acyclic port commands

For the configuration of the IO-Link ports for acyclic access, the following commands are available.

Table 6-6:

Command	Description	Reference
Set mode	Set the operating type of the IO-Link port	See Command 0x10 – Set mode
Set Validation ID / Data Storage	Adjust the supported IO-Link standard and the behaviour of the IO-Link master when connecting a new IO-Link device to the IO-Link port	See Command 0x20 – Set validation ID / data storage
Set fail-safe data pattern	Behaviour of the outputs when the EtherNet/IP connection is interrupted and setting of the corresponding fail-safe values	See Command 0x30 – Set fail-safe data pattern

The port commands use the same mechanisms as the acyclic command channel (see Acyclic commands).

7 Operation

7.1 Web interface: read device and diagnostic information

In order to read the diagnostic information about the current device status via the web interface, perform the following steps.

1. Connect laptop/PC and FB-520X via the Ethernet internet.
2. Start web browser.
3. Enter the IP address of the FB-520X into the address field of the browser and select **ENTER** to confirm.
4. Web browser shows the web interface of the device. The page shows the following date tables.

Table 7-1: Connected IO-Link Devices

Name	Description
Port	Number of the IO-Link interface
Mode	Operating mode of the IO-Link interface
Comm. Mode	Baud rate of the IO-Link interface
MasterCycle Time	Cycle time
Vendor ID	ID of the manufacturer of the IO-Link device
Device ID	ID of the IO-Link device
Name	Article number of the IO-Link device
Serial	Serial number of the IO-Link device

Table 7-2: Diagnostic Information of the Device

Name	Description
SW-Version	
Current	Current (in mA)
Voltage	Current (in mA)
Short Circuit	1: Short circuit conditions detected 0: Device is functioning properly
Overload	1: Overload conditions detected 0: Device is functioning properly
Undervoltage	1: Undervoltage conditions detected 0: Device is functioning properly

Table 7-2: Diagnostic Information of the Device *(continued)*

Name	Description
Temperature	Device temperature (in °C)

Table 7-3: Version Information of the Installed Firmware Components

Name	Description
Firmware	Firmware version
Container	Version of the firmware container
Bootloader Version	Version of the boot loader
Fieldbus Firmware	Version of the EtherNet/IP firmware

7.2 Replace IO-Link device

Prerequisites

To replace an IO-Link device:

- IO-Link device is with factory settings.
- IO-Link device supports IO-Link standard 1.1 or higher.

Procedure

1. Set data storage.
   a) Set the following parameters of the IO-Link port: Validation and Data Storage: Type compatible V1.1 device with Restore
2. Save changes.
3. Replace IO-Link device.
   a) Disconnect old IO-Link device from IO-Link master.
   b) Connect new IO-Link device with the same IO-Link port of the FB-520X. IO-Link master copies parameter values from the data memory to the new IO-Link device.

8 Maintenance

The operation of the unit is maintenance-free.

Procedure

1. Clean the surface of the unit when necessary. Do not use any caustic cleaning agents.
2. After use, dispose of the unit in an environmentally friendly way in accordance with the applicable national regulations.

9 Factory settings

In the factory settings, the device has the following parameter settings.

Parameters	Factory setting
IP address	192.168.1.250
Subnet mask	255.255.255.0
IP gateway address	0.0.0.0
Host name	Blank
Data memory	Blank

10 Reference Data

10.1 Technical data

Application

Application	
Application	Hygienic systems; I/O modules for field applications
Daily-chain function	Fieldbus interface

Electrical data

Electrical Data	
Operating voltage [V]	20…28 DC; (US; to SELV/PELV)
Current Consumption [mA]	300…3900; (US)
Protection class	III
Sensor supply US	
Max. current load total [A]	3.6

Input / outputs

Inputs / Outputs	
Total number of inputs and outputs	FB-5204: 8 FB-5208: 16

Inputs

Inputs	
Number of digital inputs	FB-5204: 8 (IO-Link Port Class A: 4 x 1) FB-5208: (IO-Link Port Class A: 8 x 2)
Switching level high [V]	11…28 DC
Switching level low [V]	0…5 DC
Digital inputs protected against short circuits	Yes

Outputs

Outputs (digital)	
Output function	FB-5204: 8 (IO-Link Port Class A: 4 x 1) FB-5208: 16 (IO-Link Port Class A: 8 x 1)
Max. current load per output [mA]	200

Outputs (digital)	
Short-circuit protection	Yes

Interfaces

Interfaces	
Communication interface	IO-Link; TCP/IP; EtherNet/IP
Ethernet	
Transmission standard	10Base-T; 100Base-TX
Transmission rate	10; 100
Protocol	TCP/IP; EtherNet/IP
Factory settings	• IP address: 192.168.1.250 • Subnet mask: 255.255.255.0 • Gateway IP address: 0.0.0.0 • MAC address: see type label
IO-Link Master	
Transmission type	COM 1 / COM 2 / COM 3
IO-Link revision	V1.1
Number of ports class A	FB-5204: 4 FB-5208: 8

Operating conditions

Operating Conditions	
Applications	Indoor use
Ambient temperature	-13 - 140 °F (-25 - 60 °C)
Storage temperature	-13 - 185 °F (-25 - 85 °C)
Max. perm. relative air humidity [%]	90
Max. height above sea level [m]	2000
Protection rating	IP 65; IP 66; IP 67; IP 69K (unused ports need to be properly sealed to maintain IP69K ratings)
Pollution Degree	2

Approvals / tests

Approvals / Tests	
EMC	• EN 61000-6-2 • EN 61000-6-4

Mechanical data

Mechanical Data	
Weight	FB-5204: 0.6 lbs. (272.8 g) FB-5208: 0.8 lbs (385 g)
Materials	Housing: PA grey; socket: stainless steel (1.4404 / 316L)

Electrical connection

Voltage Supply IN X31		
Connector	M12	
Wiring		1. + 24 V DC (US) 2. - 3. GND (US) 4. -
Ethernet IN / OUT x21, X22		
Connector	M12	
Wiring		1. TX + 2. RX + 3. RX - 4. TX -
Process connection IO-Link Ports Class A X01...X04/X08		
Connector	M12	
Wiring		1. + 24 V DC (US) 2. DI 3. GND (US) 4. C/Q IO-Link 5. -

10.2 EtherNet/IP

Supported connection types

Table 10-1:

Name	Configuration Assembly	Input Assembly - Instance	Output Assembly - Instance
Exclusive Owner IO-Acyc-Diag	199	100	150

Table 10-1: ***(continued)***

Name	Configuration Assembly	Input Assembly - Instance	Output Assembly - Instance
Exclusive Owner IO-Acyc	199	101	150
Exclusive Owner IO	199	102	151
Input only	199	100	
Listen only	199	100	

10.2.1 Parameter data

Configuration assembly (Instance 199)

Note
Ports X05…X08 are only available on FB-5208.

Table 10-2:

Bytes	Contents
0	Access Rights
1	Process Data Length
2…13	Port X01: Port configuration (see Mapping: port configuration)
14…25	Port X02: Port configuration (see Mapping: port configuration)
26…37	Port X03: Port configuration (see Mapping: port configuration)
38…49	Port X04: Port configuration (see Mapping: port configuration)
50…61	Port X05: Port configuration (see Mapping: port configuration)
62…73	Port X06: Port configuration (see Mapping: port configuration)
74…85	Port X07: Port configuration (see Mapping: port configuration)
86…97	Port X08: Port configuration (see Mapping: port configuration)

Legend:

• Access Rights	Access rights to parameter, process data and events / diagnostics data of the IO-Link master and the connected IO-Link devices	1 Byte	0x00	EtherNet/IP + IoT
			0x01	EtherNet/IP + IoT (ro)
			0x02	EtherNet/IP only
			0x03	Keep setting (default)

• Process Data Length	Length of the process input data and process output data	1 Byte	0x00	2 Bytes Input / 2 Bytes Output Data • Input Assembly: 206 Bytes • Output Assembly: 62 Bytes
			0x01	4 Bytes Input / 4 Bytes Output Data • Input Assembly: 222 Bytes • Output Assembly: 78 Bytes
			0x02	8 Bytes Input / 8 Bytes Output Data • Input Assembly: 254 Bytes • Output Assembly: 110 Bytes
			0x03	16 Bytes Input / 16 Bytes Output Data • Input Assembly: 318 Bytes • Output Assembly: 174 Bytes
			0x04	32 Bytes Input / 32 Bytes Output Data • Input Assembly: 446 Bytes • Output Assembly: 302 Bytes

Mapping: port configuration

Byte
Port Mode

Byte
Master Cycle Time
Byte Swap
Validation ID
Vendor ID (MSB)
Vendor ID (LSB)
Device ID (MSB)
Device ID
Device ID (LSB)
reserved
Failsafe Mode -- IO-Link
Failsafe Mode -- Pin 4 (DO)

Legend:

Port Mode		1 byte	0x00	Interface deactivated
			0x01	Operation as digital input (DI)
			0x02	Operation as digital output (DO)
			0x03	Operation as IO-Link port
Master Cycle Time	Cycle time of the data transmission between the IO-Link master and the IO-Link device	1 byte	0x00	As fast as possible
			0x01	2 milliseconds
			0x02	4 milliseconds
			0x03	8 milliseconds
			0x04	16 milliseconds
			0x05	32 milliseconds
			0x06	64 milliseconds
			0x07	128 milliseconds
Byte Swap	Visualisation of the process data (EtherNet/IP uses Little Endian Format (Intel), IO-Link uses Big Endian Format (Motorola))	1 byte	0x00	Byte swapping for IO-Link process data deactivated
			0x01	Byte swapping for IO-Link process data activated
Validation ID	Supported IO-Link standard and behaviour of the IO-Link master when connecting new IO-	1 byte	0x00	No validation
			0x01	V1.0 device
			0x02	V1.1 device

	Link devices to the IO-Link port		0x03	V1.1 device with Backup + Restore
			0x04	V1.1 device with Backup
Vendor ID	Vendor ID of the manufacturer of the device on the IO-Link port	2 bytes	pro Byte: 0x00...0xFF	
Device ID	Device ID of the device on the IO-Link port	3 bytes	pro Byte: 0x00...0xFF	
[Failsafe Mode --IO-Link IO-Link]	Fail-safe mode for output data when the EtherNet/IP connection is interrupted	1 byte	0x00	No Failsafe
			0x01	Failsafe Reset Value
			0x02	Failsafe Old Value
			0x03	Failsafe with Pattern
[Failsafe Mode --Pin 4 (DO)]	Fail-safe value for the operating mode "digital output (DO)"	1 byte	0x00	Failsafe Reset Value
			0x01	Failsafe Old Value
			0x02	Failsafe Set Value

10.3 Cyclic data: FB-5204

Input assembly (Instance 100): I/O data + acyclic data + diagnosis data (FB-5204)

Byte	Content
0...1	Port X01...X04: Digital input - pin 2 / 4 (DI) (see Mapping: digital input data (DI))
2...3	Status information (see Mapping: Status information)
4...45	Acyclic command area: Response channel (see Response channel)
46...47	Port X01: PQI (see Mapping: PQI)
48...63	Port X01: Diagnostic, vendor ID, device ID, events (see Mapping: IO-Link port information)
64...65	Port X02: PQI (see Mapping: PQI)
66...81	Port X02: Diagnostic, vendor ID, device ID, results (see Mapping: IO-Link port information)
82...83	Port X03: PQI (see Mapping: PQI)
84...99	Port X03: Diagnostic, vendor ID, device ID, events (see Mapping: IO-Link port information)
100...101	Port X04: PQI (see Mapping: PQI)
102...117	Port X04: Diagnostic, vendor ID, device ID, events (see Mapping: IO-Link port information)
118	Port X01: Input data IO-Link (n bytes)

Byte	Content
118+n	Port X02: Input data IO-Link (n bytes)
118+2n	Port X03: Input data IO-Link (n bytes)
118+3n	Port X04: Input data IO-Link (n bytes)

Legend: n = [2,4,8,16,32]; is determined by the parameter Process_Data_Length. See Configuration Assembly (Instance 199).

Input Assembly (Instance 101): I/O data + acyclic data (FB-5204)

Table 10-3:

Byte	Content
0…1	Port X01…X04: Digital Input pin 2 / 4 (DI) (see Mapping: digital input data (DI))
2…3	Status information (see Mapping: Status information)
4…45	Acyclic command area: Response channel (see Response channel)
46…47	Port X01: PQI (see Mapping: PQI)
48…49	Port X02: PQI (see Mapping: PQI)
50…51	Port X03: PQI (see Mapping: PQI)
52…53	Port X04: PQI (see Mapping: PQI)
54	Port X01: Input data IO-Link (n bytes)
54+n	Port X02: Input data IO-Link (n bytes)
54+2n	Port X03: Input data IO-Link (n bytes)
54+3n	Port X04: Input data IO-Link (n bytes)

Legend: n = [2,4,8,16,32]; is determined by the parameter [Process Data Length]. See Configuration Assembly (Instance 199).

Input Assembly (Instance 102): I/O data (FB-5204)

Table 10-4:

Byte	Content
0…1	Port X01…X04: Digital Input pin 2 / 4 (DI) (see Mapping: digital input data (DI))
2…3	Status information (see Mapping: Status information)
4…5	Port X01: PQI (see Mapping: PQI)
6…7	Port X02: PQI (see Mapping: PQI)
8…9	Port X03: PQI (see Mapping: PQI)
10…11	Port X04: PQI (see Mapping: PQI)
12	Port X01: Input data IO-Link (n bytes)

Table 10-4: *(continued)*

Byte	Content
12+n	Port X02: Input data IO-Link (n bytes)
12+2n	Port X03: Input data IO-Link (n bytes)
12+3n	Port X04: Input data IO-Link (n bytes)

Legend: n = [2,4,8,16,32]; is determined by the parameter [Process Data Length]. See Configuration Assembly (Instance 199).

Mapping: digital input data (DI) (FB-5204)

Table 10-5:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved	Reserved	Reserved	Reserved	X04: pin 4	X03: pin 4	X02: pin 4	X01: pin 4
Reserved	Reserved	Reserved	Reserved	X04: pin 2	X03: pin 2	X02: pin 2	X01: pin 2

Legend:

• [pin 4]	Signal level on pin 4 of the IO-Link port	1 bit	0x0	LOW
			0x1	HIGH
• [pin 2]	Signal level on pin 2 of the IO-Link port	1 bit	0x0	LOW
			0x1	HIGH

Mapping: Status information (FB-5204)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved	Reserved	Reserved	Reserved	X04: Short / OL	X03: Short / OL	X02: Short / OL	X01: Short / OL
Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Sensor PWR	AUX PWR

Legend:

• [Short / OL]	Occurrence of a short circuit or of an overvoltage on	1 bit	0x0	no error
			0x1	short circuit or overvoltage detected
• [Sensor PWR]	Status of the supply voltage US	1 bit	0x0	US not available
			0x1	US available
• [AUX PWR]	Status of the supply voltage UA	1 bit		AUX PWR not available on FB-520X

AUX PWR not available on FB-520X

Mapping: PQI (FB-5204)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved	Wrong PD Output Length	Wrong PD Input Length	Wrong Cycle Time	Wrong VID / DID	Invalid Data Bit	Device Conn	IOL Mode
Reserved							

Legend:

- [IOL Mode] Operating mode of the IO-Link port — 1 bit — 0x0: Else; 0x1: IO-Link
- [Dev Conn] Connection between IO-Link Device and IO-Link port — 1 bit — 0x0: Not connected; 0x1: Connected
- [Invalid Data] Status of the process input data on the IO-Link port — 1 bit — 0x0: Valid data; 0x1: Invalid data
- [Wrong VID/ DID] Evaluation, whether actual and projected Vendor ID and Device ID match — 1 bit — 0x0: OK; 0x1: Wrong VID and/or DID
- [Wrong Cycle Time] Evaluation, whether actual and projected cycle time match — 1 bit — 0x0: OK; 0x1: Wrong cycle time
- [Wrong Length PD IN] Evaluation, whether actual and projected input process data length match — 1 bit — 0x0: OK; 0x1: Projected length too small
- [Wrong Length PD OUT] Evaluation, whether actal and projected output process data length match — 1 bit — 0x0: OK; 0x1: Projected length too small

Mapping: IO-Link port information (FB-5204)

Table 10-6:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
VID (LSB)							

Table 10-6: ***(continued)***

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
VID (MSB)							
DID (LSB)							
DID							
DID (MSB)							
Reserved							
Event 1: Mode		Event 1: Type		Event 1: Src	Event 1: Instance		
Event 1: Code (LSB)							
Event 1: Code (MSB)							
Event 2: Mode		Event 2: Type		Event 2: Src	Event 2: Instance		
Event 2: Code (LSB)							
Event 2: Code (MSB)							
Event 3: Mode		Event 3: Type		Event 3: Src	Event 3: Instance		
Event 3: Code (LSB)							
Event 3: Code (MSB)							
Reserved							

Legend:

- [VID] — Vendor ID of the connected IO-Link device
  VID = 0x1234
  - DID (MSB) = 0x12
  - DID (LSB) = 0x34

  2 byte — Pro byte: 0x00…0xFF
- [DID] — Device ID of the connected IO-Link device
  VID = 0x1234
  - DID (MSB) = 0x12
  - DID = 0x34
  - DID (LSB) = 0x56

  3 byte — Pro byte: 0x00…0xFF
- [Event m: Mode] — Mode: Events mode — 2 bit
  - 0x0 — Reserved
  - 0x1 — Single-shot event

			0x2	Disappearing event
			0x3	Appearing event
• [Event m: Type]	Type: Event category	2 bit	0x0	Reserved
			0x1	Notification
			0x2	Warning
			0x3	Error
• [Event m: Src]	Source: Events source	1 bit	0x0	IO-Link Device
			0x1	IO-Link Master
• [Event m: instance]	Type: Event instance	3 bit	0x0	Unknown
			0x1…0x3	Reserved
			0x4	Application
			0x5…0x7	Reserved
• [Event m: Code]	Code: event code; device dependent Code = 0x1234 • Code (MSB) = 0x12 • Code (LSB) = 0x34	2 byte	depends on device (refer to IODD instructions of the IO-Link device)	

Output assembly (Instance 150): I/O data + acyclic data (FB-5204)

Byte	Content
0	Port X01…X04: Digital output - pin 4 (DO) (see Mapping: Digital output data (DO))
1	Reserved
2	Reserved
3	Reserved
4…45	Acyclic command area: Request channel (see Request channel)
46	Port X01: Output data IO-Link (n bytes)
46+n	Port X02: Output data IO-Link (n bytes)
46+2n	Port X03: Output data IO-Link (n bytes)
46+3n	Port X04: Output data IO-Link (n bytes)

Legend: n = [2,4,8,16,32]; is determined by the parameter [Process_Data_Length]. See Configuration Assembly (Instance 199).

Output Assembly (Instance 151): I/O data (FB-5204)

Byte	Content
0	Port X01...X04: Digital output - pin 4 (DO) (see Mapping: Digital output data (DO))
1	Reserved
2	Port X01: Output data IO-Link (n bytes)
2+n	Port X02: Output data IO-Link (n bytes)
2+2n	Port X03: Output data IO-Link (n bytes)
2+3n	Port X04: Output data IO-Link (n bytes)

Legend: n = [2,4,8,16,32]; is determined by the parameter [Process_Data_Length]. See Configuration Assembly (Instance 199).

Mapping: Digital output data (DO) (FB-5204)

Table 10-7:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved	Reserved	Reserved	Reserved	X04: pin 4	X03: pin 4	X02: pin 4	X01: pin 4

Legend:

• [pin 4]	Signal level on pin 4 of the IO-Link port	1 bit	0x0	LOW
			0x1	HIGH

10.4 Cyclic data: FB-5208

Input assembly (Instance 100): I/O data + acyclic data + diagnosis data (FB-5208)

Byte	Content
0...1	Port X01...X08: Digital input - pin 2 / 4 (DI) (see Mapping: digital input data (DI))
2...3	Status information (see Mapping: Status information)
4...45	Acyclic command area: Response channel (see Response channel)
46...47	Port X01: PQI (see Mapping: PQI)
48...63	Port X01: Diagnostic, vendor ID, device ID, events (see Mapping: IO-Link port information)
64...65	Port X02: PQI (see Mapping: PQI)
66...81	Port X02: Diagnostic, vendor ID, device ID, results (see Mapping: IO-Link port information)
82...83	Port X03: PQI (see Mapping: PQI)

Byte	Content
84…99	Port X03: Diagnostic, vendor ID, device ID, events (see Mapping: IO-Link port information)
100…101	Port X04: PQI (see Mapping: PQI)
102…117	Port X04: Diagnostic, vendor ID, device ID, events (see Mapping: IO-Link port information)
118…119	Port X05: PQI (see Mapping: PQI)
120…135	Port X05: Diagnostic, vendor ID, device ID, events (see Mapping: IO-Link port information)
136…137	Port X06: PQI (see Mapping: PQI)
138…153	Port X06: Diagnostic, vendor ID, device ID, events (see Mapping: IO-Link port information)
154…155	Port X07: PQI (see Mapping: PQI)
156…171	Port X07: Diagnostic, vendor ID, device ID, events (see Mapping: IO-Link port information)
172…173	Port X08: PQI (see Mapping: PQI)
174…189	Port X08: Diagnostic, vendor ID, device ID, events (see Mapping: IO-Link port information)
190	Port X01: Input data IO-Link (n bytes)
190+n	Port X02: Input data IO-Link (n bytes)
190+2n	Port X03: Input data IO-Link (n bytes)
190+3n	Port X04: Input data IO-Link (n bytes)
190+4n	Port X05: Input data IO-Link (n bytes)
190+5n	Port X06: Input data IO-Link (n bytes)
190+6n	Port X07: Input data IO-Link (n bytes)
190+7n	Port X08: Input data IO-Link (n bytes)

Legend: n = [2,4,8,16,32]; is determined by the parameter **Process_Data_Length.** See Configuration Assembly (Instance 199).

Input Assembly (Instance 101): I/O data + acyclic data (FB-5208)

Table 10-8:

Byte	Content
0…1	Port X01…X08: Digital Input pin 2 / 4 (DI) (see Mapping: digital input data (DI))
2…3	Status information (see Mapping: Status information)
4…45	Acyclic command area: Response channel (see Response channel)
46…47	Port X01: PQI (see Mapping: PQI)
48…49	Port X02: PQI (see Mapping: PQI)

Table 10-8: *(continued)*

Byte	Content
50…51	Port X03: PQI (see Mapping: PQI)
52…53	Port X04: PQI (see Mapping: PQI)
54…55	Port X05: PQI (see Mapping: PQI)
56…57	Port X06: PQI (see Mapping: PQI)
58…59	Port X07: PQI (see Mapping: PQI)
60…61	Port X08: PQI (see Mapping: PQI)
62	Port X01: Input data IO-Link (n bytes)
62+n	Port X02: Input data IO-Link (n bytes)
62+2n	Port X03: Input data IO-Link (n bytes)
62+3n	Port X04: Input data IO-Link (n bytes)
62+4n	Port X05: Input data IO-Link (n bytes)
62+5n	Port X06: Input data IO-Link (n bytes)
62+6n	Port X07: Input data IO-Link (n bytes)
62+7n	Port X08: Input data IO-Link (n bytes)

Legend: n = [2,4,8,16,32]; is determined by the parameter [Process Data Length]. See Configuration Assembly (Instance 199).

Input Assembly (Instance 102): I/O data (FB-5208)

Table 10-9:

Byte	Content
0…1	Port X01…X08: Digital Input pin 2 / 4 (DI) (see Mapping: digital input data (DI))
2…3	Status information (see Mapping: Status information)
4…5	Port X01: PQI (see Mapping: PQI)
6…7	Port X02: PQI (see Mapping: PQI)
8…9	Port X03: PQI (see Mapping: PQI)
10…11	Port X04: PQI (see Mapping: PQI)
12…13	Port X05: PQI (see Mapping: PQI)
14…15	Port X06: PQI (see Mapping: PQI)
16…17	Port X07: PQI (see Mapping: PQI)
18…19	Port X08: PQI (see Mapping: PQI)
20	Port X01: cyclic input data (n bytes)
20+n	Port X02: cyclic input data (n bytes)
20+2n	Port X03: cyclic input data (n bytes)

Table 10-9: *(continued)*

Byte	Content
20+3n	Port X04: cyclic input data (n bytes)
20+4n	Port X05: cyclic input data (n bytes)
20+5n	Port X06: cyclic input data (n bytes)
20+6n	Port X07: cyclic input data (n bytes)
20+7n	Port X08: cyclic input data (n bytes)

Legend: n = [2,4,8,16,32]; is determined by the parameter [Process Data Length]. See Configuration Assembly (Instance 199).

Mapping: digital input data (DI) (FB-5208)

Table 10-10:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
X08: pin 4	X07: pin 4	X06: pin4	X05: pin 4	X04: pin 4	X03: pin 4	X02: pin 4	X01: pin 4
X08: pin 2	X05: pin 2	X06: pin 2	X05: pin 2	X04: pin 2	X03: pin 2	X02: pin 2	X01: pin 2

Legend:

• [pin 4]	Signal level on pin 4 of the IO-Link port	1 bit	0x0	LOW
			0x1	HIGH
• [pin 2]	Signal level on pin 2 of the IO-Link port	1 bit	0x0	LOW
			0x1	HIGH

Mapping: Status information (FB-5208)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
X08: Short / OL	X07: Short / OL	X06: Short / OL	X05: Short / OL	X04: Short / OL	X03: Short / OL	X02: Short / OL	X01: Short / OL
reserved	reserved	reserved	reserved	reserved	reserved	Sensor PWR	AUX PWR

Legend:

• [Short / OL]	Occurrence of a short circuit or of an overvoltage on the IO-Link port	1 bit	0x0	No error
			0x1	Short circuit or overvoltage detected
• [Sensor PWR]	Status of the supply voltage US	1 bit	0x0	US not available
			0x1	US available

• [AUX PWR]	Status of the supply voltage UA	1 bit		AUX PWR not available on FB-520X AUX PWR not available on FB-520X

Mapping: PQI (FB-5208)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved	Wrong PD Output Length	Wrong PD Input Length	Wrong Cycle Time	Wrong VID / DID	Invalid Data Bit	Device Conn	IOL Mode
Reserved							

Legend:

• [IOL Mode]	Operating mode of the IO-Link port	1 bit	0x0 0x1	Else IO-Link
• [Dev Conn]	Connection between IO-Link Device and IO-Link port	1 bit	0x0 0x1	Not connected Connected
• [Invalid Data]	Status of the process input data on the IO-Link port	1 bit	0x0 0x1	Valid data Invalid data
• [Wrong VID/ DID]	Evaluation, whether actual and projected Vendor ID and Device ID match	1 bit	0x0 0x1	OK Wrong VID and/or DID
• [Wrong Cycle Time]	Evaluation, whether actual and projected cycle time match	1 bit	0x0 0x1	OK Wrong cycle time
• [Wrong Length PD IN]	Evaluation, whether actual and projected input process data length match	1 bit	0x0 0x1	OK Projected length too small
• [Wrong Length PD OUT]	Evaluation, whether actal and projected output process data length match	1 bit	0x0 0x1	OK Projected length too small

Mapping: IO-Link port information (FB-5208)

Table 10-11:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
VID (LSB)							
VID (MSB)							
DID (LSB)							
DID							
DID (MSB)							
Reserved							
Event 1: Mode		Event 1: Type		Event 1: Src	Event 1: Instance		
Event 1: Code (LSB)							
Event 1: Code (MSB)							
Event 2: Mode		Event 2: Type		Event 2: Src	Event 2: Instance		
Event 2: Code (LSB)							
Event 2: Code (MSB)							
Event 3: Mode		Event 3: Type		Event 3: Src	Event 3: Instance		
Event 3: Code (LSB)							
Event 3: Code (MSB)							
Reserved							

Legend:

- [VID] Vendor ID of the connected IO-Link device
  VID = 0x1234
  - DID (MSB) = 0x12
  - DID (LSB) = 0x34

  2 byte

  Pro byte: 0x00…0xFF

• [DID]	Device ID of the connected IO-Link device VID = 0x1234 • DID (MSB) = 0x12 • DID = 0x34 • DID (LSB) = 0x56	3 byte	Pro byte: 0x00…0xFF	
• [Event m: Mode]	Mode: Events mode	2 bit	0x0	Reserved
			0x1	Single-shot event
			0x2	Disappearing event
			0x3	Appearing event
• [Event m: Type]	Type: Event category	2 bit	0x0	Reserved
			0x1	Notification
			0x2	Warning
			0x3	Error
• [Event m: Src]	Source: Events source	1 bit	0x0	IO-Link Device
			0x1	IO-Link Master
• [Event m: instance]	Type: Event instance	3 bit	0x0	Unknown
			0x1…0x3	Reserved
			0x4	Application
			0x5…0x7	Reserved
• [Event m: Code]	Code: event code; device dependent Code = 0x1234 • Code (MSB) = 0x12 • Code (LSB) = 0x34	2 byte	Depends on device (refer to IODD instructions of the IO-Link device)	

Output assembly (Instance 150): I/O data + acyclic data (FB-5208)

Byte	Content
0	Port X01…X08: Digital output - pin 4 (DO) (see Mapping: Digital output data (DO))
1	Reserved
2	Reserved

Byte	Content
3	Reserved
4...45	Acyclic command area: Request channel (see Request channel)
46	Port X01: Output data IO-Link (n bytes)
46+n	Port X02: Output data IO-Link (n bytes)
46+2n	Port X03: Output data IO-Link (n bytes)
46+3n	Port X04: Output data IO-Link (n bytes)
46+4n	Port X05: Output data IO-Link (n bytes)
46+5n	Port X06: Output data IO-Link (n bytes)
46+6n	Port X07: Output data IO-Link (n bytes)
46+7n	Port X08: Output data IO-Link (n bytes)

Legend: n = [2,4,8,16,32]; is determined by the parameter [Process_Data_Length]. See Configuration Assembly (Instance 199).

Output Assembly (Instance 151): I/O data (FB-5208)

Byte	Content
0	Port X01...X08: Digital output - pin 4 (DO) (see Mapping: Digital output data (DO))
1	Reserved
2	Port X01: Output data IO-Link (n bytes)
2+n	Port X02: Output data IO-Link (n bytes)
2+2n	Port X03: Output data IO-Link (n bytes)
2+3n	Port X04: Output data IO-Link (n bytes)
2+4n	Port X05: Output data IO-Link (n bytes)
2+5n	Port X06: Output data IO-Link (n bytes)
2+6n	Port X07: Output data IO-Link (n bytes)
2+7n	Port X08: Output data IO-Link (n bytes)

Legend: n = [2,4,8,16,32]; is determined by the parameter [Process_Data_Length]. See Configuration Assembly (Instance 199).

Mapping: Digital output data (DO) (FB-5208)

Table 10-12:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
X08: pin 4	X07: pin 4	X06: pin4	X05: pin 4	X04: pin 4	X03: pin 4	X02: pin 4	X01: pin 4

Legend:

• [pin 4]	Signal level on pin 4 of the IO-Link port	1 bit	0x0	LOW
			0x1	HIGH

10.5 Acyclic data

Acyclic command channel

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

Object	Contents	Bytes	Access
Output assembly	Request channel (field bus PLC >>> IO-Link master) see Request channel	4...45	R/W
Input assembly	Response channel (IO-Link master >>> fieldbus PLC) see Response channel	4...45	R

Legend:

R = only read access rights

R/W = read and write access rights

Request channel

Table 10-13:

Byte	Content	
4	Port No. (LSB)	
5	Port No. (MSB)	
6	Index (LSB)	
7	Index (MSB)	
8	Sub-index (LSB)	
9	Sub-index (MSB)	
10	Trigger	Command ID
11	Length of the user data (number of bytes)	
12	Data (byte 0)	
13	Data (byte 1)	
..	...	
43	Data (byte 31)	
44	Reserved	
45	Reserved	

Legend:

• [Port No.]	Number of the IO-Link port Port No. = 0x1234 • Port No. (MSB) = 0x12 • Port No. (LSB) = 0x34	8 Bit	0x01 0x02 ... 0x04/0x08	Port X01 Port X02 Port X04/X08
• [Index]	Index of the IO-Link port Index No. = 0x1234 • Index (MSB) = 0x12 • Index (LSB) = 0x34	8 Bit		
• [Subindex]	Subindex of the IO-Link port Subindex No. = 0x1234 • Subindex (MSB) = 0x12 • Subindex (LSB) = 0x34	8 Bit		
• [Trigger]	Control of the command execution	1 Bit	0x0 0x1	Do not process command Execute command
• [Command ID]	Command number	7 bit	0x01 0x02	Read Write
• [Length of user data (number of bytes)]	Number of bytes that contain relevant user data	8 Bit	0x00 ... 0x20	0 bytes 32 bytes
• [Data (byte n)]	User data	8 Bit	Per byte: 0x00...0xFF	

Response channel

Table 10-14:

Byte	Content	
4	Port No. (LSB)	
5	Port No. (MSB)	
6	Index (LSB)	
7	Index (MSB)	
8	Sub-index (LSB)	
9	Sub-index (MSB)	
10	Handshake	Command
11	Result	

Table 10-14: *(continued)*

Byte	Content
12	Length of the user data (number of bytes)
13	Data (byte 0) or diagnostic data
14	Data (byte 1)
…	…
44	Data (byte 31)
45	Reserved

Legend:

• [Port No.]	Number of the IO-Link port Port No. = 0x1234 • Port No. (MSB) = 0x12 • Port No. (LSB) = 0x34	1 byte	0x01 0x02 … X04/0x08	Port X01 Port X02 Port X04/X08
• [Index]	Index of the IO-Link port Index No. = 0x1234 • Index (MSB) = 0x12 • Index (LSB) = 0x34	1 byte	Per byte: 0x00…0xFF	
• [Subindex]	Subindex of the IO-Link port Subindex No. = 0x1234 • Subindex (MSB) = 0x12 • Subindex (LSB) = 0x34	1 byte	Per byte: 0x00…0xFF	
• [Handshake]	Validity of the response data	1 Bit	0x0 0x1	Invalid data Valid data
• [Command ID]	Command number	7 bit	0x01 0x02	Read Write
• [Result]	Status of the command processing	1 byte	0x00 0x0F 0xFF	OK OK, data read >32 bytes Error occured
• [Length of the response data (number of bytes)]	Number of bytes that contain relevant userdata	1 byte	0x00 … 0x20	0 bytes 32 bytes
• [Data (byte 0) ordiagnostic data]	User data (byte 0) or error codes	1 byte	User data: 0x00…0xFF	

			Error codes: see Error codes
• [Data (byte n)]	User data	1 byte	Per byte: 0x00…0xFF

Error codes

Table 10-15:

Error Code	Description
0x71	Service not available (unknown command has been sent to the IO-Link port)
0x72	Port blocked (another cyclic process accesses the IO-Link port)
0x73	Forbidden (access right doesn't allow command)
0x74	Invalid data (wrong parameter has been sent in the command)
0x76	Wrong port (wrong port number)
0x77	Wrong port function (wrong port function or wrong parameter has been sent to the device)
0x78	Invalid length (set length is > 0x20)
0x80	Error in the device application (find additional error codes in the description of the IODD for the IO-Link Device)

10.5.1 Acyclic commands

Command 0x10 - Set Mode

The command changes the operating mode of an IO-Link port of the FB-520X.

Note
Corresponding parameter: [Port Mode] (see Mapping: Port configuration)

Command request

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
4	Port No. (LSB)							
5	Port No. (MSB)							
6	Reserved							
7	Reserved							
8	Reserved							
9	Reserved							
10	Trigger	0x10						
11	Target mode							
12…45	Reserved							

Legend:

• [Port No.]	Number of the IO-Link port Port No. = 0x1234 • Port No. (MSB) = 0x12 • Port No. (LSB) = 0x34	16 bit	0x01 0x02 ... 0x04/0x08	Port X01 Port X02 Port 0x04/X08
• [Trigger]	Control of the command execution	1 bit	0x0 0x1	Do not process command Execute command
• [Target mode]	Operating type of the IO-Link port	8 Bit	0x00 0x01 0x02 0x03	Deactivated Operation as digital input (DI) Operation as digital output (DO) Operation as IO-Link interface

Command response

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
4	Port No. (LSB)							
5	Port No. (MSB)							
6	Reserved							
7	Reserved							
8	Reserved							
9	Reserved							
10	Handshake	0x10						
11	Result							
12	Target mode							
13...45	Reserved							

Legend:

• [Port No.]	Number of the IO-Link port Port No. = 0x1234 • Port No. (MSB) = 0x12 • Port No. (LSB) = 0x34	2 byte	0x01 0x02 ... 0x04/0x08	Port X01 Port X02 Port 0x04/X08

• [Handshake]	Status of the execution of the command	1 Bit	0x0	Command is executed
			0x1	Execution of the command was successful
• [Result]	Error indication	1 byte	0x00	No error
			00x01	Error occured
• [Target mode]	Operating type of the IO-Link port	1 byte	0x00	Deactivated
			0x01	Operation as digital input (DI)
			0x02	Operation as digital output (DO)
			0x03	Operation as IO-Link intervals

Command 0x20 – Set validation ID / data storage

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

Note
Corresponding parameter: [Validation ID] (see Mapping: Port configuration).

Command request

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
4	Port No. (LSB)							
5	Port No. (MSB)							
6	Reserved							
7	Reserved							
8	Reserved							
9	Reserved							
10	Trigger	0x20						
11	Validation ID							
12...45	Reserved							

Legend:

• [Port No.]	Number of the IO-Link port Port No. = 0x1234	2 byte	0x01	Port X01
			0x02	Port X02

	• Port No. (MSB) = 0x12 • Port No. (LSB) = 0x34		... 0x04/0x08	Port 0x04/X08
• [Trigger]	Control of the command execution	1 bit	0x0	Do not process command
			0x1	Execute command
• [Validation ID]	Behavior of the IO-Link master when connecting an IO-Link device to the IO-Link port	1 byte	0x00	No check
			0x01	Type 1 compatible V1.0 device
			0x02	Type 1 compatible V1.0 device
			0x03	Type 1 compatible V1.0 device with Backup + Restore
			0x04	Type compatible V1.1 Device with Restore

Command response

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
4	Port No. (LSB)							
5	Port No. (MSB)							
6	Reserved							
7	Reserved							
8	Reserved							
9	Reserved							
10	Handshake	0x20						
11	Result							
12	Valiation ID							
13...45	Reserved							

Legend:

• [Port No.]	Number of the IO-Link port Port No. = 0x1234 • Port No. (MSB) = 0x12	2 byte	0x01 0x02 ...	Port X01 Port X02

	• Port No. (LSB) = 0x34		0x04/0x08	Port 0x04/X08
• [Handshake]	Status of the execution of the command	1 Bit	0x0	Command is executed
			0x1	Execution of the command was successful
• [Result]	Error indication	1 byte	0x00	No error
			00x01	Error occured
• [Validation ID]	Behavior of the IO-Link master when connecting an IO-Link device to the I0-Link port	1 byte	0x00	No check
			0x01	Type compatible V1.0 Device
			0x02	Type compatible V1.1 Device
			0x03	Type compatible V1.1 Device with Backup + Restore
			0x04	Type compatible V1.1 Device with Restore

Command 0x30 – Set fail-safe data pattern

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

Note
Corresponding parameter: [Fail-safe Mode] (see Mapping: Port configuration). The number of the required fail-safe values results from the size of the output data (see Configuration Assembly (Instance 199)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
4	Port No. (LSB)							
5	Port No. (MSB)							
6	Reserved							
7	Reserved							
8	Reserved							
9	Reserved							

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
10	Trigger	0x30						
11	Fail-safe mode							
12	Byte Length N							
13	Fail-safe data (byte 0)							
...								
44	Fail-safe data (byte 31)							
45	Reserved							

Legend:

- [Port No.] Number of the IO-Link port. 16 Bit.
  Port No. = 0x1234
  - Port No. (MSB) = 0x12
  - Port No. (LSB) = 0x34

  0x01 Port X01
  0x02 Port X02
  ...
  0x04/0x08 Port 0x04/X08
- [Trigger] Control command execution. 1 Bit.
  0x0 Do not process command
  0x1 Execute command
- [Fail-safe mode] Behavior of the outputs when the EtherNet/IP™ connection is interrupted and setting of the corresponding fail-safe values. 1 byte.
  0x00 No fail-safe
  00x01 Fail-safe reset value
  0x02 Fail-safe old value
  0x03 Fail-safe with pattern
- [Byte Length N] Number of the bytes that contain fail-safe values. 1 byte.
  0x00 32 bytes
  Per byte: 0x00...0xFF

Command response

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
4	Port No. (LSB)							
5	Port No. (MSB)							
6	Reserved							
7	Reserved							
8	Reserved							
9	Reserved							
10	Handshake	0x30						

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
11	Result							
12	Fail-safe mode							
13...45	Reserved							

Legend:

• [Port No.]	Number of the IO-Link port Port No. = 0x1234 • Port No. (MSB) = 0x12 • Port No. (LSB) = 0x34	2 byte	0x01 0x02 ... 0x04/0x08	Port X01 Port X02 Port 0x04/X08
• [Handshake]	Status of the execution of the command	1 Bit	0x0 0x1	Command is executed Execution of the command was successful
• [Result]	Error indication	1 byte	0x00 00x01	No error Error occured
• [Fail-safe mode]	Behavior of the outputs when the EtherNet/IP connection is interrupted	1 byte	0x00 0x01 0x02 0x03	No fail-safe Fail-safe reset value Fail-safe old value Fail-safe with pattern

10.6 Fieldbus objects

CIP class services

The device supports the following class and instance services:

Table 10-16:

Class Code		Service	Description
Dec	Hex		
01	01	Get Attribute All	Change all attribute values of the class or instance
02	02	Set Attribute All	Change all attribute values of the class or instance

Table 10-16: *(continued)*

Class Code		Service	Description
Dec	Hex		
05	05	Reset	Reset
09	09	Delete	Delete
14	0E	Get Attribute Single	Read single attribute value of the class or instance
16	10	Set Attribute Single	Change single attribute value of the class or instance
75	4B	Read ISDU	Read ISDU
76	4C	Write ISDU	Write ISDU
78	4E	Forward Close	Close connection
84	54	Forward Open	Open new connection

CIP object classes

Table 10-17:

Class Code		Object Type	Reference
Dec	Hex		
01	01	Identity Object	Identity Object (object class: 0x01)
02	02	Message Router Object	Message Router Object (object class: 0x02)
04	04	Assembly Object	Assembly Object (object class: 0x04)
06	06	Connection Manager Object	Connection Manager Object (object class: 0x06)
71	47	Device Level Ring Object	Device Level Ring Object (object class: 0x47)
72	48	Quality of Service	Quality of Service (object class: 0x48)
128	80	IO-Link Requests	IO-Link requests (object class: 0x80)
245	F5	TCP/IP Object	TCP/IP object (object class: 0xF5)
246	F6	Ethernet Link Object	Ethernet Link Object (object class: 0xF6)

Identity object (object class: 0x01)

The Identity Object contains the general information about the device.

Class attributes

Table 10-18:

Attr. ID	Access	Name	Data Type	Description	Value
1	Get	Revision	UINT	Revision of the object	1
2	Get	Max instance	UINT	Max. number of instances of the object	1
6	Get	Maximum ID number class attributes	UINT	ID of the last class attribute	7
7	Get	Maximum ID number instance attributes	UINT	ID of the last instance attribute	9

Instance attributes

Table 10-19:

Attr. ID	Access	Name	Data type	Description	Preset
1	Get	Vendor ID	UINT	Manufacturer ID	38
2	Get	Device type	UINT	Type of unit	12
3	Get	Product code	UINT	Identification of a particular product of a vendor	520X
4	Get	Revision	STRUCT	Revision of the article that is represented by the Identity Object	1.1
		• Major revision	USINT	Main revision (1...127)	1
		• Minor revision	USINT	Side revision (3 digits, if necessary with zeros in the beginning)	1
5	Get	Status	WORD	Status of the device	
6	Get	Serial number	UDINT	serial number of the device	
7	Get	Product name	SHORT STRING	Readable device designation (max. 32 ASCII characters)	Rosemount IO-Link Master
8	Get	State	USINT	Current status of the device (according to status transition diagram)	
				0 Nonexistent	
				1 Device self testing	
				2 Standby	
				3 Operational	
				4 Major recoverable fault	

Table 10-19: *(continued)*

Attr. ID	Access	Name	Data type	Description		Preset
				5	Major unrecoverable fault	
				6...254	Reserved	
				255	Default for Get_Attributes _All service	
9	Get	Configuration consistency value	UINT	The content shows the configuration of the device		0

Supported services

Table 10-20:

Service code		Name	Class	Attribute	Description
Dec	Hex				
01	01	Get_Attribute_All	Yes	Yes	Read all attributes
05	05	Reset	Yes	Yes	Reset
14	0E	Get_Attribute_Single	Yes	Yes	Read single attribute
16	10	Set_Attribute_Single	Yes	Yes	Change single attribute

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

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

Supported reset types:

- 0 Reboot the device (obligatory for all EtherNet/IP devices).
- 1 Restore factory settings and reboot the device.

Message router object (object class: 0x02)

The Message Router Object provides an access with which an EtherNet/IP client can address a service to any object class or instance in the physical device.

Class attributes

Table 10-21:

Attr. ID	Access	Name	Data Type	Description	Value
1	Get	Revision	UINT	Revision of the object	1

Table 10-21: *(continued)*

Attr. ID	Access	Name	Data Type	Description	Value
2	Get	Max instance	UINT	Max. number of instances of the object	1
3	Get	Number of instances	UINT	Number of instances	1
6	Get	Maximum ID number class attributes	UINT	ID of the last class attribute	7
7	Get	Maximum ID number instance attributes	UINT	ID of the last instance attribute	0

Instance attributes

The object has no instance attributes.

Supported services

Table 10-22:

Service code		Name	Class	Attribute	Description
Dec	Hex				
14	0E	Get_Attribute_Single	Yes	No	Read single attribute value

Assembly object (object class: 0x04)

The Assembly Object combines attributes of several objects to allow data to be sent to or received from each object via one connection.

Class attributes

Table 10-23:

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

Instance attributes

Table 10-24:

Attr. ID	Access	Name	Data type	Description	Preset
100	Get	Input assembly	STRUCT	Cyclic input data	--
101	Get	Input assembly	STRUCT	Cyclic input data	--

Table 10-24: *(continued)*

Attr. ID	Access	Name	Data type	Description	Preset
102	Get	Input assembly	STRUCT	Cyclic input data	--
150	Get, Set	Output assembly	STRUCT	Cyclic output data	--
151	Get, Set	Output assembly	STRUCT	Cyclic output data	--
199	Get, Set	Configuration assembly	STRUCT	Configuration data	--

Supported services

Table 10-25:

Service code		Name	Class	Attribute	Description
Dec	Hex				
14	0E	Get_Attribute_Single	Yes	Yes	Read attribute value
16	10	Set_Attribute_Single	No	Yes	Change attribute value

Connection manager object (object class: 0x06)

The Connection Manager Object structures and manages the internal resources that are used for the connection.

Class attributes

Table 10-26:

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

Instance attributes

The object has no instance attributes.

Supported services

Table 10-27:

Service code		Name	Class	Attribute	Description
Dec	Hex				
14	0E	Get_Attribute_Single	Yes	Yes	Read single attribute

Table 10-27: *(continued)*

Service code		Name	Class	Attribute	Description
Dec	Hex				
16	10	Set_Attribute_Single	No	Yes	Change single attribute
78	4E	Forward_Close	Yes	No	Close connection
84	54	Forward_Open	Yes	No	Open new connection

Device level ring object (object class: 0x47)

The Device Level Ring (DLR) Object represents the interface for configuration and status information.

Class attributes

Table 10-28:

Attr. ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	3
2	Get	Max instance	UINT	Max. number of instances of the object	1
6	Get	Maximum ID number class attributes	UINT	ID of the last class attribute	7
7	Get	Maximum ID number instance attributes	UINT	ID of the last instance attribute	12

Instance attributes

Table 10-29:

Attr. ID	Access	Name	Data type	Description		Preset
1	Get	Network topology	UINT	Current network topology		0
2	Get	Network status	UINT	Current network status		12
10	Get	Active supervisor	STRUCT of	Idnetification of the supervisort		1.1
			• UDINT	Main revision (1...127)		1
			USINT	Side revision (3 digits, if necessary with zeros in the beginning)		1
12	Get	Capability flags	DWORD	DLR functions of the device		0x82
				Bit 0	Announced-based ring node	0
				Bit 1	Beacon-based ring node	1

Table 10-29: *(continued)*

Attr. ID	Access	Name	Data type	Description		Preset
				Bit 2...4	Reserved	--
				Bit 5	Supervisor capable	0
				Bit 6	Redundant Gateway capable	0
				Bit 7	Flush_Table frame capable	1
				Bit 8	Reserved	--

Supported services

Table 10-30:

Service code		Name	Class	Attribute	Description
Dec	Hex				
1	01	Get_Attribute_All	No	Yes	Read all attribute values
14	0E	Get_Attribute_Single	Yes	Yes	Read single attribute value

Quality of service (object class: 0x48)

Quality of Service (QoS) enables prioritising of Ethernet frames. The priorities of the Ethernet frames can be influenced with the attributes "Differentiate Service Code Points" (DSCP) or "802.1Q Tag".

Class attributes

Table 10-31:

Attr. ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	3
2	Get	Max instance	UINT	Max. number of instances of the object	1
6	Get	Maximum ID number class attributes	UINT	ID of the last class attribute	7
7	Get	Maximum ID number instance attributes	UINT	ID of the last instance attribute	8

Instance attributes

Table 10-32:

Attr. ID	Access	Name	Data type	Description	Preset
1	Get	802.1Q tagRevision	USINT	Current network topology	0
2	Get, Set	DSCP PTP event	USINT	DSCP value for PTP event frames	59
3	Get, Set	DSCP PTP general	USINT	DSCP value for PTP general frames	47
4	Get, Set	DSCP PTP urgent	USINT	DSCP value for implicit messages with "urgent" priority	55
5	Get, Set	DSCP scheduled	USINT	DSCP value for implicit messages with "scheduled" priority	47
6	Get, Set	DSCP high	USINT	DSCP value for implicit messages with "high" priority	43
7	Get, Set	DSCP low	USINT	DSCP value for implicit messages with "high" priority	31
8	Get, Set	DSCP explicit	USINT	DSCP value for explicit messages with "scheduled" priority	27

Supported services

Table 10-33:

Service code		Name	Class	Attribute	Description
Dec	Hex				
01	01	Get_Attribute_All	Yes	Yes	Read all attribute values
14	0E	Get_Attribute_Single	No	Yes	Read single attribute value

IO-Link requests (object class: 0x80)

The manufacturer-specific object "IO-Link Requests" enables read and write access to the IO-Link objects of an IO-Link device connected to an FB-520X via ISDU (Index Service Data Unit). The object projects the mechanisms of the CIP addressing on the IO-Link protocol.

Class attributes

Table 10-34:

Attr. ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	4
2	Get	Max instance	UINT	Max. number of instances of the object	2
6	Get	Maximum ID number class attributes	UINT	Number of instances of the object	8

Instance attributes

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

Supported services

Table 10-35:

Service code		Name	Class	Attribute	Description
Dec	Hex				
75	4B	Read_ISDU	No	Yes	Read_ISDU
76	4C	Write_ISDU	No	Yes	Write_ISDU

Read_ISDU

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

Read request

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

Table 10-36:

CIP format	Data type	MSG Config	IO-Link mapping
Class ID	UINT	0x80	IO-Link acyclic access
Instance ID	UINT	0x01	IO-Link master
Attributes	USINT	0x01...0x04/0x08	Port number
Service code ID	UINT	0x4B	Read Request (ISDU_Read)
User specific service data	UINT	Index	IO-Link ISDU object index
	USINT	Subindex	IO-Link ISDU object sub-index

Read response - positive

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

Table 10-37:

CIP format	Data type	MSG Config	IO-Link mapping
Class ID	UINT	0x80	IO-Link acyclic access
Instance ID	UINT	0x01	IO-Link master
Attributes	USINT	0x01...0x04/0x08	Port number
Service code	USINT	0x4C	Read response
Error code	USINT	0x00	--
Extended error code	UINT	0x4C	--
User specific service data	UINT	e.g. 0xAB	Data (byte 0)
	USINT	e.g. 0xCD	Data (byte 1)
	...		...
	USINT	e.g. 0xEF	Data (byte n)

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

Read response - negative

If an error occurs while executing the service (Error Code < > 0), an extended error code is transmitted. The answer has the following format:

Table 10-38:

CIP format	Data type	MSG Config	IO-Link mapping
Class ID	UINT	0x80	IO-Link acyclic access
Instance ID	UINT	0x01	IO-Link master
Service code ID	USINT	0x4B	Read response
Attributes	USINT	0x01...0x04/0x08	Port number
Error code	USINT	< > 0x00	--
Extended error code	UINT	0x00	--
User specific service data	USINT		IO-Link error code (if error code = 0x1E)
	USINT		Additional code (if error code = 0x1E)

Error Code

Table 10-39:

Code	Description
0x02	Resource not available: The IO-Link port is busy processing another acyclic service.
0x05	Invalid class ID or instance ID

Table 10-39: *(continued)*

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

IO-Link error code

Table 10-40:

Code	Description
0x00	RESULT_SUCCESS
0x01	RESULT_STATE_CONFLICT
0x02	RESULT_NOT_SUPPORTED
0x03	RESULT_SERVICE_PENDING
0x04	RESULT_WRONG_PARAMETER
0x05	RESULT_NO_COMMUNICATION
0x06	RESULT_MIN_CYCLE_TIME
0x07	RESULT_NO_RESOURCES
0x08	RESULT_ABORT
0x1E	RESULT_UNKNOWN_COMMAND
0x1F	RESULT_NOT_CONNECTED
0x20	RESULT_NOT_ALLOWED
0x21	RESULT_WRONG_LENGTH
0x22	RESULT_WRONG_TYPE

Example:reading the parameter valuel of an IO-Link device

Task: reading the value of the parameter X of an IO-Link device

1. IO-Link device in the port: 0x02
2. Parameter X in the object directory of an IO-Link device: Index: 90, sub-index 3

From this, the following results for the configuration of the EtherNet/IP command Message (MSG):

Table 10-41:

CIP Format	Data Type	MSG Config	Description
Class ID	UINT	0x80	IO-Link acyclic access

Table 10-41: *(continued)*

CIP Format	Data Type	MSG Config	Description
Instance ID	UINT	0x01	IO-Link master
Attributes	USINT	0x02	Port number
Service code ID	USINT	0x4B	Service "ISDU_Read"
User specific service data	UINT	0x005A	IO-Link ISDU object index
	USINT	0x03	IO-Link ISDU object sub-index

After successful execution of the request, the response area has the following content:

Table 10-42:

CIP Format	Data Type	MSG Config	Description
Class ID	UINT	0x80	Object class "IO-Link Requests"
Instance ID	UINT	0x01	IO-Link master
Attributes	USINT	0x02	Port number
Service code ID	USINT	0x4B	Service "ISDU_Read"
Error code	USINT	0x00	Request processed successfully
Extended error code	USINT	0x00	--
User specific service data	USINT	e.g. 0x12	Parameter value that has been read (byte 0)
	USINT	e.g. 0x34	Parameter value that has been read (byte 1)

If an error occurs while the request is executed, the response area has the following content:

Table 10-43:

CIP Format	Data Type	MSG Config	Description
Class ID	UINT	0x80	Object class "IO-Link Requests"
Instance ID	UINT	0x01	IO-Link master
Attributes	USINT	0x02	Port number
Service code ID	USINT	0x4B	Service "ISDU_Read"
Error code	USINT	9x1E	Error code: Embedded service error
Extended error code	USINT	0x00	--
User specific service data	USINT	e.g. 0x04	IO-Link error code: wrong parameter

Table 10-43: *(continued)*

CIP Format	Data Type	MSG Config	Description
	USINT	e.g. 0x27	Additional code

Write_ISDU

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

Write request

Attribute determines the IO-Link port to which the IO-Link device is connected. The area "User Specific Service Data" contains the IO-Link index, the IO-Link sub-index of the IO-Link object whose value is to be changed. It is followed, bit by bit, by the value that is to be assigned to the parameter.

Table 10-44:

CIP Format	Data Type	MSG Config	Description
Class	UINT	0x80	IO-Link acyclic access
Instance	UINT	0x1	IO-Link master
Attribute	USINT	0x01...0x08	Port number
Service code ID	USINT	0x4C	Write Request (ISDU_Write)
User specific service data	UINT	Index	IO-Link ISDU object index
	USINT	Subindex	IO-Link ISDU object sub-index
	USINT	e.g. 0xAB	IO-Link ISDU data (byte 0)
	USINT	e.g. 0xBC	IO-Link ISDU data (byte 1)

Write response

Positive response

If the service has been executed successfully (Error Code = 0), the area "User Specific Data" stays empty The answer has the following format:

Table 10-45:

CIP Format	Data Type	MSG Config	Description
Class	UINT	0x80	IO-Link acyclic access
Instance	UINT	0x01	IO-Link master
Attribute	USINT	0x01...0x08	Port number
Service code ID	USINT	0x4C	Service "ISDU_Write"
Error code	USINT	0x00	--
Extended error code	USINT	0x00	--

Negative response

If an error occurs while executing the service (Error Code < > than 0), an extended error code is transmitted. The answer has the following format:

Table 10-46:

CIP Format	Data Type	MSG Config	Description
Class ID	UINT	0x80	IO-Link acyclic access
Instance ID	UINT	0x01	IO-Link master
Service code ID	USINT	0x4B	Read response
Attributes	USINT	0x01...0x08	Port number
Error code	USINT	< >0x00	--
Extended error code	USINT	0x00	--
User specific service data	USINT		IO-Link error code (if error code = 0x1E)
	USINT		Additional code (if error code = 0x1E)

Error code:

Table 10-47:

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

IO-Link error code:

Table 10-48:

Code	Description
0x00	RESULT_SUCCESS
0x01	RESULT_STATE_CONFLICT
0x02	RESULT_NOT_SUPPORTED
0x03	RESULT_SERVICE_PENDING
0x04	RESULT_WRONG_PARAMETER
0x05	RESULT_NO_COMMUNICATION
0x06	RESULT_MIN_CYCLE_TIME

Table 10-48: ***(continued)***

Code	Description
0x07	RESULT_NO_RESOURCES
0x08	RESULT_ABORT
0x1E	RESULT_UNKNOWN_COMMAND
0x1F	RESULT_NOT_CONNECTED
0x20	RESULT_NOT_ALLOWED
0x21	RESULT_WRONG_LENGTH
0x22	RESULT_WRONG_TYPE

Example: changing the parameter value of an IO-Link device

Task: changing the parameter X of an IO-Link device

1. IO-Link device in the port: 0x03
2. Parameter X in the object directory of an IO-Link device: Index: 91, sub-index 5
3. New parameter value: 0xABCD

From this, the following results for the configuration of the EtherNet/IP command Message (MSG).

Table 10-49:

CIP format	Data type	MSG Config	IO-Link mapping
Class ID	UINT	0x80	IO-Link acyclic access
Instance ID	UINT	0x01	IO-Link master
Attributes	USINT	0x03	Port number
Service code ID	USINT	0x4C	Service "ISDU_Write"
User specific service data	USINT	0x05B	IO-Link ISDU object index
	USINT	0x05	IO-Link ISDU object sub-index
	UINT	0xAB	New parameter value (MSB)
	UINT	0xCD	New parameter value (LSB)

After successful execution of the request, the response area has the following content.

Table 10-50:

CIP format	Data type	MSG Config	IO-Link mapping
Class ID	UINT	0x80	IO-Link acyclic access
Instance ID	UINT	0x01	IO-Link master
Attributes	USINT	0x3	Port number

Table 10-50: *(continued)*

CIP format	Data type	MSG Config	IO-Link mapping
Service code ID	USINT	0x4B	Service "ISDU_Write"
Error code	USINT	0x00	Request processed successfully
Extended error code	UINT	0x00	--

If an error occurs while the request is executed, the response area has the following content.

Table 10-51:

CIP format	Data type	MSG Config	IO-Link mapping
Class ID	UINT	0x80	IO-Link acyclic access
Instance ID	UINT	0x01	IO-Link master
Attributes	USINT	0x3	Port number
Service code ID	USINT	0x4B	Service "ISDU_Write"
Error code	USINT	0x00	Error code: Embedded Service Error
Extended error code	UINT	0x00	--
User specific service data	USINT	e.g. 0x04	IO-Link error code: wrong parameter
	USINT	e.g. 0x27	Additional code

10.7 TCP/IP object (object class 0xF5)

TCP/IP Interface Object enables the configuration of the physical network interface of the device.

Class attributes

Table 10-52:

Attr ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	4
2	Get	Max instance	UINT	Max. number of instances of the object	1

Instance attributes

Table 10-53:

Attr. ID	Access	Name	Data type	Description	Preset
1	Get	Status	DWORD	Status of the TCP/IP interface	

Table 10-53: ***(continued)***

Attr. ID	Access	Name	Data type	Description		Preset
				Bit 0...3	Configuration status of the interface	
				Bit 4	Mcast pending (always 0)	
				Bit 5	Interface configuration pending	
				Bit 6	ACD Status	
				Bit 7	ACD Fault	
				Bit 8...31	Reserved	
2	Get	Configuration compatibility	DWORD	Functions of the interface (flags)		0x95 (BOOTP, DHCP Client,TCP/IP configurable, ACD capable)
				Bit 0	BOOTP Client	
				Bit 1	Reserved	
				Bit 2	DHCP Client	
				Bit 3	Reserved	
				Bit 4	TCP/IP configurable via EtherNet/IP	
				Bit 5	Reserved	
				Bit 6	Reserved	
				Bit 7	ACD Capable	
				Bit 8...31	Reserved	
3	Get/set	Configuration control	DWORD	Interface control (control flags):		
				Bit 0...3	Start-up configuration	
					0	Static IP configuration
					1	Configuration via BOOTP
					2	Configuration via DHCP
				Bit 4	Reserved	
				Bit 5	Reserved	
4	Get	Physical Link Object path	STRUCT:	Logical path to the physical communication interface: the Ethernet Link object		
		• Path size	• UINT	Length (in Little Endian Format as WORD)		

Table 10-53: ***(continued)***

Attr. ID	Access	Name	Data type	Description	Preset
		• Path	• Padded EPATH	Path	20 F6 24 01
				Class ID = 0xF6 Ethernet Link Object	
				Instance ID = 1	
5	Get/set	Interface Configuration	STRUCT:	TCP/IP configuration	
		• IP address	• UDINT	IP adress	192.168.1.250
		• Network mask	• UDINT	Subnet mask	255.255.255.0
		• Gateway address	• UDINT	Default gateway address	0.0.0.0
		• Name server	• UDINT	1. Name Server	0.0.0.0
		• Name server 2	• UDINT	2. Name Server	0.0.0.0
		• Domain name	• STRING	Default domain name	0
6	Get/set	HOST NAME	STRING	Host name	0
				0 — No name configured	
8	Get	TTL value		TTL value	1
9	Get	Mcast Config			0
10	Get/set	SelectACD	BOOL	Activate ACD	1
				0 — Deactivate	
				1 — Activate	
11	Get/set	Last Conflict Detected	STRUCT:	Structure with information via the latest detected conflict	0
			• USINT	Condition of the ACD activity with the latest detected conflict	
				0 — Noconflictdetetcted	
				1 — Probelpv4Address	
				2 — OngoingDetection	

Table 10-53: *(continued)*

Attr. ID	Access	Name	Data type	Description	Preset
				3 SemiActive Probe	
			• ARRAY of 6 USINT	MAC address	
			• ARRAY of 28 USINT	Copy of the data of the ARP PDU in which the conflict was detected	
13	Get/set	Encapsulation Inactivity Timeout	UINT	Inactivity before the TCP connection is deactivated (in seconds)	120

Supported services

Table 10-54:

Service code		Name	Class	Attribute	Description
Dec	Hex				
01	01	Get_Attribute_All	No	Yes	Read all attributes
14	0E	Get_Attribute_Single	Yes	Yes	Read single attribute
16	10	Set_Attribute_Single	No	Yes	Change single attribute

10.8 Ethernet link object (object class: 0xF6)

The Ethernet Link Object contains status information of the Ethernet interface.

Class attributes

Table 10-55:

Attr ID	Access	Name	Data type	Description	Value
1	Get	Revision	UINT	Revision of the object	4
2	Get	Max instance	UINT	Max. number of instances of the object	2
3	Get	Number of instances	UINT	Number of instances of the object	2

Instance attributes

Table 10-56:

Attr. ID	Access	Name	Data type	Description		Preset
1	Get	Interface speed	UDINT	Current data rate (in bytes/s) 10 Mbps,100 Mbps.		100
2	Get	Interface Status Flags	DWORD	Status flag of the itnerface		0x20
				Bit 0	Link status	
				Bit 1	Half/full duplex	
				Bit 2...4	Auto negotiation status	
				Bit 5	Manual setting requires reset	
				Bit 6	Local hardware Fault	
				Bit 7...31	Reserved	
3	Get	Physical address	ARRAY of 6 USINTS	MAC address		
4	Get	Interface counters	STRUCT of 11 UDINTs	Interface control (control flags):		
5	Get	Physical Link Object path	STRUCT:	Medium-spedific counter		
6	Get,set	Interface Configuration	STRUCT of	Control bit: Bit 0: Auto negotiate Bit 1: Forced duplex mode (full 1, half 0)		0
			• WORD	Control bits of the interface		
				Bit 0	0 = auto-negotitation active	
					1 = auto-negotation inactive	
				Bit 1	0 = Half duplex	
					1 = Full duplex	
				Bit 2...15	Reserved	
			• UINT	Date rate of the interface		
				10	10 Mbps	
				100	100 Mpbs	

Table 10-56: ***(continued)***

Attr. ID	Access	Name	Data type	Description		Preset
7	Get	Interface type	USINT	Physical interface type		2
				0	Unknown	
				1	Internal interface	
				2	Twisted pair	
				3	Optical fibre	
				4...255	Reserved	
8	Get	Interface state	USINT	Current status of the interface		0
				0	Unknown	
				1	Active; ready for transmission and reception	
				2	Not active	
				3	Test mode	
				4...255	Reserved	
9	Get	Admin state	USINT	Control of the access to the interface		1
				0	Reserved	
				1	Activate interface	
				2	Deactivate interface	
				3...255	Reserved	
10	Get	Interface label	SHORT_STRING	Designation of the interface		"X21" (instance 1) "X22" (instance 2)
11	Get	Interface capability	STRUCT of	Capabilities of the interface		
			• DWORD	Transmission rate		
				10	10 Mbps	
				100	100 Mbps	

Table 10-56: *(continued)*

Attr. ID	Access	Name	Data type	Description		Preset
			• DWORD	2Duplex mode		
				HD	Half duplex	
				FD	Full duplex	
300	Get,set	MDIX	???	MDIX configuration		3
				0		
				1	MDI	
				2	MDIX	
				3	autoMDI	
				4...255	Reserved	

Supported services

Table 10-57:

Service code		Name	Class	Attribute	Description
Dec	Hex				
01	01	Get_Attribute_All	No	Yes	Read all attributes
14	0E	Get_Attribute_Single	Yes	Yes	Read single attribute value
16	10	Set_Attribute_Single	No	Yes	Change single attribute value

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