

WAGO I/O System Field

8-Port-IO-Link Master Class B; PROFINET; 24 V DC; 2.0 A;
8 × M12 Connection

765-4102/100-000



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Every conceivable measure has been taken to ensure the accuracy and completeness of this documentation. However, as errors can never be fully excluded, we always appreciate any information or suggestions for improving the documentation.

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1 Provisions

This document applies to the following product:

 **765-4102/100-000** (8PORT IOL-B FLD PN DC 24V 2.0A) 8-Port-IO-Link-Master Class B; PROFINET; DC 24 V; 2,0 A; 8 × M12-Anschluss

Product detail page

 www.wago.com/765-4102/100-000

The product must only be installed and operated in accordance with the operating instructions. Knowledge of the operating instructions is required for proper use. You can find all documents and information on the detailed product page.

Additional document

-  **WAGO IO-Link Configurator**

1.1 Intended Use

The product 765-4102/100-000 is used to capture field signals on sensors, actuators and hubs which have been sent or received by a higher-level controller and output them via IO-Link.

The product works as a decentralized input/output unit in PROFINET I/O networks.

- This product is intended for installation in automation technology systems.
- The product is intended for indoor use.
- Operation of the products in industrial area is permitted.
- Operation of the product in other application areas is only permitted when corresponding approvals and labeling are present.

Improper Use

Improper use of the product is not permitted. The following cases in particular constitute improper use:

- Non-observance of the intended use
- Use without protective measures in an environment in which salt water, salt spray mist, icing, corrosive fumes, explosive gases, direct sunlight and ionizing radiation can occur
- Use of the product in areas with special risk that require continuous fault-free operation and in which failure of or operation of the product can result in an imminent risk to life, limb or health or cause serious damage to property or the environment (such as the operation of nuclear power plants, weapons systems, aircraft and motor vehicles)

Warranty and Liability

The provisions of the latest WAGO General Terms and Conditions of Deliveries and Services (GTC) apply as well as the Software License Terms for Standard Software (SW-License) applicable to software products and software embedded in WAGO hardware products, both available at:  www.wago.com.

In particular, the warranty is void if:

- The product is improperly used.
- The deficiency (hardware and software configurations) is due to special instructions.

- Modifications to the hardware or software have been made by the user or third parties that are not described in this documentation and that has contributed to the fault.

Individual agreements always have priority.

Obligations of Installers/Operators

The installers and operators bear responsibility for the safety of an installation or a system assembled with the product. The installer/operator is responsible for the proper installation and safety of the system. All laws, standards, guidelines, local regulations and accepted technology standards and practices applicable at the time of installation, and the instructions in the the products' Instructions for Use, must be complied with. In addition, the installment requirements for licensing must be observed. In the event of non-compliance, the product may not be operated within the scope of the approval.

1.2 Typographical Conventions

Number Notation

100	Decimals: Normal notation
0x64	Hexadecimals: C-notation
'100'	Binary: In single quotation marks
'0110.0100'	Nibbles separated by a period

Text Markups

<i>italic</i>	Names of paths or files
bold	Menu items, entry or selection fields, emphasis
Code	Excerpts from program code
>	Selection of a menu point from a menu
"Value"	Value entries
[F5]	Identification of buttons or keys

Cross References / Links

	Cross references/links to a topic in a document
	Cross references / links to a separate document
	Cross references / links to a website
	Cross references / links to an email address

Sequence of Action

- ✓ This symbol identifies a precondition.
- 1. Action step
- 2. Action step
 - ⇒ This symbol identifies an intermediate result.
 - ➔ This symbol identifies the result of an action.
- Individual action step

Lists

- Lists, first level
 - Lists, second level

Figures

Figures in this documentation are for better understanding and may differ from the actual product design.

Warning Messages

DANGER

Type and source of hazard

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

- Action step to reduce risk

WARNING

Type and source of hazard

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

- Action step to reduce risk

CAUTION

Type and source of hazard

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

- Action step to reduce risk

NOTICE

Type and source of malfunction (property damage only)

Indicates a potentially hazardous situation which, if not avoided, may result in damage to property.

- Action step to reduce risk

Information Notices

Note

Information

Indicates information, clarifications, recommendations, referrals, etc.

2 Safety



This section presents hazards that could occur if the product is used. Builders and operators must take all hazards into account when analyzing the risk of their installed systems.

Measures to reduce the risk of hazards that are foreseeable from the manufacturer's point of view (i.e., without knowledge of the specific system built) are explained in the respective sections of this documentation (e.g., in "Planning").

Builders and operators must implement explained risk reduction measures and also take their own measures depending on the residual risk.

2.1 General Safety Regulations

- This documentation is part of the product. Therefore, retain the documentation during the entire service life of the product. Pass on the documentation to any subsequent user of the product. In addition, ensure that any supplement to this documentation is included, if necessary.
- The product must only be installed and put into operation by qualified electrical specialists per EN 50110-1/-2 and IEC 60364.
- Set up permissions management for authorized persons.
 - Physical access may only be made by authorized persons.
 - Digital access may only be made by authorized persons.
- Comply with the laws, standards, guidelines, local regulations and accepted technology standards and practices applicable at the time of installation.

2.2 Electrical Safety

Power Supply

- For non-hazardous active voltage per EN/UL/IEC 61010-1, SELV/PELV power supplies shall be used.
- Pay attention to the permissible voltage and frequency ranges of the products when using different supplies.
- Connecting impermissible current or frequency values may destroy the product.
- In the planning, ensure that the maximum current feedthrough of a supply cable is not exceeded.
- Take suitable measures to protect against overload (e.g., an external fuse).

Grounding/Protection/Fuses

- Connect the product and system to functional ground (FE).
- When handling the product, please ensure that environmental factors (personnel, work space and packaging) are properly equalized. Do not touch any conducting parts.
- Protect the product with an appropriate overcurrent protection device.

Cables

- To minimize interference (e.g., by electromagnetic interference), maintain a spatial separation between control, signal and data lines and the power supply lines.
- Always design the connection cables for the maximum anticipated current load.

Protection

- When working on the system (e.g., during maintenance), protect the facility part in question from accidental or unauthorized restart.

2.3 Mechanical Safety

- Before startup, please check the product for any damage that may have occurred during shipping. Do not put the product into operation in the event of mechanical damage.
- Use protective caps to cover unused connections.

2.4 Thermal Safety

- The surface of the housing heats up during operation. Under special conditions (e.g., in the event of a fault or increased surrounding air temperature), touching the product may cause burns. Allow the product to cool down before touching it.
- If the surface temperature of the product can exceed 55 °C, wear protective gloves and attach protective covers and/or touch-proof protection.
- Cooling of the product must not be impaired. Ensure that the air circulation is unobstructed.

2.5 Indirect Safety

- Only use a dry or cloth or a clothed dampened with water to clean the product. Do not use cleaning agents, e.g., abrasive cleaners, alcohols or acetone.
- Do not allow the product to come into contact with ketones (e.g., acetone) or chlorinated hydrocarbons (e.g., dichloromethane) under any circumstances.
- Do not use hard objects that could cause scratches for cleaning.
- Clean tools and materials are imperative for handling the product.
- If automation solutions are implemented that can lead to personal injury or significant property damage in the event of failure, you must take appropriate measures to ensure that the system remains in a safe operating state even in the event of failure.

3 Overview

The module is part of the WAGO I/O System Field 765. It is intended for industrial use within a PROFINET network and communicates with a central controller and/or directly with the control level if applicable. Multiple sensors can be connected to the product for connection to the field level. The device electronics are protected from environmental influences by the completely encapsulated device housing.

The module has a metal housing and is suitable for screw mounting on a flat support surface, e.g., on mounting profiles or directly on the system, motor or machine.

Function Overview

- PROFINET communication with the higher-level controller
 - Cyclic I/O data
 - Configuration and parameterization via PROFINET
 - Diagnostics and alarms
 - Reading/writing records, e.g. for transferring ISDU parameters
- Bluetooth® interface for diagnostics and configuration using the WAGO I/O Field app and a mobile device
- WAGO I/O Field Webserver: integrated Webserver with configuration, parameterization, diagnostic, testing and firmware update functions
- Forcing function: forcing output data, simulating input data
- Backup/restore
- Substitute values
- Shared device
- MRP client
- Measured values by channel:
 - Supply current
 - Supply voltage
 - Temperature measurement
- Monitoring functions by channel:
 - Maximum current
 - Over- and undervoltage
 - Over- and undertemperature
 - Line break detection
- Total current monitoring
- Protective functions: shutdown of a pin when the maximum current on this pin is exceeded
- Integrated MQTT client
- Integrated OPC UA server in compliance with “IO-Link Companion Specification,” expanded to include diagnostic functions
- 8 connections
 - IO-Link Master Class B
 - Pin 4 can be configured as an IO-Link Master, digital input or digital output
 - Pin 2 can be configured to provide supply voltage 2L +, supply voltage 2L+ switched off or as a digital output

4 Properties

4.1 View

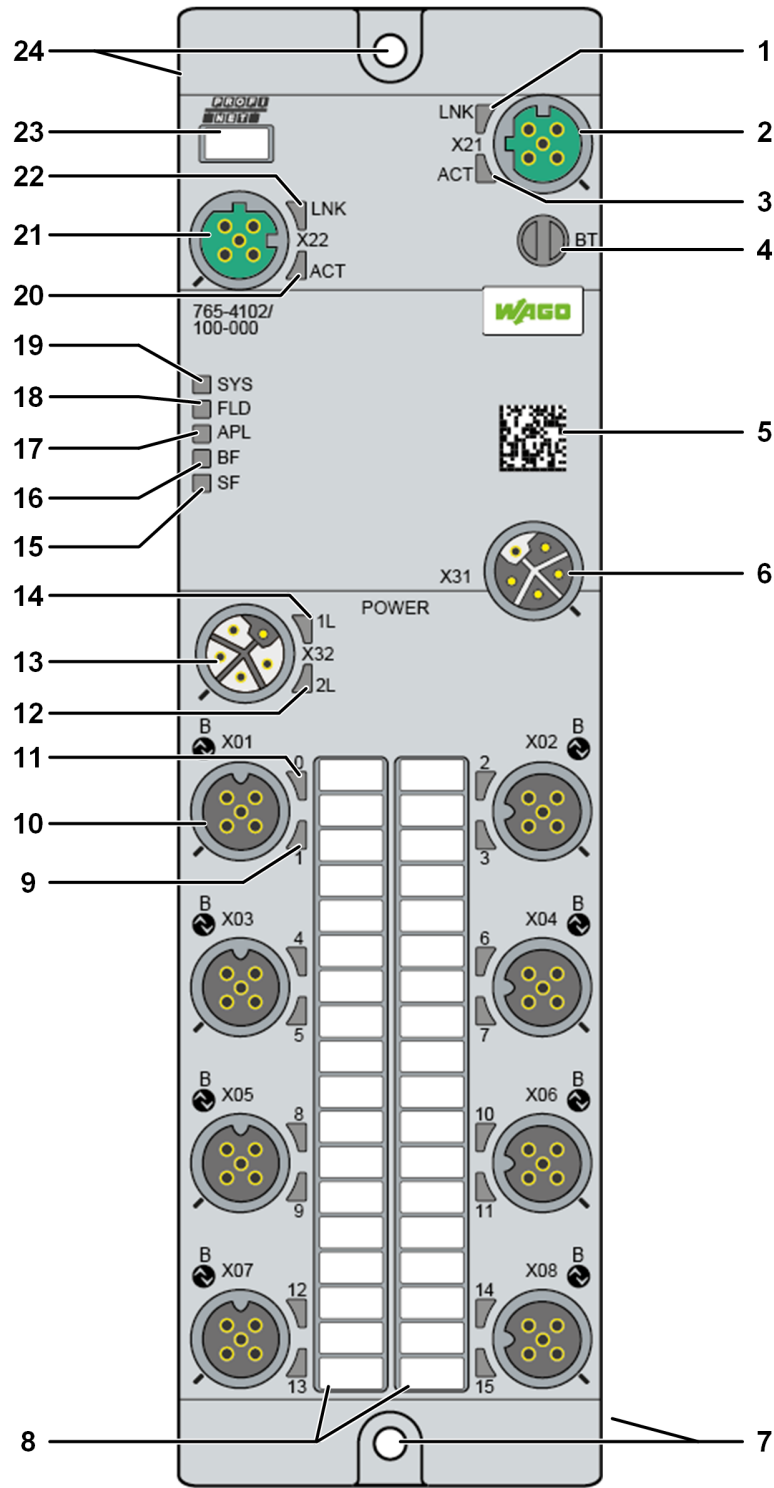


Figure 1: View

Table 1: Legend for Figure “View”

Function	Position	Designation	Description
ETHERNET	2	X21	ETHERNET interface, M12, D-coded, PROFINET port 1

Function	Position	Designation	Description
	1	LNK (X21)	Link LED for port X21
	3	ACT (X21)	Activity LED for port X21
	21	X22	ETHERNET interface, M12, D-coded, PROFINET port 2
	22	LNK (X22)	Link LED for port X22
	20	ACT (X22)	Activity LED for port X22
Bluetooth®	4	BT	Bluetooth® antenna, including Bluetooth® LED
Indicators	19	SYS	System LED
	18	FLD	Field LED
	17	APL	Application LED
	16	BF	PROFINET bus error LED
	15	SF	PROFINET system error LED
Identification	5	-	QR code Contains the serial number of the module (UII)
Supply voltage	6	X31	Power supply input (Power In)
	13	X32	Power supply output (Power Out)
	14	1L (X32)	1L power supply LED (24 VDC)
	12	2L (X32)	2L power supply LED (24 VDC)
IO-Link class B	10	X01 ... X08	IO-Link port, ports X01 ... to X08, M12, A-coded
	9	1, 3, 5, 7, 9, 11, 13, 15	LEDs with no function
	11	0, 2, 4, 6, 8, 10, 12, 14	IO-Link port LEDs for ports X01 ... X08 (pin 4)
Marking	8	-	Port marking (WMB Inline and marking strips)
	23	-	Module marking (WMB Inline)
Mounting	7	-	Mounting hole for front or side mounting
	24	-	Mounting hole for front or side mounting

4.2 Product Identification

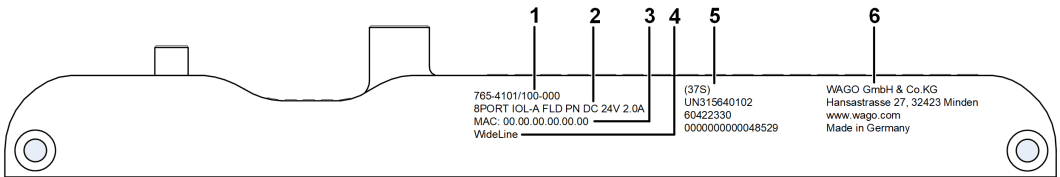


Figure 2: Type Plate, Left Side (Example View)

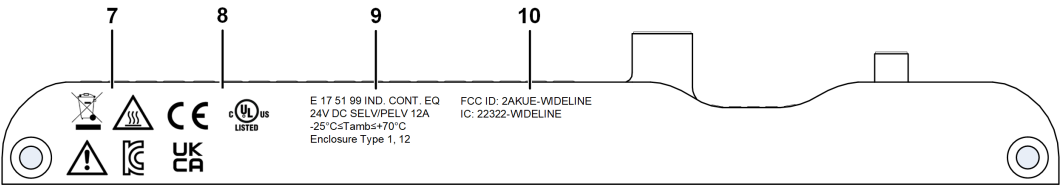


Figure 3: Type Plate, Right Side (Example View)

Table 2: Legend for Page Views

No.	Description
1	Item number
2	Product name
3	MAC address of the module
4	Module type

No.	Description
5	UII: contains the serial number of the module and is used in the Data Matrix code (DM code)
6	Manufacturer
7	Symbols
8	Safety markings and approvals
9	UL labeling
10	FCC ID and IC ID

Table 3: Explanation of Symbols

Symbol	Designation	Description
	"WEEE" mark	Note: Electrical and electronic equipment must not be disposed of with household waste! Electrical and electronic equipment contains materials and substances that can be harmful to the environment and health. Electrical and electronic equipment must be disposed of properly after use. For more information on this topic, see Disposal and Recycling [p. 180].
	"Hot surface" warning symbol	Warning: Do not touch hot surfaces! The housing surface can become hot during operation. If the product has been used at high ambient temperatures, let it cool down before touching it.
	CE mark	With the CE mark, WAGO declares that the product meets the applicable requirements as set out in Community harmonization legislation per EC Regulation 765/2008, which allows the product to carry this mark.
	"UL Listed" mark	"Certification Mark for Safety" of UL-listed products for the North America and Canadian market
	"Caution" exclamation icon	Note: Observe the product documentation! Applicable information and documents concerning the product exist which must be observed.
	"KC" registration icon	This approval mark indicates compliance with Korean product safety requirements for electrical and electronic devices and components.
	"UKCA" mark	The UKCA (UK Conformity Assessed) mark declares that the conformity requirements for the UK market are met.

4.3 Indicators

Several LEDs provide information about the operating status of the product.

Table 4: Indicators

LED	Designation
1L, 2L	Power supply LED
SYS	System LED
FLD	Field LED
APL	Application LED
BF	PROFINET bus error LED
SF	PROFINET system error LED
LNK	ETHERNET connection status LED
ACT	ETHERNET data transmission LED
BT	Bluetooth® status LED
0 ... 15	IO-Link port status LEDs

The meanings of the status indications are described section [🔗 Diagnostics via Indicators \[▶ 165\]](#).

4.4 Connections

4.4.1 Power supply (X31, X32)

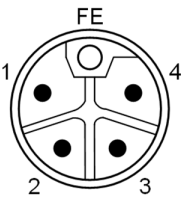
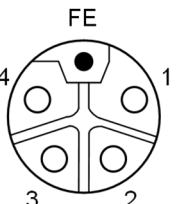
The product is powered through the X31 connection (Power in). Two supply cables can be connected to the plug:

- Supply cable 1: 1L+ (U_{1L}) and reference potential 1L–
- Supply cable 2: 2L+ (U_{2L}) and reference potential 2L–

Both supply cables are electrically isolated from each other and functional ground.

Each pin of plug X31 (Power in) is connected to the same pin of socket X32 (Power out) and makes it possible to pass the power on to the next device.

Table 5: Supply Voltage

Supply Voltage Input (X31)	Supply Voltage Output (X32)	Pin	Signal	Description
		1	1L+	24 VDC supply voltage U_{1L} for system and sensor/actuator
		2	2L–	Reference potential for 2L
		3	1L–	Reference potential for 1L
		4	2L+	24 VDC auxiliary/control voltage U_{2L}
		FE	FE	Functional ground
M12, L-coded, plug, 5-pin (4 + FE)	M12, L-coded, socket, 5-pin (4 + FE)			

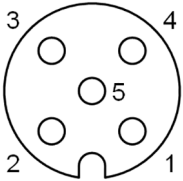
Note

Upper limit on current consumption from X32 (Power out)

Before connecting one or more products to the power supply on socket X32 (Power out), read section [🔗 Connection Examples \[▶ 98\]](#). There you will find information on the maximum permitted current consumption.

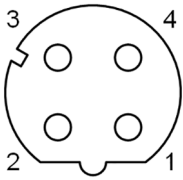
4.4.2 Communication Interfaces

Table 6: IO-Link (Class B)

IO-Link (Class B)	Pin	Signal	Description
 M12, A-coded, socket, 5-pin	1	1L+	24 VDC supply voltage U_{1L} for sensor/actuator
	2	2L+ DQ	24 VDC auxiliary/control voltage U_{2L} or digital output
	3	1L–	Reference potential for 1L+
	4	C/Q DIO (DI/DQ)	IO-Link data or digital input/output
	5	2L–	Reference potential for 2L+

4.4.3 Network Connections

Table 7: ETHERNET Interfaces

ETHERNET	Pin	Signal	Description
 M12, D-coded, socket, 4-pin	1	TX+	Positive send data
	2	RX+	Positive receive data
	3	TX–	Negative send data
	4	RX–	Negative receive data
	Housing	Shield	Shield connection; housing is connected to functional ground

4.5 Circuit Diagram

The following figure shows the schematic circuit diagram of the product.

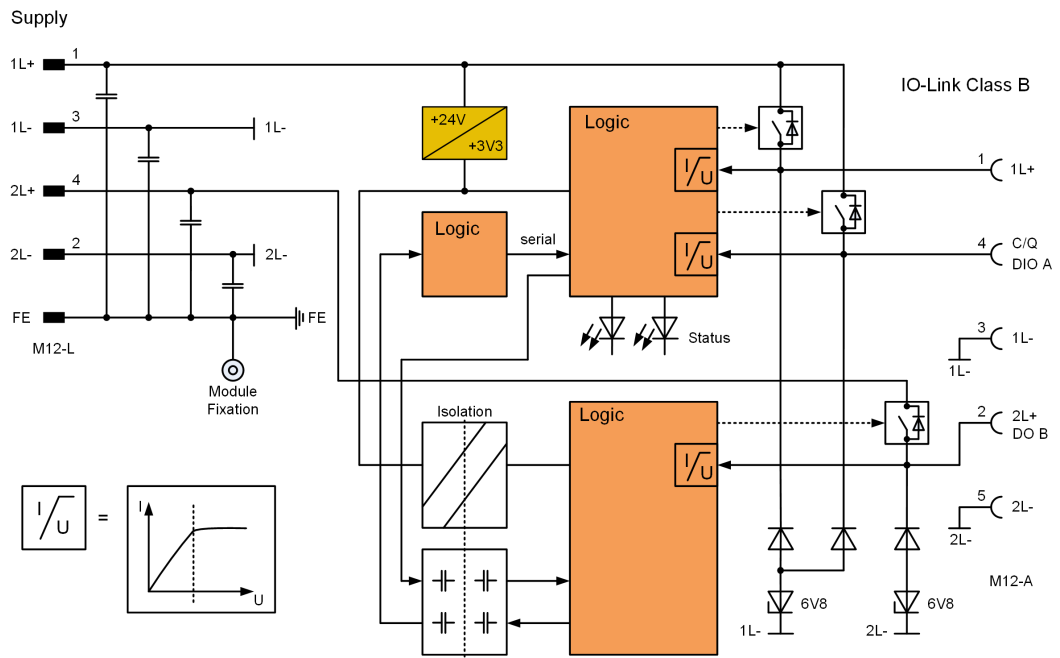


Figure 4: Circuit Diagram for Each Port

4.6 Technical Data

4.6.1 Product

Table 8: Product

Property	Value
Item Number	765-4102/100-000
Product function	8-Port IO-Link Master Class B
Product name (short)	8 PORT IOL-B FLD PN 24 VDC 2.0 A
Product name (long)	8-Port IO-Link Master Class B; PROFINET; 24 V DC; 2.0 A; 8 × M12 connection

4.6.2 Mechanical Data

Table 9: Mechanical Data

Property	Value
Width	60 mm
Height	30 mm
Length	210 mm
Weight	582.8 g
Housing	Zinc Die Casting
Mounting type	Screw mount, 2 × M4
Tightening torque	M4: 1.2 Nm
Mounting holes	Diameter: 4.5 mm
	Distance from each: 198.0 mm ± 0.2 mm

4.6.3 Connection Technology

4.6.3.1 Overview

Table 10: Connection Technology

Property	Value
Power connector	PWR IN: M12 L-coded, 5-pin, plug
	PWR OUT: M12 L-coded, 5-pin, socket
PROFINET connection	2 × M12, D-coded, socket, 4-pin
IO-Link ports	8 × M12, A-coded, socket, 5-pin
Tightening torque	M12: 1.0 Nm

4.6.3.2 IO-Link Port (Class B)

Table 11: IO-Link Port (Class B)

Property	Value	Value (per UL)
IO-Link Master (Class B)		
Specification	V1.1	
Port mode	Pin 4: IO-Link: autoconfig, manual, tool-based; DI, DO	
	Pin 2: supply voltage 2L+, supply voltage 2L+ switched off, DO (max. 10 Hz)	
Transmission mode	COM 1, COM 2, COM 3	
Min. cycle time	400 μs (IO-Link frame type_2_1 with transmission mode COM 3)	
Digital Input		

Property	Value	Value (per UL)
Characteristic	Type 3 (IEC 61131-2)	
Parameter	Digital software input filter: without, 3 ms, 15 ms, 20 ms The input signal change must be at most 2.5 kHz for correct device-internal detection of changes. However, it should be noted that transferring and processing the process data (in the device and in the controller) also take time and reduce the maximum input signal change.	
Recording cycle	200 μs	
Wiring	The digital input is not resistant to feedback. The input voltage must not exceed the supply voltage.	
Indicators	On/off status LED	
Digital Output		
Output voltage	24 VDC, −25 %/+30 % (18 VDC ... 31.2 VDC), pin 4: 1L powered, pin 2: 2L powered	24 VDC, −25 %/+20 % (DC 18 V ... DC 28.8 V), pin 4: 1L powered, pin 2: 2L powered
Current	Normal operation: max. 2.0 A per channel Overload operation: max. 2.4 A per channel, per IEC 61131-2	
Residual current	Less than 1 mA	
Wiring	High-side driver The digital output is not resistant to feedback. The input voltage must not exceed the supply voltage.	
Voltage drop through high-side path	Less than 250 mV	
Self-protection	Overcurrent, overload, overtemperature and overvoltage	
Maximum capacitive load	100 μF parallel to 12 Ω; 10 Hz	
Maximum inductive load	1.15 H / 2 A; 0.2 Hz; DC13	1.15 H / 2 A; 1 Hz; DC13; Pilot Duty
Indicators	On/off status LED	
Diagnostics	Events: overcurrent, overload and overtemperature	
Actuator/Sensor Supply		
Output voltage	24 VDC, −25 %/+30 % (18 VDC ... 31.2 VDC), 1L via pin 1 and pin 3, 2L via pin 2 and pin 5	24 VDC, −25 %/+20 % (18 VDC ... 28.8 VDC), 1L via pin 1 and pin 3, 2L via pin 2 and pin 5
Output current, L1	Maximum: 4.0 A per channel per IEC 61131-2	
Output current, L1 with IO-Link operating mode	Maximum 1.0 A with conductor size AWG 22/0.34 mm² and cable length up to 20 m (per IO-Link specification) Maximum 4.0 A with increased conductor cross-section or reduced cable length. (Voltage drop: max. 1.2 V for both feed and return line individually)	
Output current, L2	Maximum: 4.0 A per channel per IEC 61131-2	
Output current, L2 with IO-Link operating mode	Maximum 1.0 A with conductor size AWG 22/0.34 mm² and cable length up to 20 m (per IO-Link specification) Maximum 4.0 A with increased conductor cross-section or reduced cable length. (Voltage drop: max. 1.2 V for both feed and return line individually)	
Wiring	High-side driver The 1L+/2L+ output is not resistant to feedback. The input voltage must not exceed the supply voltage.	

Property	Value	Value (per UL)
Self-protection	Overcurrent, overload, overtemperature and overvoltage	
Voltage drop through high-side path	Less than 200 mV	
Maximum capacitive load	1000 μ F parallel to 24 Ω ; 0.1 Hz	
	470 μ F parallel to 12 Ω ; 0.1 Hz	
	220 μ F parallel to 6 Ω ; 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
Diagnostics (1L+, 2L+)	Events: overcurrent, overload, overtemperature and overvoltage	

4.6.3.3 Total Load

Table 12: Total Load

Parameters	Value	Value (per UL)
Maximum total load current (sum of all currents of connections X01–X08)	31.7 A	11.7 A

4.6.4 Power Supply

Table 13: Power Supply

Parameters	Value	Value (per UL)
Supply voltage, 1L, 2L	24 VDC, $-25\%/+30\%$ (18 VDC ... 31.2 VDC)	24 VDC, $-25\%/+20\%$ (18 VDC ... 28.8 VDC)
	Voltages above 34 V can permanently damage the device.	
	Voltages below approx. 11 V lead to device reset.	
Undervoltage warning, 1L, 2L	18.0 V ($\pm 5\%$ at 25 °C) message on	
	18.3 V ($\pm 5\%$ at 25 °C) message off	
Overvoltage warning, 1L, 2L	30.0 V ($\pm 5\%$ at 25 °C) message on	
	29.7 V ($\pm 5\%$ at 25 °C) message off	
Module current consumption	1L: 130 mA (at 24 VDC)	
	2L: 35 mA (at 24 VDC)	
Current consumption of supply connections	Max. 16 A; ensure external limitation or use fuses in the cables	External fuses in lines 1L and 2L: max. 16 A, time-delay, min. 30 VDC

Parameters	Value	Value (per UL)
	The maximum total current of the device, including transmission between the power supply connections, must not exceed 16 A for both 1L and 2L individually. If additional modules are connected to X32 (PWR OUT), it may be necessary for the maximum total current to be monitored with external power supply management. Maximum current: Observe derating as a function of ambient temperature.	The maximum total current of the device, including transmission between the power supply connections, must not exceed 12 A (the sum of 1L and 2L). If additional modules are connected to X32 (PWR OUT), it may be necessary for the maximum total current to be monitored with external power supply management.
Conductor cross-section	0.5 ... 2.5 mm ² Note: Observe the current carrying capacity and cable length!	2.5 mm ²
Reverse voltage protection	Yes	
Power source	24 VDC PELV (Protective Extra Low Voltage) or SELV (Safety Extra Low Voltage) power source	

4.6.5 Electrical Safety

Table 14: Electrical Safety

Property	Value
Insulation resistance	60 V DC
Test voltage	550 V AC RMS
Min. creepage distance	0.7 mm

Requirements

- PELV/SELV power supply must be used
- When a SELV power supply is used: power supply via the same mains phase
- When a PELV supply is used: supply with a secondary power supply connection to a common reference point

4.6.6 Environmental Conditions

Please note the derating for use of the product, see [🔗 Derating \[p. 69\]](#).

Table 15: Environmental Requirements

Property	Value	Value (per UL)
Ambient temperature (operation)	-25 °C ... +70 °C	
Ambient temperature (storage)	-40 °C ... +80 °C	
Maximum temperature change	3 K/min	
Relative humidity (operation)	5 % ... 95 %	
Pollution degree	3 (EN 60664-1)	
Operating altitude	0 ... 2000 m	
Overvoltage category	II (EN 60664-1)	

Property	Value	Value (per UL)
Protection type	IP67 (EN 60529)	Indoor Use (Enclosure Type 1, 12)
Protection class	III (EN 61140)	
Vibration resistance	5g (IEC 60068-2-6)	
Shock resistance	50g (IEC 60068-2-27)	

4.6.7 Communication

Table 16: Communication

Property	Value
Communication Interfaces	ETHERNET, IO-Link, Bluetooth®
Protocols	PROFINET, HTTP, OPC UA, MQTT, IO-Link
Functionality	Shared device

Table 17: Communication – PROFINET IO Device

Property	Value
Input data	16 ... 288 bytes
	Operation with 8 IO-Link 32 I / 32 O + PQI: 288 bytes (= 266 bytes of process data + 13 bytes of IOPS + 9 bytes of IOCS)
	Operation with 16 DIs: 24 bytes (= 10 bytes of process data + 13 bytes of IOPS + 1 byte of IOCS)
	Operation with 16 DOs: 16 bytes (= 2 bytes process data + 5 bytes IOPS + 9 bytes IOCS)
Output data	16 ... 280 bytes
	Operation with 8 IO-Link 32 I / 32 O + PQI: 280 bytes (= 258 bytes of process data + 9 bytes of IOPS + 13 bytes of IOCS)
	Operation with 16 DIs: 16 bytes (= 2 bytes of process data + 1 bytes of IOPS + 13 byte of IOCS)
	Operation with 16 DOs: 24 bytes (= 10 bytes process data + 9 bytes IOPS + 5 bytes IOCS)
Alarm types	Diagnostic alarm, process alarm, pull/plug alarm
Identification & maintenance (I&M)	I&M0-4
Topology recognition	LLDP, SNMP V1, physical device record objects
Minimum cycle time (MinDeviceInterval)	RT_CLASS_1: 1 ms (min. SendClockFactor 32)
	RT_CLASS_3: 1 ms (min. SendClockFactor 32)
Media redundancy	MRP client
Additional supported function	Shared device
	CAP (Client Access Point): 0xB400
PROFINET IO specification	V2.3
	"Legacy startup" of specification V2.2 is supported
Conformance class	C
Data transport layer	ETHERNET II, IEEE 802.3
Interface type	100BASE-TX, potential-free
Autonegotiation, autocrossover	Yes

Table 18: OPC UA Server

Parameters	Value
OPC UA Server	Per IO-Link Companion Specification Diagnostics according to manufacturer-specific information model with diagnostic functions
Server profile	Micro Embedded Device
Protocol	OPC UA TCP
User access	Anonymous (read access only) Username/password (read and write access)
Number of sessions	2
Number of subscriptions per session	2
Number of "monitored items" per session	20
Data coding	UA binary

Table 19: Communication – MQTT Client

Property	Value
MQTT	Client
Client services	Publish
Protocols	MQTT via TCP
Topic size	Max. 256 bytes individually per MQTT publication and max. 256 bytes of common topic prefix of the associated MQTT connection
Topics	Topic: printable UTF-8 string, NULL-terminated, multi-byte encoding (MBCS) Payload: JSON
Will Topic	Max. 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.

Table 20: Communication – Bluetooth® transmitter

Property	Value
Modulation	GFSK
Data rate	1 Mbit/s
Operating frequency	2402 ... 2480 MHz
Maximum power, including tune-up tolerance	Output power: +8 dBm Tolerance: +2 dBm / -3 dBm
Antenna type	PCB monopole
Maximum antenna gain	1.25 dBi

We declare that we meet the EN 62479 standard with respect to the limiting value for low powers less than 20 mW. Therefore, the product fundamentally corresponds to the European limiting values for high-frequency radiation.

4.7 Regulations and Standards

The following regulations and standards were used in the development of the module:

Table 21: Standards and Regulations

Standard	Title
EN 61000-6-2	Electromagnetic compatibility (EMC) – Immunity for industrial environments
EN 61000-6-4	Electromagnetic compatibility (EMC) – Emission standard for industrial environments
EN 61131-2	Programmable logic controllers
IEC 61158	PROFINET

4.8 Approvals

The following approvals have been granted for the product:

	Conformity marking
---	--------------------

	UL	UL 61010-1 and UL 61010-2-201, "Ordinary Location"
---	----	--

	KC National Radio Research Agency	Article 58-2, Clause 3	R-R-W43-FB765
---	-----------------------------------	------------------------	---------------

 Bluetooth®	Bluetooth®	This module has an RF transmitter with the following specifications: - Operating frequency: 2402–2480 MHz - Maximum RF output power: < 20 mW
--	------------	--

RED	Certificate number: R20-0935-01-TEC (Wideline)
-----	--

FCC	FCC ID: 2AKUE-WIDELINE
-----	------------------------

ISED	Certificate number: 22322-WIDELINE
------	------------------------------------

Note

More information on approvals

You can find detailed information on the approvals online at:

 www.wago.com/<item number>

5 Functions

5.1 Process Image

IO-Link Master Submodule Process Data

The process data of the digital inputs and outputs can be transferred on a port basis (the default) or pin basis. The following tables show the port and pin assignment.

Table 22: Process Data of Digital Inputs and Outputs (Port-Based Assignment)

Byte Offset	Bit	Input Process Data (PD_IN)	Output Process Data (PD_OUT)
x	0	Port X01, pin 4: DI A or DO A	0
	1	Port X01, pin 2: DO B	Port X01, pin 2: DO B
	...	...	...
	6	Port X04, Pi 4: DI A oder DO A	0
	7	Port X04, pin 2: DO B	Port X04, pin 2: DO B
x + 1	0	Port X05, pin 4: DI A or DO	0
	1	Port X05, pin 2: DO B	Port X05, pin 2: DO B
	...	...	...
	6	Port X08, pin 4: D A or DO A	0
	7	Port X08, pin 2: DO B	Port X08, pin 2: DO B

Table 23: Process Data of Digital Inputs and Outputs (Pin-Based Assignment)

Byte Offset	Bit	Input Process Data (PD_IN)	Output Process Data (PD_OUT)
x	0	Port X01, pin 4: DI A or DO A	0
	1	Port X02, pin 4: DI A or DO A	0
	...	...	...
	6	Port X07, pin 4: DI A or DO A	0
	7	Port X08, pin 4: DI A or DO A	0
x + 1	0	Port X01, pin 2: DO B	Port X01, pin 2: DO B
	1	Port X02, pin 2: DO B	Port X02, pin 2: DO B
	...	...	...
	6	Port X07, pin 2: DO B	Port X07, pin 2: DO B
	7	Port X08, pin 2: DO B	Port X08, pin 2: DO B

Process Data of a Digital Submodule

The following tables show the process data of a digital submodule.

Table 24: Process Data, IO-Link Digital Submodule (DI)

Byte Offset	Bit	Input Process Data (PD_IN)
x	0	Port X01, pin 4: DI or Port X02, pin 4: DI or ... Port X08, pin 4: DI
	1 ... 7	0

Table 25: Process Data, IO-Link Digital Submodule (DO)

Byte Offset	Bit	Output Process Data (PD_OUT)
x	0	Port X01, pin 4: DO or Port X02, pin 4: DO or ... Port X08, pin 4: DO
	1 ... 7	0

PQI (Port Qualifier Information)

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

Table 26: Port Qualifier Information

Bit	Flag	Description
0	-	Reserved, 0
1	-	Reserved, 0
2	NewPar	New parameters
		0: No IO-Link device product parameter update detected
		1: IO-Link device product parameter update detected: IO-Link master performs a "data storage upload," and a new IO-Link device backup object (0xB904) is available
3	SubstDev	Substitute product detected
		0: No substitute product detected (identical serial number)
		1: Substitute product detected (different serial number)
4	PortActive	Port activation
		0: Port was disabled via port function
		1: Port is enabled (default)
5	DevCom	IO-Link device communication
		0: No IO-Link device present
		1: IO-Link device detected in state PREOPERATE or OPERATE
6	DevErr	Port/device error
		0: No error/warning occurred
		1: Error/warning occurred on port or IO-Link device
7	PQ	Validity of the device process data
		0: Invalid I/O process data from IO-Link device
		1: Valid I/O process data from IO-Link device

Provider and Consumer Status

Table 27: Provider and Consumer Status

Bits	Name	Description
0 ... 4	-	Reserved, always 0
5 ... 6	Instance	Instance that detected the invalid data; if the value of data status (bit 7) is 1, bits 5 and 6 can be ignored
		00: detected by subslot
		01: detected by slot
		10: detected by IO-Link device
		11: detected by IO controller
7	Data status	Status of the input/output data
		0: bad; data is invalid
		1: good; data is valid

5.2 MQTT

5.2.1 General Elements of a Topic

The description of a topic contains elements that can be replaced.

Table 28: General Elements of a Topic

Element of the Topic	Description
{prefix}	Prefix of each topic. A prefix is a text that is used to identify a device.
[MASTER_NUMBER]	Number for each master in the gateway. Normally, the gateway has a master, and the MASTER_NUMBER is 1.
[PORT_NUMBER]	Number for each port of a master. For example, if the master has eight ports, then PORT_NUMBER is 1 ... 8.
[DEVICE_ALIAS]	String to identify a device connected to a port of a master: masterXportY. Example: master1port3.

5.2.2 Prefix Topics

Table 29: Prefix Topics

Topic	Description
{prefix}/Online	Publisher status Values: online, offline For an example, see Online.
{prefix}/DeviceInfo	Identification information For an example, see DeviceInfo.

Online

Example for Online JSON Object:

```
{
  "Publisher": "Online"
}
```

DeviceInfo

Table 30: DeviceInfo, "JSON Key"

JSON Key	Description
PNDeviceName	NameOfStation for PROFINET modules
IpAddress	Module IP address
SerialNumber	Module serial number
OrderNumber	Module item number
UII	Unique Item Identifier: contains the module serial number
Firmware	WAGO I/O System Field
ApplicationName_1	Application name set by the user (part 1)
ApplicationName_2	Application name set by the user (part 2)

Example for DeviceInfo JSON object:

```
{
  "PNDeviceName": "",
  "IpAddress": "192.168.10.151",
  "SerialNumber": "00000000000013444",
  "OrderNumber": "765-4101/100-000",
  "UII": "37SUN31564010260422320+00000000000013444",
  "Firmware": "WAGO I/O System Field",
  "ApplicationName_1": "",
  "ApplicationName_2": ""
}
```

5.2.3 Gateway Topics

Table 31: Gateway-Topics

Topic	Description
{prefix}/iolink/v1/gateway/identification	Identification of the gateway: MAC address, serial number, product ID, manufacturer name, product name, hardware version, firmware version For an example, see 🔗 Gateway Topics ▶ 29 .
{prefix}/iolink/v1/gateway/capabilities	Gateway functions: IODD supported, MQTT supported For an example, see 🔗 Gateway Topics ▶ 30 .
{prefix}/iolink/v1/gateway/configuration	Network configuration of the gateway: IP configuration, IP address, subnet mask, default gateway For an example, see 🔗 Gateway Topics ▶ 30 .

Gateway Identification

Example of Gateway Identification JSON Object:

```
{
  "macAddress": "1:02:03:04:05:06",
  "serialNumber": "00000000000013444",
  "productID": "765",
  "vendorName": "WAGO GmbH & Co. KG",
  "productName": "8PORT IOL-A FLD PN 24VDC 2.0A",
  "hardwareRevision": "V2.0.0",
  "firmwareRevision": "V1.2.0"
}
```

Gateway Functions

Table 32: Gateway Functions, "JSON Key"

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 Gateway Functions JSON Object:

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

Gateway Configuration

Table 33: Gateway Configuration, "JSON Key"

JSON Key	Description
"ipConfiguration"	Possible values for "ipConfiguration": • "MANUAL": IP address assignment by other device-specific means • DHCP: RFC 2131 defines the "Dynamic Host Configuration Protocol," which 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 Gateway Configuration JSON Object:

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

5.2.4 Master Topics

Table 34: Master Topics

Topic	Description
{prefix}/IoLink/v1/masters	Available masters and information for identification: master number, serial number, location tag For an example, see Master List.
{prefix}/iolink/v1/masters/[MASTER_NUMBER]/identification	Identification of the master: manufacturer name, manufacturer ID, master ID, master type, serial number, application-specific tag, location tag, function tag Example: {prefix}/iolink/v1/masters/1/identification For an example, see Master Identification.
{prefix}/iolink/v1/masters/[MASTER_NUMBER]/capabilities	Master functions: number of ports, max. power supply (of the device) Example: {prefix}/iolink/v1/masters/1/capabilities For an example, see Master Functions.
{prefix}/iolink/v1/masters/[MASTER_NUMBER]/ports	Available port number keys: port number, status information, device alias Example: {prefix}/iolink/v1/masters/1/ports For an example, see Port List.
{prefix}/iolink/v1/masters/[MASTER_NUMBER]/ports/[PORT_NUMBER]/capabilities	Information on the port functions: max. power supply (of the port), port type Example: {prefix}/iolink/v1/masters/1/ports/4/capabilities For an example, see Port Functions.
{prefix}/iolink/v1/masters/[MASTER_NUMBER]/ports/[PORT_NUMBER]/status	Current port status: status info, IO-Link revision, transmission rate, master cycle time Example: {prefix}/iolink/v1/masters/1/ports/4/status For an example, see Port Status.
{prefix}/iolink/v1/masters/[MASTER_NUMBER]/ports/[PORT_NUMBER]/configuration	Port configuration: mode, validation and backup, IQ configuration, cycle time, device alias Example: {prefix}/iolink/v1/masters/1/ports/4/configuration For an example, see Port Configuration.
{prefix}/iolink/v1/masters/[MASTER_NUMBER]/ports/[PORT_NUMBER]/diagnostics/configuration	Diagnostics/port configuration: pin 1 overcurrent, pin 1 undercurrent, pin 2 overcurrent, pin 2 undercurrent, pin 4 overcurrent, pin 4 undercurrent Example: {prefix}/iolink/v1/masters/1/ports/4/diagnostics/configuration For an example, see Port Diagnostics, Configuration
{prefix}/iolink/v1/masters/[MASTER_NUMBER]/ports/[PORT_NUMBER]/diagnostics/current	Diagnostics/port current: pin 1 current, pin 2 current, pin 4 current Example: {prefix}/iolink/v1/masters/1/ports/4/diagnostics/current For an example, see Port Diagnostics, Current
{prefix}/iolink/v1/masters/[MASTER_NUMBER]/ports/[PORT_NUMBER]/diagnostics/voltage	Diagnostics/port voltage: pin 1 voltage, pin 2 voltage, pin 4 voltage Example: {prefix}/iolink/v1/masters/1/ports/4/diagnostics/voltage For an example, see Port Diagnostics, Voltage
{prefix}/iolink/v1/masters/[MASTER_NUMBER]/ports/[PORT_NUMBER]/diagnostics/temperature	Diagnostics/port temperature: pin 1 temperature, pin 2 temperature, pin 4 temperature Example: {prefix}/iolink/v1/masters/1/ports/4/diagnostics/temperature For an example, see Port Diagnostics, Temperature
{prefix}/iolink/v1/masters/[MASTER_NUMBER]/ports/[PORT_NUMBER]/statistics/current	Statistics/port current: min. pin 1 current, max. pin 1 current, min. pin 2 current, max. pin 2 current, min. pin 4 current, max. pin 4 current Example: {prefix}/iolink/v1/masters/1/ports/4/statistics/current For an example, see Port Statistics, Current

Topic	Description
{prefix}/iolink/v1/masters/[MASTER_NUMBER]/ports/[PORT_NUMBER]/statistics/voltage	Statistics/port voltage: min. pin 1 voltage, max. pin 1 voltage, min. pin 2 voltage, max. pin 2 voltage, min. pin 4 voltage, max. pin 4 voltage Example: {prefix}/iolink/v1/masters/1/ports/4/statistics/voltage For an example, see Port Statistics, Voltage
{prefix}/iolink/v1/masters/[MASTER_NUMBER]/ports/[PORT_NUMBER]/statistics/temperature	Statistics/port temperature: min. pin 1 temperature, max. pin 1 temperature, min. pin 2 temperature, max. pin 2 temperature, min. pin 4 temperature, max. pin 4 temperature Example: {prefix}/iolink/v1/masters/1/ports/4/statistics/temperature For an example, see Port Statistics, Temperature
{prefix}/iolink/v1/masters/[MASTER_NUMBER]/diagnostics/configuration	Diagnostics/configuration: overtemperature, temperature hysteresis, lower limiting value for overvoltage 1L, lower limiting value for undervoltage 1L, lower limiting value for overvoltage 2L, lower limiting value for undervoltage 2L, voltage hysteresis, current hysteresis Example: {prefix}/iolink/v1/masters/1/diagnostics/configuration For an example, see Diagnostic Configuration
{prefix}/iolink/v1/masters/[MASTER_NUMBER]/diagnostics/value	Diagnostics/value: mean temperature, lower limiting value for mean voltage 1L, lower limiting value for mean voltage 2L, lower limiting value for total current 1L, lower limiting value for total current 2L Example: {prefix}/iolink/v1/masters/1/diagnostics/value For an example, see Diagnostic Value
{prefix}/iolink/v1/masters/[MASTER_NUMBER]/ports/[PORT_NUMBER]/datastorage	Data memory content of the port: manufacturer ID, device ID, IO-Link revision Example: {prefix}/iolink/v1/masters/1/ports/4/datastorage For an example, see Port Data Memory.

Master List

Example for Master List JSON Object:

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

Master Identification

Example for Master Identification JSON Object:

```
{
  "vendorName": "WAGO GmbH & Co. KG",
  "vendorId": 285,
  "masterId": 195846,
  "masterType": "Master acc. V1.1"
  "serialNumber": "00000000000013444",
  "applicationSpecificTag": "****",
  "locationTag": "****"
  "functionTag": "****"
}
```

Master Functions

Example for Master Functions JSON Object:

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

Port List

Table 35: Port List, "JSON Key"

JSON Key	Description
statusInfo	Enabled: "statusInfo": "DEVICE_ONLINE" Disabled: "statusInfo": "DEACTIVATED"
deviceAlias	Default value for "deviceAlias": "master1portY"

Example of Port List JSON Object:

```
[
  {
    "portNumber": 1,
    "statusInfo": "DEVICE_ONLINE",
    "deviceAlias": "master1port1"
  },
  {
    "portNumber": 2,
    "statusInfo": "DEVICE_ONLINE",
    "deviceAlias": "master1port2"
  },
  {
    "portNumber": 3,
    "statusInfo": "DEVICE_ONLINE",
    "deviceAlias": "master1port3"
  },
  {
    "portNumber": 4,
    "statusInfo": "DEACTIVATED",
    "deviceAlias": "master1port4"
  }
]
```

Port Functions

Table 36: Port Functions, "JSON Key"

JSON Key	Description
portType	Value for "portType" for IO-Link master: "CLASS_A/B"

Example of Port Functions JSON Object:

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

Port Status

Table 37: Port Status, "JSON Key"

JSON Key	Description
statusInfo	Enabled: "statusInfo": "DEVICE_ONLINE"
	Disabled: "statusInfo": "DEACTIVATED"

Example of IO-Link Port Status JSON Object:

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

Port Configuration

Table 38: Port Configuration, Configuration Values

JSON Key	Values
mode	• "DEACTIVATED" • "IOLINK_MANUAL" • "IOLINK_AUTOSTART" • "DIGITAL_INPUT" • "DIGITAL_OUTPUT"
validationAndBackup	• "NO_DEVICE_CHECK" • "TYPE_COMPATIBLE" • "TYPE_COMPATIBLE_RESTORE_ONLY" • "TYPE_COMPATIBLE_BACKUP_AND_RESTORE"

Example of IO-Link Configuration JSON Object:

```
{
  "mode": "IOLINK_MANUAL",
  "validationAndBackup": "TYPE_COMPATIBLE",
  "iqConfiguration": "DIGITAL_INPUT"
  "cycleTime": {
    "value": "5.0",
    "unit": "ms"
  }
  "deviceAlias": "master1port2"
}
```

Port Diagnostics, Configuration

Example of Port Diagnostics for 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 Port Diagnostics for 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 Port Diagnostic for Voltage JSON Object:

```
{
  "voltagePin1": {
    "value": "23.3",
    "unit": "V"
  },
  "voltagePin2": {
    "value": "0.2",
    "unit": "V"
  },
  "voltagePin4": {
    "value": "18.3",
    "unit": "V"
  }
}
```

Port Diagnostics, Temperature

Example of Port Diagnostics for 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 Port Statistics for Current JSON Object:

```
{
  "minCurrentPin1": {
    "value": "55.0",
    "unit": "mA"
  },
  "maxCurrentPin1": {
    "value": "72.0",
    "unit": "mA"
  },
  "minCurrentPin2": {
    "value": "0.0",
    "unit": "mA"
  },
  "maxCurrentPin2": {
    "value": "00.0",
    "unit": "mA"
  },
  "minCurrentPin4": {
    "value": "0.0",
    "unit": "mA"
  },
  "maxCurrentPin4": {
    "value": "0.0",
    "unit": "mA"
  }
}
```

Port Statistics, Voltage

Example of Port Statistics for 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 Port Statistics for 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 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"
  },
  "overVoltage2L": {
    "value": "30.0",
    "unit": "V"
  },
  "underVoltage2L": {
    "value": "18.0",
    "unit": "V"
  },
  "voltageHysteresis": {
    "value": "0.3",
    "unit": "V"
  },
  "currentHysteresis": {
    "value": "0.0",
    "unit": "A"
  }
}
```

Diagnostic Value

Example of Diagnostic Value JSON Object:

```
{
  "meanTemperature": {
    "value": "37.6",
    "unit": "C"
  },
  "meanVoltageL": {
    "value": "23.3",
    "unit": "V"
  },
  "meanVoltage2L": {
    "value": "0.0",
    "unit": "V"
  },
  "sumCurrentL": {
    "value": "0.5",
    "unit": "A"
  },
  "sumCurrent2L": {
    "value": "0.0",
    "unit": "A"
  }
}
```

Port Data Memory

Example of Port Data Memory JSON Object:

```
{
  "header": {
    "vendorId": 15,
    "deviceId": 65253,
    "iolinkRevision": "1.1"
  },
  "content": "YmFzZTY0IGVuY3J5cHRlZCBjb250ZW50"
}
```

5.2.5 Device Topics

Table 39: Device Topics

Topic	Description
{prefix}/iolink/v1/devices	Address all devices of all masters: device alias, master number, port number For an example, see Device List.
{prefix}/iolink/v1/devices/[DE-VICE_ALIAS]/identification	Information about the connected IO-Link device Manufacturer ID, device ID, IO-Link version, manufacturer name, product identification, revision information, application-specific text For an example, see Device Identification.
{prefix}/iolink/v1/devices/[DE-VICE_ALIAS]/processdata/value	Device process data value: Retrieve data (IO-Link, IQ value), set data (IO-Link) Example: {prefix}/iolink/v1/devices/master1port4/processdata/value For an example, see Device Process Data.
{prefix}/iolink/v1/devices/[DE-VICE_ALIAS]/processdata/get-data/value	Input process data value of the device: Retrieve data (IO-Link, IQ value) Example: {prefix}/iolink/v1/devices/master1port4/processdata/getdata/value For an example, see Input Process Data of the Device.
{prefix}/iolink/v1/devices/[DE-VICE_ALIAS]/processdata/set-data/value	Device output process data value: Set data (IO-Link) Example: {prefix}/iolink/v1/devices/master1port4/processdata/setdata/value For an example, see Output Process Data of the Device.
iolink/v1/devices/[DE-VICE_ALIAS]/events	Device event log: time, severity, origin, message Example: {prefix}/iolink/v1/devices/master1port4/events For an example, see Device Events.

Device List (JSON Object)

Table 40: Device List (JSON Object)

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

Example of 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 Identification (JSON Object)

Table 41: Device Identification (JSON Object)

JSON Key	Description
vendorId	Manufacturer ID, number
deviceId	Device ID, number
iolinkRevision	Supported IO-Link version
vendorName	Manufacturer name, text
productId	Product identification
productText	Text about the product
hardwareRevision	Hardware version
firmwareRevision	Firmware version
applicationSpecificTag	Application-specific text

Example of device identification JSON object:

```
{
    "vendorId": 12345,
    "deviceId": 5,
    "iolinkRevision": "1.1",
    "vendorName": "Vendor Name",
    "vendorText": "www.url.com",
    "productName": "A123",
    "productId": "A123",
    "productText": "Sensor",
    "hardwareRevision": "2",
    "firmwareRevision": "123",
    "applicationSpecificTag": "abcd"
}
```

Device Process Data (JSON Object)

Table 42: Device Process Data (JSON Object)

JSON Key	Description
getData	Get data
iolink	IO-Link
iqValue	IQ value
setData	Set data
iolink	IO-Link

Example of Device Process Data JSON Object (IO-Link Device):

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

Device Process Data Inputs (JSON Object)

Table 43: Device Process Data Inputs (JSON Object)

JSON Key	Description
getData	Get data
iolink	IO-Link
iqValue	IQ value

Example of Device Process Data Inputs JSON Object (IO-Link Device):

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

Device Output Process Data (JSON Object)

Table 44: Device Process Data Inputs (JSON Object)

JSON Key	Description
setData	Set data
iolink	IO-Link

Example of Device Output Process Data JSON Object (IO-Link-Device):

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

Device Event (JSON Object)

Table 45: Device Event (JSON Object)

JSON Key	Description
time	Time
severity	Severity
origin	Origin
message	Message

Example of Device Event 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
    }
  }
}
```

5.2.6 MQTT Topics

Table 46: MQTT-Topics

Topic	Description
{prefix}/iolink/v1/mqtt/configuration	MQTT client configuration: client mode, server address, username, password, last will, keep-alive time For an example, see MQTT Topics [p 51] .
{prefix}/iolink/v1/mqtt/connectionstatus	MQTT client configuration: connection status, server address, uptime For an example, see MQTT MQTT Topics [p 52] .

MQTT Configuration

Table 47: MQTT Configuration, "JSON Key"

JSON Key	Description
clientMode	Enabled: "clientMode": "ACTIVE" Disabled: "clientMode": "INACTIVE"

Example of MQTT Configuration JSON Object:

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

MQTT Connection Status

Table 48: MQTT Connection Status, "JSON Key"

JSON Key	Description
connectionStatus	Possible values for "connectionStatus": - CONNECTING - CONNECTION_ACCEPTED - CLIENT_INACTIVE

Example of MQTT Connection Status JSON Object:

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

5.3 Forcing

This section describes the “Force” function for the module’s input and output data.

In forcing, the physical states of the inputs or the output values of the higher-level controller are “forcibly” overwritten with other values. The user provides these values and identifies them as forcing values. This method is helpful for commissioning systems and troubleshooting.

The “Forcing” function can be accessed through the following tools:

- WAGO I/O Field Webserver
- OPC UA
- WAGO I/O Field app on mobile devices

Systems like SPS, TIA Portal and the like also have forcing functions. Such forcing functions should not be confused with the ones described in this section and will not be considered within the context of this section.

A distinction is made between two types of forcing:

1. Input simulation means overwriting input data with replacement values.
2. Overwriting output data with replacement values means setting or resetting the module outputs independent of the module’s process image.

Forcing Outputs

To force output data for test purposes, you can control all the outputs independent of the actual process data value and set them to a specified alternative value.

For digital outputs, you can force pin 2 and pin 4.

With IO-Link, you can force 32 data bytes per port.

Simulating Inputs

To simulate input data, you can set alternative values that are used for the input instead of the actual process data values. This allows you to test how the system (i.e., the module and a connected controller) responds to specific inputs.

With digital inputs, you can simulate pin 4.

With IO-Link, you can simulate 32 data bytes per port.

Simultaneous Access

A device-internal mechanism prevents simultaneous access by multiple instances. This ensures that only one single instance at a time ever has write access.

“Forcing” Operating Mode Must Be Enabled in the Parameterization

“Forcing” operating mode can be switched off by the higher-level controller. This is done with the “Force Mode Setting” parameter – see  [PROFINET Parameters \[► 71\]](#). To enable forcing, the “Force Mode Setting” parameter value must be set to 0 (“Enable Force Mode”). This is the default setting in the device description file provided with the device.

5.4 Monitoring Functions

The 765 Series modules have extensive internal sensors for measuring the following:

- Temperatures
- Currents
- Voltages

The measurements are performed for the module and for pin 1, pin 2 and pin 4 of each port. The controller can read out the measured values. The measured values can be displayed in the WAGO I/O Field Webserver or the WAGO I/O Field app. Alternatively, an OPC UA client can read out the measured values and display them.

In the module, the measured values are compared to limiting values. An alarm or event is generated if a value falls above or below a limiting value (e.g., a temperature limiting value). The module can send this alarm/event in the event of:

- to the OPC UA client upon: OPC UA: event.

The OPC UA client application can use the measured values, for example to implement load management. You can find information on load management in [🔗 Design of the Power Supply \[► 63\]](#).

5.5 Overload protection

The module has built-in overload protection and periodically measures the current, voltage and temperature.

If the output current, supply voltage or temperature exceeds the maximum value, the module switches off a pin/port

5.6 Parameterization Tools

5.6.1 Overview

There are several ways to set the product's parameters. The following table provides an overview of the tools.

Table 49: Overview of Parameterization Tools

Tool	Description
Control with PROFINET IO Controller	The PROFINET® IO controller must be configured to exchange process data with the 765 Series modules. The GSDML file <i>GSDML-Vx.xx-wago-series765-yyyym-mdd.GSDML</i> describes the modules of the WAGO I/O System Field. The PROFINET® IO Controller configuration software imports this GSDML file, and the user can configure and parameterize one or more 765 Series modules. The user loads the configuration into the PROFINET® controller. The PROFINET® controller configures and parameterizes the 765 Series module via PROFINET®.
WAGO I/O Field Webserver	The WAGO I/O Field Webserver is a Webserver that is integrated into the 765 Series module. Users can open the Web pages and display and modify parameters using a Web browser.
WAGO I/O Field app	The WAGO I/O Field app is an app for mobile devices and can communicate with a 765 Series module via Bluetooth®. With the app, the user can parameterize the IO-Link master and the connected IO-Link devices, read and write process data and display diagnostics. For writing parameters, the connection to the controller must be terminated.
WAGO IO-Link Configurator	WAGO IO-Link Configurator is a software solution for configuring the WAGO IO-Link master and the IO-Link devices.

Tool	Description
OPC UA	The module has an integrated OPC UA server. Therefore, an OPC UA client can establish a connection to the module in order to access the following data for parameterization, operation and/or information, for example: identification data, configuration parameters, process data, measured values, diagnostics, statistics, forcing/simulation, etc.

Three parts of the configuration and parameterization must be distinguished:

1. **PROFINET configuration:** PROFINET modules and submodules
2. **Port configuration:** digital input or output
3. **IO-Link device configuration**

The following table explains which tool can influence which part.

Table 50: Parameterization Overview

Tool	PROFINET Modules and Submodules	Port Configuration	IO-Link device configuration
PROFINET IO Controller	The PROFINET IO Controller configures the PROFINET modules and submodules of the 765 Series module.	The IO Controller sets the parameter the user selects on the basis of the parameters in the GSDML file. These parameters configure each individual port and determine whether the port is used as a digital input or digital output (or is disabled).	Optional: Parameters for the IO-Link devices can be set in the configuration software of the PROFINET IO controller. At most 32 parameters can be set per IO-Link device. These parameters are transferred to the corresponding IO-Link device via ISDU.
WAGO I/O Field Webserver	–	Yes	Input fields to read/write index. Objects can be read and written via the object index and subindex. This requires expert knowledge and the object description for the IO-Link device used. The I/O Field Webserver does not evaluate an IODD.
WAGO I/O Field app	–	Yes	Yes The app can use IODD to parameterize an IO-Link device.
WAGO IO-Link Configurator	–	Yes	Yes The WAGO IO-Link Configurator can use IODD to parameterize an IO-Link device.
OPC UA	–	Yes	–

Note

Parameters via PROFINET are always rewritten upon restart

Each time PROFINET communication starts up, the IO Controller transfers the configuration and parameters to the module. Port configuration parameters that were set by the WAGO I/O Field Webserver, the WAGO I/O Field app, the WAGO IO-Link Configurator or the OPC UA client are overwritten. Parameters via PROFINET take precedence.

If you have changed parameters of the port configuration via the WAGO I/O Field Webserver, the WAGO I/O Field app, the WAGO IO-Link Configurator or the OPC UA Client, please note that, although these changes are initially applied to the module, the I/O controller overwrites the port configuration again at the next startup. If you want to modify port configuration parameters, set them in the configuration software of the I/O controller.

5.6.2 WAGO IO-Link Configurator

The WAGO IO-Link Configurator product is an independent commissioning, configuration and management software program.

The WAGO IO-Link Configurator software can be used to configure and parameterize IO-Link devices, in conjunction with both the WAGO I/O System Field and the WAGO I/O System 750/753. It supports a large number of IO-Link masters and IO-Link sensors/actuators (in conjunction with the WAGO I/O System 750/753). Within the software, you can switch between the IO-Link masters of a node that are used without having to switch back to WAGO-I/O-CHECK. In addition, the handling of IODDs (device description files for IO-Link modules) is more flexible. For example, you can access the IODD server directly to import IODDs.

The WAGO IO-Link Configurator software can be launched from the Start menu or desktop icon, either as an independent program or in conjunction with WAGO-I/O-CHECK. It then provides the necessary functions for connecting to or searching for WAGO IO-Link masters.

You can find further information in the WAGO IO-Link Configurator product manual.

The manual is available in the download area for the WAGO IO-Link Configurator software at www.wago.com, item number 2759-106/1121-1000.

5.6.3 WAGO I/O Field Webserver

The WAGO I/O System Field module has an integrated Webserver. It can be accessed with a standard Web browser in order to use the following functions:

- Display port information for ports X01, X02 etc.
- Display and modify module settings.
- User setup and management, as well as user login and logout
- Reset module to factory settings and update firmware.
- Simulating inputs; forcing outputs

Examples of port information include:

- Display current measured values for the ports: temperature, voltage, current and state on pins 1, 2 and 4
- Display information about the connected IO-Link module
- Display the status information for the entire port
- Configure ports, e.g. set operating mode
- Configure and display load management
- Read and write access to the connected IO-Link devices
- Show process data

The module settings include:

- Select the origin of the configuration data used
- Display and enter maintenance information
- Reset module to factory settings.

- Load firmware onto the module
- Display status for Bluetooth® connection to module and control LED for Bluetooth®.
- Enable/disable Bluetooth® firmware update.

Function overview

The following overview shows the functions offered by WAGO Webserver I/O Field that is integrated into the product and the menu items/tabs in the user interface that can be used to address these functions:

Table 51: Function Overview for WAGO I/O Field Webserver and WAGO IO-Link Modules

Menu	Tab	Description	Section
Dashboard	-	Show module information	WAGO Webserver I/O Field User Interface [111]
Licenses	-	Show licenses of the software components used	Displaying Licenses [112]
Device settings	(All)	Make module settings	Configuring Ports [119]
	Device status	Device status LEDs	Device Status LEDs [112]
	Tags and labels	Tags and labels	Tags and Labels [112]
	Maintenance	Save maintenance information	Storing Maintenance Information [122]
	Device configuration	Show IP connection	Reading IP Parameters [122]
	Firmware upgrade	Update firmware	Updating Firmware [123]
	Factory reset	Reset module to factory settings	Resetting the Module to the Factory Settings [125]
Extended settings	(All)	Make extended module settings	Making Extended Settings on the Module [130]
	MQTT	Make MQTT settings	MQTT Configuration [130]
	NTP settings	Make NTP settings	NTP Settings [133]
	Power-on delay	Set power-on delay for sequential power-on	Power-on Delay [135]
	Bluetooth	Access via Bluetooth	Configure Bluetooth [135]
	Load management	Display current measured values for current, voltage and temperature. Configure threshold values and display statistics.	Load Management [138]
	Radio test	Test of the radio technology (Bluetooth)	Testing the Radio Technology [141]
Port X01, X02, ...	(All)	Port information and settings for IO-Link ports X01, X02, ...	Configuring Ports [119]

Menu	Tab	Description	Section
	Information	Display measured values of a port and information on the connected IO-Link device (temperature, voltage, current and state on pins 1, 2 and 4)	
	Status	Display status information for the port and, if applicable, the IO-Link device that is plugged in	
	Configuration	Make port settings (such as operating mode or product check for validation and backup)	
	IOL	Access to connected IO-Link devices	 Accessing a Connected IO-Link Device [► 118]
	Process data	Display the process data (input/output)	 Configuring Ports [► 119]
DIO Forcing	-	Forcing for digital inputs and outputs	 Forcing Digital Inputs and Outputs [► 128]
IOL Forcing	-	Forcing for IO-Link ports	 Forcing for IO-Link Ports [► 129]
User administration	-	Set up and manage users	 Managing Users [► 126]
Sign in, Sign out	-	Log users on and off	

5.6.4 WAGO I/O Field App

The WAGO I/O Field app is an app for maintenance, diagnostics, operation and monitoring of installed WAGO I/O System Field modules and IO-Link devices.

This app allows you to view product information, read and write process data and adjust settings and parameters for both fieldbus modules and IO-Link devices. The communication this requires takes place through the Bluetooth® interface of the mobile device data once a QR code has been scanned to select the product.

The user can log in with different rights. Outputs can be forced and inputs set in order to support commissioning of systems. The current measured values of a port can be displayed (temperature, voltage, current and states) and configured (including operating mode and filters). Products can be reset to the factory settings, and firmware can be restarted.

Short Overview

- Scanning a QR code of a module for product selection
- Establishing a Bluetooth® BLE (Bluetooth Low Energy) connection for wireless communication
- Querying product information, including serial number (UII – Unique Item Identifier)
- Managing known devices for direct selection without scanning the QR code
- Querying sensor/actuator data (diagnostics, manufacturer, configuration, status, cycle time etc.)
- Parameterizing ports (input, input filters, output and substitute value strategy)
- Forcing outputs (DO)

- Simulating inputs (DI)
- Parameterizing WAGO IO-Link Masters*
- Guided download of IODDs from the Internet for IO-Link devices (IODDfinder)*
- Importing the device description file (IODD) of the IO-Link device*
- Parameterizing IO-Link devices*
- Managing customer-specific product names
- Displaying diagnostic and status information
- Configure and display load management
- Managing product-specific documents (datasheets, manuals etc.)
- User and rights management

* Only applies to modules with integrated IO-Link master ports

The functional scope described can vary depending on the module type.

Note

Read the online help!

You can find Product-specific information on the WAGO App I/O Field in the online help for the app.

5.7 Communication Interfaces

The module has the following interfaces and supports the following protocols:

- ETHERNET Interfaces
 - PROFINET
 - HTTP for the WAGO I/O Field Webserver
 - TCP for the OPC UA server
 - TCP for the MQTT client
 - UDP for WAGO IO-Link Configurator
- Bluetooth® for the WAGO I/O Field app

5.7.1 PROFINET

The module exchanges the process data with the controller via PROFINET. The process data communication requires the controller and module to be configured and parameterized.

If a value falls above or below a limiting value, e.g., a temperature limit, the module sends and alarm to the controller.

5.7.2 OPC UA Server

The module has an integrated OPC UA server.

Function Overview

- Read module identification
- Read configuration
- Read measured values: current, voltage, temperature
- Events: overcurrent, overload and overtemperature
- Read status information
- Read process data

- Read statistics: minimum/maximum current per pin, minimum/maximum voltage per pin, minimum/maximum temperature
- User access: anonymous (only read access) or username/password (read and write access)

5.7.3 MQTT Client

The I/O module contains an integrated MQTT client and can send topics to an MQTT broker using the publish function. MQTT communication requires MQTT parameters to be set in the I/O module.

To allow MQTT communication to be used, the MQTT parameters can be set in the I/O Field Webserver. Alternatively, the MQTT parameters can be set for the I/O module in the configuration software of the PROFINET IO Controller. The GSDML file contains the optional submodule "MQTT network connection configuration" for this purpose.

6 Planning

6.1 Structure Guidelines

6.1.1 Data Security

Professional planning and design is an important requirement for securing data confidentiality, availability and integrity.

Random Influences

Data transmission and processing can be disrupted by random influences, such as temporary electromagnetic disturbances. Proper setup can significantly reduce the likelihood of corruption or destruction of data.

For additional information see:  [EMC Installations \[► 61\]](#).

Deliberate Influences

Use in ETHERNET Areas

ETHERNET products are designed for use in local networks. Please note the following when using ETHERNET products in your system:

- Do not connect control components and control networks to an open network such as the Internet or an office network.
WAGO recommends putting control components and control networks behind a fire-wall.
- In the control components, close all ports and services not required by your application to minimize the risk of cyber attacks and to enhance cybersecurity.
Only open the ports and services for the duration of the commissioning/configuration.
- Limit physical and electronic access to all automation components to authorized personnel only.
- To reduce the risk of unauthorized access to your system, change the default passwords during initial commissioning.
- To reduce the risk of unauthorized access to your system, regularly change the passwords used.
- To verify that the measures taken meet your security requirements, regularly perform threat analyses.
- To restrict access to and control of individual products and networks, employ a “defense-in-depth” mechanism in your system’s security configuration.

Additional document

-  [White Paper Cybersecurity in Production Facilities](#)

All the documentation and information is available at:  www.wago.com.

6.1.2 EMC Installations

- **Use shielded cables for data and signal lines.**

Electromagnetic interference is reduced and signal quality increased. Measurement errors, data transmission faults and interference due to excessive voltage can be prevented!

- **Keep data and signal lines separate from interference sources.**
Route data and signal lines separately from all power supply cables and other sources of high electromagnetic emissions (e.g., frequency converters or drives).
- **Connect the cable shielding with the ground potential.**
Integrated shielding is mandatory to meet technical specifications regarding measurement accuracy. Establish the connection between the cable shielding and ground potential at the inlet of the cabinet or housing. This grounding allows induced interferences to dissipate and be kept away from devices in the cabinet or housing.
- **Improve shielding performance with a large contact area.**
A low-impedance connection between shielding and ground achieves better shielding performance. For this purpose, connect the shielding over a large surface area, e.g., using the WAGO Series 790 Shield Connection System. This is especially recommended for large-scale systems where equalizing or high impulse currents may occur.

6.1.3 Mounting Position and Clearances

No particular distances need to be maintained between the modules, or between a module and a cabinet door or cover. The installation distances are determined exclusively by the plugs and cables used and their bending radii. Depending on the housing, a field-assembly pluggable connector may protrude past the edge of the housing.

Where high ambient temperatures occur at the same time as high current loads, modules must not be installed directly next to each other, to prevent them from heating each other up and to give them a large surface to dissipate heat to the ambient air.

The modules can be installed in all mounting positions

6.1.4 Safety Measures at the Installation Location

Note the following when selecting the installation location:

- For a high level of module use, the temperature-dependent operating range can be extended by installing metal surfaces, profiles or the like, or by installation in a ventilated environment. In the process, the module's internal temperature measurement can be used for optimization.
- To protect the module from any tensile forces that may occur, do not use it to bridge gaps.
- The module must not be mounted within shearing zones of moving system parts.
- Cables must not be able to get into the shearing zone of moving machine parts.
- Use protective caps to cover unused connections (see  **Accessories [▶ 177]**).

6.2 Functional Ground

There are basically two grounding options, which can also be used simultaneously:

- Via cable
- Via the housing

The I/O System Field operates in the extra-low voltage range (SELV/PELV). In these devices, interference is discharged via functional ground (FE). Functional ground (FE) is merely for discharging interference. It does not provide touch-proof protection for persons. Functional grounding is essential for fault-free operation of the device.

If you wish to perform additional grounding via the metal housing:

- Use conductive mounting screws on the mounting holes and ensure there is a good contact there
- Ensure that the mounting surface is level

6.3 Power Supply Concept

6.3.1 Design of the Power Supply

Two voltages are distinguished for the I/O System Field:

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

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

Power Supply of the Module and the Connected Sensors/Actuators

The 24 V power supply is fed in via the X31 (PWR IN) supply input. The module has two electrically isolated supply cables.

- Supply cable 1 connects 1L+ (pin 1) to 1L- (pin 3).
- Supply cable 2 connects 2L+ (pin 4) to 2L- (pin 2).

The sensors or actuators are powered through ports X01, X02 etc. The design of the power supply must take the demand of the connected sensors and actuators into account.

Successive devices can be powered through the X32 (PWR OUT) supply output. This current feedthrough must also be taken into account in the design of the power supply.

Protective Functions

The module has integrated protective functions (see  **Overload protection [► 54]**) to prevent damage in overload situations such as overcurrent or short circuit. However, it is important not to rely on these protective functions alone, but also to limit the currents externally, because these protective functions do not cover the current feedthrough for powering successive devices through the supply output (X32). The maximum supply current including the current feedthrough through X31 and X32 must be limited through fuse protection (see datasheet).

Consumption

For each supply cable, it is necessary to take into account the consumption that depends on the connected devices.

Supply Cable 1:

- Logic supply (about 200 mA)
- Power supply of all connected sensors/actuators via 1L
- Power supply of successive devices via 1L

Supply Cable 2:

- Power supply of all connected sensors/actuators via 2L
- Power supply of successive devices via 2L

Maximum Currents

Note

Note maximum currents

The following rules and calculations use the maximum currents. The ambient temperature and the requirements for UL-compliant use in particular use the maximum currents.

For planning and use of the product, always observe the information in section  **Tech-nical Data** [[▶ 18](#)].

Rules

In addition to the consumption of the connected devices, rules for the maximum load capacity must be followed. Comply with the following rules to prevent damage to the product:

- Supply voltage input X31 (PWR IN) and supply voltage input X32 (PWR OUT)
 - Rule 1: Take maximum load capacity of each connection contact (pin) into account
 - Rule 2: Take 1L and 2L current feedthrough into account
- Ports X01, X02 etc.
 - Rule 3: The current load of pin 3 must not exceed 4 A, since the sum of the pin 1 and 4 currents flows back through pin 3.

Rules 1 and 2: Supply Input X31 and Output X32

The currents for electrically isolated supply cables 1 and 2 must be considered separately. The two supply cables 1 are defined as follows:

- Supply cable 1 corresponds to the current flow path that starts at pin 1 (signal 1L+) of supply voltage connection PWR IN (X31) and passes through the device to pin 3 (signal 1L-) of PWR IN. This is shown in blue in the current flow figure in Connect Sensors/ Actuators.
- Supply cable 2 corresponds to the current flow path that starts at pin 4 (signal 2L+) of supply voltage connection PWR IN (X31) and passes through the device to pin 2 (signal 2L-) of PWR IN. This is shown in red in the current flow figure in Connect Sensors/ Actuators.

The following rule applies to both supply cables:

Rule 1 – upper limit for current in the entire supply cable (1 or 2)

The upper limit of 16 A applies to the total current in a supply cable.

For UL applications, the upper limit of 12 A applies to the sum of the two supply lines.

If this upper limit is exceeded, there is a risk of destruction of or damage to the module. To avoid this, protect each supply line with a fuse or circuit breaker. In connection with this, also read section  **Requirements on the Power Supply** [[▶ 67](#)].

In addition, observe the derating, i.e. the maximum current as a function of the ambient temperature.

The following partial currents contribute to the total current in supply cable 1:

1. The I_{logic} current for powering the device's internal electronics (the device is powered via supply cable 1)
2. The I_{X0i_1L} currents for powering the connected devices, sensors and actuators (for each port i)

3. The I_{X32_1L} current that flows through the PWR OUT (X32) supply voltage output to other connected devices (current feedthrough)

The following partial currents contribute to the total current in supply cable 2:

1. The I_{X01_2L} currents for powering the connected devices, sensors and actuators (for each port i)
2. The I_{X32_2L} current that flows through PWR OUT (X32) the supply voltage output to other connected devices

The following rule applies to both supply cables:

Rule 2 – current feedthrough limiting

The supply voltage for the devices of a supply cable that are connected to the PWR OUT output supply connection is passed on through the device via the input supply connection. The maximum permissible current feedthrough for the respective supply cable is determined by the current load capacity of the pluggable connector on the input supply connection and the PCB. The maximum is 16 A.

For UL applications, the upper limit of 12 A applies to the sum of the two supply lines.

The total current must not exceed this current carrying capacity.

Note the following:

1. When using digital outputs, the current feedthrough must be reduced by the current that flows through these outputs, for example.
2. In the worst case, the permissible current feedthrough may reach a value of **0 A!**
3. The passthrough connection between the supply voltage input and output has **no internal protective device** against overcurrent!

Therefore, the safety measures given in [🔗 Requirements on the Power Supply ▶ 67](#) (fuse protection, regulated power supply with current limitation and additional monitoring of the measured values of the sensors) are necessary.

Rule 3: Ports X01, X02 etc.

The following rules apply to each port of the product individually:

Rule 3 – Upper limits for current on the individual pins of the ports

The following upper limits apply to the currents on the pins of the individual ports:

Table 52: Upper Limits for Current on the Individual Pins of the Connections

Pin	Normal Operation	Overload Operation
1	4 A	4 A
2	2 A	2.4 A
3	4 A	4 A
4	2 A	2.4 A

The device is designed in such a way that it can be used in overload operation according to the following table “Module 765-4102/100-000 – Currents in Supply Cable 1” without time limit. The following applies to all pins:

If the maximum load capacity (upper limit of overload operation) of the pin is exceeded, there is a risk of destruction of or damage to the pluggable connector or PCB of the device.

⚠ CAUTION

Note significance of pin 3

Note that the sum of the currents of pins 1 and 4 flows to pin 3.

Product-Specific Information

For supply cable 1 of the 765-4102/100-000 IO-Link Module, the currents declared in the following table must be taken into account:

Table 53: Module 765-4102/100-000 – Currents in Supply Cable 1

Current	Description
I_{X31_1L}	Current to connection PWR IN (X31): current 1L+ / reverse current 1L–
I_{X32_1L}	Current to connection PWR OUT (X32): current 1L+ / reverse current 1L–
I_{logic}	Logic supply
$I_{X01_1L}, I_{X02_1L}, \dots, I_{X08_1L}$	Total current for supply cable 1 on port X0i (i.e. port X01, X02, ..., X08); corresponds to the current $I_{X0i_pin3_1L}$ on pin 3 (ground). This current is the sum of the currents on pins 1 and 4 of port X0i: $I_{X0i_1L} = I_{X0i_pin3_1L} = I_{X0i_pin1_1L} + I_{X0i_pin4_1L}$
I_{module_1L}	Module current $I_{module_1L} = I_{X01_pin3_1L} + I_{X02_pin3_1L} + \dots + I_{X08_pin3_1L}$

For supply cable 2 of the 765-4102/100-000 IO-Link Module, the currents declared in the following table must be taken into account:

Table 54: Module 765-4102/100-000 – Currents in Supply Cable 2

Current	Description
I_{X31_2L}	Current to connection PWR IN (X31): current 2L+ / reverse current 2L–
I_{X32_2L}	Current to connection PWR OUT (X32): current 2L+ / reverse current 2L–
$I_{X01_2L}, I_{X02_2L}, \dots, I_{X08_2L}$	Total current on port X0i (i.e. ports X01, X02, ..., X08) for supply cable 2 corresponds to the current $I_{X0i_pin5_2L}$ on pin 5 (ground). This current is the current on pin 2 of port X0i: $I_{X0i_2L} = I_{X0i_pin5_2L} = I_{X0i_pin2_2L}$
I_{module_2L}	Module current $I_{module_2L} = I_{X01_pin5_2L} + I_{X02_pin5_2L} + \dots + I_{X08_pin5_2L}$

During operation of the 765-4102/100-000 IO-Link Module, the rules below for the currents in supply cables 1 and 2 must be followed at all times:

Table 55: Rules for Supply Cables 1 and 2

Current	Supply Cable 1	Supply Line 2
Total current for the supply cable (rule 1)	$I_{X31_1L} \leq 16 \text{ A}$ $I_{X31_1L} = I_{logic} + I_{X32_1L} + I_{module_1L}$	$I_{X31_2L} \leq 16 \text{ A}$ $I_{X31_2L} = I_{X32_2L} + I_{module_2L}$
Permissible current feedthrough (rule 2)	$I_{X32_1L} \leq 16 \text{ A} - I_{logic} - I_{module_1L}$	$I_{X32_2L} \leq 16 \text{ A} - I_{module_2L}$
Ports	Ports X01, ..., X08 (henceforth summarized as port X0i for $1 \leq i \leq 8$) Pins 1, 3 und 4	Ports X01, ..., X08 (henceforth summarized as port X0i for $1 \leq i \leq 8$) Pins 2 and 5
Supply current on pin 1 (rule 3)	$I_{X0i_pin1_1L} \leq 4 \text{ A}$	$I_{X0i_2L} \leq 4 \text{ A}$
Signal current on pin 4 in normal operation (rule 3)	$I_{X0i_pin4_1L} \leq 2 \text{ A}$	-
Signal current at pin 4 in overload operation (rule 3)	$I_{X0i_pin4_1L} \leq 2.4 \text{ A}$	-
Reverse current to pin 3 or 5 (ground) (rule 3)	$I_{X0i_pin3_1L} \leq 4 \text{ A}$	$I_{X0i_pin5_2L} \leq 4 \text{ A}$

6.3.2 Power Loss Calculation

To determine whether long cable lengths still supply the product with sufficient voltage, the voltage losses on the cable can be calculated as follows:

$$U = 2 \times I \times R$$

where:

U	Voltage drop
2	Factor for feed and return lines
I	Current
R _L	Cable resistance

For WAGO 4 × 1.5 mm² supply cables, the cable resistance R_L per wire R_L ≤ 13.7 Ω/km.

Example of Voltage Drop for Feed and Return Lines with a Current of 8 A on the WAGO 4 × 1.5 mm² Supply Cable

$$U = 2 \times 8 \text{ A} \times 13.7 \text{ Ω/km} = 219.2 \text{ V/km}$$

This corresponds to a voltage drop of 2.19 V per 10 m of cable length for feed and return lines.

Example of Voltage Drop per Wire with a Current of 16 A on a 4 × 2.5 mm² Supply Cable

$$U = 2 \times 16 \text{ A} \times 8.22 \text{ Ω/km} = 263 \text{ V/km}$$

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

If the resistance of the cable used is not known, it can be calculated approximately with the following formula:

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

where:

R _L	Cable resistance
l	Cable length
K	Specific cable resistance of the conductor material (usually copper) according to manufacturer's specifications
A	Cable cross-section

6.3.3 Requirements on the Power Supply

Power Source

Use SELV/PELV power sources for non-hazardous active voltages per EN/UL/IEC 61010-1.

Note**Note the following when 1L and 2L are supplied separately:**

If 1L and 2L are to be supplied separately (e.g., for safe switch-off of 2L), then either central grounding must be implemented using two power supply units, or the power supply connection must be made on the same phase. Use of two separate power supply units is not mandatory.

Overcurrent Protection**CAUTION****Overheating due to insufficient overcurrent protection**

Inadequate overcurrent protection can lead to severe overheating in the product.

- Always use an external fuse or a circuit breaker!

Technical data of the fuse/circuit breaker:

- **Fuse:** max. 16 A, slow, min. 30 VDC (always required for UL applications)
- **Circuit breaker:** 24 VDC, max. 16 A with trip characteristic type B

6.3.4 Additional Measures

The setup must ensure that the total current that flows back through pin 3 does not exceed the load limit.

The values of all currents on all pins of all connections (except for pin 3 = ground pin) and the calculated total currents of the two supply cables are measured by the chip used in the 765 Series products and thus can be recorded by a monitoring application. These values can be accessed via the OPC UA server, for example.

On the basis of these measured values, a monitoring application with integrated current management can be implemented. This can regularly verify that all monitoring functions are satisfied on the basis of the measured current values and also monitor the temperatures and voltages on the connections.

6.4 Derating

Please note the derating for use of the product. The surrounding air temperature and the current affect the product's heat generation.

The derating curve was created with the following conditions of use: "without air movement and with 0.5 m/s air movement" and "mounting on wall with poor heat conductivity." The real conditions of use may lead to better heat dissipation from the product, e.g. due to greater air movement or better dissipation of heat to the mounting wall. The product provides measured values for temperature and current, which you can display with WAGO Webserver I/O Field or read out via OPC UA.

The following figure shows the maximum permissible current (I) that can flow into the product as a function of the surrounding air temperature (T).

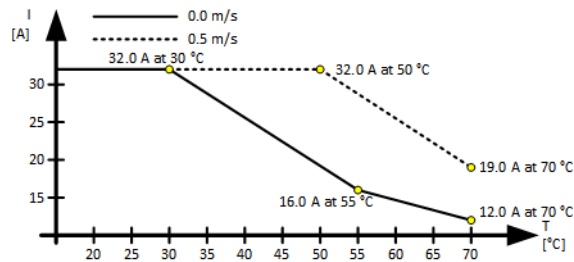
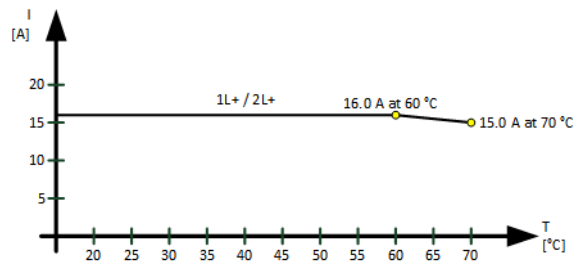
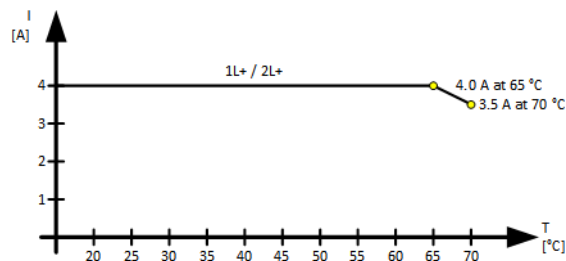


Figure 5: Derating, 765-4102/100-000

Also note the derating curve for the individual contacts (pins) of the L-coded connections X31 and X32. The following figure shows the maximum permissible current (I) that can flow through the contact (pin) as a function of the ambient temperature (T).

Figure 6: Derating of a Contact (Pin) of L-Coded Connections X31 and X32 (For Core Cross-Section = 0.25 mm²/AWG 14)

Also note the derating curve for the individual contacts (pins) of the A-coded connections port X01, X02 etc. The following figure shows the maximum permissible current (I) that can flow through the contact (pin) as a function of the ambient temperature (T).

Figure 7: Derating of a Contact (Pin) of the A-Coded Connections Port X01, X02, ... (for Core Cross-Section = 0.34 mm²/AWG 22)

High currents may occur on connection ports X01, X02, ... on pin 1, pin 2, pin 3 and pin 5.

6.5 Requirements for Wiring and Accessories

Use protective caps to cover unused connections to protect the connections and to obtain the IP67 protection type.

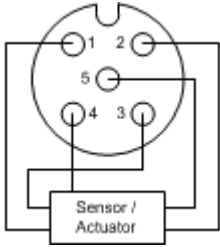
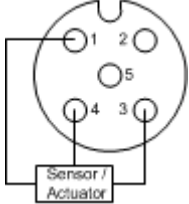
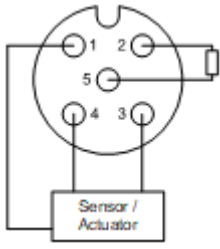
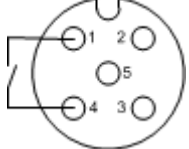
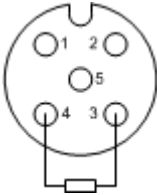
For UL Enclosure Type 1 applications, use a UL-certified cable with appropriate ratings (CYJV, DUXR or PVVA) to connect devices.

For UL enclosure type 12 applications, use the field wiring material listed in UR CYJV, E519602, DUXR.E345416 and/or PVVA.E519600. For more information, see [Accessories \[p. 177\]](#).

6.6 Connection Options

The following table shows the connection options for IO-Link devices (class B) and digital inputs and outputs.

Table 56: Connecting an IO-Link Device or Digital Input or Output

Connection Option	Description
	Connection of an IO-Link device (Class B). Required port configuration: IO-Link master and pin 2 provides supply voltage 2L+.
	Connection of an IO-Link device (Class A). Required port configuration: IO-Link master and pin 2 does not provide supply voltage.
	Connection of an IO-Link device and a digital output on channel B. Required port configuration: IO-Link master and pin 2 as a digital output. The reference potential for 2L+ (pin 2) is 2L- (pin 5).
	Connection of a digital input. Required port configuration: pin 4 as a digital input.
	Connection of a digital output. Required port configuration: pin 4 as a digital output.

6.7 Settings Options

Firmware V1.2 (Release 02) is a further development of firmware V1.1 (Release 01). The parameters of firmware V1.2 have been expanded from those of firmware V1.1. Proper operation always requires an engineering configuration that matches the device firmware. Firmware V1.1 requires a V1.1 engineering configuration; Firmware V1.2 requires a V1.2 engineering configuration; etc.

6.7.1 PROFINET Parameters

“IO-Link Master” Parameters

The following table describes the parameters of the IO-Link master, including the sub-modules for the IO-Link ports.

Table 57: “IO-Link Master” Parameters, including Submodule

Parameter Group	Parameters	Default	Value Range	Description
Digital PD layout configuration	PD layout	0	0: port-based	Order of the process data of the digital inputs and digital outputs: bit 0 = port 1 pin 4, bit 1 = port 1 pin 2, bit 2 = port 2 pin 4, bit 3 = port 2 pin 2, ...
			1: pin-based	The order of the process data of the digital inputs and digital outputs: bit 0 = port 1 pin 4, bit 1 = port 2 pin 4, bit 2 = port 3 pin 4, bit 3 = port 4 pin 4, ... bit 8 = port 1 pin 2, bit 9 = port 1 pin 2, ...
Force mode setting	Force mode setting	0	0: enable force mode	The “Forcing” operating mode is allowed to be used (default)
			1: disable force mode	The “Forcing” operating mode is not allowed to be used.
BT interface configuration	BT optical interface	0	0: activation allowed	The Bluetooth® interface can be enabled by an optical signal of a mobile device and in connection with the WAGO I/O Field app.
			1: activation denied	The Bluetooth® interface cannot be enabled by an optical signal of a mobile device and in connection with the WAGO I/O Field app.
	BT timeout [s]	30	6 ... 59	Switch-off time of the Bluetooth® interface if not used. A new Bluetooth® connection can be established by an optical signal after the Bluetooth® interface is reactivated. The unit for the switch-off time is seconds. Entering 0 is not allowed, since the Bluetooth® interface must always switch off after the switch-off time elapses.
Switch-On Delay	Switch-On Delay 1L / 2L	0	0: Disable Switch-On Delay	Power-on delay is disabled.
			1: Enable Switch-On Delay	The power-on delay is enabled, and the module switches the ports' power supply on with a delay during start-up. The ports are switched on in sequence: port X01, X02, ...
	Start delay time 1L [ms]	1	1 ... 20000	Start delay for supply voltage 1L.
	Delay to next channel 1L [ms]	1	1 ... 1000	Delay for supply voltage 1L to the next port.
	Start delay time 2L [ms]	1	1 ... 20000	Start delay for supply voltage 2L.
	Delay to next channel 2L [ms]	1	1 ... 1000	Delay for supply voltage 2L to the next port.

The following table describes the parameters of the submodules:

- IO-Link 1 I / 1 O + PQI
- IO-Link 1 I + PQI
- IO-Link 1 O + PQI

- IO-Link 2 I / 2 O + PQI
- IO-Link 2 I + PQI
- IO-Link 2 O + PQI
- IO-Link 4 I / 2 O + PQI
- IO-Link 4 I + PQI
- IO-Link 4 O + PQI
- IO-Link 8 I / 8 O + PQI
- IO-Link 8 I + PQI
- IO-Link 8 O + PQI
- IO-Link 16 I / 16 O + PQI
- IO-Link 16 I + PQI
- IO-Link 16 O + PQI
- IO-Link 32 I / 32 O + PQI
- IO-Link 32 I + PQI
- IO-Link 32 O + PQI

In the parameters of this submodule, up to 32 parameters can be set for transmission to the IO-Link device. A parameter set contains the object index, the object subindex, the parameter count and the parameter data. The maximum quantity of parameter data is 32 bytes per parameter set. Permissible values for the object index, the object subindex and the parameter data are described in the documentation of the IO-Link device used.

Table 58: Parameters of the "IO-Link XX I / XX O + PQI" Submodule

Parameter Group	Parameter	Default	Value Range	Description
IQ behavior	I/Q behavior	7	5: Power AUX	Supply cable 2L+ on pin 2.
			6: Digital output	Pin 2 is a digital output with 2L+. The reference potential is 2L- (pin 5).
			7: Power AUX off	Pin 2 supplies no output voltage.
IO-Link port parameters	Enable port diagnostics	1	0: disable	The PROFINET port diagnostics are disabled, i.e. no diagnostic alarms are triggered.
			1: Enable	PROFINET port diagnostics are enabled.
	Enable process alarm (device notification)	1	0: disable	PROFINET process alarms are disabled.
			1: Enable	PROFINET process alarms are enabled.
	Configuration source	1	0: PDCT (Port and Device Configuration Tool)	Configuration is performed via a "port and device configuration tool."
			1: PNIO	Configuration is performed via the PROFINET IO-Controller.
	Enable input fraction	0	0: disable	Input fraction is switched off.
			1: Enable	Input fraction is switched on.
	Enable pull/plug	1	0: disable	PROFINET pull/plug alarms are disabled.
			1: Enable	PROFINET pull/plug alarms are enabled.
	Port mode	2	0: Deactivated	Port operating mode: pin 4 is disabled.
			1: IOL_Manual	Pin 4 is operated as an IO-Link port with manual configuration (GSD-based port configuration).

Parameter Group	Parameter	Default	Value Range	Description
			2: IOL_Auto-start	Pin 4 is operated as an IO-Link port with automatic configuration (plug and play).
	Validation/backup	0	0: No Device check	No device check is performed for validation or backup of connected IO-Link slave devices.
			1: Type-compatible device (V1.0)	A device check for the indicated device type is performed for validation or backup of connected IO-Link slave devices.
			2: Type-compatible device (V1.1)	
			3: Type-compatible V1.1 device with backup + restore	
			4: Type-compatible V1.1 device with restore	
	Port cycle time	0	0, 4 ... 191	Port cycle time 0: calculated by IO-Link master 4 ... 191: see table Port Cycle Time [► 76].
	Vendor ID	0	0 ... 65535	Manufacturer ID The manufacturer ID is used to check whether an IO-Link device from the right manufacturer is connected. For the value of the manufacturer ID, see the documentation of the sensor/actuator used. If the value is 0, no check is performed.
	Device ID	0	0 ... 4294967295	Device ID The device ID is used to check whether the right IO-Link device is connected. For the value of the device ID, see the documentation of the sensor/actuator used. If the value is 0, no check is performed.

The following table describes the parameters of the submodules:

- IO-Link 1 I / 1 O + PQI + ISDU
- IO-Link 1 I + PQI + ISDU
- IO-Link 1 O + PQI + ISDU
- IO-Link 2 I / 2 O + PQI + ISDU
- IO-Link 2 I + PQI + ISDU
- IO-Link 2 O + PQI + ISDU
- IO-Link 4 I / 2 O + PQI + ISDU
- IO-Link 4 I + PQI + ISDU
- IO-Link 4 O + PQI + ISDU
- IO-Link 8 I / 8 O + PQI + ISDU
- IO-Link 8 I + PQI + ISDU
- IO-Link 8 O + PQI + ISDU
- IO-Link 16 I / 16 O + PQI + ISDU
- IO-Link 16 I + PQI + ISDU
- IO-Link 16 O + PQI + ISDU

- IO-Link 32 I / 32 O + PQI + ISDU
- IO-Link 32 I + PQI + ISDU
- IO-Link 32 O + PQI + ISDU

In the parameters of this submodule, up to 32 parameters can be set for transmission to the IO-Link device. A parameter set contains the object index, the object subindex, the parameter count and the parameter data. The maximum quantity of parameter data is 32 bytes per parameter set. Permissible values for the object index, the object subindex and the parameter data are described in the documentation of the IO-Link device used.

Table 59: Parameters of the "IO-Link XX I / XX O + PQI + ISDU" Submodule

Parameter Group	Parameter	Default	Value Range	Description
IQ behavior	I/Q behavior	7	5: Power AUX	Supply cable 2L+ on pin 2.
			6: Digital output	Pin 2 is a digital output with 2L+. Note: The reference potential is 2L- (pin 5).
			7: Power AUX off	Pin 2 supplies no output voltage.
ISDU Batch configuration	ISDU State Settings	0	0: disabled	Parameter transmission via ISDU disabled.
			1: enabled	Parameter transmission via ISDU enabled. The IO-Link master transmits the parameter settings to the connected IO-Link device via ISDU. The user can then set up to 32 parameters.
ISDU Batch parameterization	ISDU transfer with system command download start and end	0	0: ISDU transfer disabled	Sending of the system command "Download Start and Download Store" is disabled.
			1: ISDU transfer enabled	The IO-Link master sends the system command "Download Start and Download Store" in addition to the parameters. The IO-Link master triggers the "DSUploadFlag" in the IO-Link device.
ISDU parameter 1, ..., ISDU parameter 32	ISDU index (DEC)	0	0 ... 65535	Object index (decimal value) of the IO-Link device. A value of 0 disables the transmission of this parameter set.
	ISDU subindex (DEC)	0	0 ... 255	Object subindex (decimal value).
	ISDU length (DEC)	0	0 ... 32	Parameter count (decimal value). The parameter count determines how much of the following parameter data is valid and is transferred to the IO-Link device.
	ISDU data (HEX)	0	0 ... 0xFF	Parameter data in hexadecimal format. Always enter 32 bytes and fill unused parameter data with 00. Example: The parameter count has a value of 4. Then enter the four parameter data points, then a value of 00 28 times.
IO-Link port parameters	Enable port diagnostics	1	0: disable	The PROFINET port diagnostics are disabled, i.e. no diagnostic alarms are triggered.
			1: Enable	PROFINET port diagnostics are enabled.
	Enable process alarm (device notification)	1	0: disable	PROFINET process alarms are disabled.
			1: Enable	PROFINET process alarms are enabled.

Parameter Group	Parameter	Default	Value Range	Description
	Configura- tion source	1	0: PDCT (Port and Device Con- figuration Tool)	Configuration is performed via a “port and device config- uration tool.”
			1: PNIO	Configuration is performed via the PROFINET IO-Con- troller.
	Enable in- put fraction	0	0: disable	Input fraction is switched off.
			1: Enable	Input fraction is switched on.
	Enable pull/ plug	1	0: disable	PROFINET pull/plug alarms are disabled.
			1: Enable	PROFINET pull/plug alarms are enabled.
	Port mode	2	0: Deacti- vated	Port operating mode: pin 4 is disabled.
			1: IOL_Manual	Pin 4 is operated as an IO-Link port with manual configu- ration (GSD-based port configuration).
			2: IOL_Au- tostart	Pin 4 is operated as an IO-Link port with automatic con- figuration (plug and play).
	Validation/ backup	0	0: No De- vice check	No device check is performed for validation or backup of connected IO-Link slave devices.
			1: Type- compatible device (V1.0)	A device check for the indicated device type is performed for validation or backup of connected IO-Link slave de- vices.
			2: Type- compatible device (V1.1)	
			3: Type- compatible V1.1 device with backup + restore	
	Port cycle time	0	0, 4 ... 191	Port cycle time 0: calculated by IO-Link master 4 ... 191: see table  Port Cycle Time ► 76].
	Vendor ID	0	0 ... 65535	Manufacturer ID The manufacturer ID is used to check whether an IO-Link device from the right manufacturer is connected. For the value of the manufacturer ID, see the documentation of the sensor/actuator used. If the value is 0, no check is performed.
	Device ID	0	0 ... 429496729 5	Device ID The device ID is used to check whether the right IO-Link device is connected. For the value of the device ID, see the documentation of the sensor/actuator used. If the value is 0, no check is performed.

The “Port Cycle Time” parameter contains a factor (bits 0 to 5) and a time basis (bits 6+7). The following table describes how the port cycle time is calculated from the factor and the time basis.

Table 60: “Port Cycle Time”

Value Range	Time Basis (Bits 6+7)	Factor (Bits 0 ... 5)	Port Cycle Time (Formula)	Example
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.	-

However, the shortest port cycle time is always specified by the IO-Link device. The port cycle time can only be increased.

“DI” (Digital Input) Parameters

The following table describes the parameters of the DI submodule:

Table 61: “DI” (Digital Input) Parameters

Parameter Group	Parameter	Default	Value Range	Description
IQ behavior	I/Q behavior	7	5: Power AUX	Supply cable 1L+ on pin 2.
			6: Digital output	Pin 2 is a digital output.
			7: Power AUX off	Pin 2 supplies no output voltage.
Digital configuration	DI logic C/Q (pin 4)	0	0: DI not inverted (NO normally open)	Operating mode of the digital input: The signal on pin 4 is not inverted.
			1: DI inverted (NC normally closed)	Operating mode of the digital input: The signal on pin 4 is inverted.
	DI filter time C/Q (pin 4)	0	0: no filter	No filter active for detecting a signal change of the pin 4 input signal.
			30: 3 ms filter time	Filter time setting for detecting a signal change of the input signal. The filter time is the amount of time the signal must be present in order for a signal change to be detected.
			150: 15 ms filter time	

Parameter Group	Parameter	Default	Value Range	Description
			200: 20 ms filter time	
DO IQ substitute configuration	DO substitute configuration	0	0: Set low	Set digital output pin 2 to low level in the event of error.
			1: Set high	Set digital output pin 2 to high level in the event of error.
			2: Hold last	Hold digital output pin 2 at its last value in the event of error.
Digital port parameter	Enable port diagnostics	1	0: disable	The PROFINET port diagnostics are disabled, i.e. no diagnostic alarms are triggered.
			1: Enable	PROFINET port diagnostics are enabled.
	Configuration source	1	0: PDCT (Port and Device Configuration Tool)	Configuration is performed via a "port and device configuration tool."
			1: PNIO	Configuration is performed via the PROFINET IO-Controller.

"DO" (Digital Output) Parameters

The following table describes the parameters of the DO submodule:

Table 62: "DO" (Digital Output) Parameters

Parameter Group	Parameter	Default	Value Range	Description
IQ behavior	I/Q behavior	7	5: Power AUX	Supply cable 2L+ on pin 2.
			6: Digital output	Pin 2 is a digital output.
			7: Power AUX off	Pin 2 supplies no output voltage.
Digital configuration	DO static on C/Q pin	0	0: disable	Pin 4 supplies no output voltage.
			1: enable	Pin 4 is a digital output and supplies +24 VDC.
DO CQ substitute configuration	DO substitute configuration	0	0: Set low	Set digital output pin 4 to low level in the event of error.
			1: Set high	Set digital output pin 4 to high level in the event of error.
			2: Hold last	Hold digital output pin 4 at its last value in the event of error.
DO IQ substitute configuration	DO substitute configuration	0	0: Set low	Set digital output pin 2 to low level in the event of error.
			1: Set high	Set digital output pin 2 to high level in the event of error.
			2: Hold last	Hold digital output pin 2 at its last value in the event of error.
Digital port parameter	Enable port diagnostics	1	0: disable	The PROFINET port diagnostics are disabled, i.e. no diagnostic alarms are triggered.
			1: Enable	PROFINET port diagnostics are enabled.
	Configuration source	1	0: PDCT (Port and Device Configuration Tool)	Configuration is performed via a "port and device configuration tool."
			1: PNIO	Configuration is performed via the PROFINET IO-Controller.

The following table describes the parameters of the “deactivated” submodule. The submodule parameters are preset and cannot be modified.

Table 63: Parameters of the “Deactivated” Submodule

Parameter Group	Parameters	Default	Value Range	Description
I/Q behavior	I/Q behavior	7	7: power AUX off	Default setting for disabled port.
Digital configuration	DI logic I/Q pin	0	0: DI not inverted (NO normally open)	Default setting for disabled port.
	DI logic C/Q pin	0	0: DI not inverted (NO normally open)	
	DI filter time I/Q pin	0	0: no filter	
	DI filter time C/Q pin	0	0: no filter	
	DO static on I/Q pin	0	0: disable	
DO CQ substitute configuration	DO substitute configuration	0	0: set low	Default setting for disabled port.
DO IQ substitute configuration (only for class A)	DO substitute configuration	0	0: set low	Default setting for disabled port.
ISDU Batch configuration	ISDU State Settings	0	0: disabled	Default setting for disabled port.
Digital port parameter	Enable port diagnostics	0	0: disable	Default setting for disabled port.
	Enable process alarm (device notification)	0	0: disable	Default setting for disabled port.
	Configuration source	1	1: PNIO	Default setting: The PROFINET IO controller sends the parameters to disable the port.
	Enable input fraction	0	0: disable	Default setting for disabled port.
	Enable pull/plug	0	0: disable	Default setting for disabled port.
	Port mode	0	0: DEACTIVATED	Pin 4 is disabled.
	Validation/backup	0	0: no device check	Default setting for disabled port.

If you are using a 765-1701 Hubline module, you can select the corresponding “Hubline 765-1701” submodule and set the parameters for the Hubline module.

Table 64: "Hubline 765-1701" Submodule Parameters

Parameter Group	Parameter	Default	Value Range	Description
Hubline Port Configuration	Port X01 / pin 4, port X02 / pin 4, ...	0	0: Digital Input	Pin 4 is a digital input.
			1: Digital Output	Pin 4 is a digital output.
	Port X01 / pin 2, port X02 / pin 2, ...	0	0: Digital Input	Pin 2 is a digital input.
			1: Digital Output	Pin 2 is a digital output.
Hubline Failsafe Configuration	Port X01 / pin 4, port X02 / pin 4, ...	0	0: set low	Set digital output to low level in the event of error.
			1: set high	Set digital output to high level in the event of error.
			2: hold last	Hold digital output at its last value in the event of error.
	Port X01 / pin 2, port X02 / pin 2, ...	0	0: set low	Set digital output to low level in the event of error.
			1: set high	Set digital output to high level in the event of error.
			2: hold last	Hold digital output at its last value in the event of error.
Hubline DI Inversion Configuration	Port X01 / pin 4, port X02 / pin 4, ...	0	0: DI not inverted (NO normally open)	Operating mode as digital input: The signal on pin 4 is not inverted.
			1: DI inverted (NC normally closed)	Operating mode of the digital input: The signal on pin 4 is inverted.
	Port X01 / pin 2, port X02 / pin 2, ...	0	0: DI not inverted (NO normally open)	Operating mode of the digital input: The signal on pin 2 is not inverted.
			1: DI inverted (NC normally closed)	Operating mode of the digital input: The signal on pin 2 is inverted.
Hubline DI Filter Configuration	Port X01 / pin 4, port X02 / pin 4, ...	0	0: no filter time	No filter active for detecting a signal change of the pin 4 input signal.
			1: 1 µs filter time	Filter time setting for detecting a signal change of the input signal. The filter time is the amount of time the signal must be present in order for a signal change to be detected.
			2: 10 µs filter time	
			3: 100 µs filter time	
			4: 1 ms filter time	
			5: 2 ms filter time	
			6: 3 ms filter time	

Parameter Group	Parameter	Default	Value Range	Description
	Port X01 / pin 2, port X02 / pin 2, ...	0	0: no filter time	No filter active for detecting a signal change of the pin 2 input signal.
			1: 1 µs filter time	Filter time setting for detecting a signal change of the input signal. The filter time is the amount of time the signal must be present in order for a signal change to be detected.
			2: 10 µs filter time	
			3: 100 µs filter time	
			4: 1 ms filter time	
			5: 2 ms filter time	
			6: 3 ms filter time	
IO-Link port parameters	Enable port diagnostics	1	0: disable	The PROFINET port diagnostics are disabled, i.e. no diagnostic alarms are triggered.
			1: Enable	PROFINET port diagnostics are enabled.
	Enable process alarm (device notification)	1	0: disable	PROFINET process alarms are disabled.
			1: Enable	PROFINET process alarms are enabled.
	Enable input fraction	0	0: disable	Input fraction is switched off.
			1: Enable	Input fraction is switched on.
	Enable pull/plug	1	0: disable	PROFINET pull/plug alarms are disabled.
			1: Enable	PROFINET pull/plug alarms are enabled.
	Port mode	1	1: IOL_Manual	Pin 4 is operated as an IO-Link port with manual configuration (GSD-based port configuration).
	Validation/backup	2	2: Type-compatible device (V1.1)	A device check for the indicated device type is performed for validation or backup of connected IO-Link slave devices.
	Port cycle time: bit 0 .. 5 multipliers / bit 6.. 7 timebase [ms]	0	0, 4 ... 191	Port cycle time 0: calculated by IO-Link master 4 ... 191: see table Port Cycle Time [p. 76] .
	Vendor ID	285	285	Manufacturer ID for Wago
	Device ID	8390312	8390312	Device ID The device ID is read out and checked to see whether the correct HubLine device is connected.

If you are using a 765-1702 Hubline module, you can select the corresponding “Hubline 765-1702” submodule and set the parameters for the Hubline module.

Table 65: "Hubline 765-1702" Submodule Parameters

Parameter Group	Parameter	Default	Value Range	Description
Hubline Port Configuration	Port X01 / pin 4, port X02 / pin 4, ...	0	0: Digital Input	Pin 4 is a digital input.
			1: Digital Output	Pin 4 is a digital output.
Hubline Failsafe Configuration	Port X01 / pin 4, port X02 / pin 4, ...	0	0: set low	Set digital output to low level in the event of error.
			1: set high	Set digital output to high level in the event of error.
			2: hold last	Hold digital output at its last value in the event of error.
Hubline DI Inversion Configuration	Port X01 / pin 4, port X02 / pin 4, ...	0	0: DI not inverted (NO normally open)	Operating mode of the digital input: The signal on pin 4 is not inverted.
			1: DI inverted (NC normally closed)	Operating mode of the digital input: The signal on pin 4 is inverted.
Hubline DI Filter Configuration	Port X01 / pin 4, port X02 / pin 4, ...	0	0: no filter time	No filter active for detecting a signal change of the pin 4 input signal.
			1: 1 µs filter time	Filter time setting for detecting a signal change of the input signal. The filter time is the amount of time the signal must be present in order for a signal change to be detected.
			2: 10 µs filter time	
			3: 100 µs filter time	
			4: 1 ms filter time	
			5: 2 ms filter time	
			6: 3 ms filter time	
IO-Link port parameters	Enable port diagnostics	1	0: disable	The PROFINET port diagnostics are disabled, i.e. no diagnostic alarms are triggered.
			1: Enable	PROFINET port diagnostics are enabled.
	Enable process alarm (device notification)	1	0: disable	PROFINET process alarms are disabled.
			1: Enable	PROFINET process alarms are enabled.
	Enable input fraction	0	0: disable	Input fraction is switched off.
			1: Enable	Input fraction is switched on.
	Enable pull/plug	1	0: disable	PROFINET pull/plug alarms are disabled.
			1: Enable	PROFINET pull/plug alarms are enabled.
	Port mode	1	1: IOL_Manual	Pin 4 is operated as an IO-Link port with manual configuration (GSD-based port configuration).
	Validation/backup	2	2: Type-compatible device (V1.1)	A device check for the indicated device type is performed for validation or backup of connected IO-Link slave devices.

Parameter Group	Parameter	Default	Value Range	Description
	Port cycle time: bit 0 .. 5 multipliers / bit 6.. 7 timebase [ms]	0	0, 4 ... 191	Port cycle time 0: calculated by IO-Link master 4 ... 191: see table Port Cycle Time [▶ 76].
	Vendor ID	285	285	Manufacturer ID for Wago
	Device ID	8390313	8390313	Device ID The device ID is read out and checked to see whether the correct HubLine device is connected.

If you are using a 765-1703 Hubline module, you can select the corresponding “Hubline 765-1703” submodule and set the parameters for the Hubline module.

Table 66: “Hubline 765-1703” Submodule Parameters

Parameter Group	Parameter	Default	Value Range	Description
Hubline Port Configuration	Port X01 / pin 4, port X02 / pin 4, ...	0	0: Digital Input	Pin 4 is a digital input.
			1: Digital Output	Pin 4 is a digital output.
	Port X01 / pin 2, port X02 / pin 2, ...	0	0: Digital Input	Pin 2 is a digital input.
			1: Digital Output	Pin 2 is a digital output.
Hubline Failsafe Configuration	Port X01 / pin 4, port X02 / pin 4, ...	0	0: set low	Set digital output to low level in the event of error.
			1: set high	Set digital output to high level in the event of error.
			2: hold last	Hold digital output at its last value in the event of error.
	Port X01 / pin 2, port X02 / pin 2, ...	0	0: set low	Set digital output to low level in the event of error.
			1: set high	Set digital output to high level in the event of error.
			2: hold last	Hold digital output at its last value in the event of error.
Hubline DI Inversion Configuration	Port X01 / pin 4, port X02 / pin 4, ...	0	0: DI not inverted (NO normally open)	Operating mode as digital input: The signal on pin 4 is not inverted.
			1: DI inverted (NC normally closed)	Operating mode of the digital input: The signal on pin 4 is inverted.
	Port X01 / pin 2, port X02 / pin 2, ...	0	0: DI not inverted (NO normally open)	Operating mode of the digital input: The signal on pin 2 is not inverted.
			1: DI inverted (NC normally closed)	Operating mode of the digital input: The signal on pin 2 is inverted.

Parameter Group	Parameter	Default	Value Range	Description
Hubline DI Filter Configuration	Port X01 / pin 4, port X02 / pin 4, ...	0	0: no filter time	No filter active for detecting a signal change of the pin 4 input signal.
			1: 1 µs filter time	Filter time setting for detecting a signal change of the input signal. The filter time is the amount of time the signal must be present in order for a signal change to be detected.
			2: 10 µs filter time	
			3: 100 µs filter time	
			4: 1 ms filter time	
			5: 2 ms filter time	
			6: 3 ms filter time	
	Port X01 / pin 2, port X02 / pin 2, ...	0	0: no filter time	No filter active for detecting a signal change of the pin 2 input signal.
			1: 1 µs filter time	Filter time setting for detecting a signal change of the input signal. The filter time is the amount of time the signal must be present in order for a signal change to be detected.
			2: 10 µs filter time	
			3: 100 µs filter time	
			4: 1 ms filter time	
			5: 2 ms filter time	
			6: 3 ms filter time	
IO-Link port parameters	Enable port diagnostics	1	0: disable	The PROFINET port diagnostics are disabled, i.e. no diagnostic alarms are triggered.
			1: Enable	PROFINET port diagnostics are enabled.
	Enable process alarm (device notification)	1	0: disable	PROFINET process alarms are disabled.
			1: Enable	PROFINET process alarms are enabled.
	Enable input fraction	0	0: disable	Input fraction is switched off.
			1: Enable	Input fraction is switched on.
	Enable pull/plug	1	0: disable	PROFINET pull/plug alarms are disabled.
			1: Enable	PROFINET pull/plug alarms are enabled.
	Port mode	1	1: IOL_Manual	Pin 4 is operated as an IO-Link port with manual configuration (GSD-based port configuration).
	Validation/backup	2	2: Type-compatible device (V1.1)	A device check for the indicated device type is performed for validation or backup of connected IO-Link slave devices.
	Port cycle time: bit 0 .. 5 multipliers / bit 6.. 7 timebase [ms]	0	0, 4 ... 191	Port cycle time 0: calculated by IO-Link master 4 ... 191: see table Port Cycle Time [► 76].
	Vendor ID	285	285	Manufacturer ID for Wago

Parameter Group	Parameter	Default	Value Range	Description
	Device ID	8390309	8390309	Device ID The device ID is read out and checked to see whether the correct HubLine device is connected.

If you are using a 765-1704 Hubline module, you can select the corresponding “Hubline 765-1704” submodule and set the parameters for the Hubline module.

Parameter Group	Parameter	De- fault	Value Range	Description
Hubline Port Configuration	Port X01 / pin 4, port X02 / pin 4, ...	0	0: Digital Input	Pin 4 is a digital input.
			1: Digital Output	Pin 4 is a digital output.
	Port X01 / pin 2, port X02 / pin 2, ...	0	0: Digital Input	Pin 2 is a digital input.
			1: Digital Output	Pin 2 is a digital output.
Hubline Failsafe Configuration	Port X01 / pin 4, port X02 / pin 4, ...	0	0: set low	Set digital output to low level in the event of error.
			1: set high	Set digital output to high level in the event of error.
			2: hold last	Hold digital output at its last value in the event of error.
	Port X01 / pin 2, port X02 / pin 2, ...	0	0: set low	Set digital output to low level in the event of error.
			1: set high	Set digital output to high level in the event of error.
			2: hold last	Hold digital output at its last value in the event of error.
Hubline DI Inversion Configuration	Port X01 / pin 4, port X02 / pin 4, ...	0	0: DI not inverted (NO normally open)	Operating mode as digital input: The signal on pin 4 is not inverted.
			1: DI inverted (NC normally closed)	Operating mode of the digital input: The signal on pin 4 is inverted.
	Port X01 / pin 2, port X02 / pin 2, ...	0	0: DI not inverted (NO normally open)	Operating mode of the digital input: The signal on pin 2 is not inverted.
			1: DI inverted (NC normally closed)	Operating mode of the digital input: The signal on pin 2 is inverted.
Hubline DI Filter Configuration	Port X01 / pin 4, port X02 / pin 4, ...	0	0: no filter time	No filter active for detecting a signal change of the pin 4 input signal.
			1: 1 µs filter time	Filter time setting for detecting a signal change of the input signal. The filter time is the amount of time the signal must be present in order for a signal change to be detected.
			2: 10 µs filter time	
			3: 100 µs filter time	
			4: 1 ms filter time	
			5: 2 ms filter time	
			6: 3 ms filter time	
	Port X01 / pin 2, port X02 / pin 2, ...	0	0: no filter time	No filter active for detecting a signal change of the pin 2 input signal.
			1: 1 µs filter time	Filter time setting for detecting a signal change of the input signal. The filter time is the amount of time the signal must be present in order for a signal change to be detected.
			2: 10 µs filter time	
			3: 100 µs filter time	
			4: 1 ms filter time	
			5: 2 ms filter time	
			6: 3 ms filter time	

Parameter Group	Parameter	De- fault	Value Range	Description
IO-Link port parameters	Enable port diagnostics	1	0: disable	The PROFINET port diagnostics are disabled, i.e. no diagnostic alarms are triggered.
			1: Enable	PROFINET port diagnostics are enabled.
	Enable process alarm (device notification)	1	0: disable	PROFINET process alarms are disabled.
			1: Enable	PROFINET process alarms are enabled.
	Enable input fraction	0	0: disable	Input fraction is switched off.
			1: Enable	Input fraction is switched on.
	Enable pull/plug	1	0: disable	PROFINET pull/plug alarms are disabled.
			1: Enable	PROFINET pull/plug alarms are enabled.
	Port mode	1	1: IOL_Manual	Pin 4 is operated as an IO-Link port with manual configuration (GSD-based port configuration).
	Validation/backup	2	2: Type-compatible device (V1.1)	A device check for the indicated device type is performed for validation or backup of connected IO-Link slave devices.
	Port cycle time: bit 0 .. 5 multipliers / bit 6 .. 7 timebase [ms]	0	0, 4 ... 191	Port cycle time 0: calculated by IO-Link master 4 ... 191: see table Port Cycle Time [p. 76] .
	Vendor ID	285	285	Manufacturer ID for Wago
	Device ID	8390311	8390311	Device ID The device ID is read out and checked to see whether the correct HubLine device is connected.

If you are using a 765-1705 Hubline module, you can select the corresponding “Hubline 765-1705” submodule and set the parameters for the Hubline module.

Table 68: “Hubline 765-1705” Submodule Parameters

Parameter Group	Parameter	Default	Value Range	Description
Hubline Port Configuration	Port X01 / pin 4, port X02 / pin 4, ...	0	0: Digital Input	Pin 4 is a digital input.
			1: Digital Output	Pin 4 is a digital output.
Hubline Failsafe Configuration	Port X01 / pin 4, port X02 / pin 4, ...	0	0: set low	Set digital output to low level in the event of error.
			1: set high	Set digital output to high level in the event of error.
			2: hold last	Hold digital output at its last value in the event of error.
Hubline DI Inversion Configuration	Port X01 / pin 4, port X02 / pin 4, ...	0	0: DI not inverted (NO normally open)	Operating mode of the digital input: The signal on pin 4 is not inverted.
			1: DI inverted (NC normally closed)	Operating mode of the digital input: The signal on pin 4 is inverted.
Hubline DI Filter Configuration	Port X01 / pin 4, port X02 / pin 4, ...	0	0: no filter time	No filter active for detecting a signal change of the pin 4 input signal.
			1: 1 µs filter time	Filter time setting for detecting a signal change of the input signal. The filter time is the amount of time the signal must be present in order for a signal change to be detected.
			2: 10 µs filter time	

Parameter Group	Parameter	Default	Value Range	Description
IO-Link port parameters			3: 100 µs filter time	
			4: 1 ms filter time	
			5: 2 ms filter time	
			6: 3 ms filter time	
	Enable port diagnostics	1	0: disable	The PROFINET port diagnostics are disabled, i.e. no diagnostic alarms are triggered.
			1: Enable	PROFINET port diagnostics are enabled.
	Enable process alarm (device notification)	1	0: disable	PROFINET process alarms are disabled.
			1: Enable	PROFINET process alarms are enabled.
	Enable input fraction	0	0: disable	Input fraction is switched off.
			1: Enable	Input fraction is switched on.
	Enable pull/plug	1	0: disable	PROFINET pull/plug alarms are disabled.
			1: Enable	PROFINET pull/plug alarms are enabled.
	Port mode	1	1: IOL_Manual	Pin 4 is operated as an IO-Link port with manual configuration (GSD-based port configuration).
	Validation/backup	2	2: Type-compatible device (V1.1)	A device check for the indicated device type is performed for validation or backup of connected IO-Link slave devices.
	Port cycle time: bit 0 .. 5 multipliers / bit 6.. 7 timebase [ms]	0	0, 4 ... 191	Port cycle time 0: calculated by IO-Link master 4 ... 191: see table Port Cycle Time ▶ 76 .
	Vendor ID	285	285	Manufacturer ID for Wago
	Device ID	8390314	8390314	Device ID The device ID is read out and checked to see whether the correct HubLine device is connected.

If you are using a 765-1706 Hubline module, you can select the corresponding “Hubline 765-1706” submodule and set the parameters for the Hubline module.

Table 69: “Hubline 765-1706” Submodule Parameters

Parameter Group	Parameter	Default	Value Range	Description
Hubline Port Configuration	Port X01 / pin 4, port X02 / pin 4, ...	0	0: Digital Input	Pin 4 is a digital input.
			1: Digital Output	Pin 4 is a digital output.
	Port X01 / pin 2, port X02 / pin 2, ...	0	0: Digital Input	Pin 2 is a digital input.
			1: Digital Output	Pin 2 is a digital output.

Parameter Group	Parameter	Default	Value Range	Description
Hubline Failsafe Configuration	Port X01 / pin 4, port X02 / pin 4, ...	0	0: set low	Set digital output to low level in the event of error.
			1: set high	Set digital output to high level in the event of error.
			2: hold last	Hold digital output at its last value in the event of error.
	Port X01 / pin 2, port X02 / pin 2, ...	0	0: set low	Set digital output to low level in the event of error.
			1: set high	Set digital output to high level in the event of error.
			2: hold last	Hold digital output at its last value in the event of error.
Hubline DI Inversion Configuration	Port X01 / pin 4, port X02 / pin 4, ...	0	0: DI not inverted (NO normally open)	Operating mode as digital input: The signal on pin 4 is not inverted.
			1: DI inverted (NC normally closed)	Operating mode of the digital input: The signal on pin 4 is inverted.
	Port X01 / pin 2, port X02 / pin 2, ...	0	0: DI not inverted (NO normally open)	Operating mode of the digital input: The signal on pin 2 is not inverted.
			1: DI inverted (NC normally closed)	Operating mode of the digital input: The signal on pin 2 is inverted.
Hubline DI Filter Configuration	Port X01 / pin 4, port X02 / pin 4, ...	0	0: no filter time	No filter active for detecting a signal change of the pin 4 input signal.
			1: 1 µs filter time	Filter time setting for detecting a signal change of the input signal. The filter time is the amount of time the signal must be present in order for a signal change to be detected.
			2: 10 µs filter time	
			3: 100 µs filter time	
			4: 1 ms filter time	
			5: 2 ms filter time	
			6: 3 ms filter time	
	Port X01 / pin 2, port X02 / pin 2, ...	0	0: no filter time	No filter active for detecting a signal change of the pin 2 input signal.
			1: 1 µs filter time	Filter time setting for detecting a signal change of the input signal. The filter time is the amount of time the signal must be present in order for a signal change to be detected.
			2: 10 µs filter time	
			3: 100 µs filter time	
			4: 1 ms filter time	
			5: 2 ms filter time	
			6: 3 ms filter time	

Parameter Group	Parameter	Default	Value Range	Description
IO-Link port parameters	Enable port diagnostics	1	0: disable	The PROFINET port diagnostics are disabled, i.e. no diagnostic alarms are triggered.
			1: Enable	PROFINET port diagnostics are enabled.
	Enable process alarm (device notification)	1	0: disable	PROFINET process alarms are disabled.
			1: Enable	PROFINET process alarms are enabled.
	Enable input fraction	0	0: disable	Input fraction is switched off.
			1: Enable	Input fraction is switched on.
	Enable pull/plug	1	0: disable	PROFINET pull/plug alarms are disabled.
			1: Enable	PROFINET pull/plug alarms are enabled.
	Port mode	1	1: IOL_Manual	Pin 4 is operated as an IO-Link port with manual configuration (GSD-based port configuration).
	Validation/backup	2	2: Type-compatible device (V1.1)	A device check for the indicated device type is performed for validation or backup of connected IO-Link slave devices.
	Port cycle time: bit 0 .. 5 multipliers / bit 6.. 7 timebase [ms]	0	0, 4 ... 191	Port cycle time 0: calculated by IO-Link master 4 ... 191: see table Port Cycle Time [▶ 76].
	Vendor ID	285	285	Manufacturer ID for Wago
	Device ID	8390310	8390310	Device ID The device ID is read out and checked to see whether the correct HubLine device is connected.

Using to the extended settings, you can enable or disable module functions. Changes to these settings do not take effect until the IO controller has transferred the parameters to the module and the module is then restarted.

The following table describes the parameters of the “Extended Settings” submodule.

Table 70: Parameters of the “Extended Settings” Submodule

Parameter Group	Parameter	Default	Value Range	Description
General device settings	Website	1	0: disable website	The integrated Webserver is disabled and cannot be used via the Ethernet interface.
			1: enable website	The integrated Webserver is enabled. Note: The WAGO I/O Field app cannot be used when OPC UA communication is disabled.
	OPC UA	1	0: disable OPC UA	OPC UA is disabled.
			1: enable OPC UA	OPC UA is enabled.
	MQTT	1	0: disable MQTT	MQTT is disabled.
			1: enable MQTT	MQTT is enabled.

Parameter Group	Parameter	Default	Value Range	Description
	Pd-time-stamp	1	0: disable pd-time-stamp	Process data timestamp is disabled and process data is transferred without timestamp.
			1: enable pd-time-stamp	Process data timestamp is enabled and process data is transferred with timestamp. The timestamp requires the time from an NTP server.
	Diag-time-stamp enable	1	0: disable diag-time-stamp	Diagnostic timestamp is disabled and diagnostic data is transferred without timestamp.
			1: enable diag-time-stamp	Diagnostic timestamp is enabled and diagnostic data is transferred with timestamp.
Load management configuration	Enable analysis port 1, Enable analysis port 2, ...	0	0: disable analysis	No load management analysis is performed on port X01, port X02, ...
		1	1: enable analysis	Load management analysis is performed on port X01, port X02, ...
Load management clear port statistics ¹	Clear data statistics port 1, Clear data statistics port 2, ...	0	0: disable clear data statistics	On port X01, port X02, ... the load management data statistics are not cleared.
		1	1: enable clear data statistics	On port X01, port X02, ... the load management data statistics are cleared.

¹ Statistics are only cleared if the port's load management enable flag is switched on, since the minimum values must be calculated before resetting. The clear flag is automatically reset after the clearing process is completed.

Use the optional “Application Name Tag” submodule if you want to use application-specific name tags.

The following table describes the parameters of the “Application Name Tag” submodule.

Table 71: Parameters of the “Application Name Tag” Submodule

Parameter Group	Parameter	Default	Value Range	Description
Application Name Tag	Name 1	-	Printable ASCII string, max. 250 characters	Application name 1 Entry for an application-specific name tag.
	Name 2	-	Printable ASCII string, max. 250 characters	Application name 2 Entry for an application-specific name tag.

Use the optional “NTP Configuration” submodule if the module needs to retrieve the time from an NTP server.

The following table describes the parameters of the “NTP Configuration” submodule.

Table 72: Parameters of the “NTP Configuration” Submodule

Parameter Group	Parameter	Default	Value Range	Description
NTP IP Configuration	Server IP address	0.0.0.0	Valid IP address	IP address of the NTP server The NTP client in the module uses the IP address setting to retrieve the time from an NTP server. A value of 0.0.0.0 disables the function.
	Server fall-back IP address	0.0.0.0	Valid IP address	IP address of the NTP server (fallback) Optional additional IP address in case the NTP server cannot be reached via the first IP address. A value of 0.0.0.0 disables the function.
NTP Client configuration	Server NTP Port	123	Valid port	Port of the NTP server Port on which the NTP server processes the request. The default is port 123.
	Client NTP Port	123	Valid port	NTP port of the client Port on which the NTP client processes the request. The default is port 123.
	NTP initialization interval	1	0 ... 4294967296	NTP initialization interval Amount of time until the module sends a new request to the NTP server if no time has yet been received from the NTP server. Unit: s
	NTP refresh interval	900	0 ... 4294967296	NTP update interval Amount of time until the module sends a new request to the NTP server to update the existing time. Unit: s

Use the optional “MQTT network connection configuration” submodule if you want to use MQTT communication.

The following table describes the parameters of the “MQTT network connection configuration” submodule.

Table 73: Parameters of the “MQTT Network Connection Configuration” Submodule

Parameter Group	Parameter	Default	Value Range	Description
MQTT settings	MQTT connection enable	0	0: disable	The MQTT client application is disabled.
			1: enable	The MQTT client application is enabled.
	Clean Session	1	0: disable	After a connection is established, only the topics that have changed since the last connection are transferred to the broker. For this setting to be used, the broker must support the “preserve context” feature.
			1: enable	After a connection to the broker is established, the MQTT client transmits all topics of type “publish” to the broker.
	Broker IP address	0.0.0.0	Valid IP address	IP address of the broker; example: 192.168.10.6
	Broker Port	1883	0 ... 65536	MQTT broker port number
	Client Identifier	-	Max. 23 bytes for max. 23 characters	Unique name of the MQTT client in UTF-8 format; this name is used at the time when the connection is established. All devices connected to a broker must have a unique name. The name must consist of lowercase letters, uppercase letters and numbers only. If the field is empty, the broker assigns a name. Example: “ClientId1”

Parameter Group	Parameter	Default	Value Range	Description
	Topic Prefix	-	Text consisting of uppercase and lowercase letters and underscores	Text that precedes each topic, e.g.: "StationA." In the configuration, you can specify whether or not a prefix is added to the beginning of each individual topic. If the prefix is left empty, the firmware uses the MAC address instead of the prefix.
	Will enable	1	0: disable	The "will" function of MQTT is disabled.
			1: enable	The "will" function of MQTT is enabled.
	Enable will prefix	1	0: disable	No prefix is added to the name for the Will Topic.
			1: enable	The name for each Will Topic is preceded by a prefix.
	Enable will retain	1	0: disable 1: enable	The history of a data value is not stored by the broker. The history of a data value is stored by the broker.
	Will Topic	EXIT	Max. 128 characters of text, consisting of uppercase and lowercase letters and underscores	Unique name for the topic; editable. If "Will Topic" is left empty, the firmware uses the string "Will."
	Will Message	{Publisher: Offline}	Text consisting of uppercase and lowercase letters and underscores	User data that the broker sends to other clients that have a subscription to "Will Topic" in case an unusual disconnect occurs (if the MQTT Disconnect packet was not sent to the broker). If "Will Message" is empty, then the string "Disconnected" is sent.
	Will QoS level	1	-	"Quality of Service" level for the "Will Message"
			0: Only once	"Only once": send and forget.
			1: At least once	"At least once": confirmed delivery.
			2: Exactly once	"Exactly once": assured delivery.
	Connection Timeout	15	0: repeat immediately 1 ... 65535: repeat after waiting time	Connection establishment timeout The client attempts to establish a connection to the broker. If the broker refuses to establish a connection or connection establishment fails, the client continues to try to establish a connection. Unit: s. Repeat immediately: The client attempts to reestablish a connection after 500 ms. Repeat after waiting time: After the client has detected a connection error, the client waits for the "Connection Timeout" before attempting to reestablish a connection.
	Keep alive time	15	0: keep-alive function disabled 1 ... 65535: keep-alive function enabled	MQTT-specific mechanism to keep an unused connection (idle) in the "connected" state. Unit: s.

Use the optional “Load management threshold level” submodule if you want to set load management thresholds that are used for the counter values (overrun and underrun). The parameters of the submodule apply to one port.

The following table describes the parameters of the “Load management threshold level” submodule:

Table 74: Parameters of the “Load Management Threshold Level” Submodule

Parameter Group	Parameter	Default	Value Range	Description
Voltage, temperature and statistic settings	Overtemperature	700	-250 ... 700	Upper limiting value for the temperature of a port; unit: 0.1 °C
	Undertemperature	-250	-250 ... 700	Lower limiting value for the temperature of a port; unit: 0.1 °C
	Overvoltage Pin X	30,000	0 ... 30,000	Upper limiting value for the voltage on pin 1, 2 or 4; unit: mV
	Undervoltage Pin X	18,000	0 ... 30,000	Lower limiting value for the voltage on pin 1, 2 or 4; unit: mV
	Temperature hysteresis	20	0 ... 150	Temperature hysteresis; unit: 0.1 °C If the temperature exceeds the limiting value, the temperature must fall back below the limiting value by the hysteresis value before the diagnostic is revoked. This also applies to lower limiting value underruns.
	Voltage hysteresis	300	0 ... 10,000	Voltage hysteresis; unit: mA If the voltage exceeds the limiting value, the voltage must fall back below the limiting value by the hysteresis value before the diagnostic is revoked. This also applies to lower limiting value underruns.
	Current hysteresis	10	0 ... 1,000	Current hysteresis; unit: mA If the current exceeds the limiting value, the current must fall back below the limiting value by the hysteresis value before the diagnostic is revoked. This also applies to lower limiting value underruns.
Current threshold levels	Overcurrent Pin 1	0	0 ... 4,000	Upper limiting value for the current on pin 1; unit: mA
	Undercurrent Pin 1	0	0 ... 4,000	Lower limiting value for the current on pin 1; unit: mA
	Overcurrent Pin 2	0	Power supply: 0 ... 4,000 Digital output: 0 ... 2,000	Upper limiting value for the current on pin 2; unit: mA The value range depends on whether pin 2 is configured for supplying power or as a digital output.
	Undercurrent Pin 2	0	Power supply: 0 ... 4,000 Digital output: 0 ... 2,000	Lower limiting value for the current on pin 2; unit: mA The value range depends on whether pin 2 is configured for supplying power or as a digital output.
	Overcurrent Pin 4	0	0 ... 2,000	Upper limiting value for the current on pin 4; unit: mA
	Undercurrent Pin 4	0	0 ... 2,000	Lower limiting value for the current on pin 4; unit: mA

6.7.2 Setting the PROFINET Configuration

For each IO-Link port, specify the type of IO-Link device that is connected to the port: digital input, digital output or IO-Link device.

The PROFINET IO-Link product has a modular structure:

- Slot 0 is the PROFINET access point with four submodules.
- Slot 1 contains the IO-Link master and eight IO-Link ports.
- Slot 2 contains parameters for advanced settings.

Table 75: PROFINET Modules and Submodules

Slot	Subslot	Submodule	Description
0	1	DAP	Product access point (fixed)
0	32768	PN-IO	PROFINET interface (fixed)
0	32769	Port 1	Port 1 (fixed)
0	32770	Port 2	Port 2 (fixed)
1	1	IO-Link master	IO-Link master (fixed) 2 input bytes and 2 output bytes
1	2	Port X01 configuration	Configures the port: digital input, digital output or IO-Link communication. For selection, see the following table.
1	3	Port X02 configuration	
1	4	Port X03 configuration	
1	5	Port X04 configuration	
1	6	Port X05 configuration	
1	7	Port X06 configuration	
1	8	Port X07 configuration	
1	9	Port X08 configuration	
2	1	Extended settings	Extended settings (fixed) This submodule contains only parameters.
2	2	Application Name Tag	Application-specific name tags (optional) This submodule contains only parameters.
2	3	NTP IP Configuration	NTP server configuration (optional) This submodule contains only parameters.
2	4	MQTT network connection configuration	MQTT settings (optional) This submodule contains only parameters.
2	5 ... 12	Load management threshold level	Load management settings (optional) One submodule for each port: submodule 5 for port X01, submodule 6 for port X02 ... These submodules only contain parameters.

Table 76: Port Submodules

Submodule	Description	Input Process Data (PD_IN)	Output Process Data (PD_OUT)
Digital Input	Digital input	1 byte	-
Digital Output	Digital output	-	1 byte
IO-Link 32 I / 32 O + PQI	IO-Link with 32 bytes of input data and 32 bytes of output data and port qualifier information	32 bytes + 1 byte of PQI	32 bytes
IO-Link 16 I / 16 O + PQI	IO-Link with 16 bytes of input data and 16 bytes of output data and port qualifier information	16 bytes + 1 byte of PQI	16 bytes
IO-Link 8 I / 8 O + PQI	IO-Link with 8 bytes of input data and 8 bytes of output data and port qualifier information	8 bytes + 1 byte of PQI	8 bytes
IO-Link 4 I / 4 O + PQI	IO-Link with 4 bytes of input data and 4 bytes of output data and port qualifier information	4 bytes + 1 byte of PQI	4 bytes
IO-Link 2 I / 2 O + PQI	IO-Link with 2 bytes of input data and 2 bytes of output data and port qualifier information	2 bytes + 1 byte of PQI	2 bytes
IO-Link 1 I / 1 O + PQI	IO-Link with 1 byte of input data and 1 byte of output data and port qualifier information	1 byte + 1 byte of PQI	1 byte
IO-Link 32 O + PQI	IO-Link with 32 bytes of output data and port qualifier information	1 byte of PQI	32 bytes
IO-Link 16 O + PQI	IO-Link with 16 bytes of output data and port qualifier information	1 byte of PQI	16 bytes
IO-Link 8 O + PQI	IO-Link with 8 bytes of output data and port qualifier information	1 byte of PQI	8 bytes
IO-Link 4 O + PQI	IO-Link with 4 bytes of output data and port qualifier information	1 byte of PQI	4 bytes
IO-Link 2 O + PQI	IO-Link with 2 bytes of output data and port qualifier information	1 byte of PQI	2 bytes
IO-Link 1 O + PQI	IO-Link with 1 byte of output data and port qualifier information	1 byte of PQI	1 byte
IO-Link 32 I + PQI	IO-Link with 32 bytes of input data and port qualifier information	32 bytes + 1 byte of PQI	-
IO-Link 16 I + PQI	IO-Link with 16 bytes of input data and port qualifier information	16 bytes + 1 byte of PQI	-
IO-Link 8 I + PQI	IO-Link with 8 bytes of input data and port qualifier information	8 bytes + 1 byte of PQI	-

Submodule	Description	Input Process Data (PD_IN)	Output Process Data (PD_OUT)
IO-Link 4 I + PQI	IO-Link with 4 bytes of input data and port qualifier information	4 bytes + 1 byte of PQI	-
IO-Link 2 I + PQI	IO-Link with 2 bytes of input data and port qualifier information	2 bytes + 1 byte of PQI	-
IO-Link 1 I + PQI	IO-Link with 1 byte of input data and port qualifier information	1 byte + 1 byte of PQI	-
IO-Link 32 I / 32 O + PQI + ISDU	IO-Link with 32 bytes of input data, 32 bytes of output data, port qualifier information and ISDU parameters	32 bytes + 1 byte of PQI	32 bytes
IO-Link 16 I / 16 O + PQI + ISDU	IO-Link with 16 bytes of input data, 16 bytes of output data, port qualifier information and ISDU parameters	16 bytes + 1 byte of PQI	16 bytes
IO-Link 8 I / 8 O + PQI + ISDU	IO-Link with 8 bytes of input data, 8 bytes of output data, port qualifier information and ISDU parameters	8 bytes + 1 byte of PQI	8 bytes
IO-Link 4 I / 4 O + PQI + ISDU	IO-Link with 4 bytes of input data, 4 bytes of output data, port qualifier information and ISDU parameters	4 bytes + 1 byte of PQI	4 bytes
IO-Link 2 I / 2 O + PQI + ISDU	IO-Link with 2 bytes of input data, 2 bytes of output data, port qualifier information and ISDU parameters	2 bytes + 1 byte of PQI	2 bytes
IO-Link 1 I / 1 O + PQI + ISDU	IO-Link with 1 byte of input data, 1 byte of output data, port qualifier information and ISDU parameters	1 byte + 1 byte of PQI	1 byte
IO-Link 32 O + PQI + ISDU	IO-Link with 32 bytes of output data, port qualifier information and ISDU parameters	1 byte of PQI	32 bytes
IO-Link 16 O + PQI + ISDU	IO-Link with 16 bytes of output data, port qualifier information and ISDU parameters	1 byte of PQI	16 bytes
IO-Link 8 O + PQI + ISDU	IO-Link with 8 bytes of output data, port qualifier information and ISDU parameters	1 byte of PQI	8 bytes
IO-Link 4 O + PQI + ISDU	IO-Link with 4 bytes of output data, port qualifier information and ISDU parameters	1 byte of PQI	4 bytes
IO-Link 2 O + PQI + ISDU	IO-Link with 2 bytes of output data, port qualifier information and ISDU parameters	1 byte of PQI	2 bytes

Submodule	Description	Input Process Data (PD_IN)	Output Process Data (PD_OUT)
IO-Link 1 O + PQI + ISDU	IO-Link with 1 byte of output data, port qualifier information and ISDU parameters	1 byte of PQI	1 byte
IO-Link 32 I + PQI + ISDU	IO-Link with 32 bytes of input data, port qualifier information and ISDU parameters	32 bytes + 1 byte of PQI	-
IO-Link 16 I + PQI + ISDU	IO-Link with 16 bytes of input data, port qualifier information and ISDU parameters	16 bytes + 1 byte of PQI	-
IO-Link 8 I + PQI + ISDU	IO-Link with 8 bytes of input data, port qualifier information and ISDU parameters	8 bytes + 1 byte of PQI	-
IO-Link 4 I + PQI + ISDU	IO-Link with 4 bytes of input data, port qualifier information and ISDU parameters	4 bytes + 1 byte of PQI	-
IO-Link 2 I + PQI + ISDU	IO-Link with 2 bytes of input data, port qualifier information and ISDU parameters	2 bytes + 1 byte of PQI	-
IO-Link 1 I + PQI + ISDU	IO-Link with 1 byte of input data, port qualifier information and ISDU parameters	1 byte + 1 byte of PQI	-
Deactivated	Port is not used.	1 byte	-
765-1701 HubLine	Hubline with 1 byte of input data, 1 byte of output data and port qualifier information	1 byte + 1 byte of PQI	1 byte
765-1702 HubLine	Hubline with 1 byte of input data, 1 byte of output data and port qualifier information	1 byte + 1 byte of PQI	1 byte
765-1703 HubLine	Hubline with 2 bytes of input data, 2 bytes of output data and port qualifier information	2 byte + 1 byte of PQI	2 bytes
765-1704 HubLine	Hubline with 1 byte of input data, 1 byte of output data and port qualifier information	1 byte + 1 byte of PQI	1 byte
765-1705 HubLine	Hubline with 1 byte of input data, 1 byte of output data and port qualifier information	1 byte + 1 byte of PQI	1 byte
765-1706 HubLine	Hubline with 2 bytes of input data, 2 bytes of output data and port qualifier information	2 byte + 1 byte of PQI	2 bytes

6.8 Aids and Examples

6.8.1 Aids

The WAGO IO-Link Configurator software and the associated product manual containing a detailed description of the software are available from <https://downloadcenter.wago.com/wago/software>.

The WAGO App I/O Field, as well as the corresponding online help with detailed description of the software, are available free of charge. An iOS version can be found in the in the Apple App Store and an Android version in the Google Play Store.

The ETHERNET Device Configuration software and the associated product manual with a detailed description of the software are available from <https://hilscher.atlassian.net/wiki/spaces/ETHDEVCFG>.

6.8.2 Power Supply Example

The following figure gives an example of feeding in and passing on the supply voltages:

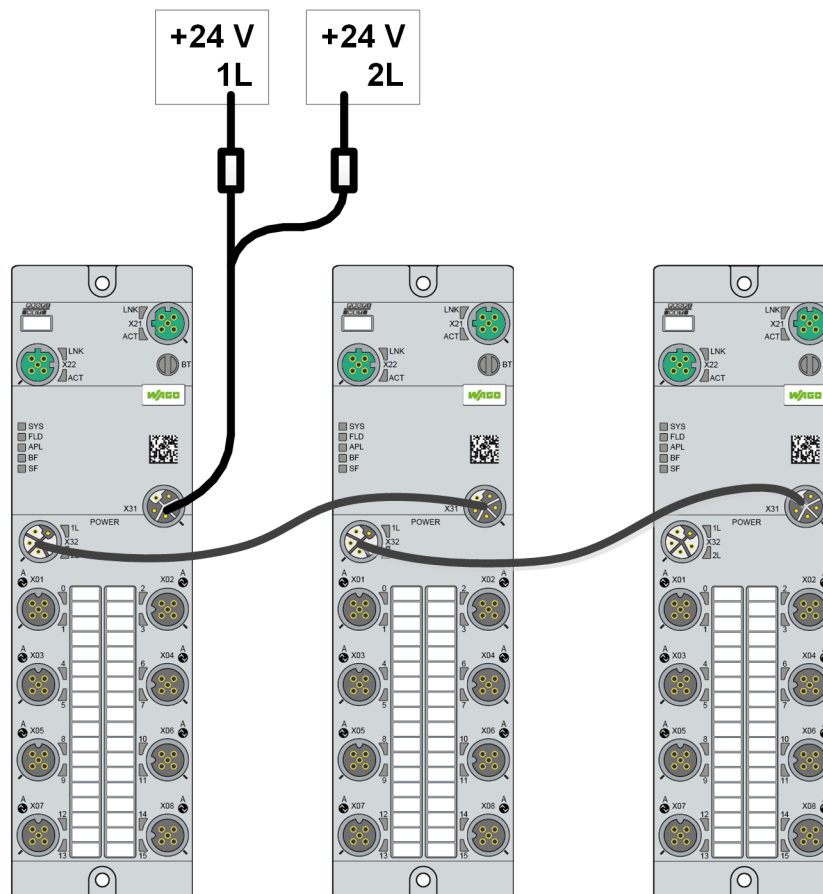


Figure 8: Example of Feeding in and Passing on the Supply Voltages

In connection with this figure, note that the cables illustrated for current paths 1L and 2L are realized not as separate cables, but rather as separate wires within one common cable.

6.8.3 Connection Examples

The product can be powered alone with its operating voltage or form part of a power supply group along with multiple products.

Power supply groups of multiple products can be formed in two ways:

1. Via the PWR OUT connection:
One or more additional products can be powered via the PWR OUT (X32) power supply output and then form a power supply group together with the product.
2. Through an IO-Link hub*:
One product forms a common power supply group with IO-Link hubs (765-170x/200-000) connected via IO-Link.

* Only applies to modules with integrated IO-Link master ports

In what follows, we present one example for the 765-4204/0100-000 product with four IO-Link inputs/outputs for each of the following:

- Individual power supply
- Power supply group via PWR OUT connection (with calculation of the permissible current feedthrough)
- Power supply group with IO-Link hubs

These examples assume that the IO-Link inputs/outputs are configured as digital outputs.

Example of a Single Power Supply

This example considers a single 765-4102/100-000 module where no additional devices are powered through its PWR OUT connection (X32).

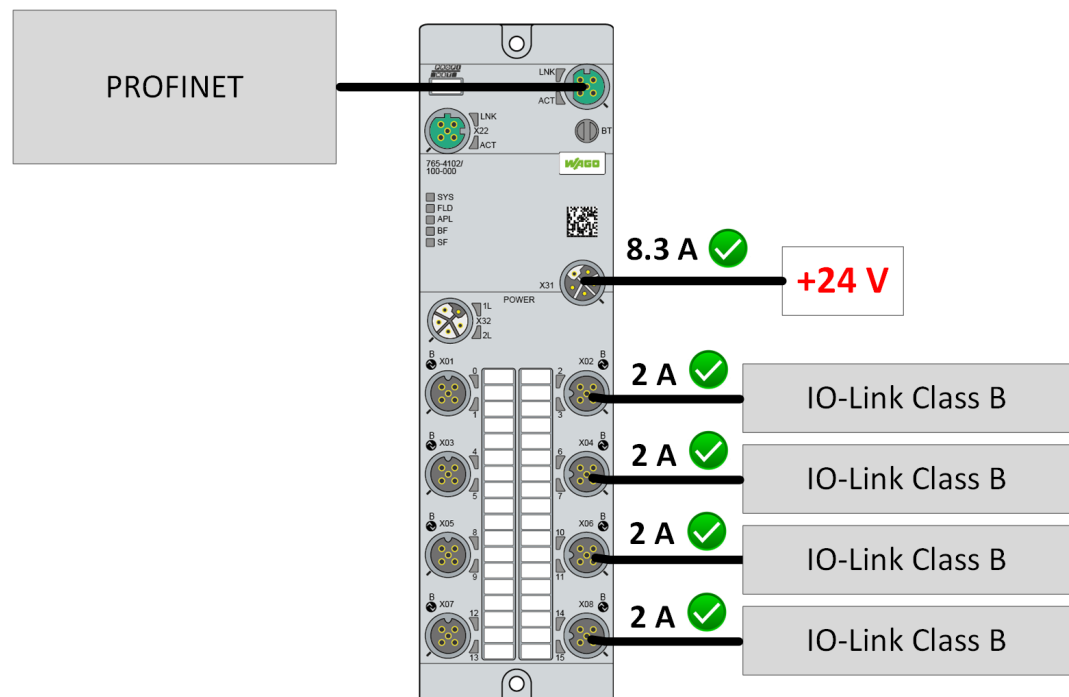


Figure 9: Connection Example with Single Power Supply

One IO-Link Class B device with max. current consumption of 2 A (max. 1 A via supply cable 1 and max. 1 A via supply cable 2) is connected to each of connection X02, connection X04, connection X06 and connection X08 of the module. The module's current consumption is 0.2 A for supply cable 1 and 0.1 A for supply cable 2.

Current consumption of supply cable 1: $4 \times 1 \text{ A} + 0.2 \text{ A} = 4.2 \text{ A}$

Current consumption of supply cable 2: $4 \times 1 \text{ A} + 0.1 \text{ A} = 4.1 \text{ A}$

The current consumption of 4.2 A for supply cable 1 and 4.1 A for supply cable 2 is below the maximum permissible value of 16 A per supply cable.

For UL applications, the maximum permissible value is 12 A for the sum of the two supply lines (sum: $4.2 \text{ A} + 4.1 \text{ A} = 8.3 \text{ A}$).

Example of a Power Supply Group via PWR OUT

If you connect another module to the PWR OUT (X32) supply voltage output, this forms a supply group.

The maximum permissible current feedthrough that this module may require is $16 \text{ A} - 4.2 \text{ A} = 11.8 \text{ A}$ for supply cable 1 and $16 \text{ A} - 4.1 \text{ A} = 11.9 \text{ A}$ for supply cable 2.

For UL applications, the maximum permissible current feedthrough is $12 \text{ A} - 8.3 \text{ A} = 3.7 \text{ A}$ for the sum of the two supply lines.

Example of a Power Supply Group with an IO-Link Hub

Connection Example 1

In what follows, we consider a power supply group consisting of a 765-4102/100-000 IO-Link Master and a 765-1701/200-000 IO-Link Hub. The two products are connected via IO-Link.

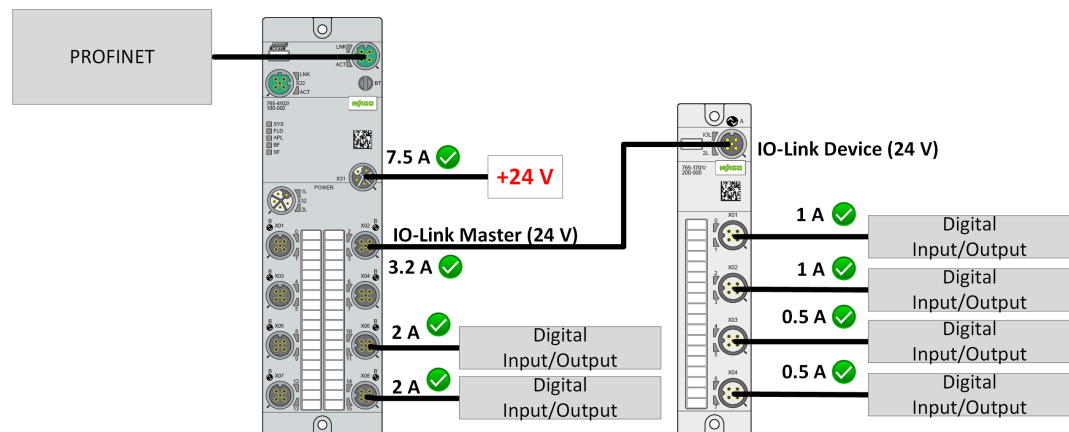


Figure 10: Power Supply Group with 765-4102/100-000 – Connection Example 1

Three devices are connected to the 765-4102/100-000 module:

- On port X02: the 765-1701/200-000 IO-Link Hub
- On port X06: one digital input/output with max. current consumption of 2 A (on pin 1)
- On port X08: one digital input/output with max. current consumption of 2 A (on pin 1)

Four devices are connected to the 765-1701/200-000 IO-Link Hub:

- On port X01: one digital input/output with max. current consumption of 1 A (on pin 1)
- On port X02: one digital input/output with max. current consumption of 1 A (on pin 1)
- On port X03: one digital input/output with max. current consumption of 0.5 A (on pin 1)
- On port X04: one digital input/output with max. current consumption of 0.5 A (on pin 1)

The current consumption of each of the two WAGO 765 Series products is 0.2 A.

Since the 765-1701/200-000 IO-Link Hub gets its operating voltage from the 765-4102/100-000 IO-Link master, port X02 (pin 1) of the module has a load of $3.2\text{ A} = 1\text{ A} + 1\text{ A} + 0.5\text{ A} + 0.5\text{ A} + 0.2\text{ A}$, which is below the maximum load capacity of 4 A and thus permissible.

Port X04 is unused.

Ports X06 and X08 each have a load of 2 A , which is also below the maximum load capacity of 4 A and thus permissible.

Connection Example 2

Now we increase the current consumption on the two ports X01 and X02 of the 765-1701/200-000 IO-Link Hub to 2 A and check whether this is permissible:

The ports of the 765-1701/200-000 IO-Link Hub can withstand a constant load of 2 A . However, the effects on the 765-4102/100-000 product must be considered.

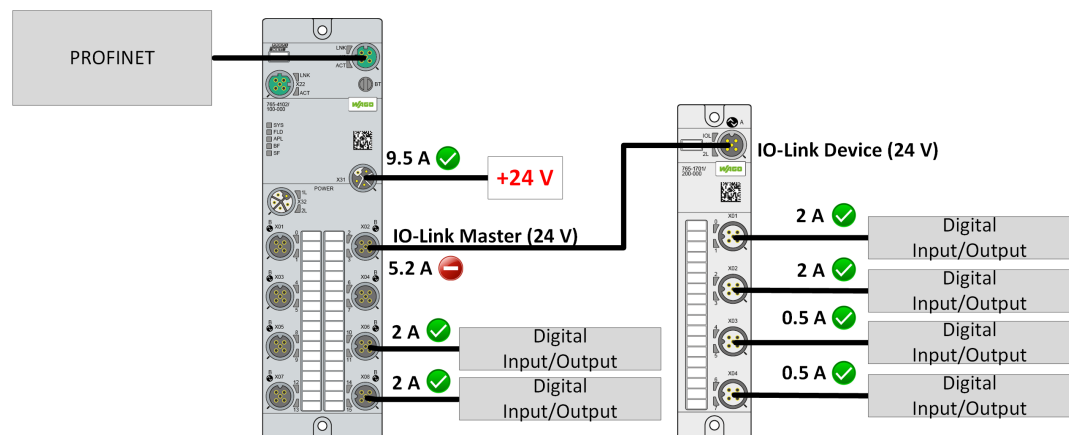


Figure 11: Power Supply Group with 765-4102/100-000 – Connection Example 2

To do so, we consider port X02 of the 765-4102/100-000 module:

This has a load of $5.2\text{ A} = 2\text{ A} + 2\text{ A} + 0.5\text{ A} + 0.5\text{ A} + 0.2\text{ A}$ on pin 1. That exceeds the maximum load capacity of 4 A and is thus not permissible. If the currents on X01 and X02 of the 765-1701/200-000 IO-Link Hub were increased, the overload protection would constantly activate and could threaten destruction of the 765-4102/100-000 IO-Link Master on its port X02.

7 Transport and Storage

The original packaging offers optimal protection during transport and storage.

- Store the product in suitable packaging, preferably the original packaging.
- Only transport the product in suitable containers/packaging.
- Make sure the product contacts are not contaminated or damaged during packing or unpacking.
- Observe the specified ambient climatic conditions for transport and storage.

8 Installation and Removal

8.1 Grounding

Functional Ground

The L-coded M12 pluggable connectors of the product's power supply have one FE (functional ground) pin, which is connected to the metal housing of the product. The metal housing in turn has a central grounding point for functional ground. You can ground the module as follows:

- Grounding via the metal housing, and/or
- Grounding via functional ground of the power supply connection, and/or
- Grounding can be done separately via a cable lug and the mounting hole if the module is installed on a non-conductive subsurface

Ensure proper contacts and a sufficient cable cross-section.

8.2 Mounting

During installation, be sure not to contaminate the connections. Contamination damages the contacts, which can limit the reliability of the contacts.

To install the product, proceed as follows:

1. Disconnect the system from the power supply.
 2. Ensure sufficient potential equalization in your system.
 3. Hold the product up to the desired position and mark the two locations where the threads should be cut.
 4. With the M4 thread cutter, cut one M4 thread at each of the marked locations. If applicable, pre-drill.
 5. Use the Allen key to screw the product into the threaded holes with two M4 cylinder head screws of adequate length on the top and bottom. Observe the tightening torque; see section [🔗 Mechanical Data \[p. 18\]](#).
- ➔ Installation is complete.

8.3 Removal

CAUTION

Hot Surface!

The surface of the housing heats up during operation. Under special conditions (e.g., in the event of a fault or increased surrounding air temperature), touching the product may cause burns!

- Allow the product to cool down before touching it.

1. Disconnect the system from the power supply.
2. Clean the product, especially dirty screw-clamp connections.

3. Unscrew all screw connections on the connectors and disconnect the cables.
 4. Unscrew the two M4 cylinder head screws.
 5. Remove the product.
- ➔ Removal is complete.

9 Connection

Note

Note planning documents!

The devices and power supply may only be connected in accordance with the planning documents provided by the system planner.

9.1 Connect Power Supply

Power Supplies 1L and 2L

Voltages 1L and 2L are electrically isolated and are fed in on connection X31.

The 1L power supply is required to power the module electronics and the connected sensors/actuators. Connect it to connection X31. If you want to power additional products through this current path, connect the cable for the additional power supply to connection X32.

The following procedure is especially advantageous:

- Install the power supply for the module electronics independently of the power supply for the actuators.
- Provide independent fuse protection for the power supplies.

This allows the network to continue to run even when peripheral parts are switched off.

WAGO recommends using pre-assembled cables.

Power supply 2L is provided to power actuators. It can be used by all products that require a second separate power supply with higher power. It can also be passed on to additional devices.

Supply Cable and Power Supply (M12)

Take the current load capacities into account. See Design Power Supply.

The temperature also affects the permissible total current. To take the effects of higher temperatures into account, note the information on temperature-dependent derating (see  [Derating \[► 69\]](#)).

You can find examples for calculating the maximum permissible current feedthrough under  [Connection Examples \[► 98\]](#).

9.2 Connecting Cables

The tightening torques given in section  [Connection Technology \[► 18\]](#) apply to the pluggable connectors of the connecting cables.

9.3 Connecting the Fieldbus

Preparing Ethernet Cable

To establish a connection to an IO Controller, connect the product to a network with a transmission rate of 100 Mbit/s in full duplex operation.

If you are not using a pre-assembled ETHERNET cable, a shielded M12 plug with protection type IP 67 should be connected to it.

For a cable that is pre-assembled on one end only (e.g., item no. 756-1201/060-xxx), proceed as follows to connect it to an RJ45 plug (e.g., item no. 750-975):



Figure 12: RJ45 Pin Assignment

Because the Auto MDI(X) functionality is enabled for the respective ETHERNET connection, a crossover cable is not necessary. This functionality automatically detects the direction for sending data and receiving data, so it is irrelevant which cable type is used (crossed or uncrossed).

Connecting an Individual Product to an ETHERNET Network

To connect the product to the ETHERNET network, proceed as follows:

1. Disconnect the power supply from the equipment parts on which you have mounted the module.
2. Connect the product to the ETHERNET network by plugging the socket of the ETHERNET cable onto the X21 connection.
3. Tighten the pluggable connector using the knurled-head screw.

Connecting Multiple Products to One ETHERNET Network

The fieldbus module of the WAGO I/O System Field has two connections with an integrated switch to allow wiring of a line topology.

The network topology in the following figure consists of a mixed star and line topology. An ETHERNET switch is required in order to set up a star topology or a mixed topology. The number of products in a star topology is limited only by the IEEE 802.3 Ethernet specification.

Multiple products can be connected to the ETHERNET network as shown in the following example:

1. De-energize the section of your system to which you wish to mount the product.
2. For the star topology, connect each ETHERNET cable (W1, W2) to port X21 of one 765 Series product and one ETHERNET switch as shown in the following figure. Then tighten the plugs of the ETHERNET cable.
3. For a line topology, connect the ETHERNET cables (W3, W4) to ports X21 and X22 on the product as shown in the following figure. Then tighten the plugs of the ETHERNET cable.

The following figure shows a mixed star and line topology:

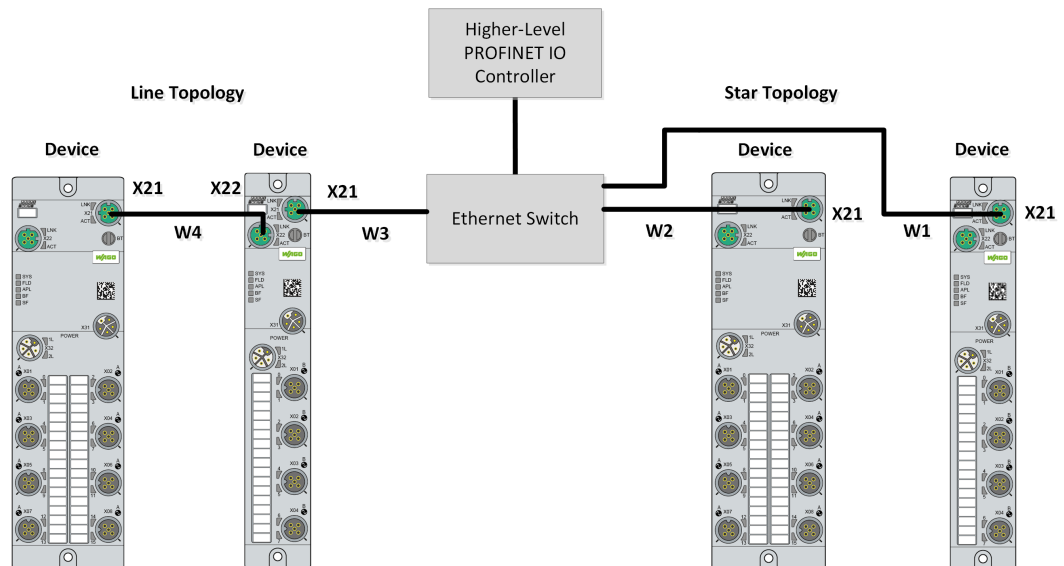


Figure 13: Network Topology (Module Appearance May Differ)

9.4 Connecting Sensors/Actuators

The sensor/actuator cable powers the connected sensors/actuators and transfers the sensor and actuator signals.

Note the current load capacity of the supply contacts; see “Rule 3,” section *Rule 3: Ports X01, X02 etc.* in [🔗 Design of the Power Supply \[p 63\]](#).

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

If a port is operated in IO-Link mode, then at most 1 A can flow through pin 1 and pin 3 without additional measures. The use of standard cables allows lengths up to 20 m as long as the current remains under 1 A.

Higher currents are possible and require a larger cable cross-section or shorter cable length to keep the voltage drop for the outgoing and return paths below 1.2 V.

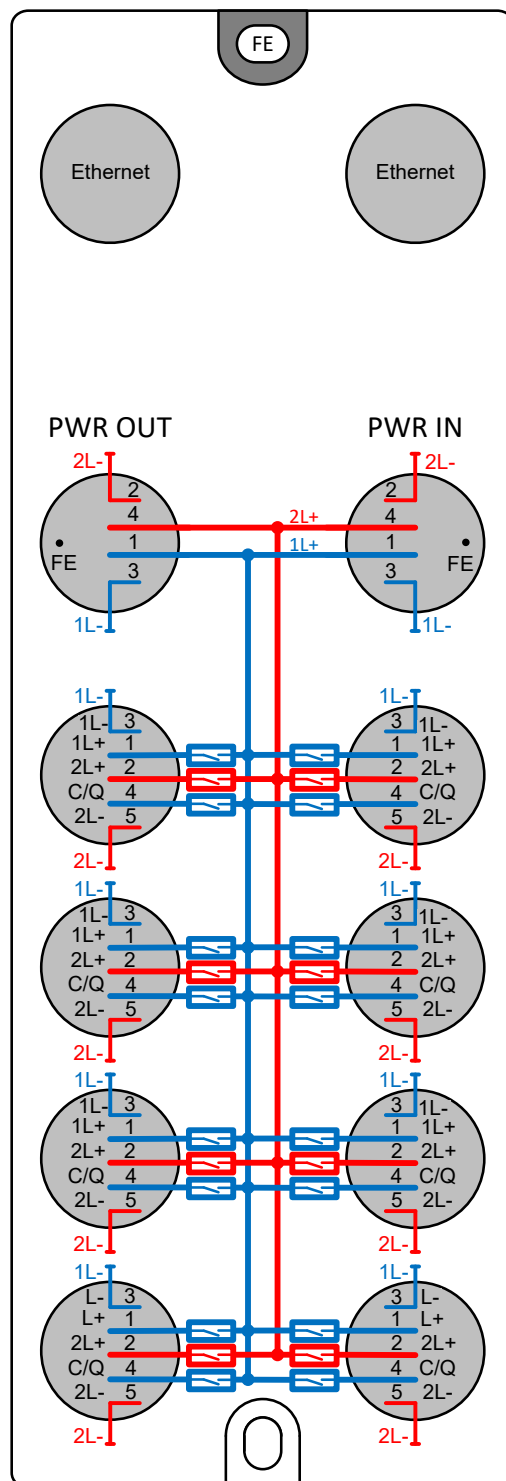


Figure 14: Schematic Circuit Diagram of the Power Supply

10 Commissioning

Note

The figures and descriptions below are an example configuration

The figures and descriptions this section contains are based on an example configuration.

Your configuration, and thus the content shown, may differ from the content illustrated here.

10.1 Setting an IP Address

The module requires an IP address in order to be addressed via the ETHERNET network. The module has no IP address when delivered. The module can get the IP address in various ways.

- The PROFINET IO controller sets the IP address when PROFINET starts up.
- You can set the IP address permanently or temporarily with the PROFINET engineering tool of the IO controller. Read the documentation of the PROFINET engineering tool.
- You can set the IP address with the ETHERNET Device Configuration software as described below (see).

Setting the IP Address with the “ETHERNET Device Configuration” Software

- Launch the “ETHERNET Device Configuration” software.
- In the menu, under **Options > Protocols**, verify that the **DCP** option is checked. If the **DCP** option is not checked, check it.
The software lists all the devices found on the local network. Under **IP Address**, either 0.0.0.0 (i.e., no IP address set) or the IP address set in the product appears.
- Click **Scan for Devices**.
A dialog appears with a list of products found on the local network:

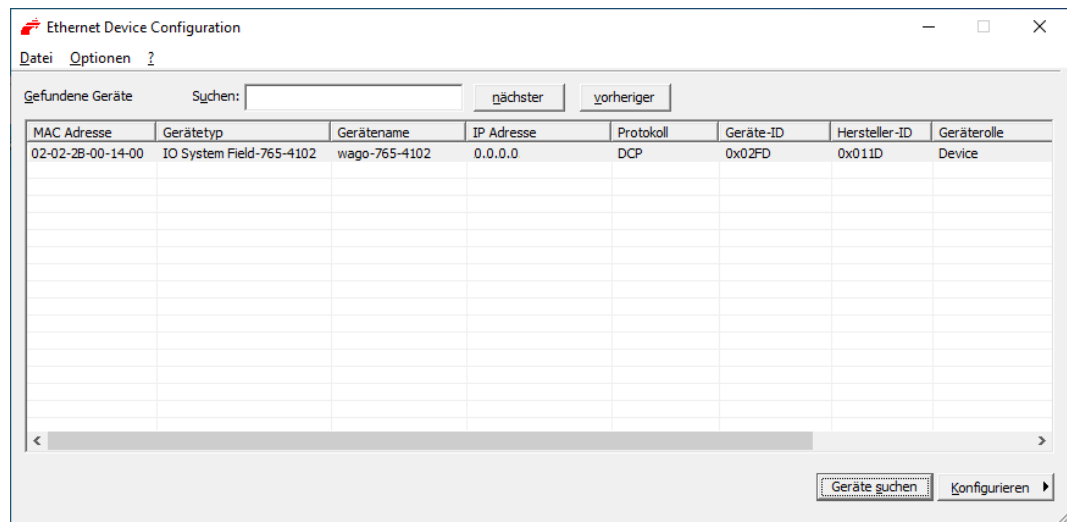


Figure 15: List of Products Found on Local Network

- Identify the device, e.g., on the basis of the MAC address or the product type `IO System Field-765-xxxx`.
- Use the mouse cursor to select the corresponding device from the list of devices found.
- Click **Configure > Set IP Address**.
The dialog for setting the IP address appears:
- Select the **Use Static IP Address** option.
- Enter the IP address and the subnet mask. Entering the IP address is optional for the standard gateway.
- With **Make Settings Temporarily**, you can specify whether the IP address should be set permanently or temporarily.
- Click **OK**.
The module is now accessible via the IP address, and you can open the WAGO I/O Field Webserver with a browser, for example.

10.2 Configuration

10.2.1 Parameterizing the Module via PROFINET

- ✓ To configure the PROFINET IO Controller, you need a GSDML file.
1. Import the GSDML file.
The GSDML file has the following structure:
GSDML-Vx.xx-wago-series765-yyyymmdd.GSDML.
“x.xx” stands for a specification of the version and “yyyymmdd” for a specification of the date (yyyy = year, mm = month, dd = day); see also  **Parameterization Tools** [▶ 54](#).
 2. Select the module from the device catalog.
 3. Configure the ports.

4. Set the parameters.

➔ The parameters are imported from the GSDML file.

10.2.1.1 Selecting the Module

Select the module used from the device catalog.

Module: WAGO 765-4102

Name: 8 PORT IOL-B FLD PN 24 VDC 2.0 A

10.2.1.2 Configure the PROFINET Station Name and IP Address

When delivered and after a factory rest, the IO device has no PROFINET product name, and the IP address is 0.0.0.0.

The IO-Device requires a unique PROFINET product name so the IO controller can communicate with the IO device.

Use the engineering software to assign the IO device a PROFINET product name.

The IO controller configures the IP address when PROFINET starts up.

10.2.1.3 Parameterizing Connections

Parameterize the ports using the information in section [🔗 Setting the PROFINET Configuration \[► 93\]](#).

10.2.1.4 Setting Parameters

Parameterize the submodule to adjust the port functions and basic settings.

You can find all the module parameters in [🔗 PROFINET Parameters \[► 71\]](#).

10.3 Parameterization

The following tools are described below:

- [🔗 WAGO Webserver I/O Field \[► 110\]](#)
- [🔗 WAGO IO-Link Configurator \[► 143\]](#)
- [🔗 WAGO I/O Field app \[► 143\]](#)
- [🔗 OPC UA Server \[► 143\]](#)

10.3.1 WAGO Webserver I/O Field

10.3.1.1 Call WAGO Webserver I/O Field

This section describes how you can use the integrated software WAGO I/O Field Webserver to get access to detailed information on the current operating state of the product and make settings to affect the product's behavior.

- ✓ Requirement: Opening the user interface of WAGO I/O Field Webserver requires that product's IP address is configured and known.

- Proceed as follows:
Enter the following text in the address bar of your Web browser to address the product:
`http://<IP-address-according-to-configuration>`
e.g., `http://192.168.10.2`.
- ➔ The WAGO I/O Field Webserver **Dashboard** appears. You can now use the functions described below.

10.3.1.2 User Interface of the WAGO Webserver I/O Field

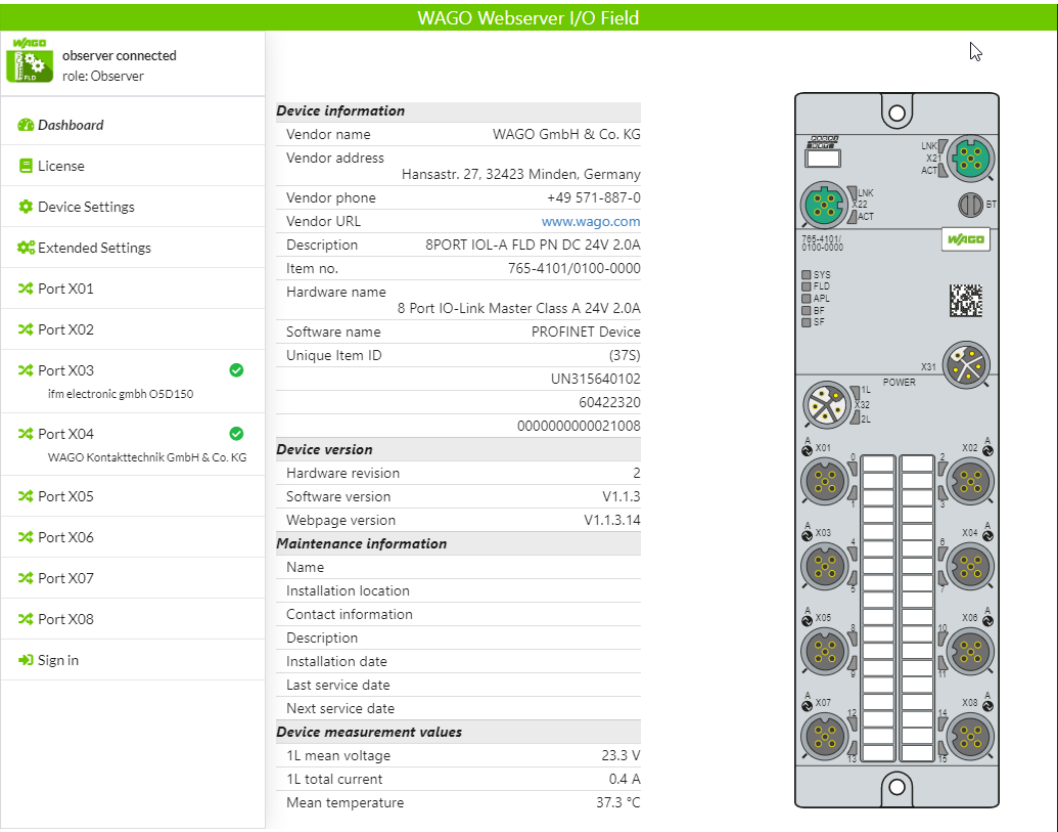


Figure 16: “Dashboard” Menu Item, Main Page (Example View)

When the user interface of the WAGO I/O Field Webserver opens, the main page of the **Dashboard** appears first.
It shows the following product information:

Table 77: Data on “Dashboard” Page

Area	Information Displayed
Device information	Product data and WAGO contact information
Device version	Information on the product version: Hardware name and version number Software name and version number Website version number
Maintenance information	Maintenance information in text form
IOL device information	Extended module and port information (measurement data on the module state)

10.3.1.2.1 Displaying Licenses

The **Licenses** menu item displays the page of the same name.

The menu item contains the following information:

- A list of the licensed software components the product contains
- A link for each licensed software component to the associated license terms

10.3.1.2.2 Advanced Module and Port Information

The extended module and port information includes the following measurement data that is measured by the integrated sensors in the module:

- Module temperature
- Supply voltage (for supply cables 1L and 2L)
- Sum of all currents (for supply cables 1L and 2L)

10.3.1.2.3 Device Status LEDs

The **Device Status** tab shows the indicators that are located on the module and the corresponding LED status. For each LED display, the current status information is displayed in text form.

Descriptions of the possible LED states can be found in section [🔗 Diagnostics via Indicators \[► 165\]](#).

Changes to settings require maintenance, specialist or admin rights. If you do not have these rights, the tab is grayed out and cannot be edited. In this case, the following error message appears:

Note: For user role "Observer", device status is not available!

10.3.1.2.4 Tags and Labels

Using the **Tags and Labels** tab, you can assign freely configurable text in the module via the Webserver:

- For the IO-Link master: the application-specific tags for name, position and function
- Two application-specific name tags

Changes to settings require maintenance, specialist or admin rights. If you do not have these rights, the tab is grayed out and cannot be edited. In this case, the following error message appears:

Note: For user role "Observer," editing tags and labels is not allowed!

The application-specific tags include the following information:

Table 78: Tags for Identification of the IO-Link Master

Name	Data Format and Length	Description
Application-specific tag for IO-Link master	Printable ASCII string, max. 64 characters	Application-specific name tag for identification of the connected IO-Link master. Example: "Fallback reader"
Location tag	Printable ASCII string, max. 64 characters	Application-specific position tag for identification of the connected IO-Link master. Example: "Down under"

Name	Data Format and Length	Description
Function tag	Printable ASCII string, max. 64 characters	Application-specific function tag for identification of the connected IO-Link master. Example: "Code reading"

Table 79: Name Tags 1 and 2

Name	Data Format and Length	Description
Application name tag 1	Printable ASCII string, max. 250 characters	Application name 1 Memory area: 0 ... 249 bytes
Application name tag 2	Printable ASCII string, max. 250 characters	Application name 2 Memory area: 250 ... 499 bytes

To assign application-specific tags, proceed as follows:

1. Select the **Device Settings** menu item on the left side of the main Webserver menu.
2. Switch to the **Tags and Labels** tab.
3. Modify the relevant fields.
4. Click the **[Apply]** button.
⇒ The changes take effect.
5. To undo the last entry, click the **Undo** button.
6. To reset the input fields for the tags and labels to the default settings, click the **Default** button.

10.3.1.2.5 Maintenance Information

The maintenance information includes information in text form that the user can set, e.g., the product name, installation location and date, contact information, description and date of the last and next product service. The texts can be edited by selecting **Settings** from the menu on the **Maintenance information** tab.

10.3.1.3 Opening the Product Information via WAGO Webserver I/O Field

10.3.1.3.1 Displaying Port Information

For each of the module's IO-Link ports (port X01, port X02 etc.), individual port information can be found on the **Information**, **Status**, **Configuration**, **IOL** and **Process data** tabs.

The **Configuration** tab also offers the option of making port settings.

You can access the port information as follows:

1. From the main menu of the Webserver (left), select the menu item „Port X0i“ which you want to view information about.
⇒ The **Information** tab opens.
2. Click the desired tab.
➔ You can now access information about the desired port.

For each port, you can select from the following five tabs:

Table 80: Tabs for Port Information and Settings (IO-Link Ports X01, X02 etc.)

Tab	Description
Information	Displays the current measured values for temperature, voltage and current, as well as the port state, individually for each of pin 1, pin 2 and pin 4. If an IO-Link device is connected to the port via pin 4, its product data is also shown. This tab is pre-configured.
Status	Displays status information for the entire port
Configuration	For displaying and setting port parameters, such as the operating time or cycle time of the port
IOL	Read/write access to data of one of the IO-Link devices connected to the port
Process data	Displays process data from IO-Link device or PIN 2 and PIN 4, if configured

10.3.1.3.2 Displaying Measured Values and Information on Connected IO-Link Devices

The **Information** tab shows the following information:

- The measured values and states of the port diagnostics
- The information on connected IO-Link devices

Displaying Pin- and Port-Specific Measured Values and States

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

- Temperature of the pin, measured in °C
- Voltage on the pin, measured in volts
- Current flowing through the pin, measured in amperes
- State of the connection pin

States of the Connection Pin

The possible states of the connection pin are:

- OK
- Short circuit
- Module-internal overload protection has triggered
- Module-internal overtemperature protection has triggered
- Module-internal overvoltage protection has triggered
- Overcurrent
- Undercurrent
- Overtemperature
- Undertemperature
- Overvoltage
- Undervoltage
- Module-internal watchdog timer has elapsed

Displaying Information on Connected IO-Link Devices

On IO-Link ports on which an IO-Link device is connected and recognized by the product's firmware, the following product information is also displayed in the **Device information** block:

Table 81: Additional Information on the Products Connected to the Selected Port

Information	Description
Min cycle time	Minimum cycle time supported by the connected product, in units of 0.1 milliseconds
Function ID	Function ID of the connected product
Number of profile IDs	Number of profile IDs in the profile characteristic (index 0x000D) of the connected product
Vendor name	Detailed name of the manufacturer/vendor of the connected device (up to 64 characters)
Vendor text	Additional text for description of the manufacturer/vendor (up to 64 characters)
Product name	Complete name of the connected product (up to 64 characters)
Product ID	Manufacturer-specific product or type information on the connected product (up to 64 characters)
Product text	Additional text for description of the connected product (up to 64 characters)
Serial number	Individual manufacturer-specific unique serial number of the connected product (up to 16 characters)
Hardware revision	Manufacturer-specific information on the hardware version (up to 64 characters)
Firmware revision	Manufacturer-specific information on the firmware version (up to 64 characters)

10.3.1.3.3 Displaying Port Status Information

The **Status** tab shows status information for pin 4 of the selected port.

This tab answers the following questions about the selected port:

- What is the current port status of the port?
- Is the process data valid for input/output?
- Is a product connected to the selected port? If so, what is this product's Revision ID?
- How high is the data transmission rate between the port and a product connected there?
- How long is the communication cycle time in the **Operate** operating mode?
- What is the true input/output data length of the connected product in bytes?
- What is the manufacturer ID or product ID of the product connected to the IO-Link port?

Proceed as follows to display the status information on a specific port:

1. From the main menu of the Webserver (left), select the menu item which you want to view information about.
 2. Open the **Status** tab.
- ➔ The **Status** tab opens. The current port status information appears.

10.3.1.3.4 State

This shows the current port information of the IO-Link port. The following table contains all possible values for the status of the IO-Link port:

Table 82: Possible values of "State" (port status information)

Value	Port Status	Description
0	No device	No product is connected to the port, or there is no communication with the connected product
1	Disabled	The port is inactive
2	Incorrect Device	The version or compatibility check failed
3	Preoperate	The product is ready for communication
4	Operate	The product is communicating
5	DI CQ (digital input)	The port is in digital input mode
6	DO CQ (digital output)	The port is in digital output mode
7	Reserved	Reserved
8	Reserved	Reserved
9	Incorrect cycle time	The cycle time according to the configuration does not match with the connected product.
254	Port Power Off	The port voltage is switched off
255	Not available	The port is not available

10.3.1.3.5 Quality

This shows the **Port Quality Info**, including information on the validity of the process data for input and output (separately). The content is binary coded.

Table 83: Meaning of the Individual Bits

Bits of Port Quality Info	Description
Bit 0	0 = input process data valid 1 = input process data invalid
Bit 1	0 = output process data valid 1 = output process data invalid
Bit 2 to bit 7	Reserved

10.3.1.3.6 Revision ID

This shows the version ID of the connected device.

A value of 0 means: no device connected.

All other values must be interpreted as the version ID of the connected device.

10.3.1.3.7 Baud Rate

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

- 4.8 kbps (COM1)
- 38.4 kbps (COM2)
- 230.4 kbps (COM3)

If no IO-Link device is connected to the port, the text `Not connected` appears here.

10.3.1.3.8 Cycle Time

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

- Bits 0 ... 5 specify a whole-number multiplier between 0 and 63.
- Bits 6 ... 7 specify the calculation formula to use according to the following table:

Table 84: Cycle Time of the Master – Bits 6 ... 7

Bits 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

10.3.1.3.9 Input Data Length

This shows the actual input data length of the connected product in bytes.

10.3.1.3.10 Output Data Length

This shows the actual output data length of the connected product in bytes.

10.3.1.3.11 Vendor ID

This value is the manufacturer ID of the connected product.

10.3.1.3.12 Device ID

This value is the device ID of the connected product.

10.3.1.3.13 Displaying Process Data

You can view the process data associated with a specific port on the **Process Data** tab.

Proceed as follows to view the process data for a port:

1. From the main menu of the Webserver (left), select the menu item which you want to view information about.
2. Open the **Process Data** tab.
 - ➔ The **Process Data** tab opens. The current values of the process data configured for “Input”/“Output” appear in hexadecimal format under “Input”/“Output”. If no process data has been configured for a data direction (input or output), the corresponding field remains empty.

10.3.1.4 Making Basic Settings via the WAGO I/O Field Webserver

You can make the following settings on the module with WAGO Webserver I/O Field:

-  [Accessing a Connected IO-Link Device \[► 118\]](#)
-  [Configuring Ports \[► 119\]](#)
-  [Reading IP Parameters \[► 122\]](#)
-  [Storing Maintenance Information \[► 122\]](#)
-  [Updating Firmware \[► 123\]](#)
-  [Resetting the Module to the Factory Settings \[► 125\]](#)
-  [Configure Bluetooth \[► 135\]](#)
-  [Managing Users \[► 126\]](#)

-  [Forcing Digital Inputs and Outputs \[► 128\]](#)
-  [Forcing for IO-Link Ports \[► 129\]](#)

10.3.1.4.1 Accessing a Connected IO-Link Device

The **IOL** tab allows read and write access to the IO-Link device connected to an IO-Link port via index and subindex. The ISDU message format (ISDU = Indexed Service Data Unit) is used for this purpose.

Note

You can find the meaning of the index and subindex values in the documentation of the connected IO-Link device.

You can find a description of the ISDU message format in the IO-Link specification.

Required Rights

Changes to settings require specialist or admin rights. If you do not have these, the tab is grayed out, and the displayed values cannot be edited. Only if the IODD of the addressed module allows is write access also possible with maintenance rights.

Access to IO-Link Device

To access the data of an IO-Link device connected to the selected IO-Link port via index and subindex (ISDU message format), proceed as follows:

1. Select the port to which the IO-Link device is connected from the menu on the left.
 2. Open the **IOL** tab.
- ➔ The **IOL** tab appears.

Read Access

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

1. On the **IOL** tab, enter the index of the connected IO-Link device you want to access into the **Index** field as a hexadecimal value.
 2. On the **IOL** tab, enter the subindex of the connected IO-Link device you want to access into the **Subindex** field as a hexadecimal value. The default setting is 00.
 3. Click the **[Read]** button.
- ➔ The read operation is performed. An entry is written to the history at the bottom of the tab and logged there with the current time.

If the operation was successful, the text **Read OK:** and the result appear in the history. The entries in the history then have the following structure:

```
Time - Index:Subindex - Read OK: <Result>
```

If the operation was not successful, an error message appears in the history with error codes from the IO-Link master and IO-Link device.

The entries in the history then have the following structure:

```
Time - Index:Subindex - Read failed:
IOLMErrCode(<error code of the IO-Link master>):
IOLDErrCode(<error code of the IO-Link device>)
```

Note

You can find information on the meaning of the error codes of IO-Link masters (IOLMErrorCode) and IO-Link devices (IOLDErrorCode) in the IO-Link specification.

The following applies in both cases:

- The time appears in HH:MM:SS format.
- The index and subindex appear in hexadecimal format.

Write Access

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

1. On the **IOL** tab, enter the index of the connected IO-Link device you want to access into the **Index** field as a hexadecimal value.
2. On the **IOL** tab, enter the subindex of the connected IO-Link device you want to access into the **Subindex** field as a hexadecimal value. The default setting is 00.
3. On the **IOL** tab, enter the data to write in the **Input data** field.
4. Click the **[Write]** button.

➔ The write operation is performed.

If the operation was successful, the text `Write ok:` and the result appear in the history. The entries in the history then have the following structure:

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

If the operation was not successful, an error message appears in the history with error codes from the IO-Link master and IO-Link device. The entries in the history then have the following structure:

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

Deleting the Read and Write Access History

To delete the logged history of read and write operations, proceed as follows:

- Click the **[Clear history]** button.
- ➔ The history of read and write access operations is deleted.

10.3.1.4.2 Configuring Ports

On the **Configuration** tab, you can view and modify the following settings of the selected port individually:

Table 85: Port Configuration Settings for IO-Link Devices

Name	Type	Description
Port mode (Pin 4)	Drop-down menu	Port operating mode (configuration of pin 4)
Digital input signal filter (Pin 4)	Drop-down menu	Filter time for digital input signals on pin 4 (only for "Port mode (pin 4)" on digital input)
IQ behavior (Pin 2)	Drop-down menu	Port operating mode (configuration of pin 2)
Validation and Backup	Drop-down menu	Validation and backup settings for device check when replacing devices

Name	Type	Description
PortCycleTime	Input field	Cycle time of the port
VendorID	Input field	Manufacturer ID of the attached module
DeviceID	Input field	Device ID of the attached module

The **Validation and Backup**, **PortCycleTime**, **VendorID** and **DeviceID** settings only appear if "IOL Manual" is selected in the **Port mode (Pin 4)** drop-down menu.

The **Validation and Backup**, **PortCycleTime**, **VendorID** and **DeviceID** settings only appear for the IOL Manual selection in the **Port mode (pin 4)** drop-down menu.

Changes to settings require specialist or admin rights. If they are not available, the **Configuration** tab is grayed out, and the displayed values cannot be edited. In this case, the following error message appears: ("xx" represents "Observer" or "Maintenance"):

Note: For user role "xx", port configuration is not allowed!

If the controller and module are exchanging process data, configuration is not possible. In this case, the following message appears:

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

To make changes to a port's configuration, proceed as follows:

1. Select the desired port (port X01, port X02 etc.) from the menu.
 2. Open the **Configuration** tab.
 3. Configure pin 4 by setting the port operating mode.
 4. If applicable, configure the filter time for the signals of the digital inputs.
 5. If applicable, configure the device check for validation and backup.
 6. If applicable, configure pin 2 by setting the I/Q behavior.
 7. If applicable, enter the vendor ID.
 8. If applicable, enter the device ID.
 9. If applicable, set the cycle time.
 10. Click the **[Apply]** button.
- ➔ Your changes now take effect.

Configuring the Operating Mode for Pin 4 of the Port

You can select the port operating mode for pin 4 of the selected IO-Link port from the **Port mode** drop-down menu. The following operating modes are available:

Table 86: "Port Mode" Drop-Down Menu: Selecting the Operating Mode for Pin 4 of the Selected IO-Link Port

Selection Option	Description
Deactivated	The port is disabled. L+ is switched off. The process data (both input and output) is set to 0. The master no longer performs actions related to this port.
IOL Manual	The port is used as an IO-Link port with manual (user-defined) configuration. The vendor ID, device ID and version ID are validated.
IOL Autostart	The port is used as an IO-Link port with automatic start. No configuration or device validation occurs.
Digital input, normally open	The port is used as a digital input. All elements of the port configuration are ignored except for the input and output data length.

Selection Option	Description
Digital input, normally closed	The port is used as a digital input. The signals on the port are inverted. All elements of the port configuration are ignored except for 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 for the input and output data length.

Setting the Filter Time for Digital Inputs

The filter time for the digital inputs can be selected from the **Digital input signal filter** drop-down menu. You can select from the following values:

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

If the **No digital input filter** option is selected, no filtering occurs.

Configuring Pin 2

The behavior of pin 2 can be selected from the **IQ behavior** drop-down menu. For IO-Link Class B ports, pin 2 typically provides the 2L+ supply voltage. The following table lists these and other selection options for pin 2.

Table 87: "IQ Behavior" Drop-Down Menu – Configuration of Pin 2 for IO-Link Class B Devices

Selection Option	Explanation
Power On	Pin 2 supplies 24 VDC output voltage 2L+. This setting is necessary for use of IO-Link Class B devices on this port.
Power Off	Pin 2 supplies no output voltage.
Digital Output	Pin 2 is a digital output and switches the voltage 2L+.

Configuring the Device Check for Validation and Backup

Note

In the "IOL Autostart" operating mode, this drop-down menu has no effect.

The **Validation and backup** drop-down menu can be used in "IOL Manual" operating mode to determine whether a validation (device check) is performed and, if so, at what level (Inspection Level) when a connected device is replaced, and whether or not the stored operating parameters of the old device are carried over to the new device.

Table 88: Options for Validation and Backup

Selection Option	Description
No device check	No check of the connected IO-Link device.
Type compatible to device V1.0	Check for type-compatible device per IO-Link specification 1.0.
Type compatible to device V1.1	Check for type-compatible device per IO-Link specification 1.1.
Type compatible to device V1.1, backup and restore	Check for type-compatible device per IO-Link specification 1.1 with backup and restore functionality. The IO-Link master applies parameter changes of the IO-Link device to its memory (data storage) if parameters have been changed in the IO-Link device. The IO-Link master transfers the stored parameters to the IO-Link device when booting.

Selection Option	Description
Type compatible to device V1.1, restore only	Check for type-compatible device per IO-Link specification 1.1 with restore functionality. The IO-Link master transfers the stored parameters (data storage) to the IO-Link device when booting.

VendorID Input Field

This element contains the expected manufacturer ID (VendorID, 2 bytes) of the connected device. The permissible values range from 1 to 0xFFFF. This information is required for the device check for type compatibility. It can be omitted if **[No device check]** is selected.

DeviceID Input Field

This element contains the expected device ID (DeviceID, 3 bytes) of the connected device. The permissible values range from 1 to 0xFFFFFF. This information is required for the device check for type compatibility. It can be omitted if **[No device check]** is selected.

PortCycleTime Drop-Down Menu

Depending on the selected operating mode, the expected cycle time of the port either can be selected from the **PortCycleTime** drop-down menu or is merely displayed. The encoding corresponds to the one in the port status.

10.3.1.4.3 Reading IP Parameters

The **Device Configuration** tab shows the following parameters for the IP protocol.

Table 89: "Device Configuration" Tab – Parameter Overview

Parameter	Settings/Action
Device IP address	IP address for the PROFINET configuration with static IP address configuration
Subnet mask	Subnet mask for the PROFINET configuration with static IP address configuration
Gateway IP address	Gateway IP address for the PROFINET configuration with static IP address configuration

The PROFINET IO controller configures the IP address of the module. Therefore, manual configuration of the IP address is neither necessary nor possible for PROFINET IO devices.

The additional tabs in the **Settings** menu item are explained below.

10.3.1.4.4 Storing Maintenance Information

On the **Maintenance Information** tab, you can store maintenance information, such as the device name, the installation location and date, contact information, a description text and the date of the last and next product service.

Changes to settings require maintenance, specialist or admin rights. If you do not have these rights, the tab is grayed out and cannot be edited. In this case, the following error message appears:

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

The maintenance information includes the following:

Table 90: Maintenance Information

Name	Data Format and Length	Description	Corresponding I&M Field
Name	Printable ASCII string, max. 64 characters	Uniform label (string) in the system for the function of this device	I&M1: TAG_FUNCTION
Installation Location	Printable ASCII string, max. 32 characters	Uniform label (string) in the system for the location where the device is installed	I&M1: TAG_LOCATION
Installation Date	ASCII time indication, max. 32 characters	Installation or commissioning date of this device; the format can be determined by the fieldbus organization.	I&M2: INSTALLATION_DATE
Contact Information	Printable ASCII string, max. 32 characters	Text for identification of a contact person for this managed node of the system, together with information on how to contact this person.	
Description	Printable ASCII string, max. 64 characters	Readable comment field (plain text) to store free text containing individual state information and comments.	I&M3: DESCRIPTOR
Signature	Printable ASCII string, max. 128 characters	Signature	I&M4: SIGNATURE
Change Count	ASCII decimal number, max. 32 characters	Counter for changes to the hardware or the device parameters; only needs to be incremented if the data has really changed.	I&M0: REV_COUNTER
Last Service Date	ASCII time indication, max. 32 characters	Date/time of the last service, e.g., firmware update	
Next Service Date	ASCII time indication, max. 32 characters	Date/time of the next service, e.g., firmware update	

To make changes to the maintenance information, proceed as follows:

1. From the Webserver main menu (left), select the **Settings** menu item.
⇒ The **Device Configuration** tab appears.
2. Select the **Maintenance Information** tab.
3. Modify the relevant fields.
4. Click the **[Apply]** button.
➔ The changes take effect.

10.3.1.4.5 Updating Firmware

The **Firmware Upgrade** tab is used to update the module's firmware.

The following section describes the procedure for updating the firmware from V1.2.x to V1.2.y.

If the module still uses V1.1.x firmware, first upgrade from V1.1 to V1.2. The procedures are described in  **Firmware Updates** [► 175].

Updating Firmware from V1.2.x to V1.2.y

NOTICE

Put the system in a safe operating state before updating the firmware

Never update the firmware during ongoing operation of the system in which the device is installed. Before any firmware update, the system must first be properly shut down and put in a safe operating state.

Otherwise, the controller will no longer receive input and output data, so outputs can no longer be controlled.

Note

Firmware backup

When you update your device's firmware, it will no longer be possible to reconstruct the state of your device before the update, including the firmware used up to that point. To avoid this, create a firmware backup before performing the firmware update.

Changes to settings require maintenance, specialist or admin rights. If you do not have these rights, the tab is grayed out and cannot be edited. In this case, the following error message appears:

Note: For user role "Observer", firmware update is not allowed!

To update the firmware, you need the correct firmware file for the module type. The file name of the firmware is "WAGO_IO_SystemField_765_XXXXXX_Vxyz.zip." The placeholder XXXXXXXX represents the communication system. The placeholder xyz represents a three-digit or multi-digit version number. You can get the file from the Downloads section of the WAGO website:  <http://www.wago.com>.

To update the firmware, proceed as follows:

1. In the left-hand column, click the **Device Settings** menu item.
2. Select the **Firmware Upgrade** tab.
3. Click the **[Select ZIP File]** button.
 - ⇒ A file selection dialog opens.
4. In this dialog, select the file WAGO_IO_SystemField_765_XXXXXX_Vxyz.zip.
 - ⇒ The name of the selected file appears.
 - ⇒ Under "Details of new firmware," information on the version and on components and their versions appears next to "Content information."
 - ⇒ Under "Details of old replaced firmware," version information appears for the firmware on the module.

5. Click on the **[Update]** button.
 - ⇒ The firmware is transferred and updated in the module. A bar indicates the progress as a percentage.
 - ⇒ When the firmware update is completed, a message appears indicating that the module will restart after **OK** is clicked and has a new (possibly different) IP address.
 6. Click the **[OK]** button.
 - ⇒ The module restarts.
- ➔ After the restart, the module executes the updated firmware.

The firmware update runs as follows:

1. The firmware from the ZIP file `WAGO_IO_System-Field_765_XXXXXXX_Vxyz.zip` is transferred to the module.
2. An internal reset is triggered.
3. The module's maintenance firmware starts, and the new firmware is installed in the module.
4. You are notified when the installation procedure finishes.
5. The device then resets again.
6. The new firmware starts.

10.3.1.4.6 Resetsetting the Module to the Factory Settings

The module stores parameters in objects. The parameters of selected objects or all objects can be reset to the factory settings via the **Factory Reset** tab.

Changes to settings require maintenance, specialist or admin rights. If you do not have these rights, the tab is not displayed.

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

Table 91: Options for Resetting the Device or Various Groups of Settings to Their Factory Defaults

Option	Resets These Parameters/Settings:
Clear stored device information and restart	Maintenance information, NTP settings, IO-Link master settings in the OPU UA server
Clear stored network settings and restart	Communication settings, IP address, NameOfStation
Clear stored device settings and restart	Port configuration, IO-Link data storage, IO-Link diagnostics, load management parameters, MQTT parameters, tags with application names
Clear all stored settings and restart	Maintenance information, NTP settings, IO-Link master settings in the OPU UA server, communication settings, IP address, NameOfStation, port configuration, IO-Link data storage, IO-Link diagnostics, load management parameters, MQTT parameters, tags with application names
Restart	Performs a module reset without resetting parameters

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

1. In the left-hand column of the WAGO I/O Field Webserver, click the **Settings** menu item.
 - ⇒ The **Device Configuration** tab appears.
2. Select the **Factory reset** tab.
3. Use the buttons to select which parameters should be reset to their factory default settings.

4. Click the **Apply** button.
5. Click the **OK** button.
- ➔ The selected parameters are reset to the factory settings.
- ➔ The module resets.

The factory settings are restored for the selected parameters.

10.3.1.4.7 Managing Users

The **User administration** tab provides role-based user administration. It allows you to create and delete users and assign them roles; their rights depend on these roles. Users can be divided into three roles:

- Maintenance
- Specialist
- Administrator

Changes to settings require admin rights. If you do not have these rights, the tab is not displayed.

Creating a New User

When you open the user administration, the **User Administration** view appears.

The `root` user with password pre-set to `password` exists by default.

To create another user, proceed as follows:

1. Click the green square with the white plus sign.
 - ⇒ The input screen for the new user appears.
2. In the **Username** field, enter a new username. Usernames that are already used are not allowed.
3. In the **Password** field, enter the password for this username.
4. Using the drop-down menu on the right, select the role for the new user you are creating. The available roles are Maintenance, Operator and Administrator.
5. Click the green field with the checkmark to finish.
- ➔ The new user is created and assigned the selected role.

Removing Users

To remove an existing user from the product's user administration, proceed as follows:

- Click the red button with the white "x" to the right of the user you want to remove.
- ➔ The user is deleted.

The user account currently being used (here: `root`) can only be deleted if you are logged in as Administrator with a different `root` user account. Otherwise, the red delete button is grayed out.

When the module is reset to factory settings, users that have been created are not deleted. Therefore, `root` users that have been deleted cannot be restored.

Changing the Password

To change the password for an existing user, proceed as follows:

1. Click the green button with the white pencil icon to the right of the user you want to edit.
⇒ The input screen for the user you want to edit appears.
2. Enter the new password of your choice in the input field below the text “Change the password of user <username>.” Here “<username>” stands for the username you want to change.
➔ The password will be changed according to what you enter.

Roles and Rights

The following table shows which module functions require rights and how these are assigned to the roles (r/w: read/write; r: read; -: not visible)

Table 92: Assignment of Rights to Roles

Right/Function	Admin	Special-ist	Mainte-nance	Observer	Description/Explanation
Managing commissioning and service information for the module	r/w	r/w	r/w	r	Installation location/date, contact person, last/next service date
Changing/managing IP address	r/w	r	r	r	Show IP address
Firmware update	r/w	r/w	r/w	r	Update the firmware on the module
Reset to factory settings (factory reset)	r/w	r/w	r/w	—	Delete selected parameters or all parameters on the module
MQTT configuration	r/w	r/w	r	r	Configure MQTT and display MQTT status
NTP server configuration	r/w	r/w	r/w	r	Set the IP address and parameters for time synchronization with an NTP server
Power-on delay	r/w	r/w	r	r	Set the power-on delay
Disabling/enabling Bluetooth®	r/w	r/w	r	r	Enable or disable Bluetooth
Load management	r/w	r/w	r	r	Configure load management and display statistics
Radio Test (Bluetooth)	r/w	—	—	—	Test functions for Bluetooth
Port configuration	r/w	r/w	r	r	Configure ports
Process data	r/w	r/w	r	r	Display process data
Forcing	r/w	r/w	—	—	Simulate inputs and force outputs
Substitute value strategy	r/w	r/w	r	r	Switch the substitute value 0/1; hold the last value
Asynchronous IO-Link data exchange	r/w	r/w	—	—	Index, subindex, data, format
ISDU access	r/w	r/w	r (rw only if supported by IODD)	r	Distinction between reading a parameter via ISDU and writing a parameter via ISDU; the IODD defines the rights.
User management	r/w	—	—	—	User management for administrator

10.3.1.4.8 Logging Users On and Off

Logging On as a User

Proceed as follows to log on as a user:

1. From the Webserver main menu (left), select the **Sign in** menu item.
⇒ The input screen for username and password appears.
 2. Enter your username and password into the corresponding fields.
 3. Click the **[Sign in]** button.
- ➔ If you have entered a known username correctly, you can now work with the WAGO I/O Field Webserver with this user's assigned rights. The username that was used to log on and the current role are shown in the upper left-hand corner. The **Sign in** menu item changes to **Sign out**.

Logging off as a User

Proceed as follows to log off as a user:

- From the Webserver main menu (left), select the **Sign out** menu item.
- ➔ You can now no longer work in the WAGO I/O Field Webserver with the rights you had been using till this point. The username used to log on is no longer shown in the upper left-hand corner. The **Sign out** menu item changes back to **Sign in**.

Guest User Access

By default, the Webserver recognizes the user `Observer` without a password and with severely restricted rights; this account has been set up to allow initial access or guest access.

Initial Login as Administrator

Upon delivery, the WAGO Webserver I/O Field can be accessed with the username `root` and the password `password`. This combination has administrator rights.

Note

Change administrator password

Change the administrator password immediately after commissioning. The factory default setting is widely known and does not provide adequate protection.

Note

Save administrator password

Once set, the administrator password cannot be reset. Keep the administrator password in a safe place.

10.3.1.4.9 Forcing Digital Inputs and Outputs

To access the forcing functionality for the digital inputs and outputs via the Webserver, you must be logged in there with specialist or administrator rights. To perform forcing, proceed as follows:

1. From the Webserver main menu (left), select the **DIO Forcing** menu item.
 2. Check the **Forcing enable** box.
- ➔ Unless another user is already accessing it, access to the forcing functionality is now enabled. A table with checkboxes in some of its cells appears on the screen:

You have three options for entering the desired substitute value strategy for each pin that supports the forcing function:

Table 93: Input Options for Selecting the Substitute Value Strategy (for Each Pin of a Port)

Option	"Force" Checkbox	"Set/Clr" Checkbox
Forcing – substitute value bit is set (1)	Checked	Checked
Forcing – substitute value bit is deleted (0)	Checked	Not checked
No forcing for this pin	Not checked	No meaning

For entering these, there are two checkboxes in the table for each pin of a port: **force** for switching the forcing functionality on/off, and **set/cclr** for setting or deleting the setpoint (1 bit); the latter checkbox is only relevant if the **force** box is checked. The following applies to this:

- All inputs for input simulation are entered in the right half of the table under "Input process data"; all the inputs for output forcing are then entered in the left half of the table under "Output process data."

You can find a description of and more information on the forcing function and explanations of terms under  **Forcing** [► 53].

Each of the eight ports (X01 ... X08) has its own table row.

Concurrent Access

As long as one user is accessing the forcing functionality through a forcing medium, e.g., the WAGO I/O Field Webserver, it is locked for all other users of the module. They cannot access the forcing functionality until the user that is active now terminates his or her access.

In this case, the Web browser displays a message box with the text "Somebody else is already forcing. Try again later." When the forcing functionality is being accessed, a small orange icon also appears in the forcing option entry in the menu bar on the left.

10.3.1.4.10 Forcing for IO-Link Ports

To access the forcing functionality for the IO-Link module via the Webserver, you must be logged in there with specialist or administrator rights. To perform forcing, proceed as follows:

- Select the **IOL Forcing** option from the main menu of the Webserver on the left and check the **Forcing enable** box at the top.
- ➔ Unless another user is already accessing it, access to the forcing functionality is now enabled. The screen shows a table with checkboxes in the **force** columns and should look something like this:

You can find a description of and more information on the forcing function and explanations of terms under  **Forcing** [► 53].

You can use the **force** checkbox to specify for each port of the port group X01...X04 or X05...X08 in its own row whether port forcing applies to this port. You can do this separately for the input and output process data. You can switch between the two port groups X01...X04 and X05...X08 with the **X01-X04** and **X05-X08** radio buttons at the top.

To enable forcing for a port and enter forcing data (i.e., substitute values) for it, proceed as follows:

1. Check the **force** box for the port in question.
2. For this port, you can enter 32 byte substitute values in hexadecimal format in the **set value (hexadecimal)** input fields of the column. However, only the bytes defined according to the subplot are used.

Concurrent Access

As long as one user is accessing the forcing functionality through a forcing medium, e.g., the WAGO I/O Field Webserver, this functionality is locked for all other users of the module. They cannot access the forcing functionality until the user that is active now terminates his or her access.

In this case, the Web browser displays a message box with the text "Somebody else is already forcing. Try again later." When the forcing functionality is being accessed, a small orange icon also appears in the forcing option entry in the menu bar on the left.

10.3.1.5 Making Extended Settings on the Module

You can make the following extended settings on the module with the I/O Field Webserver:

- MQTT settings
- NTP settings
- Power-On Delay
- Configure Bluetooth®
- Test radio technology

10.3.1.5.1 MQTT Configuration

The **MQTT** tab is used for viewing and modifying the MQTT client and the connection configuration. Changes to settings require specialist or admin rights. If you do not have these rights, the tab is grayed out and cannot be edited. In this case, the following error message appears: ("xx" represents either "Observer" or "Maintenance"):

Note: For user role "xx", MQTT configuration is not allowed!

Client Status and Client Configuration

Table 94: MQTT, Client Status

Parameter	Description	Value, Value Range
State	Status 1, 2: "CONNECTING" Status 3: "CONNECTION_ACCEPTED" Status 0, 4, 5, 6: "CLIENT_INACTIVE" Connection status code 0: Ready: initialization value, connection not established. 1: Connecting: TCP connection in progress. 2: TCP Connected: TCP connection is established. MQTT connection being established. 3: MQTT Connected: MQTT connection has been established. 4: Disconnecting: MQTT disconnecting. 5: Disconnected: TCP connection ended. 6: Wait Reconnect: waiting for permission to "reconnect." See "Connect Timeout" parameter.	CONNECTING (red) CONNECTION_ACCEPTED (green) CLIENT_INACTIVE (red)
Broker Address	Shows the IP address of the MQTT broker to which a connection should be established or has been established.	IP Address Example: 192.168.10.6
Last Error Code	Last error code related to this connection.	0: no error Not equal to 0: error code

Table 95: MQTT, Client Configuration

Parameter	Description	Value, Value Range
Client mode	Enables or disables the module's MQTT communication. "ACTIVE" means that the MQTT client application is enabled and the module should use an MQTT connection to the MQTT broker. "INACTIVE" means that the module should not use MQTT communication. Use this setting to set the connection parameters. After setting the connection parameters, set "Client mode" to "ACTIVE" to enable MQTT communication.	INACTIVE (default), ACTIVE

IP Settings

Table 96: MQTT, IP Settings

Parameter	Description	Value, Value Range
Broker Address	IP Address of the Broker	Valid IP address, default: empty
Broker Port	MQTT broker port number	Default: 1883

Session Settings

Table 97: MQTT, Session Settings

Parameter	Description	Value, Value Range
Topic Prefix	Text that precedes each topic, e.g., "device3." If the prefix is left empty, the firmware uses the MAC address instead of the prefix.	Text consisting of uppercase and lowercase letters and underscores Default: empty

Parameter	Description	Value, Value Range
Clean Session	Setting that determines whether or not all topics should be transferred to the broker once a connection is established. Enabled (default): Once a connection to the broker is established, the MQTT client transmits all topics of type "publish" to the broker. Disabled: Only topics that have changed since the last connection are transferred to the broker. Note that when this setting is used, the broker must support the "preserve context" feature.	Enabled (Default), Disabled
MQTT Keep Alive Time [seconds]	Interval at which the MQTT client sends a sign of life to the broker. The value set for the MQTT client must be less than the monitoring time set in the broker. It is appropriate to enable this timeout if the connection is used for at least one subscription, necessitating a permanent connection to the broker. Must not be enabled together with the "Connection Idle Timeout."	Given in s. 0 = no sign of life is sent to the broker. Default: 15

Will Settings

Table 98: MQTT, Will Settings

Parameter	Description	Value, Value Range
Will Enabled	Enable this option if you want to use the "Will" function of MQTT.	Enabled (Default), Disabled
Will Topic	Unique name for the topic; editable. If "Will Topic" is left empty, the firmware uses the string "Will."	Max. 128 characters of text, consisting of uppercase and lowercase letters and underscores Default: EXIT
Will Message	User data that the broker sends to other clients that have a subscription to "Will Topic" in case an unusual disconnect occurs (if the MQTT Disconnect packet was not sent to the broker). If "Will Message" is empty, then the string "Disconnected" is sent.	Text consisting of uppercase and lowercase letters and underscores Default: {"Publisher": "Offline"}
Will Retain	Determines whether or not the broker should save the history of a data value.	Enabled (Default), Disabled

Advanced Settings

Table 99: MQTT, Advanced Settings

Parameter	Description	Value, Value Range
Will QoS	"Quality of Service" level for the "Will Message" 0: "Only once": send and forget 1: "At least once": confirmed delivery 2: "Exactly once": assured delivery	Only once (default) At least once Exactly once
Will Prefix	Enables or disables the prefix of the Will topic.	Disabled (default) Enabled

Parameter	Description	Value, Value Range
Connection Timeout	The client attempts to establish a connection to the broker. If the broker refuses to establish a connection or a connection fails, the client continues to try to establish a connection.	0: Repeat immediately. The client attempts to reestablish a connection after 500 ms. 1 ... 65535: Repeat after waiting time. After the client has detected a connection error, the client waits for the "Connection Timeout" before attempting to reestablish a connection. Unit: s.
Client Identifier	Unique name of the MQTT client in UTF-8 format; this name is used at the time when the connection is established. All devices connected to a broker must have a unique name. The name must consist of lowercase letters, uppercase letters and numbers only. This field must not be empty if MQTT communication is used.	Max. 23 bytes for max. 23 characters Default: empty

To set and configure the MQTT client, proceed as follows:

1. In the left-hand column, click the **Extended Settings** menu item.
 2. Switch to the **MQTT** tab.
 3. Configure the following under **Client Configuration: Client mode, Active connection**
 4. To set and configure the MQTT connection, open **Connection configuration**.
 5. Open **IP settings** and configure the following: **Broker Address, Broker Port**
 6. Open **Session settings** and configure the following: **Topic Prefix, Clean Session, MQTT Keep Alive Time**
 7. Open **Will settings** and configure the following: **Will Enabled, Will Topic, Will Message, Will Retain**
 8. Open **Advanced settings** and configure the following: **Will QoS, Will Prefix, Connection Timeout, Client Identifier**
- ➔ The MQTT client is now set and configured.

10.3.1.5.2 NTP Settings

The module can retrieve the date and time from an NTP (Network Time Protocol) server. On the **NTP settings** tab, you can configure the IP address of the NTP server, among other things.

Changes to settings require maintenance, specialist or admin rights. If you do not have these rights, the tab is grayed out and cannot be edited. In this case, the following error message appears:

Note: For user role „Observer“, NTP settings not allowed!

The NTP server settings include the following information:

Table 100: NTP Server Settings

Parameter Group	Parameter	Description
NTP Server Settings	IP address of the network time protocol server	IP address of the NTP server The NTP client in the module uses the IP address setting to retrieve the time from an NTP server. A value of 0.0.0.0 disables the function.
	IP address of the network time protocol fallback server	IP address of the NTP server (fallback) Optional additional IP address in case the NTP server cannot be reached via the first IP address. A value of 0.0.0.0 disables the function.
NTP Client settings	Server NTP port	Port of the NTP server Port on which the NTP server processes the request. The default is port 123.
	Client NTP port	NTP port of the client Port on which the NTP client processes the request. The default is port 123.
	Connection establishment polling interval	NTP initialization interval Amount of time until the module sends a new request to the NTP server if no time has yet been received from the NTP server. Unit: s Default: 1 s
	Readjust time polling interval	NTP update interval Amount of time until the module sends a new request to the NTP server to update the existing time. Unit: s Default: 900 s
Timestamp settings	Enable timestamp in process data objects	Disabled (default): Process data timestamp is disabled and process data is transferred without timestamp. Enabled: Process data timestamp is enabled and process data is transferred with timestamp. The timestamp requires the time from an NTP server.
	Enable timestamp in diagnostic objects	Disabled (default): Diagnostic timestamp is disabled, and diagnostic data is transferred without timestamp. Enabled: Diagnostic timestamp is enabled and diagnostic data is transferred with timestamp. The timestamp requires the time from an NTP server.

To change the settings, proceed as follows:

1. Enter the parameters.
 2. Then click Apply to save the parameters.
 3. Restart the module so the settings take effect.
- ➔ The new parameters are effective.

10.3.1.5.3 Power-on Delay

The module can switch on the supply voltage of ports X01, X02, ... one after the other with a delay. On the **Power-on Delay** tab, you can enable this function and set the delay. The delays can be set separately for supply voltages 1L and 2L.

Changes to settings require specialist or admin rights. If you do not have these rights, the tab is grayed out and cannot be edited. In this case, the following error message appears: ("xx" represents either "Observer" or "Maintenance"):

Note: For user role "xx", power delay settings are not allowed!

The configuration of the power-on delay involves the following details:

Table 101: Power-on Delay Tab

Parameter	Description	Value Range
Power-on delay activation	Enables or disables the power-on delay for the supply voltage of ports X01, X02, ...	Inactive (default) Active
1L start delay	Delay before the supply voltage 1L for port X01 is switched on	1 ... 20,000 ms
1L next delay	Delay before the supply voltage 1L for the next port is switched on	1 ... 1,000 ms
2L start delay	Delay before the supply voltage 2L for port X01 is switched on	1 ... 20,000 ms
2L next delay	Delay before the supply voltage 1L for the next port is switched on	1 ... 1,000 ms

To configure the power-on delay, proceed as follows:

1. In the left-hand column, click the **Extended Settings** menu item.
 2. Switch to the **Power-on delay** tab.
 3. Set **Power-on delay activation** to **Active** to enable the power-on delay option.
 4. Set the delay for **1L start delay**, **1L next delay**, **2L start delay** and **2L next delay**. If you set the same value for **1L start delay** and **2L start delay** and the same value for **1L next delay** and **2L next delay**, this makes the ports turn on one after the other
 5. Click **Apply**.
 6. To undo the last input, click **Clear (Undo)**.
- ➔ The parameters are saved in the module and applied the next time the module restarts.

10.3.1.5.4 Configure Bluetooth

The **Bluetooth®** tab provides the following functions:

- Displaying information on the product's Bluetooth® interface module
- Displaying diagnostic information

- Activating the Bluetooth® interface via QR code
- Switching the Bluetooth® wireless connection on/off
- Switching LED forcing on/off

Changes to settings require specialist or admin rights. If you do not have these rights, the tab is grayed out and cannot be edited. In this case, the following error message appears: (“xx” represents either “Observer” or “Maintenance”):

Note: For user role “Observer,” Bluetooth configuration is not allowed!

To access these Bluetooth® functions on the WAGO I/O Field Webserver, proceed as follows:

1. In the left-hand column, click the **Extended Settings** menu item.
 2. Open the **Bluetooth®** tab.
- ➔ The **Bluetooth®** tab appears.

Displaying Information on the Product’s Bluetooth® Interface Module

The **Information** section of the **Bluetooth®** tab shows the following information on the product’s Bluetooth® interface module:

- Current version of the Bluetooth® firmware used
- Chip identifier of the Bluetooth® chip used
- Interface identifier of the Bluetooth® interface module
- Individual QR code of the product (this can be scanned with a smartphone or tablet to launch an app on it for communication with the product)

Displaying Diagnostic Information

The **Diagnostics** section of the **Bluetooth®** tab shows the following diagnostic information on the Bluetooth® connection:

- Connection status
- Connection counter; is set to 0 every time the module power is switched off and on.
- Number of bytes sent over the Bluetooth® connection
- Number of bytes received over the Bluetooth® connection
- Last error code that occurred during operation of the Bluetooth® connection

Activating the Bluetooth® Interface with the Displayed QR Code

Note

Never use the product in areas where operation of radio equipment is prohibited.

Never use the Bluetooth® interface in areas where operation of radio equipment is prohibited. The module contains a Bluetooth® radio transmitter that can impair the function of medical electronic equipment such as hearing aids and pacemakers. Disable the Bluetooth® interface in these cases.

Note

Only use the product with Bluetooth® if the product has an approval for the specific country or region.

To enable the Bluetooth® interface, you must have the WAGO I/O Field app installed on the smartphone or tablet. Proceed as follows:

- A QR code appears in the “Information” section of the **Bluetooth®** tab. Scan it with the smartphone or tablet.
 - ⇒ The smartphone or tablet then sends an optical sequence (flash code) to the product’s integrated light sensor.
- ➔ The light sensor registers this sequence. If the sequence is recognized as correct, the Bluetooth® interface is enabled, and the product attempts to establish a Bluetooth® connection to the smartphone or tablet.

Switching the Bluetooth® Interface Wireless Transmitter On/Off

To switch the Bluetooth® interface wireless transmitter on, proceed as follows:

- Slide the **Bluetooth radio** switch to the right.
- ➔ The Bluetooth® interface wireless transmitter switches on.

To switch the Bluetooth® interface wireless transmitter off, slide the **Bluetooth radio** switch to the left.

Switching LED Forcing On/Off

To switch on LED forcing (the externally controlled mode of the LEDs), proceed as follows:

- Slide the **LED forcing** switch to the right.
- ➔ LED forcing switches on. The LED on the Bluetooth® interface can now be externally controlled.

To switch LED forcing off, slide the **LED forcing** switch to the left.

10.3.1.5.5 Load Management

The **Load Management** tab allows the following:

- Configuring the limiting values for the statistics for current, temperature and voltage
- Displaying the statistical values for the overflow/underflow for each port

Changes to settings require specialist or admin rights. If you do not have these rights, the tab is grayed out and cannot be edited. In this case, the following error message appears: ("xx" represents either "Observer" or "Maintenance"):

Note: For user role "xx", bluetooth configuration is not allowed!

10.3.1.5.5.1 Limiting Value Configuration and Specifications for Statistics Collection

Load management is disabled by default. You can enable or disable load management, i.e., statistics collection, for each port. The limiting values for current and voltage that need to be configured for each port on pin 1, pin 2 and pin 4, as well as for the temperature on each port, are used for collecting statistics on overruns of the defined upper limits or underruns of the lower limits. You can clear the collected statistical values for each port.

The following table lists the port-specific limiting and hysteresis values:

- Upper and lower limits for current and voltage on pin 1, pin 2 and pin 4
- Hysteresis values for voltage, current and temperature
- Upper and lower limit for the temperature of a port

Table 102: Port-Specific Limiting and Hysteresis Values for Load Management Statistics

Parameter	Description
Upper and lower limits for current and voltage on pin 1, pin 2 and pin 4	
Overcurrent pin X level	Upper limiting value for the current on pin X set for the statistics; unit: mA 0: monitoring not enabled
Overvoltage pin X level	Upper limiting value for the voltage on pin X set for the statistics; unit: mV
Undercurrent pin X level	Lower limiting value for the current on pin X set for the statistics; unit: mA 0: monitoring not enabled
Undervoltage pin X level	Lower limiting value for the voltage on pin X set for the statistics; unit: mV
Hysteresis values for voltage, current and temperature and upper and lower limit for the temperature of a port	
Voltage hysteresis	Voltage hysteresis for statistics, unit: mV, example value 2000 = 2 V If the voltage exceeds the upper limiting value set in the configuration, the voltage must first fall back below this limiting value by the hysteresis value until the end of the limiting value overrun is detected. Similarly, if it falls below the lower limiting value, it must rise above by the same amount.
Current hysteresis	Current hysteresis for statistics, unit: mA, example value 500 = 0.5 mA If the current exceeds the upper limiting value set in the configuration, the current must first fall back below this limiting value by the hysteresis value until the end of the limiting value overrun is detected. Similarly, if it falls below the lower limiting value, it must rise above by the same amount.
Temperature hysteresis	Temperature hysteresis for statistics, unit: 0.1 °C, example value 20 = 2 °C If the temperature exceeds the upper limiting value set in the configuration, then the temperature must first fall back below this limiting value by the hysteresis value until the end of the limiting value overrun can be detected. Similarly, if it falls below the lower limiting value, it must rise above by the same amount.

Parameter	Description
Overtemperature	Upper limiting value for the temperature of a port specified for the statistics; unit: 0.1 °C
Undertemperature	Lower limiting value for the temperature of a port specified for the statistics; unit: 0.1 °C

To set the limiting value configuration for load management and set values for statistical collection, proceed as follows:

1. In the left-hand column, click the **Extended Settings** menu item.
2. Open the **Load Management** tab.
 - ⇒ The **Load Management** tab appears.
 - You can configure the limiting values in the following step.
3. To configure the limiting values, select **Configuration > Statistic threshold level**.
 - ⇒ You can enter the limiting values.
4. Open the tab for the port (**port X01, port X02 ...**) for which you want to configure the limiting value.
5. Open the tabs one after the other for **pin 1, pin 2** and **pin 4** to configure the upper and lower limits for current and voltage on pin 1, pin 2 and pin 4.
6. Open the **Temperature** and **Hysteresis** tabs to configure the upper and lower temperature limits of a port and the hysteresis values for current, voltage and temperature.
 - ⇒ In the following step, you can set the values for statistics collection.
7. To set the values for statistics collection, select **Configuration > Enable/disable/clear statistics**.
 - ⇒ In the configuration, you can specify whether statistics collection should be switched on, switched off or cleared for each individual port.
8. Under **Clear statistics** or **Enable/disable statistics**, check the boxes next to the ports you want (**port X01, port X02 ...**).
 - ⇒ You can save the configuration in the following step.
9. Click **Apply** to save the configuration.
 - ➔ The limiting values set in the configuration and the statistics collection settings are saved in the device and applied after transmission the next time the device restarts.

To undo the last input, click **Clear (Undo)**.

10.3.1.5.5.2 Statistics for Load Management

The following port-specific values provided for pin 1 are used for the statistics for load management for current, temperature and voltage:

- Minimum and maximum measured values
- Counters and durations (of limiting value overruns/underruns)

The following table lists port-specific minimum and maximum measured values for current, voltage and temperature.

Table 103: Port-Specific Min./Max. Measured Values for Load Management Statistics

Parameter	Description
Current pin 1 maximum	Maximum current on pin 1 since the last reset; unit: mA

Parameter	Description
Timestamp current pin 1 maximum	Timestamp for maximum current on pin 1 since the last reset
Current pin 1 minimum	Minimum current on pin 1 since the last reset; unit: mA
Timestamp current pin 1 minimum	Timestamp for minimum current on pin 1 since the last reset
Voltage pin 1 maximum	Maximum voltage on pin 1 since the last reset; unit: mV
Timestamp voltage pin 1 maximum	Timestamp for maximum voltage on pin 1 since the last reset
Voltage pin 1 minimum	Minimum voltage on pin 1 since the last reset; unit: mV
Timestamp voltage pin 1 minimum	Timestamp for minimum voltage on pin 1 since the last reset
Temperature maximum	Maximum temperature of a port since the last reset; unit: 0.1 °C
Timestamp temperature maximum	Timestamp for maximum temperature of a port since the last reset
Temperature minimum	Minimum temperature of a port since the last reset; unit: 0.1 °C
Timestamp temperature minimum	Timestamp for minimum temperature of a port since the last reset

The following table lists port-specific counters and the duration of overruns/underruns for current, voltage and temperature.

Table 104: Port-Specific Counters and Durations for Load Management Statistics

Parameter	Description
Current pin 1 max. counter	Counter for the upper limiting value overruns for the current on pin 1 since the last reset
Current pin 1 min. counter	Counter for the lower limiting value underruns for the current on pin 1 since the last reset
Maximum current duration pin 1 (in s)	Duration of the upper limiting value overrun for the current on pin 1. Timing restarts every time an overrun occurs. Unit: s
Minimum current duration pin 1 (in s)	Duration of the lower limiting value underrun for the current on pin 1. Timing restarts every time an underrun occurs. Unit: s
Voltage pin 1 max. counter	Counter for the upper limiting value overruns for the voltage on pin 1 since the last reset
Voltage pin 1 min. counter	Counter for the lower limiting value underruns for the voltage on pin 1 since the last reset
Maximum voltage duration pin 1 (in s)	Duration of the upper limiting value overrun for the voltage on pin 1. Timing restarts every time an overrun occurs. Unit: s
Minimum voltage duration pin 1 (in s)	Duration of the lower limiting value underrun for the voltage on pin 1. Timing restarts every time an underrun occurs. Unit: s
Temperature max. counter	Counter for the upper limiting value overruns for the temperature on a port since the last reset
Temperature min. counter	Counter for the lower limiting value underruns for the temperature on a port since the last reset
Maximum temperature duration (in s)	Duration of the upper limiting value overrun for the temperature on a port. Timing restarts every time an overrun occurs. Unit: s
Minimum temperature duration (in s)	Duration of the lower limiting value underrun for the temperature on a port. Timing restarts every time an underrun occurs. Unit: s

The firmware checks the measured values for overrun/underrun every 1.2 s.

To monitor the load management statistics for current, temperature and voltage through port-specific minimum and maximum measured values, counters and the duration of limiting value overruns/underruns, proceed as follows:

1. In the left-hand column, click the **Extended Settings** menu item.
2. Open the **Load Management** tab.
 - ⇒ The **Load Management** tab appears.
3. To view the minimum and maximum measured values for current, voltage and temperature, select **Monitor > Statistic min/max values**.
4. Open the tab for the port (**port X01, port X02 ...**).
5. Open the **Pin 1** tab to see the measured values for current and voltage.
6. Open the **Temperature** tab to see the measured values for the temperature.
7. To view the counters and the duration of limiting value overruns/underruns, select **Monitor > Statistic values**.
8. Open the tab for the port (**port X01, port X02 ...**).
9. Open the **Pin 1** tab to see the counters and the duration of current and voltage limiting value overruns/underruns.

10.3.1.5.6 Testing the Radio Technology

The **Radio test** tab lets you test the module's radio technology, which is used for Bluetooth®. The test functions cover the radio transmitter and the radio receiver. The test functions can be used without intervening in ongoing operation of the module.

Changes to settings require admin rights. If you do not have these rights, the tab is not displayed.

The test functions for the radio transmitter are listed in the left-hand column of the **Radio test** tab under the **Transmitter** heading. The following test functions are available:

Table 105: Test Functions for the Radio Transmitter

Element/Name	Test Function
High Power check box	If checked, the transmitter is operated with increased power. This is helpful in the event of poor reception conditions or a long distance from the receiver
Power amplifier level drop-down menu	Setting for the gain of the transmitter. See table "Selectable Values in the 'Power Amplifier Level' Drop-Down Menu."
Tx frequency drop-down menu	Setting for the transmission channel used, and thus the transmission frequency. See table "Selectable Transmission Channels and Frequencies of the Transmitter"
Payload length drop-down menu	Setting for the length (i.e. the number of bytes) of the test data sent in the user data area. Value range: 0 ... 37 (0x25) bytes
Payload type drop-down menu	Setting for the type of test data sent. See Table "Possible Values of the 'Payload Type' Drop-Down Menu"
Number of Packets Transmitted display field	Indicates the number of data packets sent during the test
Start transmitter / Stop transmitter button	Turns transmission of test data on and off

The **Power amplifier level** drop-down menu can be used to set the gain of the transmitter. This also depends on whether **High Power** is checked.

The values that need to be set for the transmitter gain can be determined from the following table:

Table 106: Selectable Values in the “Power Amplifier Level” Drop-Down Menu

Value	Gain (High Power Unchecked)	Gain (High Power Checked)
0	-18 db	-14 db
1	-15 db	-11 db
2	-12 db	-8 db
3	-9 db	-5 db
4	-6 db	-2 db
5	-2 db	+2 db
6	0 db	+4 db
7	+5 db	+8 db

The **Tx frequency** drop-down menu can be used to set the transmission channel used, and thus the transmission frequency.

The following table shows the adjustable channels and the associated frequency values in MHz:

Table 107: Selectable Transmission Channels and Frequencies of the Transmitter

Channel No.	Frequency	Channel No.	Frequency	Channel No.	Frequency	Channel No.	Frequency
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

The **Payload type** drop-down menu can be used to set the type of test data sent.

The following settings are possible:

Table 108: Possible Values of the “Payload Type” Drop-Down Menu

Value	Explanation
0	Pseudorandom number sequence 9
1	Bit pattern “11110000”
2	Bit pattern “10101010”
3	Pseudorandom number sequence 15
4	Bit pattern “11111111”
5	Bit pattern “00000000”
6	Bit pattern “00001111”
7	Bit pattern “01010101”

Using the **Start transmitter** and **Stop receiver** buttons, you can toggle the transmission of test data on and off.

If another tab is selected during the send operation, transmission of test data is also terminated, and the **Start transmitter** button is displayed normally again. The test functions for the radio receiver are listed in the right-hand column of the **Radio test** tab under the **Receiver** heading.

The following test functions are available:

Table 109: Test Functions for the Receive Functions

Element/Name	Test Function
Rx frequency drop-down menu	Setting for the receive frequency The adjustable channels and the associated frequency values correspond to those of the transmitter; see table "Selectable Transmission Channels and Frequencies of the Transmitter."
Number of Packets Received display field	Number of data packets received during the test
Start receiver / Stop receiver button	Switches reception of test data on and off (toggle; button text changes)
Packet error rate display field	Last determined value for the rate of incorrectly received data packets, given as a percentage
Compute PER button	Determines the current rate of data packets received with errors (PER = Packet Error Rate) and displays it in the Packet error rate field

10.3.2 WAGO IO-Link Configurator

WAGO IO-Link masters can be used in various system environments. They can be either gateways that link IO-Link to higher-level fieldbus or ETHERNET systems, modules in modular remote I/O Systems or a fixed component of devices like controllers.

In most cases, a higher-level engineering tool is used in the relevant system environment. Often, however, there is none or at least no uniform integration option. Various options are implemented for the IO-Link device tool as easy-to-use solutions for the respective cases.

The WAGO IO-Link Configurator software can be operated as a stand-alone program or via WAGO-I/O-CHECK.

You can find further information in the WAGO IO-Link Configurator product manual.

The manual is available in the download area for the WAGO IO-Link Configurator software at www.wago.com, item number 2759-106/1121-1000.

10.3.3 WAGO I/O Field app

Note

Read the online help!

You can find Product-specific information on the WAGO App I/O Field in the online help for the app.

10.3.4 OPC UA Server

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

- Device identification
- Configuration parameters

- Process Data
- Measured values
- Diagnostic information
- Statistical information

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 device parameters anonymously (only read access) or with a username/password (read/write access). The username and password are set with the WAGO Webserver IO Field.

The following figure shows an excerpt from the device's information model.

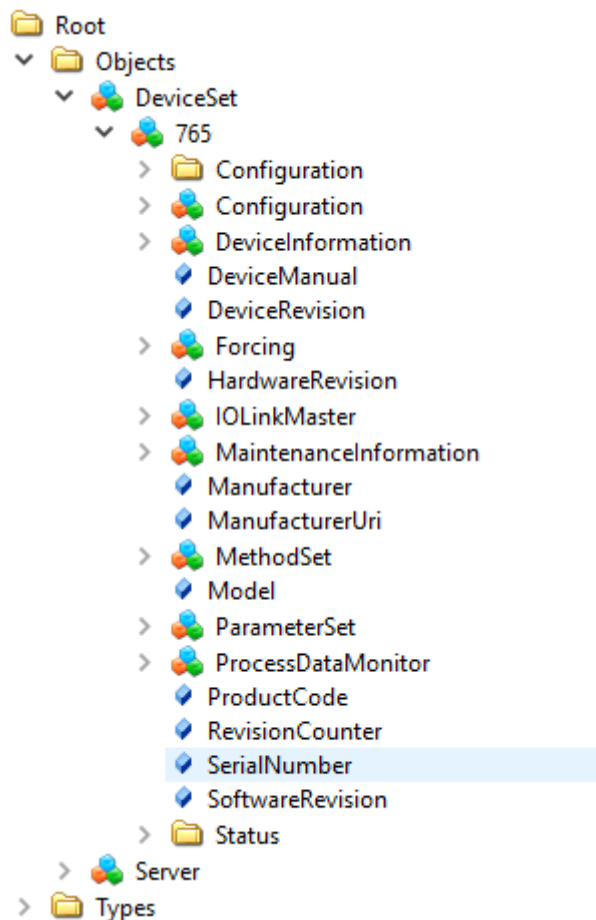


Figure 17: OPC UA: Device Information Model

10.3.4.1 Parameterizing the Product via OPC UA

10.3.4.1.1 Setting Device Parameters

The OPC UA server provides nodes with configuration parameters for the device. For example, the OPC UA client can read out the upper limiting value for temperature in the `OverTemperature` node.

The path to this node is:

Root > Object > DeviceSet > [device name] > IOLinkMaster > Diagnostics > Configuration

The following table lists device-specific configuration parameters.

Table 110: Device-Specific Configuration Parameters

Node Name	Node Class	Access	Default	Description
CurrentHysteresis	Variable	Read	10 mA	Current hysteresis; unit: mA If the current exceeds the limiting value, the current must fall back below the limiting value by the hysteresis value before the diagnostic is revoked.
OverTemperature	Variable	Read	70 °C	Upper limiting value for the temperature of a port; unit: 0.1 °C
OverVoltage1L	Variable	Read	30000 mV	Upper limiting value for the voltage in supply cable 1; pins with the following functions can be monitored: L+, DI, DO, DIO, IO-Link; unit: mV
OverVoltage2L	Variable	Read	30000 mV	Upper limiting value for the voltage in supply cable 2; unit: mV
TemperatureHysteresis	Variable	Read	2 °C	Temperature hysteresis; unit: 0.1 °C If the temperature exceeds the limiting value, the temperature must fall back below the limiting value by the hysteresis value before the diagnostic is revoked.
UnderTemperature	Variable	Read	-25 °C	Lower limiting value for the temperature of a port; unit: 0.1 °C
UnderVoltage1L	Variable	Read	18000 mV	Lower limiting value for the 1L supply voltage; pins with the following functions can be monitored: L+, DI, DO, DIO and IO-Link; unit: mV
UnderVoltage2L	Variable	Read	18000 mV	Lower limiting value for the 2L supply voltage; unit: mV
VoltageHysteresis	Variable	Read	300 mV	Voltage hysteresis; unit: mA If the voltage exceeds the limiting value, the voltage must fall back below the limiting value by the hysteresis value before the diagnostic is revoked.

10.3.4.1.2 Setting Port Parameters

The OPC UA server provides nodes with configuration parameters for each port.

The path to this node is:

Root > Object > DeviceSet > [device name] > IOLinkMaster > Diagnostics > PortXX > Configuration

The following table lists port-specific configuration parameters.

Table 111: Port-Specific Configuration Parameters

Node Name	Node Class	Access	Default	Description
OverCurrentPin1	Variable	Read	0	Warning level for current upper limit on pin 1; unit: 1 mA 0: monitoring not enabled
OverCurrentPin2	Variable	Read	0	Warning level for current upper limit on pin 2; unit: 1 mA 0: monitoring not enabled

Node Name	Node Class	Access	Default	Description
OverCurrentPin4	Variable	Read	0	Warning level for current upper limit on pin 4; unit: 1 mA 0: monitoring not enabled
UnderCurrentPin1	Variable	Read	0	Warning level for current lower limit on pin 1; unit: 1 mA 0: monitoring not enabled
UnderCurrentPin2	Variable	Read	0	Warning level for current lower limit on pin 2; unit: 1 mA 0: monitoring not enabled
UnderCurrentPin4	Variable	Read	0	Warning level for current lower limit on pin 4; unit: 1 mA 0: monitoring not enabled

10.3.4.1.3 Reading Port Process Values

The OPC UA server provides nodes with process data. For example, the OPC UA client can read out the value on pin 4 of a port in the `Pin4ProcessData` node.

IO-Link Process Data

The path to this node is:

```
Root > Objects > DeviceSet > [Device name] > IOLinkMaster > Port
XX > Device > ParameterSet
```

The following table lists port-specific IO-Link process data.

Table 112: Port-Specific IO-Link Process Data

Node Name	Node Class	Access	Description
ProcessDataInput	Variable	Read	Process data (inputs)
PDDescriptor	Variable	Read	Coding per "IO-Link Companion Specification" (node: <code>ProcessDataInput</code>)
ProcessDataLength	Variable	Read	Length of input process data (node: <code>ProcessDataOutput</code>)
ProcessDataOutput	Variable	Read	Process data (outputs)
PDDescriptor	Variable	Read	Coding per "IO-Link Companion Specification"
ProcessDataLength	Variable	Read	Output process data length

Process Data of the Digital Inputs and Outputs

The path to this node is:

```
Root > Object > DeviceSet > [device name] > IOLinkMaster > PortXX
> SIOProcessData
```

Note

OPC UA client can only read process output data

The process output data is written by the PROFINET IO-Controller. The OPC UA client can only read process output data.

The following table lists port-specific process data of the digital inputs and outputs.

Table 113: Port-Specific Process Data of the Digital Inputs and Outputs

Node Name	Node Class	Access	Description
Pin2ProcessData	Variable	Read	Process data on pin 2
Pin4ProcessData	Variable	Read	Process data on pin 4

10.3.4.1.4 Reading Measured Power Values

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

The path to this node is:

```
Root > Object > DeviceSet > [device name] > IOLinkMaster > Diagnostics > Current
```

The following table lists device-specific (calculated) measured current values.

Table 114: Device-Specific (Calculated) Measured Current Values

Node Name	Node Class	Access	Description
SumCurrent1L	Variable	Read	Total current in supply cable 1 calculated from individual measurements; unit: mA
SumCurrent2L	Variable	Read	Total current in supply cable 2 calculated from individual measurements; unit: mA

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

```
Root > Object > DeviceSet > [device name] > IOLinkMaster > Diagnostics > Temperature
```

The following table lists device-specific (calculated) measured temperature values.

Table 115: Device-Specific (Calculated) Measured Temperature Values

Node Name	Node Class	Access	Description
MeanTemperature	Variable	Read	Average value for the temperature of the assembly, calculated from the temperature values measured individually on the three chips; unit: °C

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

```
Root > Object > DeviceSet > [device name] > IOLinkMaster > Diagnostics > Voltage
```

The following table lists device-specific (calculated) measured voltage values.

Table 116: Device-Specific (Calculated) Measured Voltage Values

Node Name	Node Class	Access	Description
MeanVoltage1L	Variable	Read	Average voltage in supply cable 1; unit: mV
MeanVoltage2L	Variable	Read	Average voltage in supply cable 2; unit: mV

10.3.4.1.5 Reading out Diagnostic Information

The OPC UA server provides nodes with diagnostic information. For example, the OPC UA client can read out whether the device has detected an overcurrent on pin 1 of a port in the `DiagnosticsPin1` node.

The path to this node is:

Root > Object > DeviceSet > [device-name] > IOLinkMaster > PortXX
> Diagnostics > Flags

The following table lists port-specific diagnostic information.

Table 117: Port-Specific Diagnostics

Node Name	Node Class	Access	Description
DiagnosticsPin1, DiagnosticsPin2, DiagnosticsPin4	Variable	Read	Diagnostics on pin 1, pin 2 or pin 4; the numerical value contains bit-coded 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: diagnostics inactive 1: diagnostics active

10.3.4.1.6 Reading Statistics

The OPC UA server provides nodes with statistical information. For example, the OPC UA client can read out the maximum measured current on pin 1 of a port in the `MaxCurrentPin1` node.

The path to this node is:

Root > Object > DeviceSet > [device-name] > IOLinkMaster > PortXX
> Statistics > Current / Temperature / Voltage

The following table lists port-specific statistical information:

Table 118: Port Specific Statistical Information

Measurement	Node Name	Node Class	Access	Description
Current	MaxCurrentPin1	Variable	Read	Maximum current on pin 1 since the value was reset; unit: mA
	MaxCurrentPin2	Variable	Read	Maximum current on pin 2 since the value was reset; unit: mA
	MaxCurrentPin4	Variable	Read	Maximum current on pin 4 since the value was reset; unit: mA
	MinCurrentPin1	Variable	Read	Minimum current on pin 1
	MinCurrentPin2	Variable	Read	Minimum current on pin 2

Measurement	Node Name	Node Class	Access	Description
	MinCurrentPin4	Variable	Read	Minimum current on pin 4
Temperature	MaxTemperature-Pin1	Variable	Read	Maximum temperature on pin 1 since the value was reset; unit: °C
	MaxTemperature-Pin2	Variable	Read	Maximum temperature on pin 2 since the value was reset; unit: °C
	MaxTemperature-Pin4	Variable	Read	Maximum temperature on pin 4 since the value was reset; unit: °C
	MinTemperaturePin1	Variable	Read	Minimum temperature on pin 1 since the value was reset; unit: °C
	MinTemperaturePin2	Variable	Read	Minimum temperature on pin 2 since the value was reset; unit: °C
	MinTemperaturePin4	Variable	Read	Minimum temperature on pin 4 since the value was reset; unit: °C
Voltage	MaxVoltagePin1	Variable	Read	Maximum voltage on pin 1 since the value was reset; unit: mV
	MaxVoltagePin2	Variable	Read	Maximum voltage on pin 2 since the value was reset; unit: mV
	MaxVoltagePin4	Variable	Read	Maximum voltage on pin 4 since the value was reset; unit: mV
	MinVoltagePin1	Variable	Read	Minimum voltage on pin 1 since the value was reset; unit: mV
	MinVoltagePin2	Variable	Read	Minimum voltage on pin 2 since the value was reset; unit: mV
	MinVoltagePin4	Variable	Read	Minimum voltage on pin 4 since the value was reset; unit: mV

10.3.4.1.7 NTP Client Configuration

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

The path to these nodes is:

Root > Object > DeviceSet > [device name] > Configuration >
NTPSettings > NTPClientSettings / NTPServerSettings

The following table describes the nodes for the target: the NTP server.

Table 119: NTP Server Settings

Node Name	Node Class	Access	Default	Description
NtpClientServerIpAddress	Variable	Read/write	0	IP address of the NTP server The NTP client uses the IP address setting to retrieve the time from an NTP server. The IP address must be converted to a decimal number. The calculation is described in the table. A value of 0 disables the function.
NtpClientServerIpAddressFallback	Variable	Read/write	0	IP address of the NTP server (fallback) Optional additional IP address in case the NTP server cannot be reached via the IP address in the NtpClientServerIpAddress node. The IP address must be converted to a decimal number. The calculation is described in the table. A value of 0 disables the function.

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

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

$$((A \times 256 + B) \times 256 + C) \times 256 + D = \text{IP address as decimal number}$$

Example for IP address 192.53.103.108:

$$((192 \times 256 + 53) \times 256 + 103) \times 256 + 108 = 3224725356$$

The following table describes the nodes whose values the NTP client uses in the module.

Table 120: NTP Client Settings

Node Name	Node Class	Access	Default	Description
NtpClientPort	Variable	Read/write	0	NTP port of the client Port on which the NTP client processes the request. The default is port 123.
NtpServerPort	Variable	Read/write	0	Port of the NTP server Port on which the NTP server processes the request. The default is port 123.
NtpMaxPollInterval	Variable	Read/write	0	NTP update interval Amount of time until the module sends a new request to the NTP server to update the existing time. Default: 900. Unit: s

Node Name	Node Class	Access	Default	Description
NtpMinPollInterval	Variable	Read/write	0	NTP initialization interval Amount of time until the module sends a new request to the NTP server if no time has yet been received from the NTP server. Default: 1 s; unit: s

The OPC UA server provides a method for writing the IP address of the NTP server to the device.

The path to this node is:

```
Root > Object > DeviceSet > [device name] > Configuration > Ntp-Client
```

Table 121: NTP Client Method

Node Name	Node Class	Access	Default	Description
NtpClientUpdate-Configuration	Method	Write	–	Method for writing the NtpClientServerIpAddress and NtpClientServerIpAddressFallback nodes.

10.3.4.1.8 I/O Forcing via OPC UA

The OPC UA client can force output data and simulate input data. In what follows, forcing output data and simulating input data are referred to together as the Force function. From the product's point of view, there must be only one external instance that uses the Force function. Therefore, the OPC UA client must first obtain a Force ID from the product and send this Force ID with each Force function call. If the Force ID is incorrect, the product does not execute the Force function.

The path in the information model is:

```
Root > Objects > DeviceSet > [device name] > Forcing
```

The OPC UA client calls the "GetForcingID" method to get a Force ID and enable the Force function. The OPC UA client can now use the following methods:

- InputSimulationPin4
- OutputPin4
- IoLinkInputSimulation
- IoLinkOutput

Each of these methods has a Force ID parameter.

The module monitors the Force function with a watchdog timer. If the OPC UA client becomes inactive, or the connection via OPC UA is lost, the watchdog timer expires, and the product switches the Force function off. The watchdog timer has the value 10 s.

While the Force function is enabled, the watchdog timer needs to be triggered regularly. Triggering occurs each time an input simulation and output method is called. The watchdog timer is also triggered when the "AssignedForceID" node is read. This means that regular reading of the "AssignedForceID" node triggers the watchdog timer and keeps the Force function active.

To terminate the Force function, the OPC UA client calls the "DisableForcing" method, using the previous Force ID again. This makes value of the Force ID invalid. The OPC UA client or another instance can request a new Force ID from the product in order to reenable the Force function.

10.3.4.1.9 Using OPC UA Client

The module has an integrated OPC UA server. You can communicate with the module with an OPC UA client.

For text purposes, you can, for example, use UaExpert from Unified Automation GmbH, which is available at <http://www.unifiedautomation.com>.

An OPC UA client can have read access to the module with the authentication “anonymous.” An OPC UA client can have read and write access to the module with the authentication “username and password” if the user in question has write permission.

10.3.4.1.9.1 Connecting to the Module

Requirements

- You must have an OPC UA client.
- For write access to the module: You must know the username and password and have write permission.
- You must know the module's IP address.

Without a username and password, you can use “anonymous” to access the module and read data.

Establishing a Connection to the Module

1. Start UaExpert.
2. Create a new project with **File > New**.
3. Add a new server with **Server > Add**.
 - ⇒ The **Add Server** dialog appears with the **Discovery** tab.
4. In the **Configuration name** field, enter a name for your configuration, e.g. “Test.”
5. Select the **Advanced** tab.
6. In the **Server Information** section of the **Advanced** tab, enter the following information in the **Endpoint URL** field: `opc.tcp://<IP address>:4840`. For <IP address>, use the module's IP address.
7. In the **Authentication Settings** section, select the **Username/Password** option for write access to the module or **Anonymous** for read access.
8. If you selected the **Username/Password** option, enter your username and, if applicable, password there.
9. Click **OK**.
 - ⇒ In the project window, UaExpert enters the server under **Project > Servers**, e.g. “Test.”
10. Open the context menu of the server (“Test”) and select **Connect**.
 - ➔ The connection is established.

10.3.4.1.9.2 Setting the Module Time via OPC UA

Requirements

- You must have an OPC UA client.

- You must know the username and password and have write permission.
- You must know the IP address of the NTP server.
- You must have converted the IP address of the NTP server to a decimal number as described below.
- You must have already established a connection to the module.

Example for an NTP Server

The NTP server `ptbtime1.ptb.de` of the Federal Institute of Physics and Metrology in Brunswick, Germany with IP address `192.53.103.108`

Alternate NTP server (optional) `ptbtime2.ptb.de` of the Federal Institute of Physics and Metrology in Brunswick, Germany with IP address `192.53.103.104`

Converting an IP Address to 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.":

$$((A \times 256 + B) \times 256 + C) \times 256 + D = \text{IP address as decimal number}$$

Example for IP address `192.53.103.108`:

$$((192 \times 256 + 53) \times 256 + 103) \times 256 + 108 = 3224725356$$

Instructions

1. In the **Address Space** window, open the context menu:
`Root > Objects > DeviceSet > [device name] > Configuration > NtpClient > NtpClientUpdateConfiguration.`
2. In the context menu, select **Call**.
⇒ The **Call NtpClientUpdateConfiguration on NtpClient** dialog appears.
3. In the **Input Arguments** section, enter the value `3224725356` for the IP address of the NTP server in the **ServerIpAddress** field.
4. In the **Input Arguments** section, enter the number `3224725352` for the IP address of the alternate NTP in the **ServerIpAddressFallback** field.
5. Click **Call**.
➔ If the function call was successful, the output field in the **Output Arguments** section to the right of **Status** shows a value of 0.
A green bar appears in the **Result** section with the text "Succeeded." The two variables `ServerIpAddress` and `ServerIpAddressFallback` are now set.
The module retrieves the current time of the time server via NTP and synchronizes its internal time.

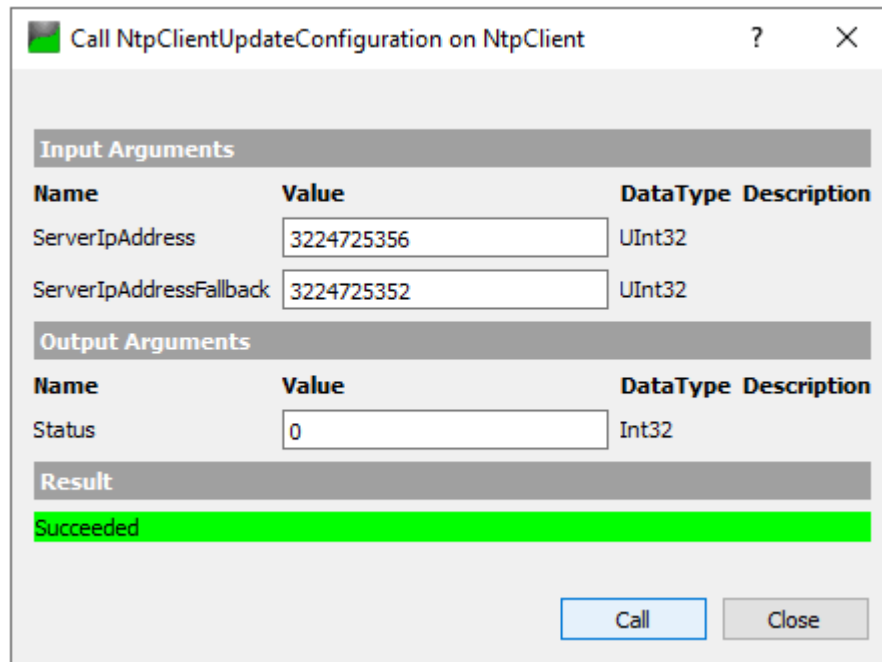


Figure 18: NTP Client Configuration Dialog (Succeeded)

Section [NTP Client Configuration \[▶ 150\]](#) describes other parameters that can be set (e.g., port numbers).

10.3.4.1.9.3 Enabling Forcing

Requirements

- You must have an OPC UA client.
- You must know the username and password, and this user must have permission to execute methods.
- You must have already established a connection to the I/O module.

Step-by-Step Instructions

1. In the **Address Space** window, open the context menu: Root > Objects > DeviceSet > [device name] > Forcing > GetForcingID
2. In the context menu, select **Call**.
 - ⇒ The **Call GetForcingID on Forcing** window appears.
3. Click **[Call]**.
 - ⇒ If the method call was successful, then the Force ID is displayed, and “0” appears under Status. The FLD LED on the I/O module flashes at a rate of 1 Hz.
 - ⇒ If the method call was not successful because the Force function is already in use, then “-1” appears under Status and “It’s being forced by someone else right now” under Message.

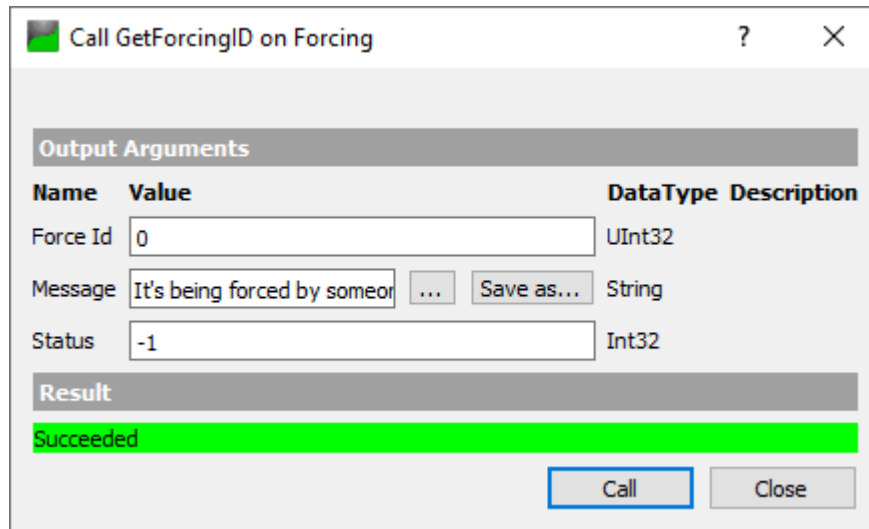


Figure 19: GetForcingID Method: Unsuccessful

4. In the OPC UA client, drag the “AssignedForceID” node into the **Data Access View** window so that the AssignedForceID is read regularly.
 - ⇒ Regular reading of the AssignedForceID triggers the watchdog timer and keeps the Force function enabled.

10.3.4.1.9.4 Simulating Digital Inputs

The InputSimulationPin4 method simulates the input value of pin 4 of one or more ports.

Requirements

- You must have an OPC UA client.
- You must know the username and password, and this user must have permission to execute methods.
- You must have already established a connection to the I/O module.
- The Force function must be enabled, i.e. you must know the Force ID.
- The pin must be configured as a digital input.

Step-by-Step Instructions

1. In the **Address Space** window, open the context menu: Root > Objects > DeviceSet > [device name] > Forcing > InputSimulationPin4
2. In the context menu, select **[Call]**.
 - ⇒ The **Call InputSimulationPin4 on Forcing** window appears.
3. Enter the **Force ID**, the **Force Mask** and the **Force Data** (see the following description of the input arguments, including the example).
4. Click **[Call]**.
 - ⇒ If the method call was successful, the input data is transmitted to the controller.
 - ⇒ If the method call was unsuccessful, then “-1” appears under Status.

Description of the Input Arguments

Table 122: Input Arguments of the InputSimulationPin Method

Input Arguments	Description
Force ID	Here the OPC UA client must use the Force ID that the OPC UA client had received after the GetForcingID method was called.
Force Mask	Ports for which simulation should be enabled. Bit mask and port assignment: Bit 0: port X01, Bit 1: port X02, Bit 2: port X03, ... Bit value 0: Simulation disabled for this port. Bit value 1: Simulation enabled for this port. Example 1: A value of 4 enables simulation for port X03. Example 2: A value of 7 enables simulation for ports X01, X02 and X03.
Force Data	Input value Bit mask and port assignment: Bit 0: port X01, Bit 1: port X02, Bit 2: port X03, ... Bit value 0: The pin has an input value of 0. Bit value 1: The pin has an input value of 1. Example 1 (Force Mask has a value of 4): A value of 0 sets the input value of port X03 to 0. A value of 4 sets the input value of port X03 to 1. Example 2 (Force Mask has a value of 7): A value of 0 sets the input value of ports X01, X02 and X03 to 0. A value of 5 sets the input value of port X02 to 0 and the input value of ports X01 and X03 to 1.

Description of the Output Arguments

Table 123: Output Arguments of the InputSimulationPin Method

Output Arguments	Description
Status and Message	0: forcing digital outputs successful -1: forcing digital outputs failed

10.3.4.1.9.5 Forcing Digital Outputs

The OutputPin4 method sets the output value of pin 4 of one or more ports.

Requirements

- You must have an OPC UA client.
- You must know the username and password, and this user must have permission to execute methods.
- You must have already established a connection to the I/O module.
- The Force function must be enabled, i.e. you must know the Force ID.
- The pin must be configured as a digital output.

Step-by-Step Instructions

1. In the **Address Space** window, open the context menu: `Root > Objects > DeviceSet > [device name] > Forcing > OutputPin4`

2. In the context menu, select **Call**.
 - ⇒ The **Call OutputPin4 on Forcing** window appears
3. Enter the **Force ID**, the **Force Mask** and the **Force Data** (see the following description of the input arguments, including the example).
4. Click **[Call]**.
 - ⇒ If the method call was successful, then the output data on the module is forced.
 - ⇒ If the method call was unsuccessful, then “-1” appears under Status.

Description of the Input Arguments

Table 124: Input Arguments of the OutputPin Method

Input Arguments	Description
Force ID	Here the OPC UA client must use the Force ID that the OPC UA client had received after the GetForcingID method was called.
Force Mask	Ports for which forcing should be enabled. Bit mask and port assignment: Bit 0: port X01, Bit 1: port X02, Bit 2: port X03, ... Bit value 0: Forcing disabled for this port. Bit value 1: Forcing enabled for this port. Example 1: A value of 4 enables the Force function for port X03. Example 2: A value of 7 enables the Force function for ports X01, X02 and X03. Format of the call input values: decimal
Force Data	Input value Bit mask and port assignment: Bit 0: port X01, Bit 1: port X02, Bit 2: port X03, ... Bit value 0: The pin has an input value of 0. Bit value 1: The pin has an input value of 1. Example 1 (Force Mask has a value of 4): A value of 0 sets the output value of port X03 to 0. A value of 4 sets the output value of port X03 to 1. Example 2 (Force Mask has a value of 7): A value of 0 sets the output value of ports X01, X02 and X03 to 0. A value of 5 sets the output value of port X02 to 0 and the output value of ports X01 and X03 to 1.

Description of the Output Arguments

Table 125: Output Arguments of the OutputPin Method

Output Arguments	Description
Status and Message	0: forcing digital outputs successful
	-1: forcing digital outputs failed

10.3.4.1.9.6 Simulating IO-Link Input Data

The “IoLinkInputSimulation” method simulates the IO-Link input data of a port.

Requirements

- You must have an OPC UA client.

- You must know the username and password, and this user must have permission to execute methods.
- You must have already established a connection to the I/O module.
- The Force function must be enabled, i.e. you must know the Force ID.
- The port must be configured as an IO-Link with input data.

Step-by-Step Instructions

1. In the **Address Space** window, open the context menu and select the port: **Root > Objects > DeviceSet > [device name] > Forcing > PortX > IoLink-InputSimulation**.
2. In the context menu, select **Call**.
 - ⇒ The **Call IoLinkInputSimulation on PortX** window appears
3. Enter the **Force ID**, check **Force Enable** and enter the **Force Data** (see the following description of the input arguments, including the example).
4. Click **[Call]**.
 - ⇒ If the method call was successful, then the IO-Link input data is transmitted to the controller.
 - ⇒ If the method call was unsuccessful, then “-1” appears under Status.

Description of the Input Arguments

Table 126: Input Arguments of the IoLinkInputSimulation Method

Input Arguments	Description
Force ID	Here the OPC UA client must use the Force ID that the OPC UA client had received after the GetForcingId method was called.
Force Enable	False: simulation disabled for this port. True: simulation enabled for this port.
Force Data	IO-Link input data 32 bytes Example: 0102030405060708090A0B0C0D0E0F10 1112131415161718191A1B1C1D1E1F20

Description of the Output Arguments

Table 127: Output Arguments of the IoLinkInputSimulation Method

Output Arguments	Description
Status and Message	0: Forcing IO-Link successful -1: Forcing IO-Link failed

10.3.4.1.9.7 Forcing IO-Link Output Data

The IoLinkOutput method sets the IO-Link output data of a port.

Requirements

- You must have an OPC UA client.
- You must know the username and password, and this user must have permission to execute methods.
- You must have already established a connection to the I/O module.
- The Force function must be enabled, i.e. you must know the Force ID.

- The port must be configured as an IO-Link with output data.

Step-by-Step Instructions

1. In the **Address Space** window, open the context menu and select the port: Root > Objects > DeviceSet > [device name] > Forcing > PortX > IoLink-Output.
2. In the context menu, select **Call**.
 - ⇒ The **Call IoLinkOutput on PortX** window appears.
3. Enter the **Force ID**, check **Force Enable** and enter the **Force Data** (see the following description of the input arguments, including the example).
4. Click **[Call]**.
 - ⇒ If the method call was successful, then the IO-Link output data on the module is forced.
 - ⇒ If the method call was unsuccessful, then “-1” appears under Status.

Description of the Input Arguments

Table 128: Input Arguments of the IoLinkOutput Method

Input Arguments	Description
Force ID	Here the OPC UA client must use the Force ID that the OPC UA client had received after the GetForcingID method was called.
Force Mask	False: setting/resetting disabled for this port. True: setting/resetting enabled for this port.
Force Data	IO-Link output data 32 bytes Example: 0102030405060708090A0B0C0D0E0F10 1112131415161718191A1B1C1D1E1F20

Description of the Output Arguments

Table 129: Output Arguments of the IoLinkOutput Method

Output Arguments	Description
Status and Message	0: Forcing IO-Link successful -1: Forcing IO-Link failed

10.3.4.1.9.8 Disabling Forcing

Requirements

- You must have an OPC UA client.
- You must know the username and password, and this user must have permission to execute methods.
- You must have already established a connection to the I/O module.
- You must have already enabled the Force function and know the Force ID.

Step-by-Step Instructions

1. In the **Address Space** window, open the context menu: Root > Objects > DeviceSet > [module name] > Forcing > DisableForcing.

2. In the context menu, select **Call**.
 - ⇒ The **Call DisableForcing on Forcing** window appears.
3. Enter the **Force ID**.
4. Click **[Call]**.
 - ⇒ If the method call was successful, then “0” appears under Status, the Force function is disabled, and the FLD LED on the module switches to the off state.
 - ⇒ If the method call was unsuccessful, then “-1” appears under Status.

Description of the Input Arguments

Table 130: Input Arguments of the DisableForcing Method

Input Arguments	Description
Force ID	Here the OPC UA client must use the Force ID that the OPC UA client had received after the GetForcingID method was called.

Description of the Output Arguments

Table 131: Output Arguments of the DisableForcing Method

Output Arguments	Description
Status and Message	0: forcing IO-Link successful
	-1: forcing IO-Link failed

10.3.4.1.10 Configuring the Power-on Delay

The OPC UA server provides nodes for configuring the power-on delay.

The module can switch on the supply voltage of ports X01, X02, ... one after the other with a delay. The function is disabled by default and can be enabled here. The delays can be set separately for supply voltages 1L and 2L.

The path to these nodes is:

vdv Root > Object > DeviceSet > [device name] > Configuration > PowerOnDelayConfiguration.

Table 132: Power-on Delay

Node Name	Node Class	Access	Default	Description
PowerOnDelayActivation	Variable	Read/ write	0	Enables or disables the power-on delay for the supply voltage of ports X01, X02, ... 0: disabled (default) 1: enabled
1LStartDelay	Variable	Read/ write	0	Delay before the supply voltage 1L for port X01 is switched on 1 ms ... 20,000 ms
1LNextDelay	Variable	Read/ write	0	Delay before the supply voltage 1L for the next port is switched on
2LStartDelay	Variable	Read/ write	0	Delay before the supply voltage 2L for port X01 is switched on 1 ms ... 20,000 ms
2LNextDelay	Variable	Read/ write	0	Delay before the supply voltage 2L for the next port is switched on

To switch the ports on one after the other, set the same value for `1LStartDelay` and `2LStartDelay`, and the same value for `1LNextDelay` and `2LNextDelay`.

The parameters are saved in the module and applied the next time the module starts.

10.3.4.1.11 Load Management

10.3.4.1.11.1 Limiting Value Configuration

The OPC UA server provides nodes for configuring the limiting values for current, voltage and temperature. These limiting values can be set for each port and each pin. A limiting value overrun or underrun is used for collecting statistical information.

For example, the OPC UA client can read out the configured upper limit for the voltage on pin 1 in the `OverVoltagePin 1` node or the valid hysteresis value for the voltage in the `VoltageHysteresis` node.

If a value falls above or below a limiting value, a corresponding message is displayed:

- The message "Upper limiting value overrun" is displayed if actual value > upper limiting value.
- The message "Upper limiting value overrun" is displayed if actual value < upper limiting value – hysteresis.
- The message "Lower limiting value underrun" is displayed if actual value < lower limiting value.
- The message "Lower limiting value underrun" is displayed if actual value > lower limiting value + hysteresis.

These values do not affect the limiting values for module protection.

The path to the nodes with the limiting and hysteresis values is:

```
Root > Object > DeviceSet > [device name] > Load management > Load
management configuration > Load management statistic threshold
level > PortXX
```

The following table lists the port-specific limiting and hysteresis values:

Table 133: Port-Specific Limiting and Hysteresis Values (Load Management)

Node Name	Node Class	Access	Description
CurrentHysteresis	Variable	Read, write	Current hysteresis, unit: mA, example value 500 = 500 mA If the current exceeds the upper limiting value set in the configuration, the current must first fall back below the upper limiting value by the hysteresis value in order for the end of the limiting value overrun to be detected. The hysteresis value also applies to lower limiting value underruns.
OverCurrent-Pin X level	Variable	Read, write	Upper limiting value for the current on pin X; unit: 1 mA 0: monitoring not enabled 1 mA ... 2000 mA / 1 mA ... 4000 mA
OverTemperature	Variable	Read, write	Upper limiting value for the temperature of a port; unit: 0.1 °C
OverVoltagePin X	Variable	Read, write	Upper limiting value for the voltage on pin X, unit: 1 mV

Node Name	Node Class	Access	Description
Temperature-Hysteresis	Variable	Read, write	Temperature hysteresis, unit: 0.1 °C, example: 20 = 2 °C If the temperature exceeds the upper limiting value set in the configuration, the temperature must first fall back below the upper limiting value by the hysteresis value in order for the end of the limiting value overrun to be detected. The hysteresis value also applies to lower limiting value underruns.
UnderCurrent-Pin X level	Variable	Read, write	Lower limiting value for the current on pin X; unit: 1 mA 0: monitoring not enabled 1 mA ... 2000 mA / 1 mA ... 4000 mA
UnderTemperature	Variable	Read, write	Lower limiting value for the temperature of a port; unit: 0.1 °C
UnderVoltagePin X	Variable	Read, write	Lower limiting value for the voltage on pin X; unit: mV
VoltageHysteresis	Variable	Read, write	Voltage hysteresis, unit: mV, example: 2000 = 2 V If the voltage exceeds the upper limiting value set in the configuration, the voltage must first fall back below the upper limiting value by the hysteresis value in order for the end of the limiting value overrun to be detected. The hysteresis value also applies to lower limiting value underruns.

10.3.4.1.11.2 Port-Specific Statistics

The OPC UA server provides nodes with load management statistics values for each port and for individual pins.

The path to the nodes is:

```
Root > Object > DeviceSet > [device name] > Load management > Load management monitor > Statistic MinMax values > PortXX
```

The following table lists port-specific minimum and maximum measured values for current, temperature and voltage.

Table 134: Port-Specific Statistics: Minimum and Maximum Values (Load Management)

Node Name	Node Class	Access	Description
Current Pin X maximal value	Variable	Read, write	Maximum current on pin X since the last reset; unit: mA
Current Pin X minimal value	Variable	Read, write	Minimum current on pin X since the last reset; unit: mA
Temperature maximal value	Variable	Read, write	Maximum temperature of a port since the last reset; unit: 0.1 °C
Temperature minimal value	Variable	Read, write	Minimum temperature of a port since the last reset; unit: 0.1 °C
Timestamp Current Pin X maximal value	Variable	Read, write	Timestamp for maximum current on pin X since the last reset
Timestamp Current Pin X minimal value	Variable	Read, write	Timestamp for minimum current on pin X since the last reset
Timestamp Temperature maximal value	Variable	Read, write	Timestamp for minimum temperature of a port since the last reset
Timestamp Temperature minimal value	Variable	Read, write	Timestamp for minimum temperature of a port since the last reset
Timestamp Voltage Pin X maximal value	Variable	Read, write	Timestamp for maximum voltage on pin X since the last reset

Node Name	Node Class	Access	Description
Timestamp Voltage Pin X minimal value	Variable	Read, write	Timestamp for minimum voltage on pin X since the last reset
Voltage Pin X maximal value	Variable	Read, write	Maximum voltage on pin X since the last reset; unit: mV
Voltage Pin X minimal value	Variable	Read, write	Minimum voltage on pin X since the last reset; unit: mV

Use of timestamps requires the module to receive the time from an NTP server.

The OPC UA server provides nodes with statistical values for each port and for individual pins. The statistical values contain counters and durations for the limiting values overruns and underruns.

The path to the nodes is:

```
Root > Object > DeviceSet > [device name] > Load management > Load management monitor > Statistic values > PortXX
```

The following table lists port-specific counters and durations for limiting values overruns and underruns for current, temperature and voltage. The counter and durations are valid for the supply connection (pin 1) of the port. The counters and durations for pins 2 and 4 are only valid if this pin is operated in "Static on" operating mode.

Table 135: Port-Specific Statistics: Minimum and Maximum Values (Load Management)

Node Name	Node Class	Access	Description
Current Pin X maximal counter	Variable	Read	Counter for the upper limiting value overruns for the current on pin X since the last reset.
Current Pin X maximal seconds	Variable	Read	Duration of the upper limiting value overrun for the current on pin X. Timing restarts every time an overrun occurs. Unit: s
Current Pin X minimal counter	Variable	Read	Counter for the lower limiting value underruns for the current on pin X since the last reset.
Current Pin X minimal seconds	Variable	Read	Duration of the lower limiting value underrun for the current on pin X. Timing restarts every time an underrun occurs. Unit: s
Temperature maximal counter	Variable	Read	Counter for the upper limiting value overruns for the temperature on a port since the last reset.
Temperature maximal seconds	Variable	Read	Duration of the upper limiting value overrun for the temperature on a port. Timing restarts every time an overrun occurs. Unit: s
Temperature minimal counter	Variable	Read	Counter for the lower limiting value underruns for the temperature on a port since the last reset.
Temperature minimal seconds	Variable	Read	Duration of the lower limiting value underrun for the temperature on a port. Timing restarts every time an underrun occurs. Unit: s
Voltage Pin X maximal counter	Variable	Read	Counter for the upper limiting value overruns for the voltage on pin X since the last reset.
Voltage Pin X maximal seconds	Variable	Read	Duration of the upper limiting value overrun for the voltage on pin X. Timing restarts every time an overrun occurs. Unit: s
Voltage Pin X minimal counter	Variable	Read	Counter for the lower limiting value underruns for the voltage on pin X since the last reset.
Voltage Pin X minimal seconds	Variable	Read	Duration of the lower limiting value underrun for the voltage on pin X. Timing restarts every time an underrun occurs. Unit: s

The firmware checks the measured values for overrun/underrun every 1.2 s.

10.3.4.2 Setting the Module Time

Webserver I/O Field

The module has an integrated clock. The module retrieves the time from an NTP server using NTP (Network Time Protocol). To do so, the module requires the IP address of the NTP server.

OPC UA Client

You can set the IP address of the NTP server with an OPC UA client.

Section  **NTP Client Configuration [▶ 150]** describes the nodes of the OPC UA server for configuring the NTP client.

Section  **Setting the Module Time via OPC UA [▶ 152]** describes how to set the IP address of the NTP server via an OPC UA client.

11 Diagnostics

11.1 Diagnostics via Indicators

Supply Voltage Status

The 1L and 2L LEDs indicate the status of the supply voltages.

Table 136: Supply Voltage Status, 1L and 2L

LED	Color	State	Description
1L	Duo LED, red/green		
	Green	On	1L supply voltage OK
	Red	On	1L undervoltage (voltage between 15.5 V and 18 V)
	Red	Flashing	1L overvoltage (voltage above 30 V)
	Off	Off	No 1L supply voltage
2L	Duo LED, red/green		
	Green	On	2L supply voltage OK
	Red	On	2L undervoltage (voltage between 15.5 V and 18 V)
	Red	Flashing	2L overvoltage (voltage above 30 V)
	Off	Off	No 2L supply voltage

System Status

The SYS LED indicates the status of the system (product).

Table 137: System Status

LED	Color	State	Description
SYS (system status)	Duo LED, yellow/green		
	Green	On	System status: OK Firmware is being executed.
	Yellow/green	Flashing 4 Hz, alternating colors	Firmware update active
	Yellow	On	During the firmware update, an error was detected, e.g., a checksum error.
	Off	Off	No power supply

Status of the Field-Side Functions

The FLD LED indicates the status of the field-side functions.

Table 138: Field LED

LED	Color	State	Description
FLD	Duo LED, green/yellow (yellow = simultaneously red and green)		
	Green	On	Normal operating state
	Green	Flashing (1 Hz)	Force mode is active
	Green	Flashing (4 Hz)	WAGO IO-Link Configurator is connected to the module
	Yellow	On	Configuration error
	Off	Off	Non-operational; no voltage

Application Status

The APL LED indicates the status of the application.

Table 139: APL LED

LED	Color	State	Description
APL	Duo LED, red/green/yellow (yellow = simultaneously red and green)		
	Off	Off	LED with no function
	Yellow	Flashing (1 Hz, 5 s)	LED flashes for 5 s at 1 Hz during module startup: The module has a NameOfStation and/or an IP address.
	Yellow	On (5 s)	LED is illuminated for 5 s during module startup: The module is using the factory settings.

PROFINET IO-Device Status

The BF and SF LEDs indicate the status of the PROFINET IO-Device. The LNK and ACT LEDs indicate the ETHERNET status.

PROFINET IO-Device Status

The following table describes the LED states of the PROFINET IO-Device.

Table 140: PROFINET IO-Device Status

LED	Color	State	Description
BF (bus error)	Red LED		
	Off	Off	No error
	Red	Flashing (2 Hz)	No data exchange
	Red	On	No configuration, slow physical connection or no physical connection
SF (system error)	Red LED		
	Off	Off	No error
	Red	Flashing (1 Hz, 3 s)	DCP signal service is triggered via the bus
	Red	On	Watchdog timeout; channel, generic or extended diagnostics present; system error; forcing active

Table 141: LED states – PROFINET IO-Device

LED State	Description
Flashing (1 Hz, 3 s)	The indicator switches on and off for 3 second in phases at a frequency of 1 Hz: on for 500 ms and then off for 500 ms
Flashing (2 Hz)	The indicator switches on and off in phases at a frequency of 2 Hz: on for 250 ms and then off for 250 ms

ETHERNET Status

The following table describes the LED states of the link and activity LEDs.

Table 142: ETHERNET Status

LED	Color	State	Description
LNK	LED green		
	Green	On	The module is connected to ETHERNET
	Off	Off	The module is not connected to ETHERNET
ACT	LED yellow		

LED	Color	State	Description
	Yellow	Flickering (load-dependent)	The module is sending/receiving ETHERNET frames
	Off	Off	The module is not sending/receiving ETHERNET frames

Table 143: LED States – ETHERNET Status

LED State	Description
Flickering (load-dependent)	The indicator switches on and off at a frequency of 10 Hz, indicating high ETHERNET activity: on for 50 ms and then off for 50 ms. The indicator switches on and off at irregularity intervals to indicate low ETHERNET activity.

Bluetooth Status

The Bluetooth® LED is integrated into the Bluetooth® antenna and indicates the connection status.

Table 144: LED States®

LED	Color	State	Description
BT	Duo LED, blue/red		
	Blue	On	Bluetooth® connection established
	Off	Off	Bluetooth® inactive

IO-Link Port Status

LEDs 0 (port X01), 2 (port X02), 4 (port X03), ..., 14 (port X08) indicate the status of the IO-Link master or digital input/output module.

Table 145: IO-Link Port Status (Class B)

LED	Color	Status	Description
0, 2, 4, ... IO-Link port channel A (Pin 4)	Duo LED, yellow/red/green (yellow = simultaneously red and green)		
	Yellow	On	Status of digital input/output channel A: 1
	Off	Off	Status of digital input/output channel A: 0
	Green	On	IO-Link communication active
	Green	Flashing 1 Hz	No IO-Link communication or incorrect IO-Link device
	Red	On	Overload, short circuit (pin 4 and pin 3)
	Red	Flashing 1 Hz	Overload, sensor supply short circuit (pin 1 and pin 3)
1, 3, 5, ... IO-Link port channel B (pin 2)	Duo LED, yellow/red (yellow = simultaneously red and green)		
	Yellow	On	Status of digital output channel B: 1
	Off	Off	Status of digital output channel B: 0
	Red	On	Overload, short circuit (pin 2 and pin 5)

11.2 Diagnostics via PROFINET

11.2.1 General Alarms

Table 146: General Alarms

Number	Alarm	Description	Corrective Action
265 (0x0109)	Short circuit on pin 4	Short circuit detected on pin 4	Eliminate short circuit

Number	Alarm	Description	Corrective Action
266 (0x010A)	Short circuit on pin 2	Short circuit detected on pin 2	Eliminate short circuit
267 (0x010B)	Short circuit on pin 1	Short circuit detected on pin 1	Eliminate short circuit
272 (0x0110)	Overcurrent, 1L	Overcurrent detected on pin 1	Check supply voltage and eliminate overload
273 (0x0111)	Extended settings rejected	"Extended Settings" parameters contain invalid values	Check and correct "Extended Settings" parameters
274 (0x0112)	Application-specific name tags rejected	Application-specific name tags contain invalid characters or are too long	Correct application-specific name tags
275 (0x0113)	NTP parameters rejected	NTP parameters contain invalid values	Check and correct NTP parameters
276 (0x0114)	MQTT parameters rejected	MQTT parameters contain invalid values	Check and correct MQTT parameters
277 (0x0115)	Port X01 load management settings port rejected	Load management parameters for port X01 contain invalid values	Check and correct load management parameters for port X01
278 (0x0116)	Port X02 load management settings port rejected	Load management parameters for port X02 contain invalid values	Check and correct load management parameters for port X02
279 (0x0117)	Port X03 load management settings port rejected	Load management parameters for port X03 contain invalid values	Check and correct load management parameters for port X03
280 (0x0118)	Port X04 load management settings port rejected	Load management parameters for port X04 contain invalid values	Check and correct load management parameters for port X04
281 (0x0119)	Port X05 load management settings port rejected	Load management parameters for port X05 contain invalid values	Check and correct load management parameters for port X05
282 (0x011A)	Port X06 load management settings port rejected	Load management parameters for port X06 contain invalid values	Check and correct load management parameters for port X06
283 (0x011B)	Port X07 load management settings port rejected	Load management parameters for port X07 contain invalid values	Check and correct load management parameters for port X07
284 (0x011C)	Port X08 load management settings port rejected	Load management parameters for port X08 contain invalid values	Check and correct load management parameters for port X08
6158 (0x180E)	P24 (Class B) missing or undervoltage	Supply voltage 2L missing or undervoltage	Check power supply on pin 2
6159 (0x180F)	Short circuit on P24 (Class B)	Short circuit detected on 2L	Check wiring (e.g., 2L+)
7936 (0x1F00)	Undervoltage	Undervoltage in supply line 1L The supply line has fallen below the limiting value for the minimum voltage	Check supply voltage
7937 (0x1F01)	Overvoltage	Overvoltage in supply line 1L The supply line has exceeded the limiting value for the maximum voltage	Check supply voltage
7938 (0x1F02)	Overtemperature	Overtemperature The device temperature has exceeded the upper limiting value	Eliminate external heat source or overload
7939 (0x1F03)	Overload	Overload in supply line 1L The total current in supply line 1L has exceeded the upper limiting value	Eliminate overload

Number	Alarm	Description	Corrective Action
7940 (0x1F04)	Overload, 2L	Overload in supply line 2L The total current in supply line 1L has exceeded the upper limiting value	Eliminate overload
7941 (0x1F05)	Undertemperature	Undertemperature The device temperature has fallen below the lower limiting value.	Thermally insulate device
7942 (0x1F06)	Undervoltage, 2L	Undervoltage in supply line 2L The power supply for supply line 2L has fallen below the limiting value for the minimum voltage	Check supply voltage
7943 (0x1F07)	Overvoltage, 2L	Overvoltage in supply line 2L The power supply for supply line 2L has exceeded the limiting value for the maximum voltage	Check supply voltage
7944 (0x1F08)	Forcing operating mode active	Forcing operating mode active (enabled by Web client or OPC UA client)	The Web client or OPC UA client should exit the Forcing operating mode as soon as forcing is no longer needed
7945 (0x1F09)	Supply voltage 1L missing	Voltage in supply cable 1L is missing	Check supply voltage 1L
7946 (0x1F0A)	Supply voltage 2L missing	Voltage in supply cable 2L is missing	Check supply voltage 2L
7947 (0x1F0B)	Power-on delay started	The power-on delay has started and the supply voltages of the ports are switched on one after the other	-

11.2.2 Diagnostic Alarms

Diagnostic alarms originate from the IO-Link master. They indicate events on the IO-Link master or its ports. 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 IO-Link master sends this event to the IO controller as a diagnostic alarm. The value of the “Channel Error (PROFINET®)” is 38146 (0x9502).

The following table lists the numbers of the IO-Link master diagnostic alarms.

Table 147: IO-Link Master Diagnostic Alarms

Channel Error	Extended Channel Error Type	Description	Corrective Action
38146 (0x9502)	6143 (0x17FF)	Process data error	Check submodule configuration
38146 (0x9502)	6144 (0x1800)	No device access / loss of communication	Check IO-Link port
	6145 (0x1801)	Start parameter error	Check parameters
	6146 (0x1802)	Incorrect manufacturer identifier	Check port configuration parameters
	6147 (0x1803)	Incorrect device identification	Check port configuration parameters
38146 (0x9502)	6148 (0x1804)	Short circuit on C/Q	Check pin 4 wiring
	6149 (0x1805)	PHY overtemperature	Check temperature and load
	6150 (0x1806)	Short circuit on L+	Check wiring

Channel Error	Extended Channel Error Type	Description	Corrective Action
	6151 (0x1807)	Overcurrent on L+	Check power supply (e.g., 1L+)
38146 (0x9502)	6152 (0x1808)	Device event overflow	Contact device manufacturer
	6153 (0x1809)	Backup inconsistency	Access outside the memory area (2048 octets)
	6154 (0x180A)	Backup inconsistency	Fix identity error
	6155 (0x180B)	Backup inconsistency	Unspecified error during data storage
38146 (0x9502)	6156 (0x180C)	Backup inconsistency	Fix upload error
	6157 (0x180D)	Parameter inconsistency	Fix download error
	6158 (0x180E)	P24 (Class B) missing or undervoltage	Check power supply
	6159 (0x180F)	Short circuit on P24 (Class B)	Check wiring (e.g., 2L+)
38146 (0x9502)	6160 (0x1810)	Short circuit on I/Q	Check wiring
	6161 (0x1811)	Short circuit on C/Q	Check wiring
	6162 (0x1812)	Overcurrent on I/Q	Check load
	6163 (0x1813)	Overcurrent on C/Q	Check load
38146 (0x9502)	7936 (0x1F00)	Undervoltage with 1L power supply	Check 1L supply voltage
	7937 (0x1F01)	Overvoltage with 1L power supply	Check 1L supply voltage
	7938 (0x1F02)	Overtemperature	Check ambient temperature and load
	7939 (0x1F03)	Overload of total current with 1L supply	Check total current of 1L supply
38146 (0x9502)	7940 (0x1F04)	Overload of total current with 2L supply	Check total current of 2L supply
	7941 (0x1F05)	Undertemperature	Check ambient temperature
	7942 (0x1F06)	Undervoltage with 2L power supply	Check 2L supply voltage
	7943 (0x1F07)	Overvoltage with 2L power supply	Check 2L supply voltage
38146 (0x9502)	7944 (0x1F08)	Force mode has been enabled	Disable Force mode after use
	7945 (0x1F09)	1L power supply failed	Check 1L supply voltage
	7946 (0x1F0A)	2L power supply failed	Check 2L supply voltage
	7947 (0x1F0B)	Power-on delay starting	-
	7950 (0x1F10)	Invalid I/Q parameters	A value setting of 0x0030 for pin 2 (Class B) requires the I/Q behavior parameters to be set to a value of 0 in record 0xB900. Modify record 0xB900.
38146 (0x9502)	24576 (0x6000)	Invalid cycle time	Check port configuration parameters
	24577 (0x6001)	Revision fault (incompatible protocol version)	Check port configuration parameters
	24578 (0x6002)	ISDU batch failed	Eliminate parameter inconsistency

11.2.3 Process Alarms

Process Alarms (Completion Notifications)

The following table describes process alarms with completion Notifications.

Table 148: Process Alarms (Completion Notifications)

Number	Alarm	Description	Corrective Action
7948 (0x1F0C)	Power-on delay ended	The power-on delay has ended and the supply voltages of all ports are switched on.	-
7949 (0x1F0D)	ISDU batch complete	All parameters were transferred to the IO-Link device via ISDU. The ISDU batch process for an IO-Link port (i.e., the IO-Link master sends parameters to the IO-Link device) is triggered by the following events: - Via the Write Record service, the IO controller enables the IO-Link master to transfer the parameters. The IO-Link master starts the ISDU batch process. - The IO-Link device switches to the "Operate" state, e.g., because the IO-Link device has been connected to the port. The IO-Link master starts the ISDU batch process. The device sends the message "ISDU Batch Complete" twice if both events occur on one port.	-

Process Alarms (IO-Link Device)

A process alarm is triggered by an IO-Link device. 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 PROFINET IO controller as a process alarm. The value of "Channel Error" is 38144 (0x9500) for "Standard Events" and 38145 (0x9501) for manufacturer-specific events. The IODD of the IO-Link device contains manufacturer-specific events with message text.

The following table describes the possible standard events of the IO-Link device.

Table 149: Process Alarms for IO-Link Device Diagnostics

Channel Error	Extended Channel Error Type	Description of the Malfunction on the Connected IO-Link Device	Corrective Action on the Connected IO-Link Device
38144 (0x9500)	4096 (0x1000)	General malfunction	IO-Link device reports unknown error
38144 (0x9500)	16384 (0x4000)	Temperature error	Eliminate overload
	16912 (0x4210)	Device overheating	Eliminate heat source
	16928 (0x4220)	Device undercooling	Insulate IO-Link device
38144 (0x9500)	20480 (0x5000)	Device hardware fault	Replace IO-Link device
38144 (0x9500)	20496 (0x5010)	Malfunction of a component	Repair or replacement
	20497 (0x5011)	Loss of data of non-volatile memory	Check batteries
	20498 (0x5012)	Batteries too weak	Replace batteries

Channel Error	Extended Channel Error Type	Description of the Malfunction on the Connected IO-Link Device	Corrective Action on the Connected IO-Link Device
38144 (0x9500)	20736 (0x5100)	General error in the power supply	Check availability
	20737 (0x5101)	Fuse blown/open	Replace fuse
38144 (0x9500)	20752 (0x5110)	Overvoltage in primary power supply	Check tolerance
	20753 (0x5111)	Undervoltage in primary power supply	Check tolerance
	20754 (0x5112)	Error in additional power supply	Check tolerance
38144 (0x9500)	24576 (0x6000)	Device software fault	Check firmware version
	25376 (0x6320)	Parameter error	Use data sheet and check values
	25377 (0x6321)	Missing parameter(s)	Check parameters
	25424 (0x6350)	Parameter change	Check configuration
38144 (0x9500)	30464 (0x7700)	Wire break on a lower-level device	Check installation
	30465 – 30479 (0x7701 – 0x770F)	Wire break of lower-level device 1 ... 15	Check installation
	30480 (0x7710)	Short circuit	Check installation (device)
	30481 (0x7711)	Grounding fault	Check installation
38145 (0x9501)	3072 (0x0C00)	Technology-specific application error	Reset device
	3073 (0x0C01)	Simulation active	Check operating mode
	3088 (0x0C10)	Value range of a process variable exceeded	Process data uncertain
	3104 (0x0C20)	Measurement overrange	Check application
	3120 (0x0C30)	Process variable value below value range	Process data uncertain
	3136 (0x0C40)	Maintenance required	Cleaning
	3137 (0x0C41)	Maintenance required	Refill
	3138 (0x0C42)	Maintenance required	Replacement of wear parts
38145 (0x9501)	3232 (0x0CA0)	Overcurrent on port X01 pin 2	Check load Check pin 2 configuration, e.g., current limit or whether disabled
	3233 (0x0CA1)	Overcurrent on port X01 pin 4	Check load Check pin 4 configuration, e.g., current limit or whether disabled
	3234 (0x0CA2)	Overcurrent on port X02 pin 2	Check load Check pin 2 configuration, e.g., current limit or whether disabled
	3235 (0x0CA3)	Overcurrent on port X02 pin 4	Check load Check pin 4 configuration, e.g., current limit or whether disabled
38145 (0x9501)	3236 (0x0CA4)	Overcurrent on port X03 pin 2	Check load Check pin 2 configuration, e.g., current limit or whether disabled
	3237 (0x0CA5)	Overcurrent on port X03 pin 4	Check load Check pin 4 configuration, e.g., current limit or whether disabled
	3238 (0x0CA6)	Overcurrent on port X04 pin 2	Check load Check pin 2 configuration, e.g., current limit or whether disabled

Channel Error	Extended Channel Error Type	Description of the Malfunction on the Connected IO-Link Device	Corrective Action on the Connected IO-Link Device
	3239 (0x0CA7)	Overcurrent on port X04 pin 4	Check load Check pin 4 configuration, e.g., current limit or whether disabled
38145 (0x9501)	3240 (0x0CA8)	Overcurrent on port X05 pin 2	Check load Check pin 2 configuration, e.g., current limit or whether disabled
	3241 (0x0CA9)	Overcurrent on port X05 pin 4	Check load Check pin 4 configuration, e.g., current limit or whether disabled
	3242 (0x0CAA)	Overcurrent on port X06 pin 2	Check load Check pin 2 configuration, e.g., current limit or whether disabled
	3243 (0x0CAB)	Overcurrent on port X06 pin 4	Check load Check pin 4 configuration, e.g., current limit or whether disabled
38145 (0x9501)	3244 (0x0CAC)	Overcurrent on port X07 pin 2	Check load Check pin 2 configuration, e.g., current limit or whether disabled
	3245 (0x0CAD)	Overcurrent on port X07 pin 4	Check load Check pin 4 configuration, e.g., current limit or whether disabled
	3246 (0x0CAE)	Overcurrent on port X08 pin 2	Check load Check pin 2 configuration, e.g., current limit or whether disabled
	3247 (0x0CAF)	Overcurrent on port X08 pin 4	Check load Check pin 4 configuration, e.g., current limit or whether disabled
38145 (0x9501)	3280 (0x0CD0)	Overcurrent, port X01	Check load Check configuration, e.g., current limit or whether disabled
	3281 (0x0CD1)	Overcurrent, port X02	Check load Check configuration, e.g., current limit or whether disabled
	3282 (0x0CD2)	Overcurrent, port X03	Check load Check configuration, e.g., current limit or whether disabled
	3283 (0x0CD3)	Overcurrent, port X04	Check load Check configuration, e.g., current limit or whether disabled
38145 (0x9501)	3284 (0x0CD4)	Overcurrent, port X05	Check load Check configuration, e.g., current limit or whether disabled
	3285 (0x0CD5)	Overcurrent, port X06	Check load Check configuration, e.g., current limit or whether disabled
	3286 (0x0CD6)	Overcurrent, port X07	Check load Check configuration, e.g., current limit or whether disabled

Channel Error	Extended Channel Error Type	Description of the Malfunction on the Connected IO-Link Device	Corrective Action on the Connected IO-Link Device
	3287 (0x0CD7)	Overcurrent, port X08	Check load Check configuration, e.g., current limit or whether disabled

12 Service

12.1 Resetting to Factory Settings

The device can be reset to the factory settings. Use the WAGO I/O Field Webserver for this purpose.

You can find information on the procedure in [🔗 Resetsetting the Module to the Factory Settings \[▶ 125\]](#).

12.2 Firmware Updates

The module's firmware can be updated. Use the WAGO I/O Field Webserver to do so.

Compared to version 1.1.x of the firmware, versions 1.2.0 and higher of the WAGO I/O Field Webserver offers an extended range of functions for updating the firmware. To update the firmware, you need the version information for the firmware used in the module and the version information for the firmware you want to load onto the module. The procedure differs depending on the version.

The WAGO I/O Field Webserver displays the version used in the module on the overview page (see [🔗 WAGO Webserver I/O Field User Interface \[▶ 111\]](#)) under "Software Version." The following figure shows the software version with "V1.x.y":

Device version	
Hardware revision	2
Software version	V1.x.y
Webpage version	Va.b.c.d

Figure 20: Firmware Version on the Module

The following cases need to be distinguished:

- Update V1.1.x to V1.1.y:
The firmware file name is "FWUPDATE.ZIP." The update is performed with the WAGO I/O Field Webserver, which is included in firmware version 1.1.
- Update V1.2.x to V1.2.y:
The firmware file name is "WAGO_IO_SystemField_765_xxxxxxx_Vxyz.zip." The update is performed with the WAGO I/O Field Webserver, which is included in firmware version 1.2.
The placeholder "xxxxxxx" stands for the communication system.
The placeholder "xyz" stands for three- or multi-digit version information. The procedures are described in Updating Firmware from V1.2.x to V1.2.y.
- Update V1.1.x to V1.2.y:
The firmware file name is "FWUPDATE.ZIP." The update is performed with the WAGO I/O Field Webserver, which is included in firmware version 1.1.
The following section describes the procedure. Updating from V1.1.x to V1.2.y only needs to be performed once.

Updating Firmware from V1.1 to V1.2

! NOTICE

Put the system in a safe operating state before updating the firmware

Never update the firmware during ongoing operation of the system in which the device is installed. Before any firmware update, the system must first be properly shut down and put in a safe operating state.

Otherwise, the controller will no longer receive input and output data, so outputs can no longer be controlled.

i Note

Firmware backup

When you update your device's firmware, it will no longer be possible to reconstruct the state of your device before the update, including the firmware used up to that point. To avoid this, create a firmware backup before performing the firmware update.

Changes to settings require maintenance, specialist or admin rights. If you do not have these rights, the tab is grayed out and cannot be edited. In this case, the following error message appears:

Note: For user role "Observer", firmware update is not allowed!

To update the firmware, you need the correct firmware file for the module type. The firmware file is named "FWUPDATE.zip" and contains the functional scope of firmware version 1.2. You can get the file from the Downloads section of the WAGO website:

 <http://www.wago.com>.

To update the firmware, proceed as follows:

1. Save the "FWUPDATE.zip" file in a folder, e.g., in the "765-Update" folder.
 2. In the left-hand column of the WAGO I/O Field Webserver, select the **Settings** menu item.
 - ⇒ The **Device Configuration** tab appears.
 3. Select the **Firmware Upgrade** tab.
 4. Click the **[Browse]** button.
 - ⇒ A file selection dialog opens.
 5. In this dialog, select the file FWUPDATE.ZIP.
 - ⇒ The name of the selected firmware container file appears the **File** display field.
 6. Click the **[Upgrade]** button.
 - ⇒ The firmware is updated. A reset is performed.
- ➔ After the restart, the module executes the updated firmware.

12.3 Required tools

For installation and removal, you need the following tools:

- Allen key for the M4 cylinder head hex screws per DIN 912 or ISO 4762

The following additional items are only required for installation where no threaded hole is present:

- M4 thread cutter (bottoming tap or hand tap set)
- Drill (for pre-drilling mounting holes for the module and installing the system)

You also need two M4 cylinder head hex screws per DIN 912 / ISO 4762 of adequate length.

12.4 Accessories

Table 150: M12 protective caps

Item No.	Product
756-8102	M12 protective cap; for unused sockets
756-8103	M12 protective cap; for unused connector plugs

Table 151: Fieldbus cables for UL Enclosure Type 12 applications

File Number	Type No.	Designation
DUXR.E345416 - WAGO GmbH & Co. KG	756-03/006%-m	&: Fieldbus type (2 digits) %: Cable material (1 digit) m: Cable length in dm (4 digits)
DUXR.E345416 - WAGO GmbH & Co. KG	756-04/006%-m	
DUXR.E345416 - WAGO GmbH & Co. KG	756-05/004%-m	
DUXR.E345416 - WAGO GmbH & Co. KG	756-06/004%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-1201/006%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-1202/006%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-1206/006%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-1207/006%-m	

Table 152: Power cables for UL Enclosure Type 12 applications

File Number	Type No.	Designation
PVVA.E519600 - WAGO GmbH & Co. KG	756-3501/0X%-m	X: Number of contacts (2 digits) %: Cable material (1 digit) m: Cable length in dm (4 digit)
PVVA.E519600 - WAGO GmbH & Co. KG	756-3502/0X%-m	
PVVA.E519600 - WAGO GmbH & Co. KG	756-3503/0X%-m	
PVVA.E519600 - WAGO GmbH & Co. KG	756-3504/0X%-m	
PVVA.E519600 - WAGO GmbH & Co. KG	756-3505/0X%-m	
PVVA.E519600 - WAGO GmbH & Co. KG	756-3506/0X%-m	
PVVA.E519600 - WAGO GmbH & Co. KG	756-3511/0X%-m	
PVVA.E519600 - WAGO GmbH & Co. KG	756-3512/0X%-m	
PVVA.E519600 - WAGO GmbH & Co. KG	756-3513/0X%-m	
PVVA.E519600 - WAGO GmbH & Co. KG	756-3514/0X%-m	
PVVA.E519600 - WAGO GmbH & Co. KG	756-3515/0X%-m	
PVVA.E519600 - WAGO GmbH & Co. KG	756-3516/0X%-m	
PVVA.E519600 - WAGO GmbH & Co. KG	756-9311/0X0-0000	
PVVA.E519600 - WAGO GmbH & Co. KG	756-9312/0X0-0000	
PVVA.E519600 - WAGO GmbH & Co. KG	756-9313/0X0-0000	

Table 153: Sensor/Actuator cables for UL Enclosure Type 12 applications

File Number	Type No.	Designation
CYJV.E519602 - WAGO GmbH & Co. KG	756-5111/003%-m	%: Cable material (1 digit) m: Cable length in dm (4 digits)
CYJV.E519602 - WAGO GmbH & Co. KG	756-5112/003%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5201/003%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5202/003%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5203/003%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5204/003%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5311/003%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5311/004%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5311/005%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5311/006%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5311/009%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5312/003%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5312/004%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5312/005%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5312/006%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5312/009%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5401/003%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5401/004%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5401/005%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5401/006%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5402/003%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5402/004%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5402/005%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5402/006%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5403/003%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5403/004%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5403/005%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5403/006%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5404/003%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5404/004%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5404/005%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5404/006%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5501/003%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5502/003%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5503/003%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5504/003%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5507/003%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5507/004%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5508/003%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5508/004%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5509/003%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5509/004%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5510/003%-m	
CYJV.E519602 - WAGO GmbH & Co. KG	756-5510/004%-m	

13 Decommissioning

13.1 Disposal and Recycling

	WEEE Mark Electrical and electronic equipment may not be disposed of with household waste. This also applies to products without this mark.
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Electrical and electronic equipment contain materials and substances that can be harmful to the environment and health. Electrical and electronic equipment must be disposed of properly after use. Environmentally friendly disposal benefits health, protects the environment from harmful substances in electrical and electronic equipment and enables sustainable and efficient use of resources.

- Observe the national and local regulations for the disposal of electrical and electronic equipment, lithium-ion batteries, lead–acid batteries and packaging.
- Clear any data stored on electrical and electronic equipment.
- Remove lithium-ion batteries, lead–acid batteries or memory cards that are added to the electrical and electronic equipment.
- Wear appropriate personal protective equipment when removing the lithium-ion batteries/lead–acid batteries.
- Dispose of the removed lithium-ion batteries/lead–acid batteries according to your local waste regulations (e. g. collection boxes at the retail or local collection points).
- Have electrical and electronic equipment sent to a local collection point.
- Dispose of all types of packaging to ensure a high level of recovery, reuse and recycling.
- Transport packages from the B2B area can be taken back free of charge via a return system in accordance with the Packaging Act. Please contact our service provider Interseroh directly. The corresponding certificate can be found at: [🌐 corporate-certificates](#).
- Throughout Europe, Directives 2006/66/EC, 94/62/EC and 2012/19/EU (WEEE) apply. National directives and laws may differ.

14 Appendix

14.1 Record Data Sets

PROFINET offers access to device parameters (records) by means of acyclic services. Records can be read from the PROFINET IO device by the PROFINET IO controller with ReadRecord and written to the PROFINET IO device with WriteRecord.

14.1.1 IOL_CALL / IO_LINK_DEVICE (Record 0xB400)

This record allows the parameters of the IO-Link device connected to the IO-Link master port to be read from and written to. The IO-Link service ISDU (Indexed Service Data Unit) is used for this purpose. This records maps PROFINET services to IO-Link services.

The PROFINET IO controller uses the "NameOfStation," slot and subslot for addressing. Depending on the PROFINET IO controller used, it may be possible to combine this information into an ID. In the TIA Portal, this is the hw_id (hardware ID).

The record number is 0xB400 (hexadecimal) or 46080 (decimal).

If you use the TIA portal: The function block name is IO_LINK_DEVICE. The function block can be downloaded from the Siemens website as an example. Use the value 16#B400 for the function block's input CAP (Client Access Point). For the input ID of the function block, use the value of the hardware ID shown in the TIA Portal, which you can find in the hardware configuration. To find it, open the "System Constants" display. In the "Names" column, find the row with the entry that ends in „~IO-Link_Master.“ In the "HW ID" column, this row contains the value you need for the input ID.

The following assignment applies for addressing the IO-Link port with the slot and subslot:

- The PROFINET IO controller addresses the IO-Link master with slot 1 and subslot 1. The **Port** parameter addresses the port to which the IO-Link device is connected.
- The PROFINET IO controller addresses port 1 directly with slot 1 and subslot 2, addresses port 2 directly with slot 1 and subslot 3 etc.

Table 154: Addressing the IO-Link Port with the Slot and Subslot

Slot/Subslot	IO-Link Port
1/1	Ports 1 ... 8 (the Port parameter determines the exact port).
1/2	Port 1
1/3	Port 2
...	...
1/9	Port 8

In the process, the following parameters (ISDU request) and user data are transferred between PROFINET and IO-Link:

- The **Port** parameter addresses the IO-Link port to which the IO-Link device is connected.
- The **Index** and **Subindex** parameters address the object of the IO-Link device. The documentation of the manufacturer of the connected IO-Link device describes the objects and parameters.

- Read: During read access, user data is transferred from the IO-Link device to the PROFINET IO controller. The user data is stored temporarily in the user data range of record 0xB400.
- Write: During write access, user data is transferred from the PROFINET IO controller to the IO-Link device. The user data is stored temporarily in the user data range of record 0xB400.

14.1.1.1 ISDU Read Service

Read Process

In order to read data from an IO-Link device via PROFINET record, the following process is required:

- The PROFINET IO controller uses WriteRecord and writes the ISDU read request to record 0xB400, indicating the index and subindex. This information addresses the port and the object of the IO-Link device that is to be read, among other things.
- The PROFINET IO controller then uses the ReadRecord to read the results (ISDU read response) from record 0xB400.

The following figure illustrates the process of reading to an IO-Link device via PROFINET record 0xB400:

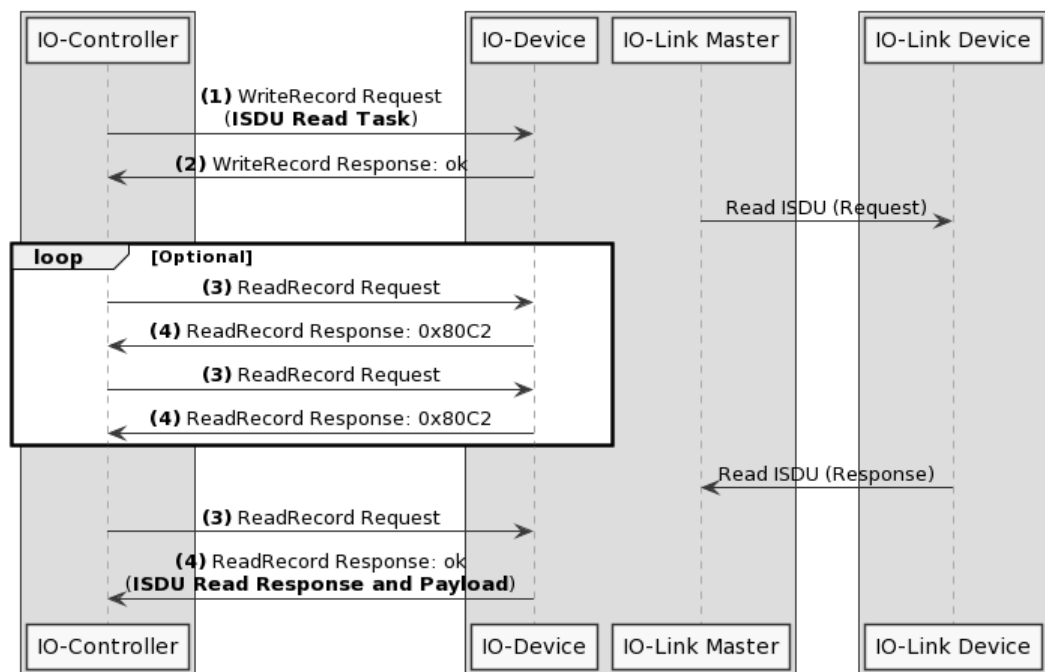


Figure 21: ISDU Read Process

(1) WriteRecord Request: Structure of IOL_CALL for an ISDU Read Request

The PROFINET IO controller uses the “NameOfStation,” slot and subslot for addressing. Depending on the PROFINET IO controller used, it may be possible to combine this information into an ID. In the TIA Portal, this is the hw_id (Hardware ID).

For the transmission of the ISDU read request (number (1) in figure “ISDU Read Process”), the record IOL_CALL (0xB400) must have the following structure:

IOL_CALL for an ISDU read request (WriteRecord request)

Table 155: Structure of IOL_CALL for an ISDU Read Request (WriteRecord Request)

Offset	Parameter Name	Description	Type	Value
0	Function	Fixed value Indicates a call header.	Unsigned8	0x08
1	Port	Port number	Unsigned8	0x01 ... 0x08
2	FI_Index	Fixed value	Unsigned16	0xFE4A
4	Control	Control octet Value 0x03 corresponds to read request on IO-Link object.	Unsigned8	0x03
5	IOL_Index	Object index of the IO-Link device to be read from.	Unsigned16	0x0000 ... 0x7FFF
7	IOL_Subindex	Object subindex of the IO-Link device to be read from.	Unsigned8	[0x00...0xFF]

(2) WriteRecord Response

The PROFINET IO controller receives the WriteRecord response.

If the status is 0, then the ISDU read request has been accepted, and the PROFINET IO controller can continue with ReadRecord as described below.

If the status is unequal to 0, there is an error. The PROFINET IO controller must restart the process with number (1) (see figure “ISDU Write Process”). Status 0xDF80B100 indicates a length error.

(3) ReadRecord Response

The PROFINET IO controller uses ReadRecord (number (3) in figure “ISDU Read Process”) with the same parameters for the “NameOfStation,” slot and subslot for addressing, or the same ID, as for the WriteRecord that has already been performed. With the ReadRecord, the PROFINET IO controller must read the response of the ISDU read service from record 0xB400.

(4) ReadRecord Response: Response of the ISDU Read Service

The PROFINET IO controller receives the ReadRecord response (number (4) in figure “ISDU Read Process”).

If the status is equal to 0, then the response of the ISDU read service has been read out, and the status octet must be evaluated.

If the status is unequal to 0, the status must be evaluated.

Status 0x80C2 (Resource busy) indicates that ReadRecord must be repeated because the response from the ISDU read service is not yet available. ReadRecord needs to be repeated (Polling) until a different value is returned.

- If the status is equal to 0, then the response of the ISDU read service has been read out. The response can be evaluated as described below.
- Otherwise, there is an error, and the operation was unsuccessful.

ReadRecord Response: Structure of the IOL_CALL (in Case of Success: Status Octet is 0x00)

If the status octet has the value 0, then the ISDU read request has been executed and the user data is located in the **IOL_Data** parameter. The response has the following structure:

Table 156: Structure of the IOL_CALL (ReadRecord Response and in Case of Success)

Offset	Parameter Name	Description	Type	Value
0	Function	Fixed value Indicates a call header.	Unsigned8	0x08
1	Port	Port number	Unsigned8	0x01 ... 0x08
2	FI_Index	Fixed value	Unsigned16	0xFE4A
4	Status	Status octet	Unsigned8	0x00: finished / transfer completed
5	IOL_Index	Object index of the IO-Link device that was read from.	Unsigned16	0x0000 ... 0x7FFF
7	IOL_Subindex	Object subindex of the IO-Link device that was read from.	Unsigned8	[0x00...0xFF]
8 ... n	IOL_Data	In the event of success, the status octet is equal to 0x00, and the user data that has been read is stored here. At most 232 bytes can be read. The value of n ranges from 8 to 239 and depends on the amount of user data that has been read. The documentation of the manufacturer of the connected IO-Link device describes contents of the user data.	Record	Value of the object of the IO-Link device that has been read out

ReadRecord Response: Structure of the IOL_CALL (in Case of Error: Status Octet is 0x80)

If the status octet has the value 0x80, then the ISDU read request could not be executed, and the **IOL_Data** parameter contains IOL_Error_PDU with error numbers. The response has the following structure:

Table 157: Structure of the IOL_CALL (ReadRecord Response and in Case of Error)

Offset	Parameter Name	Description	Type	Value
0	Function	Fixed value Indicates a call header.	Unsigned8	0x08
1	Port	Port number Value 0x00 is reserved.	Unsigned8	0x01 ... 0xFF
2	FI_Index	Fixed value	Unsigned16	0xFE4A
4	Status	Status octet	Unsigned8	0x80: IOL_Error_PDU
5	IOL_Index	Object index of the IO-Link device that could not be read from.	Unsigned16	0x0000 ... 0x7FFF
7	IOL_Subindex	Object subindex of the IO-Link device that could not be read from.	Unsigned8	0x00 ... 0xFF
8 ... 11	IOL_Data	In the event of error, the status octet equals 0x80, and IOL_Error_PDU is stored here. IOL_Error_PDU contains multiple error codes for evaluation.	Unsigned32	See table "IOL_Error_PDU Coding"

14.1.1.2 ISDU Write Service

In order to write data to an IO-Link device via PROFINET record, the following process is required:

- The PROFINET IO controller uses WriteRecord and writes the ISDU write request to record 0xB400, indicating the index and subindex. This information addresses the port and the object of the IO-Link device that is to be written to, among other things.
- The PROFINET IO controller then uses the ReadRecord to read the results (ISDU write response) from record 0xB400.

The following figure shows the process of writing to an IO-Link device via PROFINET record 0xB400:

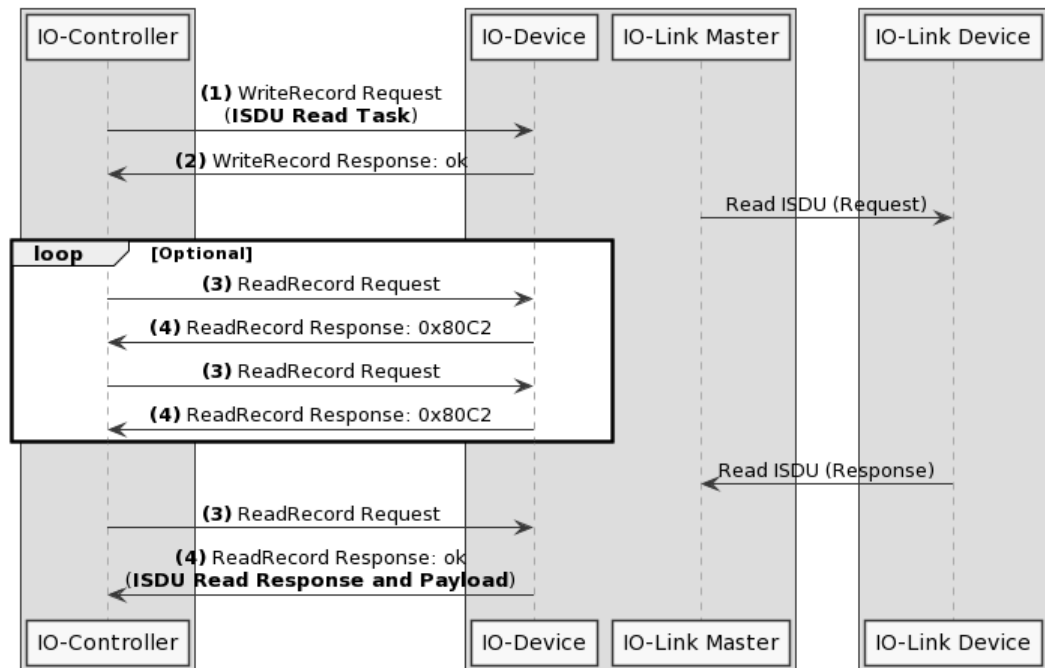


Figure 22: ISDU Write Process

(1) WriteRecord Request: Structure of IOL_CALL for an ISDU Write Request

The PROFINET IO controller uses the “NameOfStation,” slot and subslot for addressing. Depending on the PROFINET IO controller used, it may be possible to combine this information into an ID. In the TIA Portal, this is the hw_id (Hardware ID).

For the transmission of the ISDU write request (number (1) in figure “ISDU Write Process”), the record IOL_CALL must have the following structure:

Table 158: Structure of IOL_CALL for an ISDU Write Request (WriteRecord Request)

Offset	Parameter Name	Description	Type	Value
0	Function	Fixed value Indicates a call header.	Unsigned8	0x08
1	Port	Port number	Unsigned8	0x01 ... 0x08
2	FI_Index	Fixed value	Unsigned16	0xFE4A
4	Control	Control octet Value 0x02 corresponds to write request on IO-Link object.	Unsigned8	0x02
5	IOL_Index	Object index of the IO-Link device to be written to.	Unsigned16	0x0000 ... 0x7FFF

Offset	Parameter Name	Description	Type	Value
7	IOL_Subindex	Object subindex of the IO-Link device to be written to.	Unsigned8	[0x00...0xFF]
8 ... n	IOL_Data	User data for write request User data to be written to the object of the IO-Link device. At most 232 bytes can be written. The value of n ranges from 8 to 239 and depends on the amount of user data that has been written. The documentation of the manufacturer of the connected IO-Link device describes contents of the user data.	Record	-

(2) WriteRecord Response

The PROFINET IO controller receives the WriteRecord response.

If the status is 0, then the ISDU read request has been accepted, and the PROFINET IO controller can continue with ReadRecord as described below.

If the status is unequal to 0, there is an error. The PROFINET IO controller must restart the process with number (1) (see figure “ISDU Write Process”). Status 0xDF80B100 indicates a length error.

(3) ReadRecord Response

The PROFINET IO controller uses ReadRecord (number (3) in figure “ISDU Write Process”) with the same parameters for the “NameOfStation,” slot and subslot for addressing, or the same ID, as for the already WriteRecord that has already been performed.

With the ReadRecord, the PROFINET IO controller must read the response of the ISDU read service from record 0xB400.

(4) ReadRecord Response: Response from the ISDU Write Service

The PROFINET IO controller receives the ReadRecord response (number (4) in figure “ISDU Write Process”).

If the status is equal to 0, then the ISDU write service was executed, and the status octet must be evaluated.

If the status is unequal to 0, the status must be evaluated.

Status 0x80C2 (Resource busy) indicates that ReadRecord must be repeated because the response from the ISDU write service is not yet available. ReadRecord needs to be repeated (Polling) until a different value is returned.

- If the status is 0, then the response of the ISDU write service has been read out. The response can be evaluated as described below.
- Otherwise, there is an error, and the operation was unsuccessful.

ReadRecord Response: Structure of the IOL_CALL (in Case of Success: Status Octet is 0x00)

If the status octet has the value 0, then the ISDU write request has been executed. The response has the following structure:

Table 159: Structure of the IOL_CALL (ReadRecord Response and in Case of Success)

Offset	Parameter Name	Description	Type	Value
0	Function	Fixed value Indicates a call header.	Unsigned8	0x08
1	Port	Port number	Unsigned8	0x01 ... 0x08
2	FI_Index	Fixed value for reasons of compatibility	Unsigned16	0xFE4A
4	Status	Status octet	Unsigned8	0x00: finished / transfer completed
5	IOL_Index	Object index of the IO-Link device that was written to.	Unsigned16	0x0000 ... 0x7FFF
7	IOL_Subindex	Object subindex of the IO-Link device that was written to.	Unsigned8	[0x00...0xFF]

ReadRecord Response: Structure of the IOL_CALL (in Case of Error: Status Octet is 0x80)

If the status octet has the value 0x80, then the ISDU write request could not be executed, and the IOL_Data parameter contains IOL_Error_PDU with error numbers. The response has the following structure:

Table 160: Structure of the IOL_CALL (ReadRecord Response and in Case of Error)

Offset	Parameter Name	Description	Type	Value
0	Function	Fixed value Indicates a call header.	Unsigned8	0x08
1	Port	Port number	Unsigned8	0x01 ... 0x08
2	FI_Index	Fixed value for reasons of compatibility	Unsigned16	0xFE4A
4	Status	Status octet	Unsigned8	0x80: IOL_Error_PDU
5	IOL_Index	Object index of the IO-Link device that was not written to.	Unsigned16	0x0000 ... 0x7FFF
7	IOL_Subindex	Object subindex of the IO-Link device that was not written to.	Unsigned8	0x00 ... 0xFF
8 ... 11	IOL_Data	In the event of error, the status octet equals 0x80, and IOL_Error_PDU is stored here. IOL_Error_PDU contains multiple error codes for evaluation.	Unsigned32	See table "IOL_Error_PDU Coding."

14.1.1.3 Error Handling

In the event of an error, the 32-bit value IOL_Error_PDU contains information on the error and cause; see the following tables:

Table 161: IOL_Error_PDU Coding

Offset	Parameter	Contents	Data Type
0	Port Error	Port-specific error information; see "Port Error Coding." These error codes are identified by the linking module or the IO-Link client.	Unsigned16

Offset	Parameter	Contents	Data Type
2	Error code	IO-Link error codes	Unsigned8
3	Additional Code	Additional IO-Link error codes (Additional Code)	Unsigned8

Port Errors

Table 162: Port Errors (Error Codes)

Error code	Port Error	Description
0x0000	No error	No error detected
0x0001 ... 0x6FFF	Reserved	Reserved
0x7000	IOL_CALL conflict	Inconsistent header information
0x7001	Incorrect IOL_CALL	Inconsistent header information (send/receive)
0x7002	Port blocked	Potential temporarily unavailable
0x7003 ... 0x7FFF	Reserved	Reserved
0x8000	Timeout	IOL_CALL not terminated correctly (busy resource detected)
0x8001	Invalid port number	Invalid port number, or port not supported
0x8002	Invalid IOL_Index	Invalid index
0x8003	Invalid IOL_Subindex	Invalid subindex
0x8004	No device	No device detected
0x8005 ... 0x8050	Reserved	Reserved
0x8051	Decode error	Error detected while decoding the IOL_CALL request
0x8052	RDREC fault	Error when calling the read record
0x8053	WRREC fault	Error when calling the write record
0x8054	Unexpected error	Sequence error
0x8055	Function error	Port function failed (non-specific)
0x8056	Function not available	Port function unavailable
0x8057	Function not supported	Port function not supported (for this port)
0x8058 ... 0xFFFF	-	Manufacturer-specific

Error Code and Additional Code: Application-Specific Errors

The following table explains the possible combinations of error codes and additional codes for application-specific errors:

Table 163: Application-Specific Errors

Error code	Additional Code	Event	Error Name Description
0x80	0x00	Error in the device application – no details	APP_DEV This error type is used if the device application refused to execute the requested service and no detailed information about the event is available.
0x80	0x11	Index not available	IDX_NOTAVAIL This error type is used whenever an attempt is made to read from or write to a non-existent index.
0x80	0x12	Subindex not available	SUBIDX_NOTAVAIL This error type is used whenever an attempt is made to read from or write to a non-existent subindex.

Error code	Additional Code	Event	Error Name Description
0x80	0x20	Service temporarily unavailable	SERV_NOTAVAIL This error type is used if a parameter for a read or write service cannot be accessed due to the current state of the device application.
0x80	0x21	Service temporarily unavailable – local control	SERV_NOTAVAIL_LOCTRL This error type is used if a parameter cannot be accessed for a read or write service due to an ongoing local operation on the device (e.g., operation or parameterization via on-board device control panel).
0x80	0x22	Service temporarily unavailable – device control	SERV_NOTAVAIL_DEVCTRL This error type is used if a read or write service cannot be accessed due to a state of the device application caused externally (e.g., parameterization during a teach-in operation or calibration caused externally).
0x80	0x23	Access denied	IDX_NOT_WRITEABLE This error type is used if a service accesses a read-only parameter in order to write to it.
0x80	0x30	Parameter outside value range	PAR_VALOUTOFRNG This error type is used if a service receives a parameter outside its allowed range of values.
0x80	0x31	Parameter value exceeds limiting value	PAR_VALGTLM This error type is used if a write service receives a parameter above its specified value range.
0x80	0x32	Parameter value falls below limiting value	PAR_VALLTLM This error type is used if a write service receives a parameter below its specified value range.
0x80	0x33	Parameter length too large	VAL_LENVERRUN This error type is used if, in a write service to a parameter, the content is greater than the specified parameter length. This error type is also used if a data object is too large to be processed by the device application (e.g., due to an ISDU buffer size limit).
0x80	0x34	Parameter length too small	VAL_LENUNDRUN This error type is used if, for a write service to a parameter, the content is smaller than the specified parameter length (e.g., write access by an Unsigned16 value to an Unsigned32 parameter).
0x80	0x35	Function unavailable	FUNC_NOTAVAIL This error type is used for a write service if its command code is not supported by the device application (e.g., a system command with an unimplemented value).
0x80	0x36	Function temporarily unavailable	FUNC_UNAVAILTEMP This error type is used for a write service if its command code calls a device function that is unavailable due to the current state of the device application (e.g., a system command).
0x80	0x40	Invalid parameter set	PAR_SETINVALID This type of error is applied if values sent by an individual parameter transfer are incompatible with other current parameter settings.

Error code	Additional Code	Event	Error Name Description
0x80	0x41	Inconsistent parameter set	PAR_SETINCONSIST This error type is used if a block parameter transfer ends with with ParamDownloadEnd or ParamDownloadStore and the plausibility check identifies inconsistencies.
0x80	0x82	Application not ready	APP_DEVNOTRDY This error type is used if a read or write service is refused due to temporary unavailability of an application (e.g., a peripheral controller during startup).
0x81	0x00	Vendor-specific	UNSPECIFIC This error type is forwarded directly by the IO-Link master as an error (no warning) for processing at a higher level.
0x81	0x01 ... 0xFF	Vendor-specific	VENDOR_SPECIFIC This error type is forwarded directly by the IO-Link master as an error (no warning) for processing at a higher level.

Error Codes and Additional Codes: “Derived” Errors

The following table explains the possible combinations of error codes and additional codes for the “derived” errors:

Table 164: “Derived” Errors

Error code	Additional Code	Event	Error Name Description
0x10	0x00	IO-Link master – communication error	COM_ERR The IO-Link master generates a negative response for the service with this error type if a communication error occurs during the read or write service, e.g., an interruption of the SDCI connection.
0x11	0x00	IO-Link master – ISDU timeout	I-SERVICE_TIMEOUT The IO-Link master generates a negative response for the service for this error type if a read or write service waits longer than the specified I-Service timeout in the master.
0x11	0x00	Device event – ISDU error (DL)	I-SERVICE_TIMEOUT If the IO-Link master receives an event with event qualifier DL, error, event single shot and event code 0x5600, then a negative response is generated and returned, indicating a timeout of the service.
0x11	0x00	Device event – ISDU illegal service primitives (AL)	I-SERVICE_TIMEOUT If the IO-Link master receives an event with event qualifier AL, error, event single shot and event code 0x5800, then a negative response is generated and returned, indicating a timeout of the service.
0x56	0x00	IO-Link master – ISDU checksum error	M_ISDU_CHECKSUM The IO-Link master generates a negative response for the service for this error type if its data link layer (DLL) detects an ISDU checksum error.
0x57	0x00	IO-Link master – ISDU illegal service primitives	M_ISDU_ILLEGAL The IO-Link master generates a negative response for the service for this error type if its data link layer (DLL) detects an illegal ISDU service primitive.

Error code	Additional Code	Event	Error Name Description
0x80	0x33	Device event – ISDU buffer overflow (DL)	VAL_LENORRRUN If the IO-Link master receives an event with event qualifier DL, error, event single shot and event code 0x5200, then a negative response is generated and returned, indicating that the permissible parameter length of the service has been exceeded.

14.2 Load Management via PROFINET

This section shows you how to access important load management information from the PROFINET IO controller in read mode, and, in some cases, also in write mode. The following table shows which objects you can access via which index, slot and subslot values.

Table 165: List of Index Values for Query via PROFINET

Index	Object Name	Slot	Sub-slot	Access Rights	Description
0x0104	Device Info	2	1	r	Timestamp, total currents, temperature and voltage
0x0106	Statistic min / max	2	5 ..11	r	Minimum and maximum measured temperature since the last reset Minimum and maximum measured voltage on pins 1, 2 and 4 since the last reset Minimum and maximum measured current on pins 1, 2 and 4 since the last reset
0x0105	Connector statistic values	2	5 ..11	r	Number and duration of threshold underruns and overruns for minimum and maximum temperatures, voltages and currents
0x0107	Connector Values	2	5 ..11	r	Timestamp, device temperature, voltages and currents at the pins
0x0102	Statistic voltage level	2	5 .. 11	r / w	Lower and upper thresholds for temperature, voltages and currents Hysteresis level for temperature, voltage and current
0x0103	Connector diagnosis level	2	5 .. 11	r / w	Warning levels for current upper limits and current lower limits
0x0100	Load management enable analysis	2	1	r / w	Flags to turn statistics collection on and off separately for each individual port
0x0101	Load management clear port statistic	2	1	r / w	Flags to clear statistics collection separately for each individual port

14.2.1 Record 0x0102 (Statistic Voltage Level)

Via index 0x0102 (Statistic Voltage Level), you can set and read lower and upper threshold values for temperature, voltages and currents, as well as the hysteresis levels for temperature, voltage and current.

Table 166: Statistic Voltage Level (Index 0x0102)

Record Index	Slot	Subslot	Access	Description
0x0102	2	1	Read	Lower and upper thresholds for temperature, voltages and currents Hysteresis level for temperature, voltage and current

The parameters in the “Statistic Voltage Level” record can be both read and written under index 0x0102, slot 2, subslots 5 ... 11.

Table 167: Statistic Voltage Level – Data (Index 0x0102, Slot 2, Subslots 5 ... 11)

Parameter Name	Type	Values	Description	Unit
IOvertemperature	INT32	Default: 700 → 70 °C	Upper threshold for the temperature of a port	0.1 °C
IUndertemperature	INT32	Default: -250 → -25 °C	Lower threshold for the temperature of a port	0.1 °C
IOvervoltagePin1	INT32	Default: 30000 → 30 V	Upper threshold for the voltage on pin #1	mV
IUndervoltagePin1	INT32	Default: 18000 → 18 V	Lower threshold for the voltage on pin #1	mV
IOvervoltagePin2	INT32	Default: 30000 → 30 V	Upper threshold for the voltage on pin #2	mV
IUndervoltagePin2	INT32	Default: 18000 → 18 V	Lower threshold for the voltage on pin #2	mV
IOvervoltagePin4	INT32	Default: 30000 → 30 V	Upper threshold for the voltage on pin #4	mV
IUndervoltagePin4	INT32	Default: 18000 → 18 V	Lower threshold for the voltage on pin #4	mV
IOvercurrentPin1	INT32	<= 4000 (→ 4 A)	Upper threshold for the current on pin #1	mA
usTemperatureHysteresis	UINT16	20 → 2 °C	Temperature hysteresis If the temperature exceeds the threshold, the temperature must fall back below the threshold by the hysteresis value before the diagnostic is revoked.	0.1 °C
usVoltageHysteresis	UINT16	2000 → 2 V	Voltage hysteresis If the voltage exceeds the threshold, the voltage must fall back below the threshold by the hysteresis value before the diagnostic is revoked.	mV
usCurrentHysteresis	UINT16	500 → 500 mA	Current hysteresis If the current exceeds the threshold, the current must fall back below the threshold by the hysteresis value before the diagnostic is revoked.	mA

14.2.2 Record 0x0103 (Connector Diagnosis Level)

Via index 0x0103 (Connector Diagnosis Level), you can set and read out warning levels for current upper limits and current lower limits.

Table 168: Connector Diagnosis Level (Index 0x0103)

Record Index	Slot	Subslot	Access	Description
0x0103	2	1	Read/write	Set/read out warning levels for current upper limits and current lower limits

The parameters in the “Connector Diagnosis Level” record can be both read and written under index 0x0103, slot 2, subslots 5 ... 11.

Table 169: Connector Diagnosis Level – Data (Index 0x0103, Slot 2, Subslots 5 ... 11)

Parameter Name	Type	Values	Description	Unit
IOverCurrentPin1	INT32	0 <= IOverCurrent-Pin1 <= 4000 (→ 4 A)	Warning level for current upper limit on pin 1 0: monitoring not enabled	mA
IUnderCurrentPin1	INT32	0 <= IUnderCurrent-Pin1 <= 4000 (→ 4 A)	Warning level for current lower limit on pin 1 0: monitoring not enabled	mA
IOverCurrentPin2	INT32	0 <= IOverCurrent-Pin2 <= 2400 (→ 2.4 A) Recommendation: 2000 (→ 2 A)	Warning level for current upper limit on pin 2 0: monitoring not enabled	mA
IUnderCurrentPin2	INT32	0 <= IUnderCurrent-Pin2 <= 2000 (→ 2 A)	Warning level for current lower limit on pin 2 0: monitoring not enabled	mA
IOverCurrentPin4	INT32	0 <= IOverCurrent-Pin4 <= 2400 (→ 2.4 A) Recommendation: 2000 (→ 2 A)	Warning level for current upper limit on pin 4 0: monitoring not enabled	mA
IUnderCurrentPin4	INT32	0 <= IUnderCurrent-Pin4 <= 2000 (→ 2 A)	Warning level for current lower limit on pin 4 0: monitoring not enabled	mA

14.2.3 Record 0x0104 (Device Info)

Via index 0x0104 (Device Info), you can read out timestamps, total currents and temperature and voltage values.

Table 170: Device Information (Index 0x0104)

Record Index	Slot	Subslot	Access	Description
0x0104	2	1	Read	Timestamp, total currents, temperature and voltage

The parameters in the “Device Info” record can be read under index 0x0104, slot 2, subslot 1.

Table 171: Device Information – Data (Index 0x0104, Slot 2, Subslot 1)

Parameter Name	Type	Values	Description	Unit
ullTimestamp	UINT64	TDB	Timestamp Format: The upper dword contains the number of seconds since 1970-01-01; the lower dword contains the number of nanoseconds elapsed	s/ns
ISumCurrentL	INT32	0 ... 16000 (0 ... 16 A)	Total current, 1L Total current in supply cable 1 calculated from individual measurements	mA

Parameter Name	Type	Values	Description	Unit
ISumCurrentL2	INT32	0 ... 16000 (0 ... 16 A)	Total current, 2L Total current in supply cable 2 calculated from individual measurements	mA
IMeanTemperature	INT32	<= 105 (105 °C) >= -40 (-40 °C)	Temperature average Average value for the temperature of the subassembly, calculated from the temperature values measured individually on the three chips	°C
IMeanVoltageL	INT32	0 ... 34000 (0 ... 34 V)	Voltage average, 1L Average voltage in supply cable 1	mV
IMeanVoltageL2	INT32	0 ... 34000 (0 ... 34 V)	Voltage average, 2L Average voltage in supply cable 2	mV

14.2.4 Record 0x0105 (Connector Statistic Values)

Via index 0x0105 (Connector Statistic Values), you can read out the number and duration of the limiting value underruns and limiting value overruns for minimum and maximum temperatures, voltages and currents.

Table 172: Connector Statistic Values (Index 0x0105)

Record Index	Slot	Subslot	Access	Description
0x0105	2	1	Read	Number and duration of the limiting value underruns and overruns for minimum and maximum temperatures, voltages and currents

The parameters in the “Connector Statistic Values” record can be read under index 0x0105, slot 2, subslots 5 ... 11.

The following table lists port-specific counters and durations for limiting values overruns and underruns for current, temperature and voltage. The counters and durations are valid for the supply connection (pin 1) of the port. The counters and durations for pins 2 and 4 are only valid if this pin is operated in “Static on” operating mode.

Table 173: Connector Statistic Values – Data (Index 0x0105, Slot 2, Subslots 5 ... 11)

Parameter Name	Type	Values	Description	Unit
ulMinTemperature-Count	uint32	0 ... 4294967295 (0xFFFFFFFF)	Counter for the lower limiting value underruns for the temperature on a port since the last reset.	Counter
ulMaxTemperature-Count	uint32	0 ... 4294967295 (0xFFFFFFFF)	Counter for the upper limiting value overruns for the temperature on a port since the last reset.	Counter
ulMinTemperature-Duration	uint32	0 ... 4294967295 (0xFFFFFFFF)	Duration of the lower limiting value underrun for the temperature on a port. Timing restarts every time an underrun occurs.	s
ulMaxTemperature-Duration	uint32	0 ... 4294967295 (0xFFFFFFFF)	Duration of the upper limiting value overrun for the temperature on a port. Timing restarts every time an overrun occurs.	s
ulMinVoltagePin1-Count	uint32	0 ... 4294967295 (0xFFFFFFFF)	Counter for the lower limiting value underruns for the voltage on pin 1 since the last reset.	Counter
ulMaxVoltagePin1-Count	uint32	0 ... 4294967295 (0xFFFFFFFF)	Counter for the upper limiting value overruns for the voltage on pin 1 since the last reset.	Counter

Parameter Name	Type	Values	Description	Unit
ulMinVoltagePin1Duration	uint32	0 ... 4294967295 (0xFFFFFFFF)	Duration of the lower limiting value under-run for the voltage on pin 1. Timing restarts every time an underrun occurs.	s
ulMaxVoltagePin1Duration	uint32	0 ... 4294967295 (0xFFFFFFFF)	Duration of the upper limiting value overrun for the voltage on pin 1. Timing restarts every time an overrun occurs.	s
ulMinVoltagePin2Count	uint32	0 ... 4294967295 (0xFFFFFFFF)	Counter for the lower limiting value under-runs for the voltage on pin 2 since the last reset.	Counter
ulMaxVoltagePin2Count	uint32	0 ... 4294967295 (0xFFFFFFFF)	Counter for the upper limiting value over-runs for the voltage on pin 2 since the last reset.	Counter
ulMinVoltagePin2Duration	uint32	0 ... 4294967295 (0xFFFFFFFF)	Duration of the lower limiting value under-run for the voltage on pin 2. Timing restarts every time an underrun occurs.	s
ulMaxVoltagePin2Duration	uint32	0 ... 4294967295 (0xFFFFFFFF)	Duration of the upper limiting value overrun for the voltage on pin 2. Timing restarts every time an overrun occurs.	s
ulMinVoltagePin4Count	uint32	0 ... 4294967295 (0xFFFFFFFF)	Counter for the lower limiting value under-runs for the voltage on pin 4 since the last reset.	Counter
ulMaxVoltagePin4Count	uint32	0 ... 4294967295 (0xFFFFFFFF)	Counter for the upper limiting value over-runs for the voltage on pin 4 since the last reset.	Counter
ulMinVoltagePin4Duration	uint32	0 ... 4294967295 (0xFFFFFFFF)	Duration of the lower limiting value under-run for the voltage on pin 4. Timing restarts every time an underrun occurs.	s
ulMaxVoltagePin4Duration	uint32	0 ... 4294967295 (0xFFFFFFFF)	Duration of the upper limiting value overrun for the voltage on pin 4. Timing restarts every time an overrun occurs.	s
ulMinCurrentPin1Count	uint32	0 ... 4294967295 (0xFFFFFFFF)	Counter for the lower limiting value under-runs for the current on pin 1 since the last reset.	Counter
ulMaxCurrentPin1Count	uint32	0 ... 4294967295 (0xFFFFFFFF)	Counter for the upper limiting value over-runs for the current on pin 1 since the last reset.	Counter
ulMinCurrentPin1Duration	uint32	0 ... 4294967295 (0xFFFFFFFF)	Duration of the lower limiting value under-run for the current on pin 1. Timing restarts every time an underrun occurs.	s
ulMaxCurrentPin1Duration	uint32	0 ... 4294967295 (0xFFFFFFFF)	Duration of the upper limiting value overrun for the current on pin 1. Timing restarts every time an overrun occurs.	s
ulMinCurrentPin2Count	uint32	0 ... 4294967295 (0xFFFFFFFF)	Counter for the lower limiting value under-runs for the current on pin 2 since the last reset.	Counter
ulMaxCurrentPin2Count	uint32	0 ... 4294967295 (0xFFFFFFFF)	Counter for the upper limiting value over-runs for the current on pin 2 since the last reset.	Counter
ulMinCurrentPin2Duration	uint32	0 ... 4294967295 (0xFFFFFFFF)	Duration of the lower limiting value under-run for the current on pin 2. Timing restarts every time an underrun occurs.	s
ulMaxCurrentPin2Duration	uint32	0 ... 4294967295 (0xFFFFFFFF)	Duration of the upper limiting value overrun for the current on pin 2. Timing restarts every time an overrun occurs.	s

Parameter Name	Type	Values	Description	Unit
ulMinCurrentPin4-Count	uint32	0 ... 4294967295 (0xFFFFFFFF)	Counter for the lower limiting value under-runs for the current on pin 4 since the last reset.	Counter
ulMaxCurrentPin4-Count	uint32	0 ... 4294967295 (0xFFFFFFFF)	Counter for the upper limiting value over-runs for the current on pin 4 since the last reset.	Counter
ulMinCurrentPin4Duration	uint32	0 ... 4294967295 (0xFFFFFFFF)	Duration of the lower limiting value under-run for the current on pin 4. Timing restarts every time an underrun occurs.	s
ulMaxCurrentPin4Duration	uint32	0 ... 4294967295 (0xFFFFFFFF)	Duration of the upper limiting value overrun for the current on pin 4. Timing restarts every time an overrun occurs.	s

All counters run without restriction over the full 32 bit value range from 0 to 4294967295 (0xFFFFFFFF). In the event of counter overflow, the value jumps back to 0.

The firmware checks the measured values for overrun/underrun every 1.2 s.

14.2.5 Record 0x0106 (Statistic Min / Max)

Via index 0x0106 (Statistics min / max), you can read out minimum and maximum measured temperatures, voltages and currents.

Table 174: Statistics Min / Max (Index 0x0106)

Record Index	Slot	Subslot	Access	Description
0x0106	2	1	Read	Minimum and maximum measured temperature since the last reset Minimum and maximum measured voltage on pins 1, 2 and 4 since the last reset Minimum and maximum measured current on pins 1, 2 and 4 since the last reset

The parameters in the “Statistics min / max” record can be read under index 0x0106, slot 2, subslots 5 ... 11.

Table 175: Statistics Min / Max – Data (Index 0x0106, Slot 2, Subslots 5 ... 11)

Parameter Name	Type	Values	Description	Unit
IMinTemperature	int32	-250 (-25 °C) d IMinTemperature	Minimum measured temperature since the last reset	0.1 °C
IMaxTemperature	int32	IMaxTemperature ≤ 1050 (-105 °C)	Maximum measured temperature since the last reset	0.1 °C
IMinVoltagePin1	int32	IMinVoltagePin1 ≥ 15500 → 15.5 V	Minimum measured voltage on pin 1 since the last reset	mV
IMaxVoltagePin1	int32	IMaxVoltagePin1 ≤ 34000 → 34 V	Maximum measured voltage on pin 1 since the last reset	mV
IMinVoltagePin2	int32	IMinVoltagePin2 ≥ 15500 → 15.5 V	Minimum measured voltage on pin 2 since the last reset	mV
IMaxVoltagePin2	int32	IMaxVoltagePin2 ≤ 34000 → 34 V	Maximum measured voltage on pin 2 since the last reset	mV
IMinVoltagePin4	int32	IMinVoltagePin4 ≥ 15500 → 15.5 V	Minimum measured voltage on pin 4 since the last reset	mV
IMaxVoltagePin4	int32	IMaxVoltagePin4 ≤ 34000 → 34 V	Maximum measured voltage on pin 4 since the last reset	mV

Parameter Name	Type	Values	Description	Unit
IMinCurrentPin1	int32	IMinCurrentPin1 ≥ 0	Minimum measured current on pin 1 since the last reset	mA
IMaxCurrentPin1	int32	IMaxCurrentPin1 ≤ 4000 ($\rightarrow 4$ A)	Maximum measured current on pin 1 since the last reset,	mA
IMinCurrentPin2	int32	IMinCurrentPin2 ≥ 0	Minimum measured current on pin 2 since the last reset	mA
IMaxCurrentPin2	int32	IMaxCurrentPin2 ≤ 4000 ($\rightarrow 4$ A)	Maximum measured current on pin 2 since the last reset	mA
IMinCurrentPin4	int32	IMinCurrentPin4 ≥ 0	Minimum measured current on pin 4 since the last reset	mA
IMaxCurrentPin4	int32	IMaxCurrentPin4 ≤ 4000 ($\rightarrow 4$ A)	Maximum measured current on pin 4 since the last reset	mA
ullTimestamp-MinTemperature	uint64	-	Timestamp of minimum temperature on a pin	s/ns
ullTimestampMax-Temperature	uint64	-	Timestamp of maximum temperature on a pin	s/ns
ullTimestampMin-VoltagePin1	uint64	-	Timestamp of minimum voltage on pin 1	s/ns
ullTimestampMax-VoltagePin1	uint64	-	Timestamp of maximum voltage on pin 1	s/ns
ullTimestampMin-VoltagePin2	uint64	-	Timestamp of minimum voltage on pin 2	s/ns
ullTimestampMax-VoltagePin2	uint64	-	Timestamp of maximum voltage on pin 2	s/ns
ullTimestampMin-VoltagePin4	uint64	-	Timestamp of minimum voltage on pin 4	s/ns
ullTimestampMax-VoltagePin4	uint64	-	Timestamp of maximum voltage on pin 4	s/ns
ullTimestampMinCurrentPin1	uint64	-	Timestamp of minimum current on pin 1	s/ns
ullTimestampMax-CurrentPin1	uint64	-	Timestamp of maximum current on pin 1	s/ns
ullTimestampMinCurrentPin2	uint64	-	Timestamp of minimum current on pin 2	s/ns
ullTimestampMax-CurrentPin2	uint64	-	Timestamp of maximum current on pin 2	s/ns
ullTimestampMinCurrentPin4	uint64	-	Timestamp of minimum current on pin 4	s/ns
ullTimestampMax-CurrentPin4	uint64	-	Timestamp of maximum current on pin 4	s/ns

14.2.6 Record 0x0107 (Connector Values)

Via index 0x0107 (Connector Values), you can read out timestamps, device temperature, voltages and currents at the pins.

Table 176: Connector Values (Index 0x0107)

Record Index	Slot	Subslot	Access	Description
0x0107	2	1	Read	Timestamp, device temperature, voltages and currents at the pins

These records can be used to read out the measured values determined at the port. All values are read-only and available for all ports.

Table 177: Connector Values Data (Index 0x0107, Slot 2, Subslots 5 ... 11)

Parameter Name	Type	Values	Description	Unit
ulValidFlags	Boolean32	(Flags)	Flags for validity (internal)	(Flags)
ullTimestamp	UINT64	-	Timestamp Format: The upper dword contains the number of seconds since 1970-01-01. The lower dword contains the number of nanoseconds elapsed.	s/ns
ITemperature	INT32	ITemperature $\leq$ 1050 → 105 °C	Device temperature in 0.1 °C increments	0.1 °C
IVoltagePin1	INT32	IVoltagePin1 $\geq$ 15500 → 15.5 V IVoltagePin1 $\leq$ 34000 → 34 V	Voltage measured on pin 1	mV
IVoltagePin2	INT32	IVoltagePin2 $\geq$ 15500 → 15.5 V IVoltagePin2 $\leq$ 34000 → 34 V	Voltage measured on pin 2	mV
IVoltagePin4	INT32	IVoltagePin4 $\geq$ 15500 → 15.5 V IVoltagePin4 $\leq$ 34000 → 34 V	Voltage measured on pin 4	mV
ICurrentPin1	INT32	ICurrentPin1 $\geq$ 0 ICurrentPin1 $\leq$ 4000 (→ 4 A)	Current measured on pin 1	mA
ICurrentPin2	INT32	ICurrentPin2 $\geq$ 0 ICurrentPin2 $\leq$ 4000 (→ 4 A)	Current measured on pin 2	mA
ICurrentPin4	INT32	ICurrentPin4 $\geq$ 0 ICurrentPin4 $\leq$ 4000 (→ 4 A)	Current measured on pin 4	mA

14.2.7 Record 0x0100 (Load Management Enable Analysis)

Via index 0x0100 (Load Management Enable Analysis), you can set and read the flags for switching on and off statistics collection separately for each individual port.

Table 178: Load Management Enable Analysis (Index 0x0100)

Record Index	Slot	Subslot	Access	Description
0x0100	2	1	Read/write	Flags to turn statistics collection on and off separately for each individual port

The parameters in the “Load management enable analysis” record can be both read and written under index 0x0100, slot 2, subslot 1.

Table 179: Load Management Clear Port Statistic - Data (Index 0x0100, Slot 2, Subslot 1)

Parameter Name	Bit Position Byte/Bit	Values	Description	Format
Port#1	0 - 0	Enable (=1) / Disable (=0)	Load management and statistical functions	(Flag)

Parameter Name	Bit Position Byte/Bit	Values	Description	Format
Port#2	0 - 1	Enable (=1) / Disable (=0)	Load management and statistical functions	(Flag)
Port#3	0 - 2	Enable (=1) / Disable (=0)	Load management and statistical functions	(Flag)
Port#4	0 - 3	Enable (=1) / Disable (=0)	Load management and statistical functions	(Flag)
Port#5	0 - 4	Enable (=1) / Disable (=0)	Load management and statistical functions	(Flag)
Port#6	0 - 5	Enable (=1) / Disable (=0)	Load management and statistical functions	(Flag)
Port#7	0 - 6	Enable (=1) / Disable (=0)	Load management and statistical functions	(Flag)
Port#8	0 - 7	Enable (=1) / Disable (=0)	Load management and statistical functions	(Flag)
Reserved	2 - 0 to 3 - 7			

14.2.8 Record 0x0101 (Load Management Clear Port Statistic)

Using index 0x0101 (Load Management Clear Port Statistic), you can set and read the flags for clearing the statistics collection separately for each individual port.

Statistics are only cleared if the port's load management enable flag is switched on, since the minimum values must be calculated before resetting. The clear flag is automatically reset after the clearing process is completed.

Table 180: Load Management Clear Port Statistic (Index 0x0101)

Record Index	Slot	Subslot	Access	Description
0x0101	2	1	Read/write	Flags for clearing statistics collection separately for each individual port

The parameters in the “Load Management Clear Port Statistic” record can be both read and written under index 0x0101, slot 2, subslot 1.

Table 181: Load Management Clear Port Statistic – Data (Index 0x0101, Slot 2, Subslot 1)

Parameter Name	Bit Position Byte/Bit	Values	Description	Format
Port#1	0 - 0	Clear (=1) / not clear (=0)	Load management – clear port statistic	(Flag)
Port#2	0 - 1	Clear (=1) / not clear (=0)	Load management – clear port statistic	(Flag)
Port#3	0 - 2	Clear (=1) / not clear (=0)	Load management – clear port statistic	(Flag)
Port#4	0 - 3	Clear (=1) / not clear (=0)	Load management – clear port statistic	(Flag)
Port#5	0 - 4	Clear (=1) / not clear (=0)	Load management – clear port statistic	(Flag)
Port#6	0 - 5	Clear (=1) / not clear (=0)	Load management – clear port statistic	(Flag)

Parameter Name	Bit Position Byte/Bit	Values	Description	Format
Port#7	0 - 6	Clear (=1) / not clear (=0)	Load management – clear port statistic	(Flag)
Port#8	0 - 7	Clear (=1) / not clear (=0)	Load management – clear port statistic	(Flag)
Reserved	2 - 0 to 3 - 7			

14.3 Installation Regulations Specified by Approvals

Because the following information refers to language-specific regulations, standards or certifications applicable to the specific installation and operation location, it is presented in the respective original language.

EU Declaration of Conformity

Hereby, WAGO GmbH & Co. KG declares that the radio equipment type 765-4102/100-000 is in compliance with Directive 2014/53/EU. The full text of the EU declaration of conformity is available at the following internet address:

 [www.wago.com /765-4102/100-000](https://www.wago.com/765-4102/100-000).

FCC/ISED

Legal information:

Radiofrequency radiation exposure Information: This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

NOTICE: This device complies with Part 15 of the FCC Rules and contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS standard(s). Operation is subject to the following two conditions:

1. this device may not cause harmful interference, and
2. this device must accept any interference received, including interference that may cause undesired operation.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

1. l'appareil ne doit pas produire de brouillage, et
2. l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Changes or modifications made to this equipment not expressly approved by WAGO GmbH & Co. KG may void the FCC authorization to operate this equipment.

14.4 Regulation-specific safety information for the French-speaking regions

The following information applies to the use of the product in French-speaking regions and is therefore only given in the original language.

Sécurité électrique

Alimentation:

- Utilisez des alimentations SELV/PELV en cas de tensions actives non dangereuses conformément à la norme EN/UL/CEI 61010-1.
- Pour différentes alimentations, faites attention aux plages de tension et de fréquence admissibles des produits.
- L'activation de valeurs de tension ou de fréquence non autorisées peut entraîner la destruction de l'appareil.
- Lors de la planification, veiller à ce que le courant de passage maximal d'une ligne d'alimentation ne soit pas dépassé.
- Pour la protection contre les surcharges, prendre les mesures de protection appropriées (par ex. un fusible externe).

Mise à la terre/protection (contre la foudre)/fusible:

- Connectez le produit et l'installation à la terre fonctionnelle (FE).
- Lors de l'utilisation du produit, veillez à la compensation de potentiel de l'environnement (personnes, poste de travail et emballage). Ne touchez pas aux composants conducteurs.
- Protégez le produit avec un fusible adapté.

Câbles:

- Posez les lignes de contrôle/signal/données séparément des lignes d'alimentation pour minimiser l'interférence (par ex. par des influences électromagnétiques).
- Concevez toujours les câbles de raccordement pour la charge électrique maximale.

Protection:

- Lors de travaux sur l'installation (par ex. lors d'une maintenance), sécurisez la partie concernée de l'installation contre toute remise en marche involontaire ou sans autorisation.

Sécurité mécanique

- Avant la mise en service du produit, assurez-vous qu'il ne présente pas d'éventuels dommages causés par le transport. Le produit ne doit pas être mis en service s'il est endommagé.
- Refermer les connexions non utilisées avec des capots de protection.

Sécurité thermique

- Pendant le fonctionnement, la surface du boîtier se réchauffe. Dans des conditions spéciales (p. ex. en cas de panne ou d'augmentation de la température ambiante), tout contact avec le produit peut provoquer des brûlures. Laissez le produit refroidir avant de le toucher.
- Si la température superficielle du produit peut dépasser 55 °C, porter des gants de protection et appliquer des couvercles de protection ou une protection contre les contacts accidentels.
- Il convient de ne pas entraver le refroidissement de l'appareil. Assurer une circulation d'air libre.

Sécurité indirecte

- Nettoyez le produit uniquement avec un chiffon doux, sec ou humidifié à l'eau. N'utilisez pas de détergents, comme par ex. des abrasifs, de l'alcool, de l'acétone.
- Ne mettez en aucun cas le produit en contact avec des cétones (par exemple l'acétone) et des hydrocarbures chlorés (par exemple le dichlorométhane).
- Ne pas utiliser pour le nettoyage d'objets durs susceptibles de provoquer des rayures.
- De manière générale, utilisez des outils et du matériel propres pour manipuler le produit.
- Si des solutions d'automatisation sont mises en œuvre qui peuvent provoquer des blessures corporelles ou des dommages matériels majeurs en cas de panne, vous devez prendre les mesures appropriées pour vous assurer que le système reste dans un état de fonctionnement sûr même en cas de panne.
- Prendre des mesures appropriées, externes et indépendantes pour éviter des dommages corporels ou matériels dans des applications à risques correspondants.
- Faites uniquement appel à un personnel spécialisé homologué par WAGO pour les travaux de réparation.

14.5 Operational Description

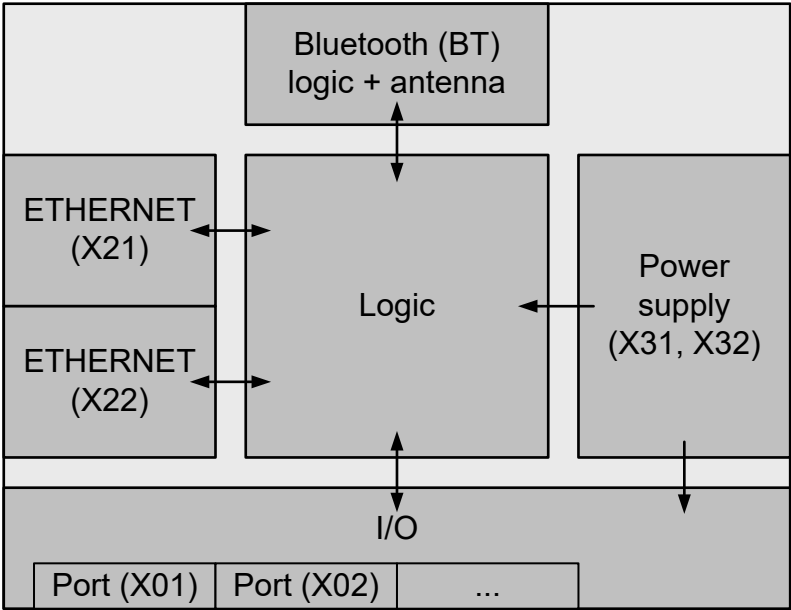
Product Description

The product 765-4102/100-000 is used to capture field signals on sensors, actuators and hubs which have been sent or received by a higher-level controller and output them via IO-Link.

Description of operation (FCC)

The product, a fieldbus module in the IP67 housing, serves the acquisition and output of data via sensors and actuators for the industrial control technology. The integrated Bluetooth® interface of the product allows the parameterization, operation, diagnosis, and monitoring using a mobile device and the WAGO App I/O Field.

The following figure shows the block diagram of the module.



Bluetooth® Transmitter

Table 182: Bluetooth® Transmitter

Technology used	Bluetooth® Low Energy
Modulation	GFSK
Data rate	1 Mbit/s
Work frequency	2402 ... 2480 MHz
Maximum power including tune up tolerance	Output power: +8 dBm Tolerance: +2 dBm / –3 dBm
Antenna type	PCB monopole
Maximum antenna gain	1.25 dBi

We declare that we meet the EN 62479 standard with respect to the limiting value for low powers less than 20 mW. Therefore, the product fundamentally corresponds to the European limiting values for high-frequency radiation.

Product Designs

SlimLine (W × H × D)	35 × 30 × 210 mm
WideLine (W × H × D)	60 × 30 × 210 mm

Temperature Ranges

Table 183: Temperature Ranges

Ambient temperature (operation)	–25 °C ... +70 °C
Ambient temperature (storage)	–40 °C ... +80 °C
Maximum temperature change	3 K/min

Voltage Ranges

Table 184: Voltage Ranges

Power source	24 VDC PELV (Protective Extra Low Voltage) or SELV (Safety Extra Low Voltage)
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Voltage 1L	24 VDC, -25 %/+30 % (18 VDC ... 31.2 VDC)
Voltage 2L	
Digital output	Output voltage: 24 VDC, 1L powered
Actuator/sensor power supply	Output voltage: 24 VDC, 1L powered and 2L powered
Overvoltage category	II (EN 60664-1)

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