

WAGO I/O System Field

4-Channel Analog Input RTD/TC + 4-Port IO Link Master Class A;
PROFINET; 24 VDC; 2.0 A; 8 × M12 Connection

765-2102/100-000



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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

1.1 Gültigkeitsbereich

This document applies to the following product:

🔗 **765-2102/100-000** (4AI RTD/TC + 4PORT IOL-A FLD PN DC 24V 2.0A) 4-Channel Analog Input RTD/TC + 4-Port IO Link Master Class A; PROFINET; 24 VDC; 2.0 A; 8 × M12 Connection

Product Detail Page

🔗 www.wago.com/765-2102/100-000

Note

Note applicable documents!

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

Applicable document

Cybersecurity Manual

- Threats
- Vulnerabilities in Network Access
- Vulnerabilities in Physical Access
- Potential Targets
- Hardening and Cybersecurity Capabilities

Additional document

-  **WAGO IO-Link Configurator**

1.2 Intended Use

The 765-2102/100-000 product is used to capture analog signals, as well as to capture field signals that have been sent or received by a higher-level controller and output them via IO-Link to sensors, actuators and hubs.

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.

Improper use occurs in particular in the following cases:

- 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
- Implementation of a Known Misuse
- 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 und software embedded in WAGO hardware products, both available at: www.wago.com.

In particular, the warranty is void when:

- The product is improperly used.
- The defect is based on (customer-)specific specifications (hardware and software configurations).
- Modifications of the hardware or software by the user or third parties were made that are not described in this documentation and are at least responsible for the occurrence of the defect.

Individual agreements always take precedence.

Obligations of the installer/operator

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 the safety of the system. It must comply with the laws, standards, guidelines, local regulations, the state and the rules of technology applicable at the time of installation and must observe the guidelines and instructions described in the operating instructions. The installation requirements of the approvals must also be met.

In the event of non-compliance, operation of product within the scope of the approval is not permitted.

1.3 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

Links

	Link to a topic in a document
	Link to a separate document
	Link to a website
	Link to an email address
Glossary	Link to a glossary entry

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.

1.4 Legal Information

Intellectual property

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Third-party trademarks are referred to in the product documentation. The "®" and "™" symbols are omitted hereinafter. The trademarks are listed in the Appendix:  **Protected Rights** [\[> 279\]](#).

Subject to Change

The instructions, guidelines, standards, etc., in this manual correspond to state of the art at the time the documentation was created and are not subject to updating service. The installer and operator bear sole responsibility to ensure they are complied with in their currently applicable form. WAGO GmbH & Co. KG retains the right to carry out technical changes and improvements of the products and the data, specifications and illustrations of this manual. All claims for change or improvement of products that have already been delivered – excepting change or improvement performed under guarantee agreement – are excluded.

Licenses

The product contains open-source software. The requisite license information is saved in the product. This information is also available under [🔗 www.wago.com](https://www.wago.com).

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, diagnostics, testing and firmware update functions
- Backup/restore
- Substitute values
- Shared Device
- MRP client
- Total current monitoring
- Integrated MQTT client
- Integrated OPC UA server in compliance with "IO-Link Companion Specification," expanded to include diagnostic functions
- Four connections
 - IO-Link Master Class A
 - Pin 4, configurable as an IO-Link Master, digital input or digital output
 - Pin 2, configurable as a digital input or digital output
- Four connections
 - Temperature measurement: resistance thermometer or thermocouple
 - Resistance measurement, PTC or potentiometer
 - Voltage measurement

For ports X01 to X04:

- Force function: forcing output signals, simulating input signals
- Measured values for each channel
 - Output and supply current
 - Supply voltage
 - Temperature measurement
- Monitoring functions for each channel
 - Maximum current
 - Over- and undervoltage
 - Over- and undertemperature
 - Line break detection
- Protective functions: shutdown of the switching or supply outputs if the maximum current at this pin is exceeded

For ports X05 to X08:

- Force function: simulation of input signals and status word

- Measured values for each channel
- User limiting value
- Scaling function
- Calibration function

4 Properties

4.1 View

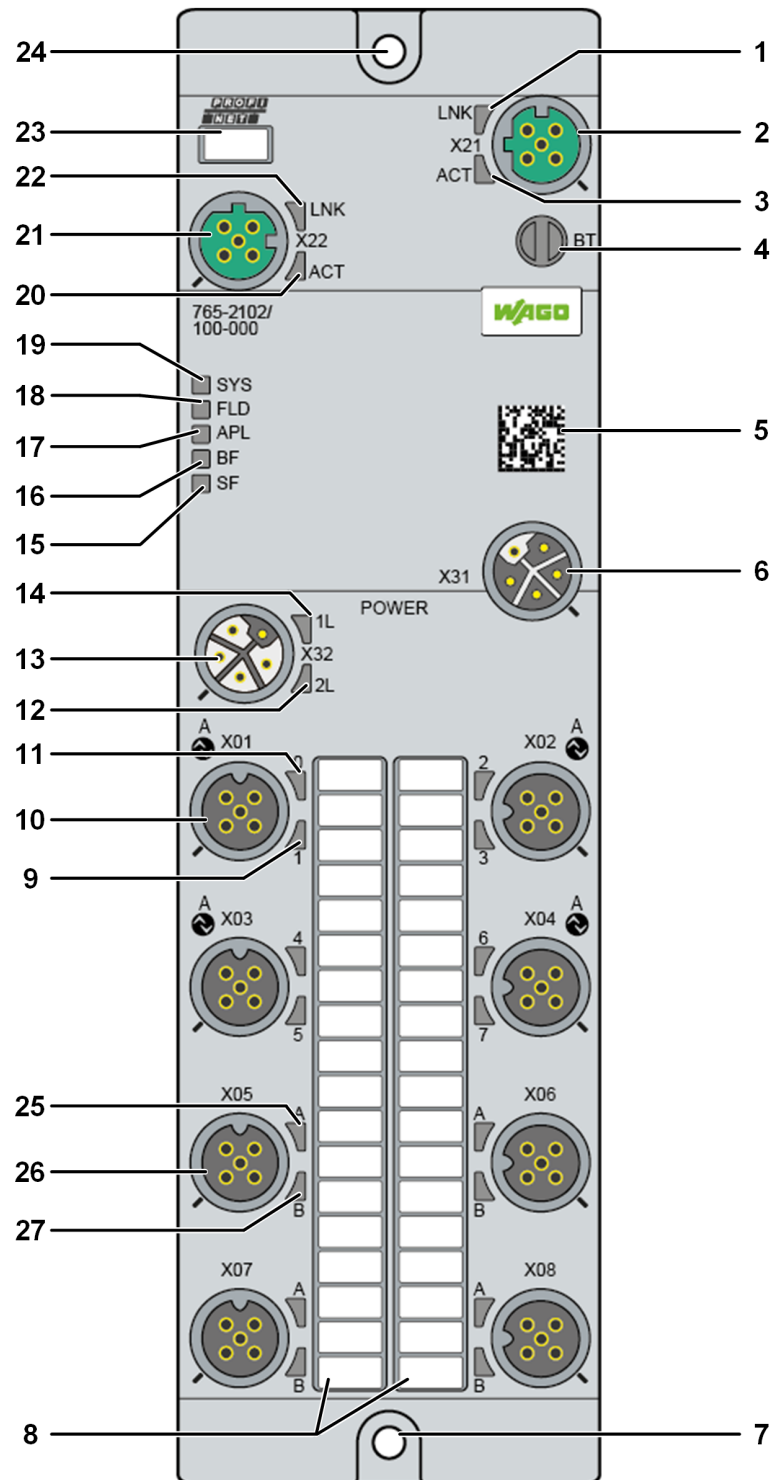


Figure 1: View

Function	Position	Designation	Description
ETHERNET	2	X21	ETHERNET interface, M12, D-coded, PROFINET port 1
	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 A	10	X01 ... X04	IO-Link port, Ports X01 ... X04, M12, A-coded
	9	1, 3, 5, 7	IO-Link port LEDs for ports X01 ... X04, channel B (pin 2)
	11	0, 2, 4, 6	IO-Link port LEDs for ports X01 ... X04, IO-Link or channel A (pin 4)
Analog inputs (1L powered)	26	X05 ... X08	Analog inputs, ports X05 ... X08, M12-A coded
	25	A	Port LED for ports X05 ... X08, operational readiness of port
	27	B	Port LED for ports X05 ... X08, port errors
Marking	8	-	Port marking (WMB Inline and marking strips)
	23	-	Module marking (WMB Inline)
Assembly	7	-	Mounting hole for front or side mounting
	24	-	Mounting hole for front or side mounting

4.2 Product Identification

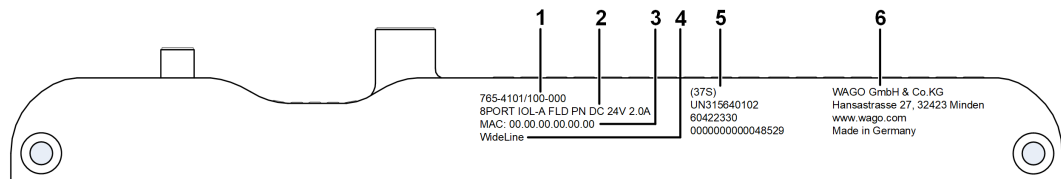


Figure 2: Type Plate, Left Side (Example View)

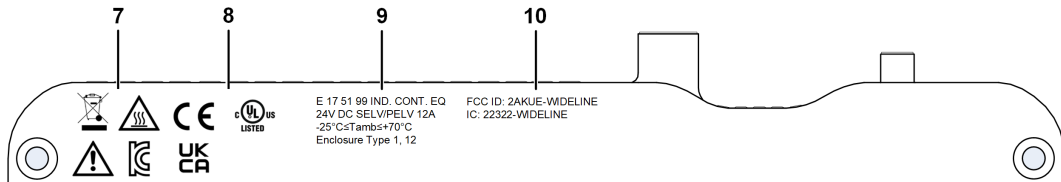


Figure 3: Type Plate, Right Side (Example View)

No.	Description
1	Item number
2	Product name
3	MAC address of the module
4	Module type
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 1: 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. 256] .
	"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 mark 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.

Symbol	Designation	Description
	"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 2: 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 ... 7	IO-Link port status LEDs
A, B	Analog port status LEDs

The meanings of the status indications are described section [🔗 Diagnostics via Indicators \[p. 240\]](#).

4.4 Connections

4.4.1 Versorgungsspannung (X31, X32)

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

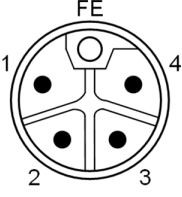
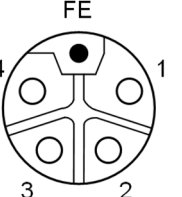
- Supply cable 1: 1L+ (U_{1L}) and reference potential 1L–
- Supply cable 2: 2L+ (U_{2L}) and reference potential 2L–

The two supply cables are electrically isolated from each other and from 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.

The device only forwards supply line 2L from X31 to X32 and does not require supply voltage 2L for operation.

Table 3: 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}
		FG	FG	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)

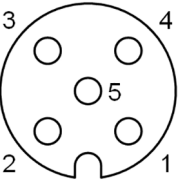
Before connecting one or more products to the power supply on socket X32 (Power out), read section [Connection Examples](#) [► 155]. There you will find information on the maximum permitted current consumption.

4.4.2 Analog Inputs (X05 ... X08)

The following table shows the assignment of the analog inputs (X05 to X08). The following sensors can be connected to the analog inputs:

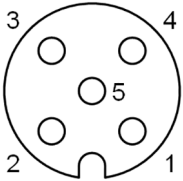
- Resistance temperature detector (RTD) in 2-/3-/4-wire connection technology
- Thermocouple (TC) in 2-wire connection technology
- Ohmmeter in 2-wire connection technology
- PTC in 2-wire connection technology
- Potentiometer in 3-wire connection technology or
- Millivolt sensor in 2-wire connection technology

Table 4: Analog Inputs

AI Port	Pin	2-Wire: RTD, Resistance, PTC	3-Wire: RTD, Potentiometer	4-Wire: RTD	2-Wire: TC	2-Wire: Voltage
	1	Measurement input R+	Measurement input R+	Measurement input R+	-	-
	2	-	Measurement input RL+	Measurement input RL+	Thermocouple +	Millivolt sensor +
	3	Measurement input R-	Measurement input R-	Measurement input R-	-	-
	4	-	-	Measurement input RL-	Thermocouple -	Millivolt sensor -
	5	Not connected	Not connected	Not connected	Not connected	Not connected
M12, A-coded, socket, 5-pin						

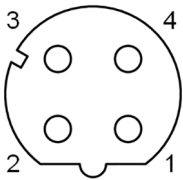
4.4.3 Communication Interfaces (X01 ... X04)

Table 5: IO-Link (Class A)

IO-Link (Class A)	Pin	Signal	Description
 M12, A-coded, socket, 5-pin	1	1L+	24 VDC supply voltage U_{1L} for sensor/actuator
	2	DIO B (DI B/DQ B)	Digital input/output channel B
	3	1L–	Reference potential for 1L+
	4	C/Q DIO A (DI A/DQ A)	IO-Link data or digital input/output channel A
	5	n. c.	Not connected

4.4.4 Network Interfaces (X21 ... X22)

Table 6: 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.

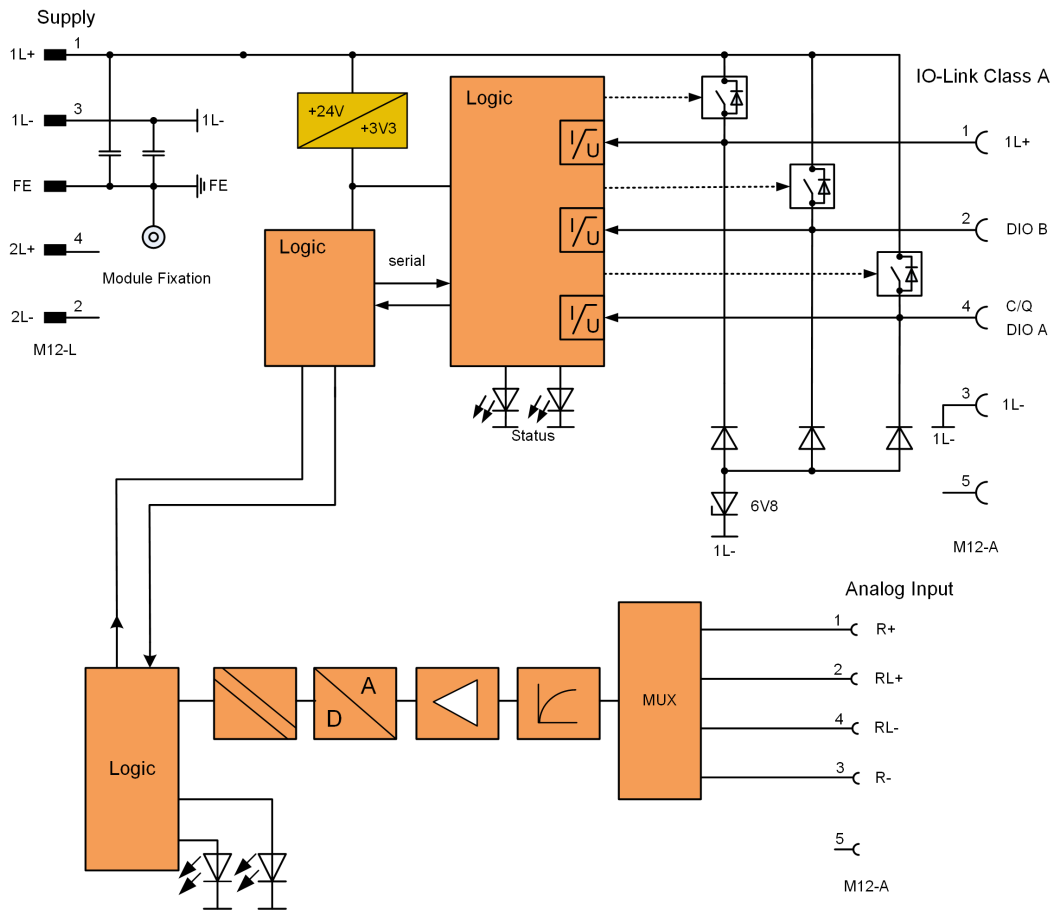


Figure 4: Circuit Diagram for Each Port

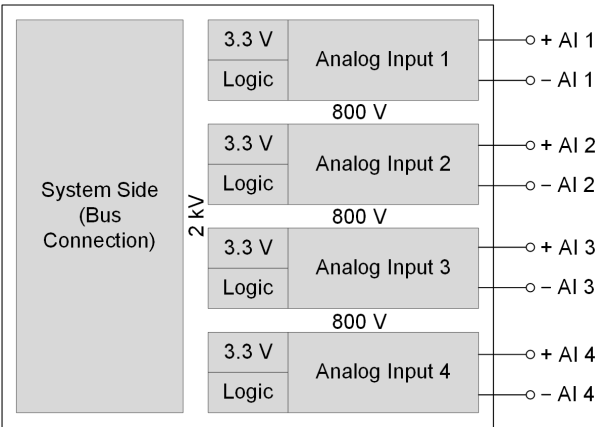


Figure 5: Galvanic Isolation

4.6 Technical Data

4.6.1 Product

Table 7: Product

Property	Value
Item number	765-2102/100-000
Product function	4-Kanal-Analogeingang RTD/TC + 4-Port-IO Link Master Class A
Product name (short)	4AI RTD/TC + 4PORT IOL-A FLD PN DC 24V 2.0A
Product name (long)	4-Channel Analog Input RTD/TC + 4-Port IO Link Master Class A; PROFINET; 24 VDC; 2.0 A; 8 × M12 Connection

4.6.2 Mechanical Data

Table 8: Mechanical Data

Property	Value
Width	60 mm
Height	30 mm
Length	210 mm
Weight	600 g
Housing	Zinkdruckguss
Mounting type	Schraubmontage, 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 9: Connection Technology

Property	Value
Power connection	PWR IN: M12 L-kodiert, 5-polig, Stecker
	PWR OUT: M12 L-kodiert, 5-polig, Buchse
PROFINET connection	2 × M12, D-kodiert, Buchse, 4-polig
Analog Input	4 × M12, A-kodiert, Buchse, 5-polig
IO-Link ports	4 × M12, A-kodiert, Buchse, 5-polig
Tightening torque	M12: 1,0 Nm

4.6.3.2 IO-Link Port

This information is valid for ports X01 to X04.

Table 10: IO-Link Port (Class A)

Property	Value	Value (per UL)
IO-Link Master (Class A)		
Specification	V1.1	
Port mode	Pin 4: IO-Link: autoconfig, manual, tool-based; DI, DO	
	Pin 2: DI, DO, disabled	
Transmission mode	COM 1, COM 2, COM 3	

Property	Value	Value (per UL)
Min. cycle time	400 μs (IO-Link frame type_2_1 with transmission mode COM 3)	
Digital Input		
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	
Circuit	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), 1L powered	24 VDC, −25 %/+20 % (18 VDC ... 28.8 VDC), 1L 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	
Circuit	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 powered	24 VDC, −25 %/+20 % (18 VDC ... 28.8 VDC), 1L powered
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 (max. voltage drop of 1.2 V for both feed and return line individually)	
Circuit	High-side driver The 1L+ output is not resistant to feedback. The input voltage must not exceed the supply voltage.	
Self-protection	Overcurrent, overload, overtemperature and overvoltage	
Voltage drop through high-side path	Less than 200 mV	
Maximum capacitive load	1000 μF parallel to 24 Ω; 0.1 Hz 470 μF parallel to 12 Ω; 0.1 Hz 220 μF parallel to 6 Ω; 0.1 Hz	
Diagnostics (1L+)	Events: overcurrent, overload, overtemperature and overvoltage	

4.6.3.3 Analog Input (RTD/TC)

This information is valid for ports X05 to X08.

Table 11: Analog Input (RTD/TC)

Property	Value	Value (per UL)
Analog Input		
Signal type: resistance thermometer (RTD)	Pt100, Pt200, Pt500, Pt1000 (–200 ... +850 °C) Ni100, Ni120, Ni200, Ni500, Ni1000 (–60 ... +250 °C)	
Signal type: thermocouples (TC)	Type B (+250 ... +1820 °C)	
	Type C (0 ... +2315 °C)	
	Type E (–200 ... +1000 °C)	
	Type J (–210 ... +1200 °C)	
	Type K (–200 ... +1372 °C)	
	Type N (–200 ... +1300 °C)	
	Type R (–50 ... +1768 °C)	
	Type S (–50 ... +1768 °C)	
	Type T (–200 ... +400 °C)	
Signal type: resistance	0 ... 250 Ω, 0 ... 500 Ω, 0 ... 1 kΩ, 0 ... 2 kΩ, 0 ... 4 kΩ	
Signal type: resistance (PTC)	Max. 4 kΩ	
Signal type: resistance (potentiometers)	0 ... 100 % (max. 4 kΩ)	
Signal type: millivolt sensor	±30 mV, ±60 mV, ±120 mV, ±250 mV, ±500 mV, ±1000 mV, ±2000 mV	
Signal characteristics	Differential	
Measurement range	RTDs: Pt100, Pt200, Pt500, Pt1000, Ni100, Ni120, Ni200, Ni500, Ni1000, Ni1000-TK5000	
	Resistance: 250 Ω, 500 Ω, 1 kΩ, 2 kΩ, 4 kΩ, PTC	
	Potentiometer setting: 0 ... 100 %	
	Thermocouples: Type B; Type C; Type E; Type J; Type K; Type N; Type R, Type S; Type T	
	Sensor: ±30 mV, ±60 mV, ±120 mV, ±250 mV, ±500 mV, ±1000 mV, ±2000 mV	
Sensor connection	RTD, TC, resistance, millivolt sensors: 2-wire	
	RTD, potentiometer: 3-wire	
	RTD: 4-wire	
Cable type and length	Shielded, ≤ 30 m	
Analog value resolution	16 bits (15 bits and sign)	
Analog value resolution, temperature	0.1 °C/°F/K per digit	
	0.01 °C/°F/K per digit (measurement range –50 ... +150 °C; type C: measurement range 0 ... +150 °C)	
Analog value representation	Two's complement, magnitude/sign	
Conversion method	Delta-sigma	
Minimum conversion time	Approx. 10 ms (filter disabled) for all four channels	
Conversion time	2-wire: ≥ 10 ms per channel ¹	
	3-wire: ≥ 20 ms per channel ¹	
	4-wire: ≥ 20 ms per channel ¹	
Voltage-proof	Up to 31.2 V	
Maximum measurement error at 25 °C	Factory setting: - All types except J: ±0.1 % of upper-range value² - Type J: < ±0.3 % of upper-range value²	
	Through user calibration, measurement accuracy can be optimized by having the module calibrate the measure- ment chain.	

Property	Value	Value (per UL)
Temperature Error	$\leq \pm 0.003 \text{ \%}/\text{K}$ of the upper range value ² for voltage measurement and resistance measurement	
	$\leq \pm 0.01 \text{ \%}/\text{K}$ of the upper range value ² for thermocouples	
Interference frequency suppression	Filters 10 Hz, 50 Hz ³ , 60 Hz, 400 Hz	
Diagnostics	Measurement overrange/underrange	
	Overflow/underflow	
	Wire break	
	Internal error	
Measured voltage (typical)	0.1 mA (RTD)	
Measuring current (typical)	< 500 μA	
Cold junction compensation	External (see Accessories [p. 255])	
Indicators	Status LED for operational readiness, channel error	

¹ For RTD/R and TC/U, the conversion time depends on the setting in the module.

² Value reached during calibration in operating environment $-25 = T_A = 70 \text{ }^\circ\text{C}$

³ Factory setting

4.6.3.4 Total Load

Table 12: Total Load

Parameters	Value	Value (per UL)
Maximum total load current (sum of all currents of connections X01 to X08)	15.7 A	11.7 A

4.6.4 Power Supply

Table 13: Power Supply

Parameters	Value	Value (per UL)
Supply voltage, 1L, 2L	24 VDC, $-25 \text{ \%}/+30 \text{ \%}$ (18 VDC ... 31.2 VDC)	24 VDC, $-25 \text{ \%}/+20 \text{ \%}$ (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	18.0 V ($\pm 5 \text{ \%}$ at 25 $^\circ\text{C}$) message on	
	18.3 V ($\pm 5 \text{ \%}$ at 25 $^\circ\text{C}$) message off	
Overvoltage warning, 1L	30.0 V ($\pm 5 \text{ \%}$ at 25 $^\circ\text{C}$) message on	
	29.7 V ($\pm 5 \text{ \%}$ at 25 $^\circ\text{C}$) message off	
Module current consumption	1L: 100 mA (at 24 VDC)	
	2L: 10 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, system/channel	2 kV DC
Test voltage, channel/channel	800 V DC
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 \[p. 31\]](#).

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 – Analog PROFINET IO Device

Parameter	Value
Input Data	18 ... 177 bytes Operation with 4 IO-Link 32 I / 32 O + PQI and 4 AIs (with status word): 170 bytes (= 150 bytes of process data + 15 bytes of IOPS + 5 bytes of IOCS) Operation with 8 DIs and 4 AIs (with status word): 38 bytes (= 22 bytes of process data + 15 bytes of IOPS + 1 byte of IOCS) Operation with 8 DOs and 4 AIs (with status word): 34 bytes (= 18 bytes of process data + 11 bytes of IOPS + 5 bytes of IOCS) It may be possible to add an additional 1 to 7 bytes of IOPS and 1 to 7 bytes of IOCS, depending on the configuration.
Output Data	18 ... 157 bytes Operation with 4 IO-Link 32 I / 32 O + PQI and 4 AIs (with status word): 150 bytes (= 130 bytes of process data + 5 bytes of IOPS + 15 bytes of IOCS) Operation with 8 DIs and 4 AIs (with status word): 18 bytes (= 2 bytes of process data + 1 byte of IOPS + 15 bytes of IOCS) Operation with 8 DOs and 4 AIs (with status word): 22 bytes (= 6 bytes of process data + 5 bytes of IOPS + 11 bytes of IOCS) It may be possible to add an additional 1 to 7 bytes of IOPS and 1 to 7 bytes of IOCS, depending on the configuration.
Alarm Types	Diagnostic alarm, Process alarm, Plug/pull alarm
Identification and Maintenance (I&M)	I&M0-3
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

Parameter	Value
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 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).

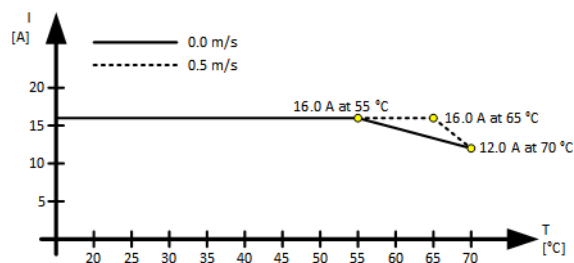


Figure 6: Derating, 765-2102/100-000

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).

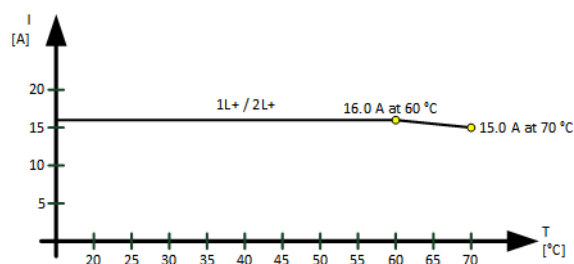


Figure 7: Derating of a Contact (Pin) of L-Coded Connections X31 and X32 (For Core Cross-Section = 0.25 mm²/ AWG 14)

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).

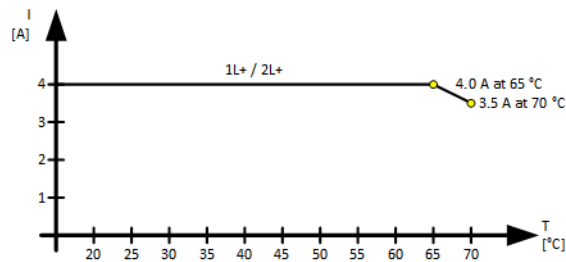


Figure 8: Derating of a Contact (Pin) of the A-Coded Connections Port X01, X02, ... (for Core Cross-Section = 0.34 mm²/AWG 22)

High currents may occur on connections port X01, X02, ... on pin 1 and pin 3.

4.8 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

4.9 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®	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 Off-set	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: DI B or DO B	Port X01, pin 2: DO B
	...	...	...
	6	Port X04, pin 4: DI A or DO A	0
	7	Port X04, pin 2: DI B or DO B	Port X04, pin 2: DO B
x + 1	0 ... 7	0	0

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

Byte Off-set	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
	2	Port X03, pin 4: DI A or DO A	0
	3	Port X04, pin 4: DI A or DO A	0
	4 ... 7	0	0
x + 1	0	Port X01, pin 2: DI B or DO B	Port X01, pin 2: DO B
	1	Port X02, pin 2: DI B or DO B	Port X02, pin 2: DO B
	2	Port X03, pin 2: DI B or DO B	Port X03, pin 2: DO B
	3	Port X04, pin 2: DI B or DO B	Port X04, pin 2: DO B
	4 ... 7	0	0

Process Data of a Port Submodule

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

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

Byte Offset	Bit	Input Process Data (PD_IN)
x	0	Port X01, pin 4: DI A or Port X02, pin 4: DI A or Port X03, pin 4: DI A or Port X04, pin 4: DI A
	1 ... 7	0

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

Byte Offset	Bit	Output Process Data (PD_OUT)
x	0	Port X01, pin 4: DO A or Port X02, pin 4: DO A or Port X03, pin 4: DO A or Port X04, pin 4: DO A

Byte Offset	Bit	Output Process Data (PD_OUT)
	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

Process Data of an Analog Input Submodule

For a "1AI, INT 16 I" submodule, the module provides process data with a 16 bit measured value (INT16) without a status word.

The following table shows the assignment of the process data of an analog input submodule (without a status word).

Table 27: Analog Input Submodule Process Data (without Status Word)

Byte Off-set	Bit	Input Process Data (PD_IN)
x	0 ... 7	16 bit measured value
x+1	8 ... 15	Byte offset x contains the low byte of the measured value, and byte offset x+1 contains the high byte of the measured value.

The following table shows the assignment of the process data of an analog input submodule (with a status word).

Table 28: Analog Input Submodule Process Data (with Status Word)

Byte Off-set	Bit	Input Process Data (PD_IN)
x	0 ... 7	16 bit measured value
x+1	8 ... 15	Byte offset x contains the low byte of the measured value, and byte offset x+1 contains the high byte of the measured value.
x+2	0 ... 7	16 bit status word
x+3	8 ... 15	Byte offset x+2 contains the low byte of the status word, and byte offset x+3 contains the high byte of the status word; see the following table.

Table 29: Status word

Bit	Input Process Data
0	Measurement underrange 0: The measured value is above the lower limiting value of the measurement range. 1: The measured value is below the lower limiting value of the measurement range.
1	Measurement overrange 0: The measured value is below the upper limiting value of the measurement range. 1: The measured value is above the upper limiting value of the measurement range.
2	User limiting value underrange 0: The measured value is above the lower limiting value of the measurement range set by the user. 1: The measured value is below the lower limiting value of the measurement range set by the user. The underrange does not lead to the error message "Process data invalid."
3	User limiting value overrange 0: The measured value is below the upper limiting value of the measurement range set by the user. 1: The measured value is above the upper limiting value of the measurement range set by the user. The overrange does not lead to the error message "Process data invalid."
4	Underflow 0: no underflow 1: underflow
5	Overflow 0: no overflow 1: overflow
6	Wire break 0: no wire break 1: wire break
7 ... 8	Reserved
9	Internal error 0: no internal error 1: internal error occurred. Examples of internal errors: "ADC defective" and CRC error
10 ... 13	Reserved
14	Channel busy 0: channel is performing measurements 1: channel busy: channel is performing configuration or self-calibration, for example.

Bit	Input Process Data
15	Process value valid/invalid Used to determine the validity of the channel process value. 0: process value valid 1: process value invalid; substitute value used - Substitute value for underflow : -32768 (0x8000) for two's complement or -32767 (0xFFFF) for magnitude/sign - Substitute value for overflow and other errors: 32767 (0x7FFF)

The firmware always reports only one specific status.

The following table describes the priority of the diagnostic messages.

Table 30: Status Bit Priority

Priority	Status	Description
10	Channel busy	Channel is performing configuration or self-calibration, for example
9	Reserved	Reserved
8	Wire break	Wire break
7	Internal error	Examples of internal errors: "ADC defective" and CRC error
6	Reserved	Reserved
5	Overflow	Measured value overflow occurred
4	Underflow	Measured value underflow occurred
3	Sensor measurement range overflow	Value above sensor measurement range
2	Sensor measurement range underflow	Value below sensor measurement range
1	Upper user limit exceeded	Value above upper user limiting value
0	Lower user limit undershot	Value below lower user limiting value

Provider and Consumer Status

Table 31: 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

5.1.1 Temperature Measurement (Degrees Celsius)

5.1.1.1 Pt100, Pt200, Pt500, Pt1000 Degrees Celsius (Normal Resolution)

The following two tables describe the process data for the following signal types of resistance thermometers (RTD) Pt100, Pt200, Pt500 and Pt1000 (EN 60751).

Resolution: 0.1 °C per digit

Temperature range: -200 ... +850 °C

Value range: -2000 ... +8500

In the following table, the values are represented in two's complement format.

Table 32: Pt100, Pt200, Pt500, Pt1000 Degrees Celsius (Two's Complement)

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -225.1	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	-225.0	1111.0111.0011.0110	0xF736	-2250	0x8001	On
	-200.1	1111.1000.0010.1111	0xF82F	-2001		
Nominal range	-200.0	1111.1000.0011.0000	0xF830	-2000	0x0000	Off
	850.0	0010.0001.0011.0100	0x2134	8500		
Overrange	850.1	0010.0001.0011.0101	0x2135	8501	0x8002	On
	875.0	0010.0010.0010.1110	0x222E	8750		
Overflow	≥ 875.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 33: Pt100, Pt200, Pt500, Pt1000 Degrees Celsius (Magnitude/Sign)

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -225.1	1111.1111.1111.1111	0xFFFF	-32767	0x8010	On
Underrange	-225.0	1000.1000.1100.1010	0x88CA	-2250	0x8001	On
	-200.1	1000.0111.1101.0001	0x87D1	-2001		
Nominal range	-200.0	1000.0111.1101.0000	0x87D0	-2000	0x0000	Off
	850.0	0010.0001.0011.0100	0x2134	8500		
Overrange	850.1	0010.0001.0011.0101	0x2135	8501	0x8002	On
	875.0	0010.0010.0010.1110	0x222E	8750		
Overflow	≥ 875.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.1.2 Ni100, Ni120, Ni200, Ni500, Ni1000 Degrees Celsius (Normal Resolution)

The following two tables describe the process data for the signal types of resistance thermometers (RTD) Ni100, Ni120, Ni200, Ni500, Ni1000 (TK6180, DIN 43760) and Ni1000 (TK5000, DIN 43760).

Resolution: 0.1 °C per digit

Temperature range: -60 ... +250 °C

Value range: -600 ... +2500

In the following table, the values are represented in two's complement format.

Table 34: Ni100, Ni120, Ni200, Ni500, Ni1000 Degrees Celsius (Two's Complement)

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -85.1	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	-85.0	1111.1100.1010.1110	0xFCAE	-850	0x8001	On
	-60.1	1111.1101.1010.0111	0xFDA7	-601		
Nominal range	-60.0	1111.1101.1010.1000	0xFDA8	-600	0x0000	Off

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
	250.0	0000.1001.1100.0100	0x09C4	2500		
Overrange	250.1	0000.1001.1100.0101	0x09C5	2501	0x8002	On
	275.0	0000.1010.1011.1110	0x0ABE	2750		
Overflow	≥ 275.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 35: Ni100, Ni120, Ni200, Ni500, Ni1000 Degrees Celsius (Magnitude/Sign)

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -85.1	1111.1111.1111.1111	0xFFFF	-32767	0x8010	On
Underrange	-85.0	1000.0011.0101.0010	0x8352	-850	0x8001	On
	-60.1	1000.0010.0101.1001	0x8259	-601		
Nominal range	-60.0	1000.0010.0101.1000	0x8258	-600	0x0000	Off
	250.0	0000.1001.1100.0100	0x09C4	2500		
Overrange	250.1	0000.1001.1100.0101	0x09C5	2501	0x8002	On
	275.0	0000.1010.1011.1110	0x0ABE	2750		
Overflow	≥ 275.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.1.3 Thermocouple Type B Degrees Celsius (Normal Resolution)

The following two tables describe the process data for the signal type of thermocouple (TC) type B (DIN EN 60584-1).

Resolution: 0.1 °C per digit

Temperature range: +250 ... +1820 °C

Value range: +2500 ... +18200

In the following table, the values are represented in two's complement format.

Table 36: TC Type B Degrees Celsius (Two's Complement)

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ 224.9	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	225.0	0000.1000.1100.1010	0x08CA	2250	0x8001	On
	249.9	0000.1001.1100.0011	0x09C3	2499		
Nominal range	250.0	0000.1001.1100.0100	0x09C4	2500	0x0000	Off
	1820.0	0100.0111.0001.1000	0x4718	18200		
Overrange	1820.1	0100.0111.0001.1001	0x4719	18201	0x8002	On
	1845.0	0100.1000.0001.0010	0x4812	18450		
Overflow	≥ 1845.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 37: TC Type B Degrees Celsius (Magnitude/Sign)

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ 224.9	1111.1111.1111.1111	0xFFFF	−32767	0x8010	On
Underrange	225.0	0000.1000.1100.1010	0x08CA	2250	0x8001	On
	249.9	0000.1001.1100.0011	0x09C3	2499		
Nominal range	250.0	0000.1001.1100.0100	0x09C4	2500	0x0000	Off
	1820.0	0100.0111.0001.1000	0x4718	18200		
Overrange	1820.1	0100.0111.0001.1001	0x4719	18201	0x8002	On
	1845.0	0100.1000.0001.0010	0x4812	18450		
Overflow	≥ 1845.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.1.4 Thermocouple Type C Degrees Celsius (Normal Resolution)

The following two tables describe the process data for the signal type of thermocouple (TC) type C (DIN EN 60584-1).

Resolution: 0.1 °C per digit

Temperature range: 0 ... +2315 °C

Value range: 0 ... +23150

In the following table, the values are represented in two's complement format.

Table 38: TC Type C Degrees Celsius (Two's Complement)

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ −25.1	1000.0000.0000.0000	0x8000	−32768	0x8010	On
Underrange	−25.0	1111.1111.0000.0110	0xFF06	−250	0x8001	On
	−0.1	1111.1111.1111.1111	0xFFFF	−1		
Nominal range	0.0	0000.0000.0000.0000	0x0000	0	0x0000	Off
	2315.0	0101.1010.0110.1110	0x5A6E	23150		
Overrange	2315.1	0101.1010.0110.1111	0x5A6F	23151	0x8002	On
	2340.0	0101.1011.0110.1000	0x5B68	23400		
Overflow	≥ 2340.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 39: TC Type C Degrees Celsius (Magnitude/Sign)

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ −25.1	1111.1111.1111.1111	0xFFFF	−32767	0x8010	On
Underrange	−25.0	1000.0000.1111.1010	0x80FA	−250	0x8001	On
	−0.1	1000.0000.0000.0001	0x8001	−1		
Nominal range	0.0	0000.0000.0000.0000	0x0000	0	0x0000	Off
	2315.0	0101.1010.0110.1110	0x5A6E	23150		
Overrange	2315.1	0101.1010.0110.1111	0x5A6F	23151	0x8002	On
	2340.0	0101.1011.0110.1000	0x5B68	23400		
Overflow	≥ 2340.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.1.5 Thermocouple Type E Degrees Celsius (Normal Resolution)

The following two tables describe the process data for the signal type of thermocouple (TC) type E (DIN EN 60584-1).

Resolution: 0.1 °C per digit

Temperature range: -200 ... +1000 °C

Value range: -2000 ... +10000

In the following table, the values are represented in two's complement format.

Table 40: TC Type E Degrees Celsius (Two's Complement)

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -225.1	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	-225.0	1111.0111.0011.0110	0xF736	-2250	0x8001	On
	-200.1	1111.1000.0010.1111	0xF82F	-2001		
Nominal range	-200.0	1111.1000.0011.0000	0xF830	-2000	0x0000	Off
	1000.0	0010.0111.0001.0000	0x2710	10000		
Overrange	1000.1	0010.0111.0001.0001	0x2711	10001	0x8002	On
	1025.0	0010.1000.0000.1010	0x280A	10250		
Overflow	≥ 1025.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 41: TC Type E Degrees Celsius (Magnitude/Sign)

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -225.1	1111.1111.1111.1111	0xFFFF	-32767	0x8010	On
Underrange	-225.0	1000.1000.1100.1010	0x88CA	-2250	0x8001	On
	-200.1	1000.0111.1101.0001	0x87D1	-2001		
Nominal range	-200.0	1000.0111.1101.0000	0x87D0	-2000	0x0000	Off
	1000.0	0010.0111.0001.0000	0x2710	10000		
Overrange	1000.1	0010.0111.0001.0001	0x2711	10001	0x8002	On
	1025.0	0010.1000.0000.1010	0x280A	10250		
Overflow	≥ 1025.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.1.6 Thermocouple Type J Degrees Celsius (Normal Resolution)

The following two tables describe the process data for the signal type of thermocouple (TC) type J (DIN EN 60584-1).

Resolution: 0.1 °C per digit

Temperature range: -210 ... +1200 °C

Value range: -2100 ... +12000

In the following table, the values are represented in two's complement format.

Table 42: TC Type J Degrees Celsius (Two's Complement)

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -235.1	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	-235.0	1111.0110.1101.0010	0xF6D2	-2350	0x8001	On
	-210.1	1111.0111.1100.1011	0xF7CB	-2101		
Nominal range	-210.0	1111.0111.1100.1100	0xF7CC	-2100	0x0000	Off
	1200.0	0010.1110.1110.0000	0x2EE0	12000		
Overrange	1200.1	0010.1110.1110.0001	0x2EE1	12001	0x8002	On
	1225.0	0010.1111.1101.1010	0x2FDA	12250		
Overflow	≥ 1225.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 43: TC Type J Degrees Celsius (Magnitude/Sign)

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -235.1	1111.1111.1111.1111	0xFFFF	-32767	0x8010	On
Underrange	-235.0	1000.1001.0010.1110	0x892E	-2350	0x8001	On
	-210.1	1000.1000.0011.0101	0x8835	-2101		
Nominal range	-210.0	1000.1000.0011.0100	0x8834	-2100	0x0000	Off
	1200.0	0010.1110.1110.0000	0x2EE0	12000		
Overrange	1200.1	0010.1110.1110.0001	0x2EE1	12001	0x8002	On
	1225.0	0010.1111.1101.1010	0x2FDA	12250		
Overflow	≥ 1225.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.1.7 Thermocouple Type K Degrees Celsius (Normal Resolution)

The following two tables describe the process data for the signal type of thermocouple (TC) type K (DIN EN 60584-1).

Resolution: 0.1 °C per digit

Temperature range: -200 ... +1372 °C

Value range: -2000 ... +13720

In the following table, the values are represented in two's complement format.

Table 44: TC Type K Degrees Celsius (Two's Complement)

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -225.1	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	-225.0	1111.0111.0011.0110	0xF736	-2250	0x8001	On
	-200.1	1111.1000.0010.1111	0xF82F	-2001		
Nominal range	-200.0	1111.1000.0011.0000	0xF830	-2000	0x0000	Off
	1372.0	0011.0101.1001.1000	0x3598	13720		
Overrange	1372.1	0011.0101.1001.1001	0x3599	13721	0x8002	On
	1397.0	0011.0110.1001.0010	0x3692	13970		
Overflow	≥ 1397.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 45: TC Type K Degrees Celsius (Magnitude/Sign)

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -225.1	1111.1111.1111.1111	0xFFFF	-32767	0x8010	On
Underrange	-225.0	1000.1000.1100.1010	0x88CA	-2250	0x8001	On
	-200.1	1000.0111.1101.0001	0x87D1	-2001		
Nominal range	-200.0	1000.0111.1101.0000	0x87D0	-2000	0x0000	Off
	1372.0	0011.0101.1001.1000	0x3598	13720		
Overrange	1372.1	0011.0101.1001.1001	0x3599	13721	0x8002	On
	1397.0	0011.0110.1001.0010	0x3692	13970		
Overflow	≥ 1397.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.1.8 Thermocouple Type N Degrees Celsius (Normal Resolution)

The following two tables describe the process data for the signal type of thermocouple (TC) type N (DIN EN 60584-1).

Resolution: 0.1 °C per digit

Temperature range: -200 ... +1300 °C

Value range: -2000 ... +13000

In the following table, the values are represented in two's complement format.

Table 46: TC Type N Degrees Celsius (Two's Complement)

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -225.1	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	-225.0	1111.0111.0011.0110	0xF736	-2250	0x8001	On
	-200.1	1111.1000.0010.1111	0xF82F	-2001		
Nominal range	-200.0	1111.1000.0011.0000	0xF830	-2000	0x0000	Off
	1300.0	0011.0010.1100.1000	0x32C8	13000		
Overrange	1300.1	0011.0010.1100.1001	0x32C9	13001	0x8002	On
	1325.0	0011.0011.1100.0010	0x33C2	13250		
Overflow	≥ 1325.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 47: TC Type N Degrees Celsius (Magnitude/Sign)

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -225.1	1111.1111.1111.1111	0xFFFF	-32767	0x8010	On
Underrange	-225.0	1000.1000.1100.1010	0x88CA	-2250	0x8001	On
	-200.1	1000.0111.1101.0001	0x87D1	-2001		
Nominal range	-200.0	1000.0111.1101.0000	0x87D0	-2000	0x0000	Off
	1300.0	0011.0010.1100.1000	0x32C8	13000		
Overrange	1300.1	0011.0010.1100.1001	0x32C9	13001	0x8002	On
	1325.0	0011.0011.1100.0010	0x33C2	13250		

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Overflow	≥ 1325.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.1.9 Thermocouple Types R and S Degrees Celsius (Normal Resolution)

The following two tables describe the process data for the signal type of thermocouples (TC) type R and type S (DIN EN 60584-1).

Resolution: 0.1 °C per digit

Temperature range: -50 ... +1768 °C

Value range: -500 ... +17680

In the following table, the values are represented in two's complement format.

Table 48: TC Type R and Type S Degrees Celsius (Two's Complement)

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -75.1	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	-75.0	1111.1101.0001.0010	0xFD12	-750	0x8001	On
	-50.1	1111.1110.0000.1011	0xFE0B	-501		
Nominal range	-50.0	1111.1110.0000.1100	0xFE0C	-500	0x0000	Off
	1768.0	0100.0101.0001.0000	0x4510	17680		
Overrange	1768.1	0100.0101.0001.0001	0x4511	17681	0x8002	On
	1793.0	0100.0110.0000.1010	0x460A	17930		
Overflow	≥ 1793.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 49: TC Type R and Type S Degrees Celsius (Magnitude/Sign)

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -75.1	1111.1111.1111.1111	0xFFFF	-32767	0x8010	On
Underrange	-75.0	1000.0010.1110.1110	0x82EE	-750	0x8001	On
	-50.1	1000.0001.1111.0101	0x81F5	-501		
Nominal range	-50.0	1000.0001.1111.0100	0x81F4	-500	0x0000	Off
	1768.0	0100.0101.0001.0000	0x4510	17680		
Overrange	1768.1	0100.0101.0001.0001	0x4511	17681	0x8002	On
	1793.0	0100.0110.0000.1010	0x460A	17930		
Overflow	≥ 1793.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.1.10 Thermocouple Type T Degrees Celsius (Normal Resolution)

The following two tables describe the process data for the signal type of thermocouple (TC) type T (DIN EN 60584-1).

Resolution: 0.1 °C per digit

Temperature range: -200 ... +400 °C

Value range: -2000 ... +4000

In the following table, the values are represented in two's complement format.

Table 50: TC Type T Degrees Celsius (Two's Complement)

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -225.1	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	-225.0	1111.0111.0011.0110	0xF736	-2250	0x8001	On
	-200.1	1111.1000.0010.1111	0xF82F	-2001		
Nominal range	-200.0	1111.1000.0011.0000	0xF830	-2000	0x0000	Off
	400.0	0000.1111.1010.0000	0x0FA0	4000		
Overrange	400.1	0000.1111.1010.0001	0x0FA1	4001	0x8002	On
	425.0	0001.0000.1001.1010	0x109A	4250		
Overflow	≥ 425.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 51: TC Type T Degrees Celsius (Magnitude/Sign)

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -225.1	1111.1111.1111.1111	0xFFFF	-32767	0x8010	On
Underrange	-225.0	1000.1000.1100.1010	0x88CA	-2250	0x8001	On
	-200.1	1000.0111.1101.0001	0x87D1	-2001		
Nominal range	-200.0	1000.0111.1101.0000	0x87D0	-2000	0x0000	Off
	400.0	0000.1111.1010.0000	0x0FA0	4000		
Overrange	400.1	0000.1111.1010.0001	0x0FA1	4001	0x8002	On
	425.0	0001.0000.1001.1010	0x109A	4250		
Overflow	≥ 425.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.1.11 RTD and TC Degrees Celsius (High Resolution)

For temperature measurement, high resolution (0.01 °C per digit) can be set.

High resolution is available for all thermocouples (TC) except type B.

The following two tables describe the process data for the following signal types:

- Resistance thermometers (RTD) Pt100, Pt200, Pt500 and Pt1000 (EN 60751)
- Resistance thermometers (RTD) Ni100, Ni120, Ni200, Ni500, Ni1000 (TK6180, DIN 43760) and Ni1000 (TK5000, DIN 43760)
- Thermocouple (TC) types E, J, K, N, R, S and T (DIN EN 60584-1)

Resolution: 0.01 °C per digit

Temperature range: -50 ... +150 °C

Value range: -5000 ... +15000

In the following table, the values are represented in two's complement format.

Table 52: Temperature (High Resolution) Degrees Celsius (Two's Complement)

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -60.01	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	-60.00	1110.1000.1001.0000	0xE890	-6000	0x8001	On

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
	-50.01	1110.1100.0111.0111	0xEC77	-5001		
Nominal range	-50.00	1110.1100.0111.1000	0xEC78	-5000	0x0000	Off
	150.00	0011.1010.1001.1000	0x3A98	15000		
Overrange	150.01	0011.1010.1001.1001	0x3A99	15001	0x8002	On
	160.00	0011.1110.1000.0000	0x3E80	16000		
Overflow	≥ 160.01	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 53: Temperature (High Resolution) Degrees Celsius (Magnitude/Sign)

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -60.01	1111.1111.1111.1111	0xFFFF	-32767	0x8010	On
Underrange	-60.00	1001.0111.0111.0000	0x9770	-6000	0x8001	On
	-50.01	1001.0011.1000.1001	0x9389	-5001		
Nominal range	-50.00	1001.0011.1000.1000	0x9388	-5000	0x0000	Off
	150.00	0011.1010.1001.1000	0x3A98	15000		
Overrange	150.01	0011.1010.1001.1001	0x3A99	15001	0x8002	On
	160.00	0011.1110.1000.0000	0x3E80	16000		
Overflow	≥ 160.01	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

The following two tables describe the process data for the signal type of thermocouple (TC) type C (DIN EN 60584-1).

Resolution: 0.01 °C per digit

Temperature range: 0 ... +150 °C

Value range: 0 ... +15000

In the following table, the values are represented in two's complement format.

Table 54: TC Type C (High Resolution) Degrees Celsius (Two's Complement)

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -10.01	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	-10.00	1111.1100.0001.1000	0xFC18	-1000	0x8001	On
	-0.01	1111.1111.1111.1111	0xFFFF	-1		
Nominal range	0.00	0000.0000.0000.0000	0x0000	0	0x0000	Off
	150.00	0011.1010.1001.1000	0x3A98	15000		
Overrange	150.01	0011.1010.1001.1001	0x3A99	15001	0x8002	On
	160.00	0011.1110.1000.0000	0x3E80	16000		
Overflow	≥ 160.01	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 55: TC Type C (High Resolution) Degrees Celsius (Magnitude/Sign)

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -10.01	1111.1111.1111.1111	0xFFFF	-32767	0x8010	On
Underrange	-10.00	1000.0011.1110.1000	0x83E8	-1000	0x8001	On
	-0.01	1000.0000.0000.0001	0x8001	-1		
Nominal range	0.00	0000.0000.0000.0000	0x0000	0	0x0000	Off
	150.00	0011.1010.1001.1000	0x3A98	15000		
Overrange	150.01	0011.1010.1001.1001	0x3A99	15001	0x8002	On
	160.00	0011.1110.1000.0000	0x3E80	16000		
Overflow	≥ 160.01	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.2 Temperature Measurement (Degrees Fahrenheit)

5.1.2.1 Pt100, Pt200, Pt500, Pt1000 Degrees Fahrenheit (Normal Resolution)

The following two tables describe the process data for the following signal types of resistance thermometers (RTD) Pt100, Pt200, Pt500 and Pt1000 (EN 60751).

Resolution: 0.1 °F per digit

Temperature range: -328 ... +1562 °F

Value range: -3280 ... +15620

In the following table, the values are represented in two's complement format.

Table 56: Pt100, Pt200, Pt500, Pt1000 Degrees Fahrenheit (Two's Complement)

Range	Temperature [°F]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -373.1	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	-373.0	1111.0001.0110.1110	0xF16E	-3730	0x8001	On
	-328.1	1111.0011.0010.1111	0xF32F	-3281		
Nominal range	-328.0	1111.0011.0011.0000	0xF330	-3280	0x0000	Off
	1562.0	0011.1101.0000.0100	0x3D04	15620		
Overrange	1562.1	0011.1101.0000.0101	0x3D05	15621	0x8002	On
	1607.0	0011.1110.1100.0110	0x3EC6	16070		
Overflow	≥ 1607.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 57: Pt100, Pt200, Pt500, Pt1000 Degrees Fahrenheit (Magnitude/Sign)

Range	Temperature [°F]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -373.1	1111.1111.1111.1111	0xFFFF	-32767	0x8010	On
Underrange	-373.0	1000.1110.1001.0010	0x8E92	-3730	0x8001	On
	-328.1	1000.1100.1101.0001	0x8CD1	-3281		
Nominal range	-328.0	1000.1100.1101.0000	0x8CD0	-3280	0x0000	Off
	1562.0	0011.1101.0000.0100	0x3D04	15620		
Overrange	1562.1	0011.1101.0000.0101	0x3D05	15621	0x8002	On
	1607.0	0011.1110.1100.0110	0x3EC6	16070		

Range	Temperature [°F]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Overflow	≥ 1607.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.2.2 Ni100, Ni120, Ni200, Ni500, Ni1000 Degrees Fahrenheit (Normal Resolution)

The following two tables describe the process data for the signal types of resistance thermometers (RTD) Ni100, Ni120, Ni200, Ni500, Ni1000 (TK6180, DIN 43760) and Ni1000 (TK5000, DIN 43760).

Resolution: 0.1 °F per digit

Temperature range: -76 ... +482 °F

Value range: -760 ... +4820

In the following table, the values are represented in two's complement format.

Table 58: Ni100, Ni120, Ni200, Ni500, Ni1000 Degrees Fahrenheit (Two's Complement)

Range	Temperature [°F]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -121.1	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	-121.0	1111.1011.0100.0110	0xFB46	-1210	0x8001	On
	-76.1	1111.1101.0000.0111	0xFD07	-761		
Nominal range	-76.0	1111.1101.0000.1000	0xFD08	-760	0x0000	Off
	482.0	0001.0010.1101.0100	0x12D4	4820		
Overrange	482.1	0001.0010.1101.0101	0x12D5	4821	0x8002	On
	527.0	0001.0100.1001.0110	0x1496	5270		
Overflow	≥ 527.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 59: Ni100, Ni120, Ni200, Ni500, Ni1000 Degrees Fahrenheit (Magnitude/Sign)

Range	Temperature [°F]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -121.1	1111.1111.1111.1111	0xFFFF	-32767	0x8010	On
Underrange	-121.0	1000.0100.1011.1010	0x84BA	-1210	0x8001	On
	-76.1	1000.0010.1111.1001	0x82F9	-761		
Nominal range	-76.0	1000.0010.1111.1000	0x82F8	-760	0x0000	Off
	482.0	0001.0010.1101.0100	0x12D4	4820		
Overrange	482.1	0001.0010.1101.0101	0x12D5	4821	0x8002	On
	527.0	0001.0100.1001.0110	0x1496	5270		
Overflow	≥ 527.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.2.3 Thermocouple Type B Degrees Fahrenheit (Normal Resolution)

The following two tables describe the process data for the signal type of thermocouple (TC) type B (DIN EN 60584-1).

Resolution: 0.1 °F per digit

Temperature range: +482 ... +3270 °F

Value range: +4820 ... +32700

In the following table, the values are represented in two's complement format.

Table 60: TC Type B Degrees Fahrenheit (Two's Complement)

Range	Temperature [°F]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ 436.9	1000.0000.0000.0000	0x8000	−32768	0x8010	On
Underrange	437.0	0001.0001.0001.0010	0x1112	4370	0x8001	On
	481.9	0001.0010.1101.0011	0x12D3	4819		
Nominal range	482.0	0001.0010.1101.0100	0x12D4	4820	0x0000	Off
	3270.0	0111.1111.1011.1100	0x7FBC	32700		
Overrange	3270.1	0111.1111.1011.1101	0x7FBD	32701	0x8002	On
	3275.0	0111.1111.1110.1110	0x7FEE	32750		
Overflow	≥ 3275.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 61: TC Type B Degrees Fahrenheit (Magnitude/Sign)

Range	Temperature [°F]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Deci- mal	Status Word, Hex.	Error LED
Underflow	≤ 436.9	1000.0000.0000.0000	0x8000	−32768	0x8010	On
Underrange	437.0	0001.0001.0001.0010	0x1112	4370	0x8001	On
	481.9	0001.0010.1101.0011	0x12D3	4819		
Nominal range	482.0	0001.0010.1101.0100	0x12D4	4820	0x0000	Off
	3270.0	0110.0110.0011.0	0xFEC8	33080		
		1100.1100.0110				
	0000.1100.1100.0110					
Overrange	3270.1	0111.1111.1011.1101	0x7FBD	32701	0x8002	On
	3275.0	0111.1111.1110.1110	0x7FEE	32750		
Overflow	≥ 3275.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.2.4 Thermocouple Type C Degrees Fahrenheit (Normal Resolution)

The following two tables describe the process data for the signal type of thermocouple (TC) type C (DIN EN 60584-1).

Resolution: 0.1 °F per digit

Temperature range: +32 ... +3270 °F

Value range: +320 ... +3270

In the following table, the values are represented in two's complement format.

Table 62: TC Type C Degrees Fahrenheit (Two's Complement)

Range	Temperature [°F]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ −13.1	1000.0000.0000.0000	0x8000	−32768	0x8010	On
Underrange	−13.0	1111.1111.0111.1110	0xFF7E	−130	0x8001	On
	31.9	0000.0001.0011.1111	0x013F	319		
Nominal range	32.0	0000.0001.0100.0000	0x0140	320	0x0000	Off

Range	Temperature [°F]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
	3270.0	0111.1111.1011.1100	0x7FBC	32700		
Overrange	3270.1	0111.1111.1011.1101	0x7FBD	32701	0x8002	On
	3275.0	0111.1111.1110.1110	0x7FEE	32750		
Overflow	≥ 3275.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 63: TC Type C Degrees Fahrenheit (Magnitude/Sign)

Range	Temperature [°F]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -13.1	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	-13.0	1111.1111.0111.1110	0xFF7E	-130	0x8001	On
	31.9	0000.0001.0011.1111	0x013F	319		
Nominal range	32.0	0000.0001.0100.0000	0x0140	320	0x0000	Off
	3270.0	0111.1111.1011.1100	0x7FBC	32700		
Overrange	3270.1	0111.1111.1011.1101	0x7FBD	32701	0x8002	On
	3275.0	0111.1111.1110.1110	0x7FEE	32750		
Overflow	≥ 3275.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.2.5 Thermocouple Type E Degrees Fahrenheit (Normal Resolution)

The following two tables describe the process data for the signal type of thermocouple (TC) type E (DIN EN 60584-1).

Resolution: 0.1 °F per digit

Temperature range: -328 ... +1832 °F

Value range: -3280 ... +18320

In the following table, the values are represented in two's complement format.

Table 64: TC Type E Degrees Fahrenheit (Two's Complement)

Range	Temperature [°F]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -373.1	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	-373.0	1111.0001.0110.1110	0xF16E	-3730	0x8001	On
	-328.1	1111.0011.0010.1111	0xF32F	-3281		
Nominal range	-328.0	1111.0011.0011.0000	0xF330	-3280	0x0000	Off
	1832.0	0100.0111.1001.0000	0x4790	18320		
Overrange	1832.1	0100.0111.1001.0001	0x4791	18321	0x8002	On
	1877.0	0100.1001.0101.0010	0x4952	18770		
Overflow	≥ 1877.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 65: TC Type E Degrees Fahrenheit (Magnitude/Sign)

Range	Temperature [°F]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -373.1	1111.1111.1111.1111	0xFFFF	-32767	0x8010	On
Underrange	-373.0	1000.1110.1001.0010	0x8E92	-3730	0x8001	On
	-328.1	1000.1100.1101.0001	0x8CD1	-3281		
Nominal range	-328.0	1000.1100.1101.0000	0x8CD0	-3280	0x0000	Off
	1832.0	0100.0111.1001.0000	0x4790	18320		
Overrange	1832.1	0100.0111.1001.0001	0x4791	18321	0x8002	On
	1877.0	0100.1001.0101.0010	0x4952	18770		
Overflow	≥ 1877.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.2.6 Thermocouple Type J Degrees Fahrenheit (Normal Resolution)

The following two tables describe the process data for the signal type of thermocouple (TC) type J (DIN EN 60584-1).

Resolution: 0.1 °F per digit

Temperature range: -346 ... +2192 °F

Value range: -3460 ... +21920

In the following table, the values are represented in two's complement format.

Table 66: TC Type J Degrees Fahrenheit (Two's Complement)

Range	Temperature [°F]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -391.1	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	-391.0	1111.0000.1011.1010	0xF0BA	-3910	0x8001	On
	-346.1	1111.0010.0111.1011	0xF27B	-3461		
Nominal range	-346.0	1111.0010.0111.1100	0xF27C	-3460	0x0000	Off
	2192.0	0101.0101.1010.0000	0x55A0	21920		
Overrange	2192.1	0101.0101.1010.0001	0x55A1	21921	0x8002	On
	2237.0	0101.0111.0110.0010	0x5762	22370		
Overflow	≥ 2237.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 67: TC Type J Degrees Fahrenheit (Magnitude/Sign)

Range	Temperature [°F]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -391.1	1111.1111.1111.1111	0xFFFF	-32767	0x8010	On
Underrange	-391.0	1000.1111.0100.0110	0x8F46	-3910	0x8001	On
	-346.1	1000.1101.1000.0101	0x8D85	-3461		
Nominal range	-346.0	1000.1101.1000.0100	0x8D84	-3460	0x0000	Off
	2192.0	0101.0101.1010.0000	0x55A0	21920		
Overrange	2192.1	0101.0101.1010.0001	0x55A1	21921	0x8002	On
	2237.0	0101.0111.0110.0010	0x5762	22370		
Overflow	≥ 2237.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.2.7 Thermocouple Type K Degrees Fahrenheit (Normal Resolution)

The following two tables describe the process data for the signal type of thermocouple (TC) type K (DIN EN 60584-1).

Resolution: 0.1 °F per digit

Temperature range: -328 ... +2502 °F

Value range: -3280 ... +25020

In the following table, the values are represented in two's complement format.

Table 68: TC Type K Degrees Fahrenheit (Two's Complement)

Range	Temperature [°F]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -373.1	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	-373.0	1111.0001.0110.1110	0xF16E	-3730	0x8001	On
	-328.1	1111.0011.0010.1111	0xF32F	-3281		
Nominal range	-328.0	1111.0011.0011.0000	0xF330	-3280	0x0000	Off
	2502.0	0110.0001.1011.1100	0x61BC	25020		
Overrange	2502.1	0110.0001.1011.1101	0x61BD	25021	0x8002	On
	2547.0	0110.0011.0111.1110	0x637E	25470		
Overflow	≥ 2547.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 69: TC Type K Degrees Fahrenheit (Magnitude/Sign)

Range	Temperature [°F]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -373.1	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	-373.0	1111.0001.0110.1110	0xF16E	-3730	0x8001	On
	-328.1	1111.0011.0010.1111	0xF32F	-3281		
Nominal range	-328.0	1111.0011.0011.0000	0xF330	-3280	0x0000	Off
	2502.0	0110.0001.1011.1100	0x61BC	25020		
Overrange	2502.1	0110.0001.1011.1101	0x61BD	25021	0x8002	On
	2547.0	0110.0011.0111.1110	0x637E	25470		
Overflow	≥ 2547.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.2.8 Thermocouple Type N Degrees Fahrenheit (Normal Resolution)

The following two tables describe the process data for the signal type of thermocouple (TC) type N (DIN EN 60584-1).

Resolution: 0.1 °F per digit

Temperature range: -328 ... +2372 °F

Value range: -3280 ... +23720

In the following table, the values are represented in two's complement format.

Table 70: TC Type N Degrees Fahrenheit (Two's Complement)

Range	Temperature [°F]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -373.1	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	-373.0	1111.0001.0110.1110	0xF16E	-3730	0x8001	On
	-328.1	1111.0011.0010.1111	0xF32F	-3281		
Nominal range	-328.0	1111.0011.0011.0000	0xF330	-3280	0x0000	Off
	2372.0	0101.1100.1010.1000	0x5CA8	23720		
Overrange	2372.1	0101.1100.1010.1001	0x5CA9	23721	0x8002	On
	2417.0	0101.1110.0110.1010	0x5E6A	24170		
Overflow	≥ 2417.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 71: TC Type N Degrees Fahrenheit (Magnitude/Sign)

Range	Temperature [°F]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -373.1	1111.1111.1111.1111	0xFFFF	-32767	0x8010	On
Underrange	-373.0	1000.1110.1001.0010	0x8E92	-3730	0x8001	On
	-328.1	1000.1100.1101.0001	0x8CD1	-3281		
Nominal range	-328.0	1000.1100.1101.0000	0x8CD0	-3280	0x0000	Off
	2372.0	0101.1100.1010.1000	0x5CA8	23720		
Overrange	2372.1	0101.1100.1010.1001	0x5CA9	23721	0x8002	On
	2417.0	0101.1110.0110.1010	0x5E6A	24170		
Overflow	≥ 2417.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.2.9 Thermocouple Type R and Type S Degrees Fahrenheit (Normal Resolution)

The following two tables describe the process data for the signal type of thermocouples (TC) type R and type S (DIN EN 60584-1).

Resolution: 0.1 °F per digit

Temperature range: -58 ... +3214 °F

Value range: -580 ... +32140

In the following table, the values are represented in two's complement format.

Table 72: TC Type R and Type S Degrees Fahrenheit (Two's Complement)

Range	Temperature [°F]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -103.1	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	-103.0	1111.1011.1111.1010	0xFBFA	-1030	0x8001	On
	-58.1	1111.1101.1011.1011	0xFDBB	-581		
Nominal range	-58.0	1111.1101.1011.1100	0xFDBC	-580	0x0000	Off
	3214.0	0111.1101.1000.1100	0x7D8C	32140		
Overrange	3214.1	0111.1101.1000.1101	0x7D8D	32141	0x8002	On
	3259.0	0111.1111.0100.1110	0x7F4E	32590		
Overflow	≥ 3259.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 73: TC Type R and Type S Degrees Fahrenheit (Magnitude/Sign)

Range	Temperature [°F]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -103.1	1111.1111.1111.1111	0xFFFF	-32767	0x8010	On
Underrange	-103.0	1000.0100.0000.0110	0x8406	-1030	0x8001	On
	-58.1	1000.0010.0100.0101	0x8245	-581		
Nominal range	-58.0	1111.1101.1011.1100	0xFDBC	-580	0x0000	Off
	3214.0	0111.1101.1000.1100	0x7D8C	32140		
Overrange	3214.1	0111.1101.1000.1101	0x7D8D	32141	0x8002	On
	3259.0	0111.1111.0100.1110	0x7F4E	32590		
Overflow	≥ 3259.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.2.10 Thermocouple Type T Degrees Fahrenheit (Normal Resolution)

The following two tables describe the process data for the signal type of thermocouple (TC) type T (DIN EN 60584-1).

Resolution: 0.1 °F per digit

Temperature range: -328 ... +752 °F

Value range: -3280 ... +7520

In the following table, the values are represented in two's complement format.

Table 74: TC Type T Degrees Fahrenheit (Two's Complement)

Range	Temperature [°F]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -373.1	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	-373.0	1111.0001.0110.1110	0xF16E	-3730	0x8001	On
	-328.1	1111.0011.0010.1111	0xF32F	-3281		
Nominal range	-328.0	1111.0011.0011.0000	0xF330	-3280	0x0000	Off
	752.0	0001.1101.0110.0000	0x1D60	7520		
Overrange	752.1	0001.1101.0110.0001	0x1D61	7521	0x8002	On
	797.0	0001.1111.0010.0010	0x1F22	7970		
Overflow	≥ 797.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 75: TC Type T Degrees Fahrenheit (Magnitude/Sign)

Range	Temperature [°F]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -373.1	1111.1111.1111.1111	0xFFFF	-32767	0x8010	On
Underrange	-373.0	1000.1110.1001.0010	0x8E92	-3730	0x8001	On
	-328.1	1000.1100.1101.0001	0x8CD1	-3281		
Nominal range	-328.0	1000.1100.1101.0000	0x8CD0	-3280	0x0000	Off
	752.0	0001.1101.0110.0000	0x1D60	7520		
Overrange	752.1	0001.1101.0110.0001	0x1D61	7521	0x8002	On
	797.0	0001.1111.0010.0010	0x1F22	7970		

Range	Temperature [°F]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Overflow	≥ 797.1	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.2.11 RTD and TC Degrees Fahrenheit (High Resolution)

For temperature measurement, high resolution (0.01 °F per digit) can be set.

High resolution is available for all thermocouples (TC) except type B.

The following two tables describe the process data for the following signal types:

- Resistance thermometers (RTD) Pt100, Pt200, Pt500 and Pt1000 (EN 60751)
- Resistance thermometers (RTD) Ni100, Ni120, Ni200, Ni500, Ni1000 (TK6180, DIN 43760) and Ni1000 (TK5000, DIN 43760)
- Thermocouple (TC) types E, J, K, N, R, S and T (DIN EN 60584-1)

Resolution: 0.01 °F per digit

Temperature range: -58 ... +302 °F

Value range: -5800 ... +30200

In the following table, the values are represented in two's complement format.

Table 76: Temperature (High Resolution) Degrees Fahrenheit (Two's Complement)

Range	Temperature [°F]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -76.01	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	-76.00	1110.0010.0101.0000	0xE250	-7600	0x8001	On
	-58.01	1110.1001.0101.0111	0xE957	-5801		
Nominal range	-58.00	1110.1001.0101.1000	0xE958	-5800	0x0000	Off
	302.00	0111.0101.1111.1000	0x75F8	30200		
Overrange	302.01	0111.0101.1111.1001	0x75F9	30201	0x8002	On
	320.00	0111.1101.0000.0000	0x7D00	32000		
Overflow	≥ 320.01	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 77: Temperature (High Resolution) Degrees Fahrenheit (Magnitude/Sign)

Range	Temperature [°F]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -76.01	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	-76.00	1110.0010.0101.0000	0xE250	-7600	0x8001	On
	-58.01	1110.1001.0101.0111	0xE957	-5801		
Nominal range	-58.00	1110.1001.0101.1000	0xE958	-5800	0x0000	Off
	302.00	0111.0101.1111.1000	0x75F8	30200		
Overrange	302.01	0111.0101.1111.1001	0x75F9	30201	0x8002	On
	320.00	0111.1101.0000.0000	0x7D00	32000		
Overflow	≥ 320.01	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

For temperature measurement, high resolution (0.01 °F per digit) can be set.

The following two tables describe the process data for the signal type of thermocouple (TC) type C (DIN EN 60584-1).

Resolution: 0.01 °F per digit

Temperature range: +32 ... +302 °F

Value range: +3200 ... +30200

In the following table, the values are represented in two's complement format.

Table 78: TC Type C (High Resolution) Degrees Fahrenheit (Two's Complement)

Range	Temperature [°F]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ 13.99	1111.1111.1111.1111	0xFFFF	-32768	0x8010	On
Underrange	14.00	0000.0000.1000.1100	0x0578	1400	0x8001	On
	31.99	0000.0001.0011.1110	0x0C7F	3199		
Nominal range	32.00	0000.0001.0100.0000	0x0C80	3200	0x0000	Off
	302.00	0000.1011.1100.1100	0x75F8	30200		
Overrange	302.01	0000.1011.1100.1101	0x75F9	30201	0x8002	On
	320.00	0000.1100.1000.0000	0x7D00	32000		
Overflow	≥ 320.01	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 79: TC Type C (High Resolution) Degrees Fahrenheit (Magnitude/Sign)

Range	Temperature [°F]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ 13.99	1111.1111.1111.1111	0xFFFF	-32768	0x8010	On
Underrange	14.00	0000.0000.1000.1100	0x0578	1400	0x8001	On
	31.99	0000.0001.0011.1110	0x0C7F	3199		
Nominal range	32.00	0000.0001.0100.0000	0x0C80	3200	0x0000	Off
	302.00	0000.1011.1100.1100	0x75F8	30200		
Overrange	302.01	0000.1011.1100.1101	0x75F9	30201	0x8002	On
	320.00	0000.1100.1000.0000	0x7D00	32000		
Overflow	≥ 320.01	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.3 Temperature Measurement (Kelvin)

5.1.3.1 Pt100, Pt200, Pt500, Pt1000 Kelvin (Normal Resolution)

The following two tables describe the process data for the following signal types of resistance thermometers (RTD) Pt100, Pt200, Pt500 and Pt1000 (EN 60751).

Resolution: 0.1 K per digit

Temperature range: -+73.2 ... +1123.2 K

Value range: +732 ... +11232

In the following table, the values are represented in two's complement format.

Table 80: Pt100, Pt200, Pt500, Pt1000 Kelvin (Two's Complement)

Range	Temperature [K]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ 48.1	1000.0000.0000.0000	0x8000	−32768	0x8010	On
Underrange	48.2	0000.0001.1110.0010	0x01E2	482	0x8001	On
	73.1	0000.0010.1101.1011	0x02DB	731		
Nominal range	73.2	0000.0010.1101.1100	0x02DC	732	0x0000	Off
	1123.2	0010.1011.1110.0000	0x2BE0	11232		
Overrange	1123.3	0010.1011.1110.0001	0x2BE1	11233	0x8002	On
	1148.2	0010.1100.1101.1010	0x2CDA	11482		
Overflow	≥ 1148.3	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 81: Pt100, Pt200, Pt500, Pt1000 Kelvin (Magnitude/Sign)

Range	Temperature [K]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ 48.1	1000.0000.0000.0000	0x8000	−32768	0x8010	On
Underrange	48.2	0000.0001.1110.0010	0x01E2	482	0x8001	On
	73.1	0000.0010.1101.1011	0x02DB	731		
Nominal range	73.2	0000.0010.1101.1100	0x02DC	732	0x0000	Off
	1123.2	0010.1011.1110.0000	0x2BE0	11232		
Overrange	1123.3	0010.1011.1110.0001	0x2BE1	11233	0x8002	On
	1148.2	0010.1100.1101.1010	0x2CDA	11482		
Overflow	≥ 1148.3	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.3.2 Ni100, Ni120, Ni200, Ni500, Ni1000 Kelvin (Normal Resolution)

The following two tables describe the process data for the signal types of resistance thermometers (RTD) Ni100, Ni120, Ni200, Ni500, Ni1000 (TK6180, DIN 43760) and Ni1000 (TK5000, DIN 43760).

Resolution: 0.1 K per digit

Temperature range: +213.2 ... +523.2 K

Value range: +2132 ... +5232

In the following table, the values are represented in two's complement format.

Table 82: Ni100, Ni120, Ni200, Ni500, Ni1000 Kelvin (Two's Complement)

Range	Temperature [K]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ 188.1	1000.0000.0000.0000	0x8000	−32768	0x8010	On
Underrange	188.2	0000.0111.0101.1010	0x075A	1882	0x8001	On
	213.1	0000.1000.0101.0011	0x0853	2131		
Nominal range	213.2	0000.1000.0101.0100	0x0854	2132	0x0000	Off
	523.2	0001.0100.0111.0000	0x1470	5232		
Overrange	523.3	0001.0100.0111.0001	0x1471	5233	0x8002	On
	548.2	0001.0101.0110.1010	0x156A	5482		
Overflow	≥ 548.3	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 83: Ni100, Ni120, Ni200, Ni500, Ni1000 Kelvin (Magnitude/Sign)

Range	Temperature [K]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ 188.1	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	188.2	0000.0111.0101.1010	0x075A	1882	0x8001	On
	213.1	0000.1000.0101.0011	0x0853	2131		
Nominal range	213.2	0000.1000.0101.0100	0x0854	2132	0x0000	Off
	523.2	0001.0100.0111.0000	0x1470	5232		
Overrange	523.3	0001.0100.0111.0001	0x1471	5233	0x8002	On
	548.2	0001.0101.0110.1010	0x156A	5482		
Overflow	≥ 548.3	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.3.3 Thermocouple Type B Kelvin (Normal Resolution)

The following two tables describe the process data for the signal type of thermocouple (TC) type B (DIN EN 60584-1).

Resolution: 0.1 K per digit

Temperature range: +523.2 ... +2093.2 K

Value range: +5232 ... +20932

In the following table, the values are represented in two's complement format.

Table 84: TC Type B Kelvin (Two's Complement)

Range	Temperature [K]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ 498.1	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	498.2	0001.0011.0111.0110	0x1376	4982	0x8001	On
	523.1	0001.0100.0110.1111	0x146F	5231		
Nominal range	523.2	0001.0100.0111.0000	0x1470	5232	0x0000	Off
	2093.2	0101.0001.1100.0100	0x51C4	20932		
Overrange	2093.3	0101.0001.1100.0101	0x51C5	20933	0x8002	On
	2118.2	0101.0010.1011.1110	0x52BE	21182		
Overflow	≥ 2118.3	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 85: TC Type B Kelvin (Magnitude/Sign)

Range	Temperature [K]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ 498.1	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	498.2	0001.0011.0111.0110	0x1376	4982	0x8001	On
	523.1	0001.0100.0110.1111	0x146F	5231		
Nominal range	523.2	0001.0100.0111.0000	0x1470	5232	0x0000	Off
	2093.2	0101.0001.1100.0100	0x51C4	20932		
Overrange	2093.3	0101.0001.1100.0101	0x51C5	20933	0x8002	On
	2118.2	0101.0010.1011.1110	0x52BE	21182		

Range	Temperature [K]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Overflow	≥ 2118.3	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.3.4 Thermocouple Type C Kelvin (Normal Resolution)

The following two tables describe the process data for the signal type of thermocouple (TC) type C (DIN EN 60584-1).

Resolution: 0.1 K per digit

Temperature range: +273.2 ... +2588.2 K

Value range: +2372 ... +25882

In the following table, the values are represented in two's complement format.

Table 86: TC Type C Kelvin (Two's Complement)

Range	Temperature [K]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ 248.1	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	248.2	0000.1001.1011.0010	0x09B2	2482	0x8001	On
	273.1	0000.1010.1010.1011	0x0AAB	2731		
Nominal range	273.2	0000.1010.1010.1100	0x0AAC	2732	0x0000	Off
	2588.2	0110.0101.0001.1010	0x651A	25882		
Overrange	2588.3	0110.0101.0001.1011	0x651B	25883	0x8002	On
	2613.2	0110.0110.0001.0100	0x6614	26132		
Overflow	≥ 2613.3	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 87: TC Type C Kelvin (Magnitude/Sign)

Range	Temperature [K]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ 248.1	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	248.2	0000.1001.1011.0010	0x09B2	2482	0x8001	On
	273.1	0000.1010.1010.1011	0x0AAB	2731		
Nominal range	273.2	0000.1010.1010.1100	0x0AAC	2732	0x0000	Off
	2588.2	0110.0101.0001.1010	0x651A	25882		
Overrange	2588.3	0110.0101.0001.1011	0x651B	25883	0x8002	On
	2613.2	0110.0110.0001.0100	0x6614	26132		
Overflow	≥ 2613.3	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.3.5 Thermocouple Type E Kelvin (Normal Resolution)

The following two tables describe the process data for the signal type of thermocouple (TC) type E (DIN EN 60584-1).

Resolution: 0.1 K per digit

Temperature range: +73.2 ... +1273.2 K

Value range: +732 ... +12732

In the following table, the values are represented in two's complement format.

Table 88: TC Type E Kelvin (Two's Complement)

Range	Temperature [K]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ 48.1	1000.0000.0000.0000	0x8000	−32768	0x8010	On
Underrange	48.2	0000.0001.1110.0010	0x01E2	482	0x8001	On
	73.1	0000.0010.1101.1011	0x02DB	731		
Nominal range	73.2	0000.0010.1101.1100	0x02DC	732	0x0000	Off
	1273.2	0011.0001.1011.1100	0x31BC	12732		
Overrange	1273.3	0011.0001.1011.1101	0x31BD	12733	0x8002	On
	1298.2	0011.0010.1011.0110	0x32B6	12982		
Overflow	≥ 1298.3	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 89: TC Type E Kelvin (Magnitude/Sign)

Range	Temperature [K]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ 48.1	1000.0000.0000.0000	0x8000	−32768	0x8010	On
Underrange	48.2	0000.0001.1110.0010	0x01E2	482	0x8001	On
	73.1	0000.0010.1101.1011	0x02DB	731		
Nominal range	73.2	0000.0010.1101.1100	0x02DC	732	0x0000	Off
	1273.2	0011.0001.1011.1100	0x31BC	12732		
Overrange	1273.3	0011.0001.1011.1101	0x31BD	12733	0x8002	On
	1298.2	0011.0010.1011.0110	0x32B6	12982		
Overflow	≥ 1298.3	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.3.6 Thermocouple Type J Kelvin (Normal Resolution)

The following two tables describe the process data for the signal type of thermocouple (TC) type J (DIN EN 60584-1).

Resolution: 0.1 K per digit

Temperature range: +63.2 ... +1473.2 K

Value range: +632 ... +14732

In the following table, the values are represented in two's complement format.

Table 90: TC Type J Kelvin (Two's Complement)

Range	Temperature [K]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ 38.1	1000.0000.0000.0000	0x8000	−32768	0x8010	On
Underrange	38.2	0000.0001.0111.1110	0x017E	382	0x8001	On
	63.1	0000.0010.0111.0111	0x0277	631		
Nominal range	63.2	0000.0010.0111.1000	0x0278	632	0x0000	Off
	1473.2	0011.1001.1000.1100	0x398C	14732		
Overrange	1473.3	0011.1001.1000.1101	0x398D	14733	0x8002	On
	1498.2	0011.1010.1000.0110	0x3A86	14982		

Range	Temperature [K]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Overflow	≥ 1498.3	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 91: TC Type J Kelvin (Magnitude/Sign)

Range	Temperature [K]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ 38.1	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	38.2	0000.0001.0111.1110	0x017E	382	0x8001	On
	63.1	0000.0010.0111.0111	0x0277	631		
Nominal range	63.2	0000.0010.0111.1000	0x0278	632	0x0000	Off
	1473.2	0011.1001.1000.1100	0x398C	14732		
Overrange	1473.3	0011.1001.1000.1101	0x398D	14733	0x8002	On
	1498.2	0011.1010.1000.0110	0x3A86	14982		
Overflow	≥ 1498.3	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.3.7 Thermocouple Type K Kelvin (Normal Resolution)

The following two tables describe the process data for the signal type of thermocouple (TC) type K (DIN EN 60584-1).

Resolution: 0.1 K per digit

Temperature range: +73.2 ... +1645.2 K

Value range: +732 ... +16452

In the following table, the values are represented in two's complement format.

Table 92: TC Type K Kelvin (Two's Complement)

Range	Temperature [K]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ 48.1	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	48.2	0000.0001.1110.0010	0x01E2	482	0x8001	On
	73.1	0000.0010.1101.1011	0x02DB	731		
Nominal range	73.2	0000.0010.1101.1100	0x02DC	732	0x0000	Off
	1645.2	0100.0000.0100.0100	0x4044	16452		
Overrange	1645.3	0100.0000.0100.0101	0x4045	16453	0x8002	On
	1670.2	0100.0001.0011.1110	0x413E	16702		
Overflow	≥ 1670.3	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 93: TC Type K Kelvin (Magnitude/Sign)

Range	Temperature [K]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ 48.1	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	48.2	0000.0001.1110.0010	0x01E2	482	0x8001	On
	73.1	0000.0010.1101.1011	0x02DB	731		

Range	Temperature [K]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Nominal range	73.2	0000.0010.1101.1100	0x02DC	732	0x0000	Off
	1645.2	0100.0000.0100.0100	0x4044	16452		
Overrange	1645.3	0100.0000.0100.0101	0x4045	16453	0x8002	On
	1670.2	0100.0001.0011.1110	0x413E	16702		
Overflow	≥ 1670.3	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.3.8 Thermocouple Type N Kelvin (Normal Resolution)

The following two tables describe the process data for the signal type of thermocouple (TC) type N (DIN EN 60584-1).

Resolution: 0.1 K per digit

Temperature range: 73.2 ... 1573.2 K

Value range: +732 ... +15732

In the following table, the values are represented in two's complement format.

Table 94: TC Type N Kelvin (Two's Complement)

Range	Temperature [K]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ 48.1	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	48.2	0000.0001.1110.0010	0x01E2	482	0x8001	On
	73.1	0000.0010.1101.1011	0x02DB	731		
Nominal range	73.2	0000.0010.1101.1100	0x02DC	732	0x0000	Off
	1573.2	0011.1101.0111.0100	0x3D74	15732		
Overrange	1573.3	0011.1101.0111.0101	0x3D75	15733	0x8002	On
	1598.2	0011.1110.0110.1110	0x3E6E	15982		
Overflow	≥ 1598.3	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 95: TC Type N Kelvin (Magnitude/Sign)

Range	Temperature [K]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ 48.1	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	48.2	0000.0001.1110.0010	0x01E2	482	0x8001	On
	73.1	0000.0010.1101.1011	0x02DB	731		
Nominal range	73.2	0000.0010.1101.1100	0x02DC	732	0x0000	Off
	1573.2	0011.1101.0111.0100	0x3D74	15732		
Overrange	1573.3	0011.1101.0111.0101	0x3D75	15733	0x8002	On
	1598.2	0011.1110.0110.1110	0x3E6E	15982		
Overflow	≥ 1598.3	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.3.9 Thermocouple Type R and Type S Kelvin (Normal Resolution)

The following two tables describe the process data for the signal type of thermocouples (TC) type R and type S (DIN EN 60584-1).

Resolution: 0.1 K per digit

Temperature range: 223.2 ... +2041.2 K

Value range: +2232 ... +20412

In the following table, the values are represented in two's complement format.

Table 96: TC Type R and Type S Kelvin (Two's Complement)

Range	Temperature [K]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ 198.1	1000.0000.0000.0000	0x8000	−32768	0x8010	On
Underrange	198.2	0000.0111.1011.1110	0x07BE	1982	0x8001	On
	223.1	0000.1000.1011.0111	0x08B7	2231		
Nominal range	223.2	0000.1000.1011.1000	0x08B8	2232	0x0000	Off
	2041.2	0100.1111.1011.1100	0x4FBC	20412		
Overrange	2041.3	0100.1111.1011.1101	0x4FBD	20413	0x8002	On
	2066.2	0101.0000.1011.0110	0x50B6	20662		
Overflow	≥ 2066.3	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 97: TC R and Type S (Magnitude/Sign)

Range	Temperature [K]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ 198.0	1000.0000.0000.0000	0x8000	−32768	0x8010	On
Underrange	198.1	0000.0111.1011.1101	0x07BD	1981	0x8001	On
	223.0	0000.1000.1011.0110	0x08B6	2230		
Nominal range	223.1	0000.1000.1011.0111	0x08B7	2231	0x0000	Off
	2041.1	0100.1111.1011.1011	0x4FBB	20411		
Overrange	2041.2	0100.1111.1011.1100	0x4FBC	20412	0x8002	On
	2066.1	0101.0000.1011.0101	0x50B5	20661		
Overflow	≥ 2066.2	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.3.10 Thermocouple Type T Kelvin (Normal Resolution)

The following two tables describe the process data for the signal type of thermocouple (TC) type T (DIN EN 60584-1).

Resolution: 0.1 K per digit

Temperature range: 73.2 ... 673.2 K

Value range: +732 ... +6732

In the following table, the values are represented in two's complement format.

Table 98: TC Type T Kelvin (Two's Complement)

Range	Temperature [K]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ 48.1	1000.0000.0000.0000	0x8000	−32768	0x8010	On
Underrange	48.2	0000.0001.1110.0010	0x01E2	482	0x8001	On
	73.1	0000.0010.1101.1011	0x02DB	731		

Range	Temperature [K]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Nominal range	73.2	0000.0010.1101.1100	0x02DC	732	0x0000	Off
	673.2	0001.1010.0100.1100	0x1A4C	6732		
Overrange	673.3	0001.1010.0100.1101	0x1A4D	6733	0x8002	On
	698.2	0001.1011.0100.0110	0x1B46	6982		
Overflow	≥ 698.3	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 99: TC Type T Kelvin (Magnitude/Sign)

Range	Temperature [K]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ 48.1	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	48.2	0000.0001.1110.0010	0x01E2	482	0x8001	On
	73.1	0000.0010.1101.1011	0x02DB	731		
Nominal range	73.2	0000.0010.1101.1100	0x02DC	732	0x0000	Off
	673.2	0001.1010.0100.1100	0x1A4C	6732		
Overrange	673.3	0001.1010.0100.1101	0x1A4D	6733	0x8002	On
	698.2	0001.1011.0100.0110	0x1B46	6982		
Overflow	≥ 698.3	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.3.11 RTD and TC Kelvin (High Resolution)

For temperature measurement, high resolution (0.01 K per digit) can be set.

High resolution is available for all thermocouples (TC) except type B.

The following two tables describe the process data for the following signal types:

- Resistance thermometers (RTD) Pt100, Pt200, Pt500 and Pt1000 (EN 60751)
- Resistance thermometers (RTD) Ni100, Ni120, Ni200, Ni500, Ni1000 (TK6180, DIN 43760) and Ni1000 (TK5000, DIN 43760)
- Thermocouple (TC) types E, J, K, N, R, S and T (DIN EN 60584-1)

Resolution: 0.01 K per digit

Temperature range: +223.15 ... +327 K

Value range: -22315 ... +32700

In the following table, the values are represented in two's complement format.

Table 100: Temperature (High Resolution) Kelvin (Two's Complement)

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ 213.14	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	213.15	0101.0011.0100.0011	0x5343	21315	0x8001	On
	223.14	0101.0111.0010.1010	0x572A	22314		
Nominal range	223.15	0101.0111.0010.1011	0x572B	22315	0x0000	Off
	327.00	0111.1111.1011.1100	0x7FBC	32700		
Overrange	327.01	0111.1111.1011.1101	0x7FBD	32701	0x8002	On
	327.50	0111.1111.1110.1110	0x7FEE	32750		

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Overflow	≥ 327.51	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 101: Process Image – Temperature (High Resolution) Kelvin (Magnitude/Sign)

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ 213.14	1000.0000.0000.0000	0x8000	–32768	0x8010	On
Underrange	213.15	0101.0011.0100.0011	0x5343	21315	0x8001	On
	223.14	0101.0111.0010.1010	0x572A	22314		
Nominal range	223.15	0101.0111.0010.1011	0x572B	22315	0x0000	Off
	327.00	0111.1111.1011.1100	0x7FBC	32700		
Overrange	327.01	0111.1111.1011.1101	0x7FBD	32701	0x8002	On
	327.50	0111.1111.1110.1110	0x7FEE	32750		
Overflow	≥ 327.51	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

The following two tables describe the process data for the signal type of thermocouple (TC) type C (DIN EN 60584-1).

Resolution: 0.01 °C per digit

Temperature range: +273.15 ...+327 K

Value range: +27315 ... +32700

In the following table, the values are represented in two's complement format.

Table 102: TC Type C (High Resolution) Kelvin (Two's Complement)

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ 263.14	1000.0000.0000.0000	0x8000	–32768	0x8010	On
Underrange	263.15	0110.0110.1100.1011	0x66CB	26315	0x8001	On
	273.14	0110.1010.1011.0010	0x6AB2	27314		
Nominal range	273.15	0110.1010.1011.0011	0x6AB3	27315	0x0000	Off
	327.00	0111.1111.1011.1100	0x7FBC	32700		
Overrange	327.01	0111.1111.1011.1101	0x7FBD	32701	0x8002	On
	327.50	0111.1111.1110.1110	0x7FEE	32750		
Overflow	≥ 327.51	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 103: TC Type C (High Resolution) Kelvin (Magnitude/Sign)

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ 263.14	1000.0000.0000.0000	0x8000	–32768	0x8010	On
Underrange	263.15	0110.0110.1100.1011	0x66CB	26315	0x8001	On
	273.14	0110.1010.1011.0010	0x6AB2	27314		
Nominal range	273.15	0110.1010.1011.0011	0x6AB3	27315	0x0000	Off

Range	Temperature [°C]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
	327.00	0111.1111.1011.1100	0x7FBC	32700		
Overrange	327.01	0111.1111.1011.1101	0x7FBD	32701	0x8002	On
	327.50	0111.1111.1110.1110	0x7FEE	32750		
Overflow	≥ 327.51	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.4 Resistance Measurement

5.1.4.1 Resistance 0 to 250 Ω

The following two tables describe the process data for the signal type of resistance 0 to 250 Ω.

Resolution: 0.01 Ω per digit

Resistance range: 0 ... 250 Ω

Value range: 0 ... +25000

In the following table, the values are represented in two's complement format.

Table 104: Resistance Measurement 0 ... 250 Ω (Two's Complement)

Range	Resistance [Ω]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	< 0.0	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Nominal range	0.0	0000.0000.0000.0000	0x0000	0	0x0000	Off
	50	0001.0011.1000.1000	0x1388	5000		
	100	0010.0111.0001.0000	0x2710	10000		
	150	0011.1010.1001.1000	0x3A98	15000		
	200	0100.1110.0010.0000	0x4E20	20000		
	250	0110.0001.1010.1000	0x61A8	25000		
Overrange	250.01	0110.0001.1010.1001	0x61A9	25001	0x8002	On
	275.0	0110.1011.0110.1100	0x6B6C	27500		
Overflow	≥ 275.01	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 105: Resistance Measurement 0 ... 250 Ω (Magnitude/Sign)

Range	Resistance [Ω]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	< 0.0	1111.1111.1111.1111	0xFFFF	-32767	0x8010	On
Nominal range	0.0	0000.0000.0000.0000	0x0000	0	0x0000	Off
	50	0001.0011.1000.1000	0x1388	5000		
	100	0010.0111.0001.0000	0x2710	10000		
	150	0011.1010.1001.1000	0x3A98	15000		
	200	0100.1110.0010.0000	0x4E20	20000		
	250	0110.0001.1010.1000	0x61A8	25000		
Overrange	250.01	0110.0001.1010.1001	0x61A9	25001	0x8002	On
	275.0	0110.1011.0110.1100	0x6B6C	27500		
Overflow	≥ 275.01	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.4.2 Resistance 0 to 500 Ω

The following two tables describe the process data for the signal type of resistance 0 to 500 Ω .

Resolution: 0.02 Ω per digit

Resistance range: 0 ... 500 Ω

Value range: 0 ... +25000

In the following table, the values are represented in two's complement format.

Table 106: Resistance Measurement 0 ... 500 Ω (Two's Complement)

Range	Resistance [Ω]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	< 0.0	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Nominal range	0.0	0000.0000.0000.0000	0x0000	0	0x0000	Off
	50	0000.1001.1100.0100	0x09C4	2500		
	100	0001.0011.1000.1000	0x1388	5000		
	150	0001.1101.0100.1100	0x1D4C	7500		
	250	0011.0000.1101.0100	0x30D4	12500		
	500	0110.0001.1010.1000	0x61A8	25000		
Overrange	500.02	0110.0001.1010.1001	0x61A9	25001	0x8002	On
	550	0110.1011.0110.1100	0x6B6C	27500		
Overflow	$\geq$ 550.02	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 107: Resistance Measurement 0 ... 500 Ω (Magnitude/Sign)

Range	Resistance [Ω]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	< 0.0	1111.1111.1111.1111	0xFFFF	-32767	0x8010	On
Nominal range	0.0	0000.0000.0000.0000	0x0000	0	0x0000	Off
	50	0000.1001.1100.0100	0x09C4	2500		
	100	0001.0011.1000.1000	0x1388	5000		
	150	0001.1101.0100.1100	0x1D4C	7500		
	250	0011.0000.1101.0100	0x30D4	12500		
	500	0110.0001.1010.1000	0x61A8	25000		
Overrange	500.02	0110.0001.1010.1001	0x61A9	25001	0x8002	On
	550	0110.1011.0110.1100	0x6B6C	27500		
Overflow	$\geq$ 550.02	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.4.3 Resistance 0 to 1 k Ω

The following two tables describe the process data for the signal type of resistance 0 to 1 k Ω .

Resolution: 0.04 Ω per digit

Resistance range: 0 ... 1 k Ω

Value range: 0 ... +25000

In the following table, the values are represented in two's complement format.

Table 108: Resistance Measurement 0 ... 1 k Ω (Two's Complement) (Two's Complement)

Range	Resistance [Ω]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	< 0.0	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Nominal range	0.0	0000.0000.0000.0000	0x0000	0	0x0000	Off
	50	0000.0100.1110.0010	0x04E2	1250		
	100	0000.1001.1100.0100	0x09C4	2500		
	250	0001.1000.0110.1010	0x186A	6250		
	500	0011.0000.1101.0100	0x30D4	12500		
	1000	0110.0001.1010.1000	0x61A8	25000		
Overrange	1000.04	0110.0001.1010.1001	0x61A9	25001	0x8002	On
	1100	0110.1011.0110.1100	0x6B6C	27500		
Overflow	$\geq$ 1100.04	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 109: Resistance Measurement 0 ... 1 k Ω (Magnitude/Sign)

Range	Resistance [Ω]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	< 0.0	1111.1111.1111.1111	0xFFFF	-32767	0x8010	On
Nominal range	0.0	0000.0000.0000.0000	0x0000	0	0x0000	Off
	50	0000.0100.1110.0010	0x04E2	1250		
	100	0000.1001.1100.0100	0x09C4	2500		
	250	0001.1000.0110.1010	0x186A	6250		
	500	0011.0000.1101.0100	0x30D4	12500		
	1000	0110.0001.1010.1000	0x61A8	25000		
Overrange	1000.04	0110.0001.1010.1001	0x61A9	25001	0x8002	On
	1100	0110.1011.0110.1100	0x6B6C	27500		
Overflow	$\geq$ 1100.04	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.4.4 Resistance 0 to 2 k Ω

The following two tables describe the process data for the signal type of resistance 0 to 2 k Ω .

Resolution: 0.08 Ω per digit

Resistance range: 0 ... 2 k Ω

Value range: 0 ... +25000

In the following table, the values are represented in two's complement format.

Table 110: Resistance Measurement 0 ... 2 k Ω (Two's Complement)

Range	Resistance [Ω]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	< 0.0	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Nominal range	0.0	0000.0000.0000.0000	0x0000	0	0x0000	Off
	100	0000.0100.1110.0010	0x04E2	1250		
	250	0000.1100.0011.0101	0x0C35	3125		
	500	0001.1000.0110.1010	0x186A	6250		

Range	Resistance [Ω]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
	1000	0011.0000.1101.0100	0x30D4	12500		
	2000	0110.0001.1010.1000	0x61A8	25000		
Overrange	2000.08	0110.0001.1010.1001	0x61A9	25001	0x8002	On
	2200	0110.1011.0110.1100	0x6B6C	27500		
Overflow	≥ 2200.08	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 111: Resistance Measurement 0 2 k Ω (Magnitude/Sign)

Range	Resistance [Ω]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	< 0.0	1111.1111.1111.1111	0xFFFF	-32767	0x8010	On
Nominal range	0.0	0000.0000.0000.0000	0x0000	0	0x0000	Off
	100	0000.0100.1110.0010	0x04E2	1250		
	250	0000.1100.0011.0101	0x0C35	3125		
	500	0001.1000.0110.1010	0x186A	6250		
	1000	0011.0000.1101.0100	0x30D4	12500		
	2000	0110.0001.1010.1000	0x61A8	25000		
Overrange	2000.08	0110.0001.1010.1001	0x61A9	25001	0x8002	On
	2200	0110.1011.0110.1100	0x6B6C	27500		
Overflow	≥ 2200.08	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.4.5 Resistance 0 to 4 k Ω and PTC

The following two tables describe the process data for the signal types of resistance 0 to 4 k Ω and PTC.

Resolution: 0.16 Ω per digit

Resistance range: 0 ... 4 k Ω

Value range: 0 ... +25000

In the following table, the values are represented in two's complement format.

Table 112: Resistance Measurement 0 ... 4 k Ω and PTC (Two's Complement)

Range	Resistance [Ω]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	< 0.0	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Nominal range	0.0	0000.0000.0000.0000	0x0000	0	0x0000	Off
	200	0000.0100.1110.0010	0x04E2	1250		
	500	0000.1100.0011.0101	0x0C35	3125		
	1000	0001.1000.0110.1010	0x186A	6250		
	2000	0011.0000.1101.0100	0x30D4	12500		
	4000	0110.0001.1010.1000	0x61A8	25000		
Overrange	4000.16	0110.0001.1010.1001	0x61A9	25001	0x8002	On
	4016	0110.0010.0000.1100	0x620C	25100		
Overflow	≥ 4016.16	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 113: Resistance Measurement 0 ... 4 k Ω (Magnitude/Sign)

Range	Resistance [Ω]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	< 0.0	1111.1111.1111.1111	0xFFFF	-32767	0x8010	On
Nominal range	0.0	0000.0000.0000.0000	0x0000	0	0x0000	Off
	200	0000.0100.1110.0010	0x04E2	1250		
	500	0000.1100.0011.0101	0x0C35	3125		
	1000	0001.1000.0110.1010	0x186A	6250		
	2000	0011.0000.1101.0100	0x30D4	12500		
	4000	0110.0001.1010.1000	0x61A8	25000		
Overrange	4000.16	0110.0001.1010.1001	0x61A9	25001	0x8002	On
	4016	0110.0010.0000.1100	0x620C	25100		
Overflow	≥ 4016.16	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.4.6 Potentiometer

The following two tables describe the process data for the signal type of potentiometer (0 to 4 k Ω). The value is given as the ratio between the loop resistance and the total resistance.

Resolution: 0.005 % per digit

Ratio range: 0 ... 100 %

Value range: 0 ... 20000

In the following table, the values are represented in two's complement format.

Table 114: Potentiometer (Two's Complement)

Range	Percent [%]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	< 0.0	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Nominal range	0.0	0000.0000.0000.0000	0x0000	0	0x0000	Off
	25.0	0001.0011.1000.1000	0x1388	5000		
	50.0	0010.0111.0001.0000	0x2710	10000		
	75.0	0011.1010.1001.1000	0x3A98	15000		
	100.0	0100.1110.0010.0000	0x4E20	20000		
Overrange	100.005	0100.1110.0010.0001	0x4E21	20001	0x8002	On
	105	0101.0010.0000.1000	0x5208	21000		
Overflow	≥ 105.005	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 115: Potentiometer (Magnitude/Sign)

Range	Percent [%]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	< 0.0	1111.1111.1111.1111	0xFFFF	-32767	0x8010	On
Nominal range	0.0	0000.0000.0000.0000	0x0000	0	0x0000	Off
	25.0	0001.0011.1000.1000	0x1388	5000		
	50.0	0010.0111.0001.0000	0x2710	10000		

Range	Percent [%]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
	75.0	0011.1010.1001.1000	0x3A98	15000		
	100.0	0100.1110.0010.0000	0x4E20	20000		
Overrange	100.005	0100.1110.0010.0001	0x4E21	20001	0x8002	On
	105	0101.0010.0000.1000	0x5208	21000		
Overflow	≥ 105.005	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.5 Voltage Measurement

5.1.5.1 Voltage ±30 mV

The following two tables describe the process data for the signal type of voltage measurement ±30 mV.

Resolution: 0.0012 mV per digit

Voltage range: -30 ... +30 mV

Value range: -25000 ... +25000

In the following table, the values are represented in two's complement format.

Table 116: Voltage Measurement ±30 mV (Two's Complement)

Range	Voltage [mV]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -35.0012	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	-35.0	1000.1110.0001.0001	0x8E11	-29167	0x8001	On
	-30.0012	1001.1110.0101.0111	0x9E57	-25001		
Nominal range	-30.0	1001.1110.0101.1000	0x9E58	-25000	0x0000	Off
	-15.0	1100.1111.0010.1100	0xCF2C	-12500		
	15.0	0011.0000.1101.0100	0x30D4	12500		
	30.0	0110.0001.1010.1000	0x61A8	25000		
Overrange	30.0012	0110.0001.1010.1001	0x61A9	25001	0x8002	On
	35.0	0111.0001.1110.1111	0x71EF	29167		
Overflow	≥ 35.0012	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 117: Voltage Measurement ±30 mV (Magnitude/Sign)

Range	Voltage [mV]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -35.0012	1111.1111.1111.1111	0xFFFF	-32767	0x8010	On
Underrange	-35.0	1111.0001.1110.1111	0xF1EF	-29167	0x8001	On
	-30.0012	1110.0001.1010.1001	0xE1A9	-25001		
Nominal range	-30.0	1110.0001.1010.1000	0xE1A8	-25000	0x0000	Off
	-15.0	1011.0000.1101.0100	0xB0D4	-12500		
	15.0	0011.0000.1101.0100	0x30D4	12500		
	30.0	0110.0001.1010.1000	0x61A8	25000		
Overrange	30.0012	0110.0001.1010.1001	0x61A9	25001	0x8002	On
	35.0	0111.0001.1110.1111	0x71EF	29167		

Range	Voltage [mV]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Overflow	≥ 35.0012	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.5.2 Voltage ± 60 mV

The following two tables describe the process data for the signal type of voltage measurement ± 60 mV.

Resolution: 0.0024 mV per digit

Voltage range: -60 ... +60 mV

Value range: -25000 ... +25000

In the following table, the values are represented in two's complement format.

Table 118: Voltage Measurement ± 60 mV (Two's Complement)

Range	Voltage [mV]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -70.0024	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	-70.0	1000.1110.0001.0001	0x8E11	-29167	0x8001	On
	-60.0024	1001.1110.0101.0111	0x9E57	-25001		
Nominal range	-60.0	1001.1110.0101.1000	0x9E58	-25000	0x0000	Off
	-30.0	1100.1111.0010.1100	0xCF2C	-12500		
	30.0	0011.0000.1101.0100	0x30D4	12500		
	60.0	0110.0001.1010.1000	0x61A8	25000		
Overrange	60.0024	0110.0001.1010.1001	0x61A9	25001	0x8002	On
	70.0	0111.0001.1110.1111	0x71EF	29167		
Overflow	≥ 70.0024	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 119: Voltage Measurement ± 60 mV (Magnitude/Sign)

Range	Voltage [mV]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -70.0024	1111.1111.1111.1111	0xFFFF	-32767	0x8010	On
Underrange	-70.0	1111.0001.1110.1111	0xF1EF	-29167	0x8001	On
	-60.0024	1110.0001.1010.1001	0xE1A9	-25001		
Nominal range	-60.0	1110.0001.1010.1000	0xE1A8	-25000	0x0000	Off
	-30.0	1011.0000.1101.0100	0xB0D4	-12500		
	30.0	0011.0000.1101.0100	0x30D4	12500		
	60.0	0110.0001.1010.1000	0x61A8	25000		
Overrange	60.0024	0110.0001.1010.1001	0x61A9	25001	0x8002	On
	70.0	0111.0001.1110.1111	0x71EF	29167		
Overflow	≥ 70.0024	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.5.3 Voltage ± 120 mV

The following two tables describe the process data for the signal type of voltage measurement ± 120 mV.

Resolution: 0.0048 mV per digit

Voltage range: -120 ... +120 mV

Value range: -25000 ... +25000

In the following table, the values are represented in two's complement format.

Table 120: Voltage Measurement ± 120 mV (Two's Complement)

Range	Voltage [mV]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -140.0048	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	-140.0	1000.1110.0001.0001	0x8E11	-29167	0x8001	On
	-120.0048	1001.1110.0101.0111	0x9E57	-25001		
Nominal range	-120.0	1001.1110.0101.1000	0x9E58	-25000	0x0000	Off
	-60.0	1100.1111.0010.1100	0xCF2C	-12500		
	60.0	0011.0000.1101.0100	0x30D4	12500		
	120.0	0110.0001.1010.1000	0x61A8	25000		
Overrange	120.0048	0110.0001.1010.1001	0x61A9	25001	0x8002	On
	140.0	0111.0001.1110.1111	0x71EF	29167		
Overflow	≥ 140.0048	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 121: Voltage Measurement ± 120 mV (Magnitude/Sign)

Range	Voltage [mV]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -140.0048	1111.1111.1111.1111	0xFFFF	-32767	0x8010	On
Underrange	-140.0	1111.0001.1110.1111	0xF1EF	-29167	0x8001	On
	-120.0048	1110.0001.1010.1001	0xE1A9	-25001		
Nominal range	-120.0	1110.0001.1010.1000	0xE1A8	-25000	0x0000	Off
	-60.0	1011.0000.1101.0100	0xB0D4	-12500		
	60.0	0011.0000.1101.0100	0x30D4	12500		
	120.0	0110.0001.1010.1000	0x61A8	25000		
Overrange	120.0048	0110.0001.1010.1001	0x61A9	25001	0x8002	On
	140.0	0111.0001.1110.1111	0x71EF	29167		
Overflow	≥ 140.0048	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.5.4 Voltage ± 250 mV

The following two tables describe the process data for the signal type of voltage measurement ± 250 mV.

Resolution: 0.01 mV per digit

Voltage range: -250 ... +250 mV

Value range: -25000 ... +25000

In the following table, the values are represented in two's complement format.

Table 122: Voltage Measurement ± 250 mV (Two's Complement)

Range	Voltage [mV]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -290.01	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	-290.0	1000.1110.1011.1000	0x8EB8	-29000	0x8001	On
	-250.01	1001.1110.0101.0111	0x9E57	-25001		
Nominal range	-250.0	1001.1110.0101.1000	0x9E58	-25000	0x0000	Off
	-125.0	1100.1111.0010.1100	0xCF2C	-12500		
	125.0	0011.0000.1101.0100	0x30D4	12500		
	250.0	0110.0001.1010.1000	0x61A8	25000		
Overrange	250.01	0110.0001.1010.1001	0x61A9	25001	0x8002	On
	290.0	0111.0001.0100.1000	0x7148	29000		
Overflow	≥ 290.01	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 123: Voltage Measurement ± 250 mV (Magnitude/Sign)

Range	Voltage [mV]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -290.01	1111.1111.1111.1111	0xFFFF	-32767	0x8010	On
Underrange	-290.0	1111.0001.0100.1000	0xF148	-29000	0x8001	On
	-250.01	1110.0001.1010.1001	0xE1A9	-25001		
Nominal range	-250.0	1110.0001.1010.1000	0xE1A8	-25000	0x0000	Off
	-125.0	1011.0000.1101.0100	0xB0D4	-12500		
	125.0	0011.0000.1101.0100	0x30D4	12500		
	250.0	0110.0001.1010.1000	0x61A8	25000		
Overrange	250.01	0110.0001.1010.1001	0x61A9	25001	0x8002	On
	290.0	0111.0001.0100.1000	0x7148	29000		
Overflow	≥ 290.01	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.5.5 Voltage ± 500 mV

The following two tables describe the process data for the signal type of voltage measurement ± 500 mV.

Resolution: 0.02 mV per digit

Voltage range: -500 ... +500 mV

Value range: -25000 ... +25000

In the following table, the values are represented in two's complement format.

Table 124: Voltage Measurement ± 500 mV (Two's Complement)

Range	Voltage [mV]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -580.02	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	-580.0	1000.1110.1011.1000	0x8EB8	-29000	0x8001	On
	-500.02	1001.1110.0101.0111	0x9E57	-25001		
Nominal range	-500.0	1001.1110.0101.1000	0x9E58	-25000	0x0000	Off
	-250.0	1100.1111.0010.1100	0xCF2C	-12500		

Range	Voltage [mV]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
	250.0	0011.0000.1101.0100	0x30D4	12500		
	500.0	0110.0001.1010.1000	0x61A8	25000		
Overrange	500.02	0110.0001.1010.1001	0x61A9	25001	0x8002	On
	580.0	0111.0001.0100.1000	0x7148	29000		
Overflow	≥ 580.02	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 125: Voltage Measurement ±500 mV (Magnitude/Sign)

Range	Voltage [mV]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -580.02	1111.1111.1111.1111	0xFFFF	-32767	0x8010	On
Underrange	-580.0	1111.0001.0100.1000	0xF148	-29000	0x8001	On
	-500.02	1110.0001.1010.1001	0xE1A9	-25001		
Nominal range	-500.0	1110.0001.1010.1000	0xE1A8	-25000	0x0000	Off
	-250.0	1011.0000.1101.0100	0xB0D4	-12500		
	250.0	0011.0000.1101.0100	0x30D4	12500		
	500.0	0110.0001.1010.1000	0x61A8	25000		
Overrange	500.02	0110.0001.1010.1001	0x61A9	25001	0x8002	On
	580.0	0111.0001.0100.1000	0x7148	29000		
Overflow	≥ 580.02	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.5.6 Voltage ±1000 mV

The following two tables describe the process data for the signal type of voltage measurement ±1000 mV.

Resolution: 0.04 mV per digit

Voltage range: -1000 ... +1000 mV

Value range: -25000 ... +25000

In the following table, the values are represented in two's complement format.

Table 126: Voltage Measurement ±1000 mV (Two's Complement)

Range	Voltage [mV]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -1160.04	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	-1160.0	1000.1110.1011.1000	0x8EB8	-29000	0x8001	On
	-1000.04	1001.1110.0101.0111	0x9E57	-25001		
Nominal range	-1000.0	1001.1110.0101.1000	0x9E58	-25000	0x0000	Off
	-500.0	1100.1111.0010.1100	0xCF2C	-12500		
	500.0	0011.0000.1101.0100	0x30D4	12500		
	1000.0	0110.0001.1010.1000	0x61A8	25000		
Overrange	1000.04	0110.0001.1010.1001	0x61A9	25001	0x8002	On
	1160.0	0111.0001.0100.1000	0x7148	29000		
Overflow	≥ 1160.04	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 127: Voltage Measurement ± 1000 mV (Magnitude/Sign)

Range	Voltage [mV]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -1160.04	1111.1111.1111.1111	0xFFFF	-32767	0x8010	On
Underrange	-1160.0	1111.0001.0100.1000	0xF148	-29000	0x8001	On
	-1000.04	1110.0001.1010.1001	0xE1A9	-25001		
Nominal range	-1000.0	1110.0001.1010.1000	0xE1A8	-25000	0x0000	Off
	-500.0	1011.0000.1101.0100	0xB0D4	-12500		
	500.0	0011.0000.1101.0100	0x30D4	12500		
	1000.0	0110.0001.1010.1000	0x61A8	25000		
Overrange	1000.04	0110.0001.1010.1001	0x61A9	25001	0x8002	On
	1160.0	0111.0001.0100.1000	0x7148	29000		
Overflow	≥ 1160.04	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.1.5.7 Voltage ± 2000 mV

The following two tables describe the process data for the signal type of voltage measurement ± 2000 mV.

Resolution: 0.08 mV per digit

Voltage range: -2000 ... +2000 mV

Value range: -25000 ... +25000

In the following table, the values are represented in two's complement format.

Table 128: Voltage Measurement ± 2000 mV (Two's Complement)

Range	Voltage [mV]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -2320.08	1000.0000.0000.0000	0x8000	-32768	0x8010	On
Underrange	-2320.0	1000.1110.1011.1000	0x8EB8	-29000	0x8001	On
	-2000.08	1001.1110.0101.0111	0x9E57	-25001		
Nominal range	-2000.0	1001.1110.0101.1000	0x9E58	-25000	0x0000	Off
	-1000.0	1100.1111.0010.1100	0xCF2C	-12500		
	1000.0	0011.0000.1101.0100	0x30D4	12500		
	2000.0	0110.0001.1010.1000	0x61A8	25000		
Overrange	2000.08	0110.0001.1010.1001	0x61A9	25001	0x8002	On
	2320.0	0111.0001.0100.1000	0x7148	29000		
Overflow	≥ 2320.08	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

In the following table, the values are shown as a magnitude with sign.

Table 129: Voltage Measurement ± 2000 mV (Magnitude/Sign)

Range	Voltage [mV]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Underflow	≤ -2320.08	1111.1111.1111.1111	0xFFFF	-32767	0x8010	On
Underrange	-2320.0	1111.0001.0100.1000	0xF148	-29000	0x8001	On
	-2000.08	1110.0001.1010.1001	0xE1A9	-25001		

Range	Voltage [mV]	Numeric Value, Binary	Numeric Value, Hex.	Numeric Value, Decimal	Status Word, Hex.	Error LED
Nominal range	–2000.0	1110.0001.1010.1000	0xE1A8	–25000	0x0000	Off
	–1000.0	1011.0000.1101.0100	0xB0D4	–12500		
	1000.0	0011.0000.1101.0100	0x30D4	12500		
	2000.0	0110.0001.1010.1000	0x61A8	25000		
Overrange	2000.08	0110.0001.1010.1001	0x61A9	25001	0x8002	On
	2320.0	0111.0001.0100.1000	0x7148	29000		
Overflow	≥ 2320.08	0111.1111.1111.1111	0x7FFF	32767	0x8020	On

5.2 MQTT

The connection between the module (MQTT client) and the broker is established anonymously, i.e., no user-password combination is used.

Topics are transmitted once when the module restarts. After that, topics are only transmitted when the value changes.

However, topics with process data are transferred cyclically. The process data of ports X01 to X04 is transmitted every 5 s, and the process data of ports X05 to X08 every 1 s. Transmission of the process data has low priority in the firmware and is therefore not deterministic.

The individual topics are described below.

5.2.1 General Elements of a Topic

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

Table 130: 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 131: 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 132: 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": "0000000000013444",
  "OrderNumber": "765-4101/100-000",
  "UII": "37SUN31564010260422320+0000000000013444",
  "Firmware": "WAGO I/O System Field",
  "ApplicationName_1": "",
  "ApplicationName_2": ""
}
```

5.2.3 Gateway Topics

The following topics apply to ports X01 to X04.

Table 133: 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 [> 80] .
{prefix}/iolink/v1/gateway/capabilities	Gateway functions: IODD supported, MQTT supported For an example, see 🔗 Gateway Topics [> 81] .
{prefix}/iolink/v1/gateway/configuration	Network configuration of the gateway: IP configuration, IP address, subnet mask, default gateway For an example, see 🔗 Gateway Topics [> 81] .

Gateway Identification

Example of Gateway Identification JSON Object:

```
{
  "macAddress": "1:02:03:04:05:06",
  "serialNumber": "0000000000013444",
  "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 134: 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 135: 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

The following topics apply to ports X01 to X04.

Table 136: 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

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 137: 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 138: 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 139: 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 140: 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"
  }
}
```

5.2.5 Device Topics

The following topics apply to ports X01 to X04.

Table 141: 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/[DEVICE_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/[DEVICE_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/[DEVICE_ALIAS]/processdata/getdata/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/[DEVICE_ALIAS]/processdata/setdata/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/[DEVICE_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 142: 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 143: 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 144: 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 145: 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 146: 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 147: 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 Analog Topics

The following topics apply to ports X05 to X08.

Table 148: Analog Topics

Topic	Description
{prefix}/analog/V1/module/identification	AI module identification: MAC address, product ID, manufacturer name, product name, hardware revision and firmware version For an example, see AI-Modulidentifikation (JSON-Objekt) [► 102] .
{prefix}/analog/V1/module/configuration	Module configuration for all AI ports: input filter For an example, see AI-Modulkonfiguration (JSON-Objekt) [► 103] .
{prefix}/analog/V1/ports/[PORT_NUMBER]/processdata/getdata	Process data value of the AI port Example: {prefix}/analog/V1/ports/X05/processdata/getdata For an example, see AI-Port-Prozesswert (JSON-Objekt) [► 103] .
{prefix}/analog/V1/ports/[PORT_NUMBER]/configuration	AI port configuration Example: {prefix}/analog/V1/ports/X05/configuration For an example, see AI-Port-Konfiguration (JSON-Objekt) [► 103] .
{prefix}/analog/V1/ports/[PORT_NUMBER]/diagnostics/configuration	AI port configuration Example: {prefix}/analog/V1/ports/X05/diagnostics/configuration For an example, see AI-Port-Diagnosekonfiguration (JSON-Objekt) [► 105] .

AI Module Identification (JSON Object)

Table 149: AI Module Identification (JSON Object)

JSON Key	Description
macAddress	MAC address of the module
productID	Product ID: 765
vendorName	Manufacturer name: WAGO GmbH & Co. KG
productName	Product name
hardwareRevision	Hardware version
firmwareRevision	Firmware version

Example of AI Module Identification JSON Object:

```
{
  "macAddress": "01:02:03:04:05:06",
  "serialNumber": "0000000000020020"
  "productID": "765",
  "vendorName": "WAGO GmbH & Co. KG",
  "productName": "WAGO 4 AI-RTD/TC, 4 IOL-A FLD PN 2.0A",
  "hardwareRevision": "V1.0.0",
  "firmwareRevision": "V1.2.3"
}
```

AI Module Configuration (JSON Object)

Table 150: AI Module Configuration (JSON Object)

JSON Key	Description
portFilter	Input filter for the module: 10 Hz, 50 Hz, 60 Hz or 400 Hz
tempUnit	Unit for measured temperature values: "degrees Celsius °C," "degrees Fahrenheit °F" or "Kelvin."

Example of AI module configuration JSON object:

```
{
  "filterFrequency": "50 Hz"
  "tempUnit": "Grad Celsius °C"
}
```

AI Port Process Value (JSON Object)

Table 151: AI Port Process Value (JSON Object)

JSON Key	Description
time	Timestamp
status	Status information true: process value is valid false: process value is invalid
data	Process value
unit	Unit of the process value: m°C, m°F, mK, mΩ, mV or m%

Example of AI port process value JSON object:

```
{
  "time": "2031-01-11T16:59:37.405Z",
  "status": false,
  "data": 123,
  "unit": "mΩ"
}
```

AI Port Configuration (JSON Object)

Table 152: AI Port Configuration (JSON Object)

JSON Key	Description
portSignalType	Signal type Example: "RTD 3-wire Pt100"
portSmoothing	Smoothing for the analog value: "OFF," "WEAK," "MEDIUM" or "STRONG"
portTempResolution	Resolution for temperature values: 0.1 °C (°F or K) or 0.01 °C (°F or K) per digit
portWireCompensation	Compensation resistance: line resistance value that needs to be taken into account in the calculation of the measured values for 2-wire RTD measurement; unit: mΩ
portNumberFormat	Representation of the process data value: two's complement or magnitude/sign

JSON Key	Description
userScalActive	User scaling true: user scaling is switched on for this port false: user scaling is switched off for this port
userScalOffset	The offset value causes a zero offset of the process value (shift along the Y axis) Value range: -32768 ... 32767
userScalGain	Gain factor applied to the process data value; a value of 10000 corresponds to a gain factor of 1.0000. A value of 20000 corresponds to a gain factor of 2.0000. Value range: -30000 ... 30000
userCaliActive	User calibration true: user calibration is switched on for this port false: user calibration is switched off for this port
userCaliOffset	Offset value for user calibration Value range: -32768 ... 32767
userCaliGain	Gain factor for user calibration A value of 10000 corresponds to a gain factor of 1.0000. A value of 20000 corresponds to a gain factor of 2.0000. Value range: -30000 ... 30000
portSimulationActive	Simulation true: simulation is switched on for this port false: simulation is switched off for this port
portSimulationStatus	Simulation status word
portSimulationValue	Simulation process value

Example of AI port configuration JSON object:

```
{
  "portSignalType": "RTD 3-wire Pt100",
  "portSmoothing": "OFF",
  "portTempResolution": "0,1",
  "portWireCompensation": 0,
  "portNumberFormat": "Two's complement",
  "userScalActive": true,
  "userScalOffset": 0,
  "userScalGain": 10000,
  "userCaliActive": true,
  "userCaliOffset": 0,
  "userCaliGain": 10000,
  "portSimulationActive": false,
  "portSimulationStatus": 0,
  "portSimulationValue": 0
}
```

AI Port Diagnostic Configuration (JSON Object)

Table 153: AI Port Diagnostic Configuration (JSON Object)

JSON Key	Description
setMeasuringRangeUnderflow	"Measurement underrange" diagnostic true: this diagnostic is switched on false: this diagnostic is switched off
setMeasuringRangeOverflow	"Measurement overrange" diagnostic true: this diagnostic is switched on false: this diagnostic is switched off
setLowerUserLimitValueUnder-shot	"Lower user limiting value underrange" diagnostic true: this diagnostic is switched on false: this diagnostic is switched off
setUpperUserLimitValueEx-ceeded	"Upper user limiting value overrange" diagnostic true: this diagnostic is switched on false: this diagnostic is switched off
setUnderflow	"Underflow" diagnostic true: this diagnostic is switched on false: this diagnostic is switched off
setOverflow	"Overflow" diagnostic true: this diagnostic is switched on false: this diagnostic is switched off
setInternalError	"Internal Error" diagnostic true: this diagnostic is switched on false: this diagnostic is switched off
setChannelDiagnostics	PROFINET channel diagnostics true: PROFINET channel diagnostics are switched on false: PROFINET channel diagnostics are switched off, i.e., no diagnostic alarms are triggered
setLowerUserLimitValue	Lower user limiting value Value range: -32768 ... 32767
setUpperUserLimitValue	Upper user limiting value Value range: -32768 ... 32767
setWireBreak	"Wire break" diagnostic true: this diagnostic is switched on false: this diagnostic is switched off

Example of AI Port Diagnostic Configuration JSON Object:

```
{
  "setMeasuringRangeUnderflow": true
  "setMeasuringRangeOverflow": true,
  "setLowerUserLimitValueUndershot": true,
  "setUpperUserLimitValueExceeded": true,
  "setUnderflow": true
  "setOverflow": true,
```

```
    "setInternalError": true,  
    "setChannelDiagnostics": true,  
    "setLowerUserLimitValue": -32768,  
    "setUpperUserLimitValue": 32767  
    "setWireBreak": true  
}
```

5.2.7 MQTT Topics

Table 154: MQTT Topics

Topic	Beschreibung
{prefix}/iolink/v1/mqtt/connectionstatus	MQTT client configuration: connection status, server address, uptime For an example, see MQTT Topics [p. 107] .

MQTT Connection Status

Table 155: MQTT Connection Status, "JSON Key"

JSON key	Beschreibung
connectionStatus	Possible values for "connectionStatus": - CONNECTING - CONNECTION_ACCEPTED

Example of MQTT Connection Status JSON Object:

```
{  
  "connectionStatus" : "CONNECTION_ACCEPTED",  
  "serverAddress" : "192.168.2.1",  
  "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 2 and pin 4.

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

For analog inputs, you can simulate one status value and one 16 bit value 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 \[► 126\]](#). 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 Überwachungsfunktionen

Ports X01 to X04

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 \[► 118\]](#).

Ports X05 to X08

Diagnostics are performed for each channel.

5.5 Overload protection

Ports X01 to X04

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

Ports X05 to X08

The sensor power supplies are monitored.

5.6 Parameterization Tools

5.6.1 Übersicht

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

Table 156: 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-yyyymmdd.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 onto 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, the connected IO-Link devices and the analog ports, as well as 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 but not for configuring the analog ports.
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.

Four parts of the configuration and parameterization must be distinguished:

1. **PROFINET configuration:** PROFINET modules and submodules
2. **Port configuration:** digital input or output for ports X01 to X04
3. **Analog configuration:** analog input for ports X05 to X08
4. **IO-Link device configuration:** for ports X01 to X04

The following table explains which tool can influence which part.

Table 157: Parameterization Overview

Tool	PROFINET Modules and Submodules	Port Configuration (IO-Link and Analog Input)	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. For ports X01 to X04, these parameters determine whether the port is used as an IO-Link master, a digital input or a digital output or is disabled. For ports X05 to X08, these parameters determine how the analog input is used (or 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.

Tool	PROFINET Modules and Submodules	Port Configuration (IO-Link and Analog Input)	IO-Link Device Configuration
WAGO I/O Field app	–	Yes	Yes The app can use IODD to parameterize an IO-Link device.
WAGO IO-Link Configurator	–	Only the WAGO IO-Link master and the IO-Link devices but not for configuring the analog ports.	Yes WAGO IO-Link Configurator can use IODD to parameterize an IO-Link device.
OPC UA	–	Yes	–
MQTT	–	No	–

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 Webserver I/O Field

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:

- Ports X01 ... X04: 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 158: Function Overview of the WAGO I/O System Field Webserver for WAGO IO-Link Modules

Menu	Tab	Description	Section
Dashboard	-	View module information	WAGO Webserver I/O Field User Interface [► 169]
Licenses	-	Show licenses of the software components used	Displaying Licenses [► 170]
Device settings	(All)	Make module settings	Ports konfigurieren [► 177]
	Device status	Device status LEDs	Device Status LEDs [► 170]
	Tags and labels	Tags and labels	Tags and Labels [► 170]
	Maintenance	Store maintenance information	Maintenance Information [► 171]
	Device configuration	Show IP connection	Reading IP Parameters [► 181]
	Firmware upgrade	Update firmware	Firmware aktualisieren [► 182]
	Factory reset	Reset module to factory settings	Resetting the Module to the Factory Settings [► 184]
Extended settings	(All)	Make advanced module settings	Making Extended Settings on the Module [► 190]

Menu	Tab	Description	Section
	MQTT	Make MQTT settings	MQTT Configuration [► 190]
	NTP settings	Make NTP settings	NTP Settings [► 194]
	Power-on delay	Set power-on delay for sequential power-on	Power-on Delay [► 195]
	Bluetooth	Configure Bluetooth*	Bluetooth konfigurieren [► 196]
	Load management	Show current measured values for current, voltage and temperature; configure threshold values and display statistics	Load Management [► 198]
	Radio test	Test wireless technology (Bluetooth*)	Testing the Radio Technology [► 201]
Ports X01, X02, X03, X04	(All)	Port information and settings for IO-Link ports X01, X02, ...	Ports konfigurieren [► 177]
	Information	Show 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	Show 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 connected IO-Link devices	Accessing a Connected IO-Link Device [► 176]
	Process data	Show process data (input/output)	Ports konfigurieren [► 177]
General AI settings	-	Settings for all of analog inputs of the module	Making General Settings for Analog Inputs [► 203]
AI ports X05, X06, X07, X08	(All)	Port-specific information and settings for AI ports X05, X06, X07 and X08	Configuring Analog Input Ports [► 204]
	Channel parameters	Make port-specific settings (e.g., set measurement range, enable/disable diagnostic functions)	Channel Parameters [► 204]
	Scaling	Set the AI port scaling	Scaling [► 207]
	Calibration	Calibrate AI port	Calibration [► 208]
	Process data	Show process data (input) and status word	Displaying Analog Process Data [► 210]
DIO Forcing	-	Force digital inputs and outputs	Forcing Digital Inputs and Outputs [► 187]
AI Forcing	-	Force analog inputs	Forcing for Analog Inputs [► 188]
IOL Forcing	-	Force IO-Link ports	Forcing for IO-Link Ports [► 189]

Menu	Tab	Description	Section
User administration	-	Set up and manage users	🔑 Managing Users [► 185]
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 an 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 \[▶ 116\]](#).

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 firewall.
- 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](https://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 \[p. 255\]](#)).

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 consumption of the connected sensors and actuators into account.

Downstream devices can be powered through the X32 (PWR OUT) supply output. The design of the power supply must also take this current feedthrough into account.

Protective Functions

The module has integrated protective functions (see [🔗 Overload protection \[► 109\]](#)) to prevent damage in overload situations (e.g., overcurrent or short circuit).

However, the integrated protective functions do not cover the current feedthrough for powering downstream devices through the supply output (X22). Therefore, overcurrent protection is required to limit the current feedthrough via X21 and X22 (e.g., a fuse or circuit breaker).

This is because these protective functions do not cover the current feedthrough for powering downstream devices through the supply output (X32). Overcurrent protection must be used to limit the maximum supply current, including the current feedthrough through X31 and X32.

Consumption

For each supply cable, it is necessary to take into account the consumption that depends on the connected devices. The following partial currents contribute to this:

Supply Cable 1:

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

Supply Cable 2:

- Power supply for downstream 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 [🔗 Technical Data \[▶ 24\]](#).

Rules

In addition to the consumption of the connected devices, rules for the maximum load capacity must be followed. Observe the following rules to prevent damage to the device.

- 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 ... X04
 - Rule 3: The current load of pin 3 must not exceed 4 A, since the sum of the pin 1, 2 and 4 currents flows back through pin 3.

The current on pin 1 and pin 3 of ports X05 to X08 is at most 400 mA and is thus below the maximum load capacity of a pin.

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 \[▶ 164\]](#).
- 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 \[▶ 164\]](#).

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 \[▶ 122\]](#).

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:

- The I_{X32_2L} current that flows through PWR OUT (X32) to 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 value 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 \[p. 122\]](#) (fuse protection, regulated power supply with current limitation and additional monitoring of the measured values of the sensors) are necessary.

Rule 3 – Upper Limits for Current on the Individual Pins of the Ports

Rule 3 for Ports X01 to X04:

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

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

Table 159: Upper Limits for Current on the Individual Pins of the Ports (X01 to X04)

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 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.

Rule 3 for Ports X05 to X08:

The analog ports are high-impedance. Each pin of ports X05 to X08 can handle a maximum current of 10 mA. Therefore, the value is within the permissible range for the current load of a pin.

Product-Specific Information

For supply cable 1 of the 765-2102/100-000 IO-Link module, the currents declared in the following table must be taken into account:

Table 160: 765-2102/100-000 Module – Currents in Supply Cable 1

Current	Description
I_{X31_1L}	Current to PWR IN connection (X31): current 1L+ / reverse current 1L–
I_{X32_1L}	Current to PWR OUT connection (X32): current 1L+ / reverse current 1L–
I_{logic}	Logic power supply
$I_{X01_1L}, I_{X02_1L}, I_{X03_1L}, I_{X04_1L}$	The total current for supply cable 1 at digital input/output port X0i (i.e., ports X01, X02, X03 or X04) corresponds to the current $I_{X0i_pin3_1L}$ at pin 3 (ground). This current is the sum of the currents on pins 1, 2 and 4 of port X0i: $I_{X0i_1L} = I_{X0i_pin3_1L} = I_{X0i_pin1_1L} + I_{X0i_pin2_1L} + I_{X0i_pin4_1L}$
$I_{X05_1L}, I_{X06_1L}, I_{X07_1L}, I_{X08_1L}$	The total current for supply cable 1 at digital input/output port X0i (i.e., ports X05, X06, X07 or X08) corresponds to the current $I_{X0i_pin3_1L}$ at pin 3 (ground). $I_{X0i_1L} = I_{X0i_pin3_1L} = I_{X0i_pin1_1L}$
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 765-2102/100-000 IO-Link module, the currents declared in the following table must be taken into account:

Table 161: 765-2102/100-000 Module – Currents in Supply Cable 2

Current	Description
I_{X31_2L}	Current to PWR IN connection (X31): current 2L+ / reverse current 2L–
I_{X32_2L}	Current to PWR OUT connection (X32): current 2L+ / reverse current 2L–
I_{module_2L}	Module current $I_{module_2L} = 0$

For this module, supply cable 2 is only used for transmission between the PWR IN (X31) and PWR OUT (X32) connections.

During operation of the 765-2102/100-000 IO-Link module, the rules below for the currents in supply cables 1 and 2 must be followed at all times:

Table 162: 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)	$I_{X32_1L} \leq 16 \text{ A} - I_{logic} - I_{module_1L}$	$I_{X32_2L} \leq 16 \text{ A} - I_{module_2L}$
IO-Link ports (X01 to X04)	Ports X01, ..., X04 (henceforth summarized as port X0i for $1 \leq i \leq 4$)	–
Supply current on pin 1 (rule 3, ports X01 to X04)	$I_{X0i_pin1_1L} \leq 4 \text{ A}$	–
Signal current on pin 2/4 in normal operation (rule 3, ports X01 to X04)	$I_{X0i_pin2_1L} \leq 2 \text{ A}$ $I_{X0i_pin4_1L} \leq 2 \text{ A}$	–
Signal current on pin 2/4 in overload operation (rule 3, ports X01 to X04)	$I_{X0i_pin2_1L} \leq 2.4 \text{ A}$ $I_{X0i_pin4_1L} \leq 2.4 \text{ A}$	–
Reverse current on pin 3 (ground) (rule 3, ports X01 to X04)	$I_{X0i_pin3_1L} \leq 4 \text{ A}$	–

Current	Supply Cable 1	Supply Line 2
Analog ports (X05 to X08)	Ports X05, ..., X08 (henceforth summarized as port X0i for $5 \leq i \leq 8$)	–
Current on pin 1 or reverse current on pin 3 (ports X05 to X08)	$I_{X0i_pin1_1L} \leq 0.4 \text{ A}$ $I_{X0i_pin3_1L} \leq 0.4 \text{ A}$	–

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 $4 \times 1.5 \text{ mm}^2$ supply cables, the cable resistance R_L per wire $R_L \leq 13.7 \text{ } \Omega/\text{km}$.

Example of Voltage Drop for Feed and Return Lines with a Current of 8 A on the WAGO $4 \times 1.5 \text{ mm}^2$ Supply Cable

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

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 $4 \times 2.5 \text{ mm}^2$ Supply Cable

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

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.

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.

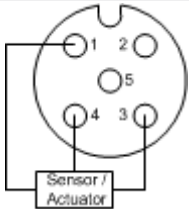
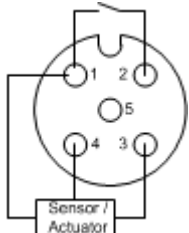
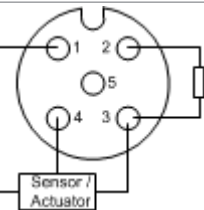
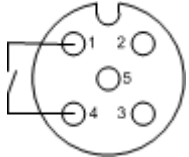
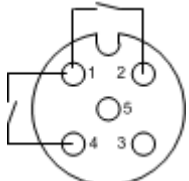
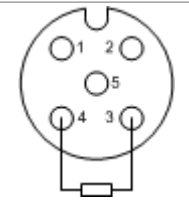
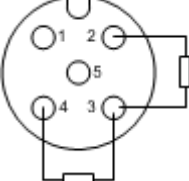
On the basis of these measured values, a monitoring application with integrated current management can be implemented. This can regularly verify that all monitoring functions are satisfied on the basis of the measured current values and also monitor the temperatures and voltages on the connections.

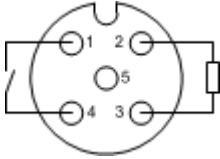
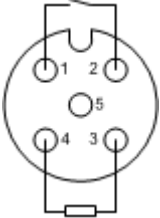
6.4 Connection Options

Ports X01 to X04

The following table shows the connection options for IO-Link devices (Class A), digital inputs and digital outputs on ports X01 to X04.

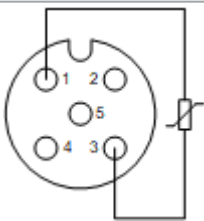
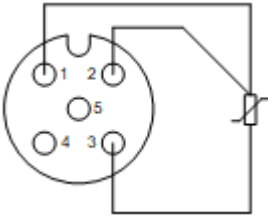
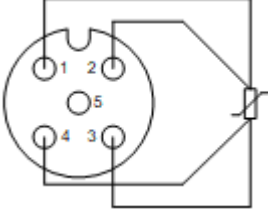
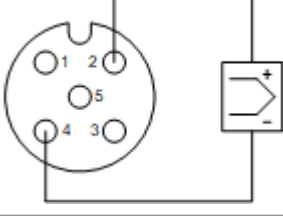
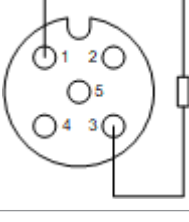
Table 163: Connecting an IO-Link Device or Digital Input or Output

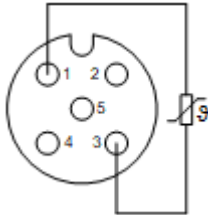
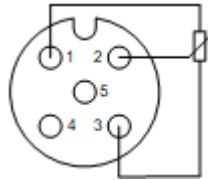
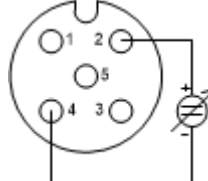
Connection Option	Description
	Connection of an IO-Link device Required port configuration: IO-Link master and pin 2 disabled.
	Connection of an IO-Link device and a digital input on channel B. Required port configuration: IO-Link master and pin 2 as a digital input.
	Connection of an IO-Link device and a digital output on channel B. Required port configuration: IO-Link master and pin 2 as a digital output.
	Connection of a digital input at channel A. Required port configuration: pin 4 as digital input and pin 2 disabled.
	Connection of two digital inputs on channels A and B. Required port configuration: pin 4 and pin 2 as digital inputs.
	Connection of a digital output on channel A. Required port configuration: pin 4 as a digital output and pin 2 disabled.
	Connection of two digital outputs on channels A and B. Required port configuration: pin 4 and pin 2 as digital outputs.

Connection Option	Description
	Connection of a digital input on channel A and a digital output on channel B. Required port configuration: pin 4 as a digital input and pin 2 as a digital output.
	Connection of a digital output on channel A and a digital input on channel B. Required port configuration: pin 4 as a digital output and pin 2 as a digital input.

Ports X05 to X08

Table 164: Connecting an Analog Input

Connection Option	Description
	Connection of an analog input for temperature measurement (RTD) with two conductors. Required port configuration: signal type set to RTD 2.
	Connection of an analog input for temperature measurement (RTD) with three conductors. Required port configuration: signal type set to RTD 3.
	Connection of an analog input for temperature measurement (RTD) with four conductors. Required port configuration: signal type set to RTD 4.
	Connection of an analog input for temperature measurement (TC) with two conductors. Required port configuration: signal type set to thermocouple.
	Connection of an analog input for resistance measurement with two conductors. Required port configuration: signal type set to resistance and measurement range set to 0 ... X Ω.

Connection Option	Description
	Connection of an analog input for resistance measurement (PTC) with two conductors. Required port configuration: signal type set to resistance and measurement range set to PTC.
	Connection of an analog input for resistance measurement (potentiometer) with three conductors. Required port configuration: signal type set to resistance and measurement range set to potentiometer.
	Connection of an analog input for voltage measurement with two conductors. Required port configuration: signal type set voltage.

6.5 Settings Options

6.5.1 PROFINET Parameters

"IO-Link Master" Parameters

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

Table 165: "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.

Parameter Group	Parameters	Default	Value Range	Description
	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 1: Enable Switch-On delay	Switch-on delay is disabled. 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.

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 / 4 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 166: Parameters of the "IO-Link XX I / XX O + PQI" Submodule

Parameter Group	Parameter	Default	Value Range	Description
Digital configuration	DI logic I/Q (pin 2)	0	0: DI not inverted (NO normally open)	Pin 2 is a digital input. The input signal is not inverted.

Parameter Group	Parameter	Default	Value Range	Description
	DI filter time I/Q (pin 2)	0	1: DI inverted (NC normally closed)	Pin 2 is a digital input. The input signal is inverted.
			0: no filter	No filter active for detecting a signal change of the pin 2 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	
			200: 20 ms filter time	
	DO static on I/Q (pin 2)	0	0: disable	Pin 2 supplies no output voltage.
DO IQ (pin 2) substitute configuration (only for Class A)	DO substitute configuration	0	1: Enable	Pin 2 is a digital output and switched on (+24 VDC).
			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.
IO-Link port parameters	Enable port diagnostics	1	2: Hold last	Hold digital output pin 2 at its last value in the event of error.
			0: disable	The PROFINET port diagnostics are disabled, i.e. no diagnostic alarms are triggered.
	Enable process alarm (device notification)	1	1: Enable	PROFINET port diagnostics are enabled.
			0: disable	PROFINET process alarms are disabled.
	Configuration source	1	1: Enable	PROFINET process alarms are enabled.
			0: PDCT (Port and Device Configuration Tool)	Configuration is performed via a "port and device configuration tool."
	Enable input fraction	0	1: PNIO	Configuration is performed via the PROFINET IO-Controller.
			0: disable	Input fraction is switched off.
	Enable pull/plug	1	1: Enable	Input fraction is switched on.
			0: disable	PROFINET pull/plug alarms are disabled.
	Port mode	2	1: Enable	PROFINET pull/plug alarms are enabled.
			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).
	Validation/backup	0	2: IOL_Autostart	Pin 4 is operated as an IO-Link port with automatic configuration (plug and play).
			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.

Parameter Group	Parameter	Default	Value Range	Description
			2: Type-compatible device (V1.1)	
			3: Type-compatible V1.1 device with backup + restore	
			4: Type-compatible V1.1 device with restore	
	I/Q behavior	1	0: Not supported	Pin 2 is not used.
			1: Digital input	Pin 2 is a digital input.
			2: Digital output	Pin 2 is a digital output.
	Port cycle time	0	0, 4 ... 191	Port cycle time 0: calculated by IO-Link master 4 ... 191: see table Port Cycle Time [p. 132].
	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 IO-Link device used.
	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 IO-Link device used.

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 / 4 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 167: Parameters of the "IO-Link XX I / XX O + PQI + ISDU" Submodule

Parameter Group	Parameter	Default	Value Range	Description
Digital configuration	DI logic I/Q (pin 2)	0	0: DI not inverted (NO normally open)	Pin 2 is a digital input. The input signal is not inverted.
			1: DI inverted (NC normally closed)	Pin 2 is a digital input. The input signal is inverted.
	DI filter time I/Q (pin 2)	0	0: no filter	No filter active for detecting a signal change of the pin 2 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	
			200: 20 ms filter time	
	DO static on I/Q (pin 2)	0	0: disable	Pin 2 supplies no output voltage.
			1: Enable	Pin 2 is a digital output and switched on (+24 VDC).
DO IQ (pin 2) substitute configuration (only for Class A)	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.
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.

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.
	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).
			2: IOL_Autostart	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	
	I/Q behavior	1	0: Not supported	Pin 2 is not used.
			1: Digital input	Pin 2 is a digital input.
			2: Digital output	Pin 2 is a digital output.
	Port cycle time	0	0, 4 ... 191	Port cycle time 0: calculated by IO-Link master 4 ... 191: see table Port Cycle Time [► 132].

Parameter Group	Parameter	Default	Value Range	Description
	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 IO-Link device used.
	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 IO-Link device used.

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 168: "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 169: "DI" (Digital Input) Parameters

Parameter Group	Parameter	Default	Value Range	Description
Digital configuration	DI logic I/Q (pin 2)	0	0: DI not inverted (NO normally open)	Operating mode as 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
	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 I/Q (pin 2)	0	0: no filter	No filter active for detecting a signal change of the pin 2 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	
			200: 20 ms filter time	
	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	
			200: 20 ms filter time	
	DO static on I/Q (pin 2)	0	0: disable	Pin 2 supplies no output voltage.
			1: Enable	Pin 2 is a digital output and supplies +24 VDC.
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.
	I/Q behavior	0	0: Not supported	Pin 2 is not supported
			1: Digital input	Pin 2 is a digital input.
			2: Digital output	Pin 2 is a digital output.

"DO" (Digital Output) Parameters

The following table describes the parameters of the DO submodule:

Table 170: "DO" (Digital Output) Parameters

Parameter Group	Parameter	Default	Value Range	Description
IQ behavior	I/Q behavior	7	1: Digital input	Pin 2 is a digital input.
			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 I/Q pin (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.
	DI filter time I/Q pin (pin 2)	0	0: no filter	No filter active for detecting a signal change of the pin 2 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	
			200: 20 ms filter time	
	DO static on I/Q pin (pin 2)	0	0: disable	Pin 2 supplies no output voltage.
			1: enable	Pin 2 is a digital output and supplies +24 VDC.
	DO static on C/Q pin (pin 4)	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.
	I/Q behavior	0	0: Not supported	Pin 2 is not supported
			1: Digital input	Pin 2 is a digital input.

Parameter Group	Parameter	Default	Value Range	Description
			2: Digital output	Pin 2 is a digital output.
			5: Power AUX	Supply cable 1L+ on pin 2.

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

Table 171: 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.

Parameter Group	Parameters	Default	Value Range	Description
	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 172: “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 Fail-safe 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	

Parameter Group	Parameter	Default	Value Range	Description
	Port X01 / pin 2, port X02 / pin 2, ...	0	5: 2 ms filter time	No filter active for detecting a signal change of the pin 2 input signal. 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.
			6: 3 ms filter time	
			0: no filter time	
			1: 1 µs filter time	
			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. 132].
	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 173: "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 Fail-safe 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 [p. 132] .
	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 174: "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 Fail-safe 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 [p. 132] .
	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.

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 175: 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.
	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 176: 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 177: 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 fallback 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 178: 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"
	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	The history of a data value is not stored by the broker.
			1: enable	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.

Parameter Group	Parameter	Default	Value Range	Description
			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 179: 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.

Parameter Group	Parameter	Default	Value Range	Description
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	0 ... 2,000	Upper limiting value for the current on pin 2; unit: mA
	Undercurrent Pin 2	0	0 ... 2,000	Lower limiting value for the current on pin 2; unit: mA
	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

The following table describes the parameters of the "Analog Input Module Proxy RTD/TC" submodule.

The input filter is used to suppress interfering mains frequency signal components. The frequency depends on the application location and can be set for the module. This parameter is valid for ports X05 to X08.

Table 180: Parameters of the "Analog Input Module Proxy RTD/TC" Submodule

Parameter Group	Parameter	Default	Value Range	Description
AI module settings	Input filter frequency	1	0: 10 Hz	The input filter is switched on for the module. The mains frequency is 10 Hz.
			1: 50 Hz	The input filter is switched on for the module. The mains frequency is 50 Hz (e.g., Europe).
			2: 60 Hz	The input filter is switched on for the module. The mains frequency is 60 Hz (e.g., USA).
			3: 400 Hz	The input filter is switched on for the module. The mains frequency is 400 Hz
	Temperature unit	0	0: Celsius	The unit of temperature measured values for all AI ports is degrees Celsius.
			1: Fahrenheit	The unit of temperature measured values for all AI ports is degrees Fahrenheit.
			2: Kelvin	The unit of temperature measured values for all AI ports is Kelvin.
	Forcing	0	0 ... 1	"Forcing" mode is enabled or disabled in the "IO-Link Master Proxy (Slot 1/Subslot 1)" submodule.
	BT optical interface	0	0 ... 1	The Bluetooth® interface is enabled or disabled in the "IO-Link Master Proxy (Slot 1/Subslot 1)" submodule.
	BT (timeout) [s]	0	0	The switch-off time for the Bluetooth® interface is set in the "IO-Link Master Proxy (Slot 1/Subslot 1)" submodule.

The following table describes the parameters of the submodules:

- 1AI, INT 16 I
- 1AI, {INT 16, UINT16} I
- 1AI, deactivated

Each port has one channel.

The default value for the "Connection and sensor type" parameter is "RTD-3W Pt100." The "1AI, deactivated" submodule sets the "Connection and sensor type" parameter to the value "Port deactivated."

Table 181: Parameters of the "IO-Link XX I / XX O + PQI + ISDU" Submodule

Parameter Group	Parameter	Default	Value Range	Description
AI Port Settings	Connection and sensor type	64	0: Port deactivated	The port is disabled. Use this setting if no sensor is connected to the port. The process data value is 0x7FFF.
			32: RTD-2W Pt100	The AI port operates using 2-wire connection technology and, depending on the value range, with the following temperature sensor: Pt100 temperature sensor
			33: RTD-2W Pt200	
			34: RTD-2W Pt500	
			35: RTD-2W Pt1000	
			36: RTD-2W Ni100	The AI port operates using 2-wire connection technology and, depending on the value range, with the following temperature sensor: Ni100 temperature sensor
			37: RTD-2W Ni120	
			38: RTD-2W Ni200	
			39: RTD-2W Ni500	
			40: RTD-2W Ni1000	
			41: RTD-2W Ni1000-TK5000	
AI Port Settings (continued)	Connection and sensor type (continued)	64	64: RTD-3W Pt100	The AI port operates using 3-wire connection technology and, depending on the value range, with the following temperature sensor: Pt100 temperature sensor
			65: RTD-3W Pt200	
			66: RTD-3W Pt500	
			67: RTD-3W Pt1000	
			68: RTD-3W Ni100	The AI port operates using 3-wire connection technology and, depending on the value range, with the following temperature sensor: Ni100 temperature sensor
			69: RTD-3W Ni120	
			70: RTD-3W Ni200	
			71: RTD-3W Ni500	
			72: RTD-3W Ni1000	
			73: RTD-3W Ni1000-TK5000	

Parameter Group	Parameter	Default	Value Range	Description
AI Port Settings (continued)	Connection and sensor type (continued)	64	96: RTD-4W Pt100 97: RTD-4W Pt200 98: RTD-4W Pt500 99: RTD-4W Pt1000	The AI port operates using 4-wire connection technology and, depending on the value range, with the following temperature sensor: Pt100 temperature sensor Pt200 temperature sensor Pt500 temperature sensor Pt1000 temperature sensor
			100: RTD-4W Ni100 101: RTD-4W Ni120 102: RTD-4W Ni200 103: RTD-4W Ni500 104: RTD-4W Ni1000 105: RTD-4W Ni1000-TK5000	The AI port operates using 4-wire connection technology and, depending on the value range, with the following temperature sensor: Ni100 temperature sensor Ni120 temperature sensor Ni200 temperature sensor Ni500 temperature sensor Ni1000 temperature sensor Ni1000 (TK5000) temperature sensor
AI Port Settings (continued)	Connection and sensor type (continued)	64	128: R 0-250 129: R 0-500 130: R 0-1k 131: R 0-2k 132: R 0-4k	The AI port operates using 2-wire connection technology and, depending on the value range, with the following temperature sensor: 0 ... 250 Ω resistance 0 ... 500 Ω resistance 0 ... 1 kΩ resistance 0 ... 2 kΩ resistance 0 ... 4 kΩ resistance
			133: PTC	The AI port operates using 2-wire connection technology and a PTC.
			134: Potentiometer	The AI port operates using 3-wire connection technology and a potentiometer.

Parameter Group	Parameter	Default	Value Range	Description
			160: TC type B	The AI port operates using 2-wire connection technology and, depending on the value range, with the following temperature sensor: Thermocouple type B Thermocouple type C Thermocouple type E Thermocouple type J Thermocouple type K Thermocouple type N Thermocouple type R Thermocouple type S Thermocouple type T
			161: TC type C	
			162: TC type E	
			163: TC type J	
			164: TC type K	
			166: TC type N	
			167: TC type R	
			168: TC type S	
			169: TC type T	
			192: ± 30 mV	The AI port operates using 2-wire connection technology for the following voltage measurement (depending on the value range): ± 30 mV voltage measurement ± 60 mV voltage measurement ± 120 mV voltage measurement ± 250 mV voltage measurement ± 500 mV voltage measurement ± 1000 mV voltage measurement ± 2000 mV voltage measurement
AI Port Settings (continued)	Smoothing	0	193: ± 60 mV	
			194: ± 120 mV	
			195: ± 250 mV	
	Number format	0	196: ± 500 mV	
			197: ± 1000 mV	
			198: ± 2000 mV	
			0: deactivated	Smoothing for the analog value is disabled.
	Resolution	0	1: weak	Weak smoothing for the analog value is enabled.
			2: medium	Medium smoothing for the analog value is enabled.
			3: strong	Strong smoothing for the analog value is enabled.
	Compensation resistor [m Ω]	0	0: two's complement	Representation of the process data value: two's complement
			1: sign/magnitude	Representation of the process data value: magnitude/sign
	Upper user limit value	32767	0: 0.1	Resolution for temperature values: 0.1 °C (°F or K) per digit
			1: 0.01	Resolution for temperature values: 0.01 °C (°F or K) per digit
	Lower user limit value	-32768	0 ... 65535	Compensation resistance: line resistance value that needs to be taken into account in the calculation of the measured values for 2-wire RTD measurement; unit: m Ω
			-32768 ... 32767	Upper user limiting value The upper user limiting value must be greater than the lower user limiting value.
	Upper user limit value	32767	-32768 ... 32767	Lower user limiting value

Parameter Group	Parameter	Default	Value Range	Description
	User scaling	0	0	User scaling is switched off.
			1	User scaling is switched on.
	Offset	0	-32768 ... 32767	The offset value causes a zero offset of the process value (shift along the Y axis)
	Gain	10000	-30000 ... 30000	Gain factor applied to the process data value; a value of 10000 corresponds to a gain factor of 1.0000. A value of 20000 corresponds to a gain factor of 2.0000.
AI Alarm Settings	Measuring range underflow	1	0	"Measurement underrange" diagnostics are switched off.
			1	"Measurement underrange" diagnostics are switched on. PROFINET channel diagnostics ("Port diagnostics" parameter) must be switched on.
	Measuring range overflow	1	0	"Measurement overrange" diagnostics are switched off.
			1	"Measurement overrange" diagnostics are switched on. PROFINET channel diagnostics ("Port diagnostics" parameter) must be switched on.
	Lower user limit under-shot	0	0	"User limiting value underrange" diagnostics are switched off.
			1	"User limiting value underrange" diagnostics are switched on. PROFINET channel diagnostics ("Port diagnostics" parameter) must be switched on.
	Upper user limit exceeded	0	0	"User limiting value overrange" diagnostics are switched off.
			1	"User limiting value overrange" diagnostics are switched on. PROFINET channel diagnostics ("Port diagnostics" parameter) must be switched on.
	Underflow	1	0	"Underflow" diagnostics are switched off.
			1	"Underflow" diagnostics are switched on. PROFINET channel diagnostics ("Port diagnostics" parameter) must be switched on.
	Overflow	1	0	"Overflow" diagnostics are switched off.
			1	"Overflow" diagnostics are switched on. PROFINET channel diagnostics ("Port diagnostics" parameter) must be switched on.
	Wirebreak	1	0	Wire break detection is switched off.
			1	Wire break detection is switched on. PROFINET channel diagnostics ("Port diagnostics" parameter) must be switched on.
	Internal error	1	0	"Internal error" diagnostics are switched off.
			1	"Internal error" diagnostics are switched on. Examples of internal errors: "ADC defective" and CRC error PROFINET channel diagnostics ("Port diagnostics" parameter) must be switched on.
	Port diagnostics	0	0	PROFINET channel diagnostics are switched off, i.e., no diagnostic alarms are triggered. Note: With the default setting, the module does not send any diagnostic alarms. Set this parameter to 1 so the module can send diagnostic alarms.
			1	PROFINET channel diagnostics are switched on. In this parameter group, switch on the diagnostic alarms that the module should send in the event of an error as well.

6.5.2 Setting the PROFINET Configuration

For each IO-Link port, specify which type of IO-Link device is connected to the port: a digital input, digital output or IO-Link device. If a given port is not used, disable the port in the settings.

For each analog input port (AI port), specify whether the process data is transmitted with or without a status word. If an AI port is not used, disable it in the settings.

The PROFINET product has a modular structure.

- Slot 0 is the PROFINET access point with four submodules.
- Slot 1 contains the IO-Link master and four IO-Link ports.
- Slot 2 contains parameters for advanced settings.
- Slot 3 contains the four analog input ports

Table 182: PROFINET Modules and Submodules

Slot	Subslot	Submodule	Description
0	1	DAP	Device access point (fixed)
0	32768	PN-IO	PROFINET interface (fixed)
0	32769	Port1	Port 1 (fixed)
0	32770	Port2	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 next table: "Port Submodules."
1	3	Port X02 configuration	
1	4	Port X03 configuration	
1	5	Port X04 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 ... 8	Load management threshold level	Load management settings (optional) One submodule for each port: submodule 5 for port X01, submodule 6 for port X02, etc. These submodules contain only parameters.

Slot	Subslot	Submodule	Description
3	1	4-port analog input RTD/TC	Settings for analog ports (fixed) This submodule contains only parameters.
3	2	AI port X05 configuration	Configures the AI port. For selection, see the next table: "AI Port Submodules."
3	3	AI port X06 configuration	
3	4	AI port X07 configuration	
3	5	AI port X08 configuration	

Table 183: 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

Submodule	Description	Input Process Data (PD_IN)	Output Process Data (PD_OUT)
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	-
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

Submodule	Description	Input Process Data (PD_IN)	Output Process Data (PD_OUT)
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
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

Table 184: AI Port Submodules

Submodule	Description	Input Process Data (PD_IN)	Output Process Data (PD_OUT)
1AI, INT16 I	Analog input 16 bit value	2 bytes	–
1AI, {INT16, UINT16} I	Analog input 16 bit value and 16 bit status word	4 bytes	–
1AI, deactivated	AI port is not used	–	–

6.6 Requirements for Wiring and Accessories

Only use shielded cables to connect the sensors to the analog ports.

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 \[p. 255\]](#).

6.7 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](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](https://hilscher.atlassian.net/wiki/spaces/ETHDEVCFG).

6.8 Power Supply Example

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

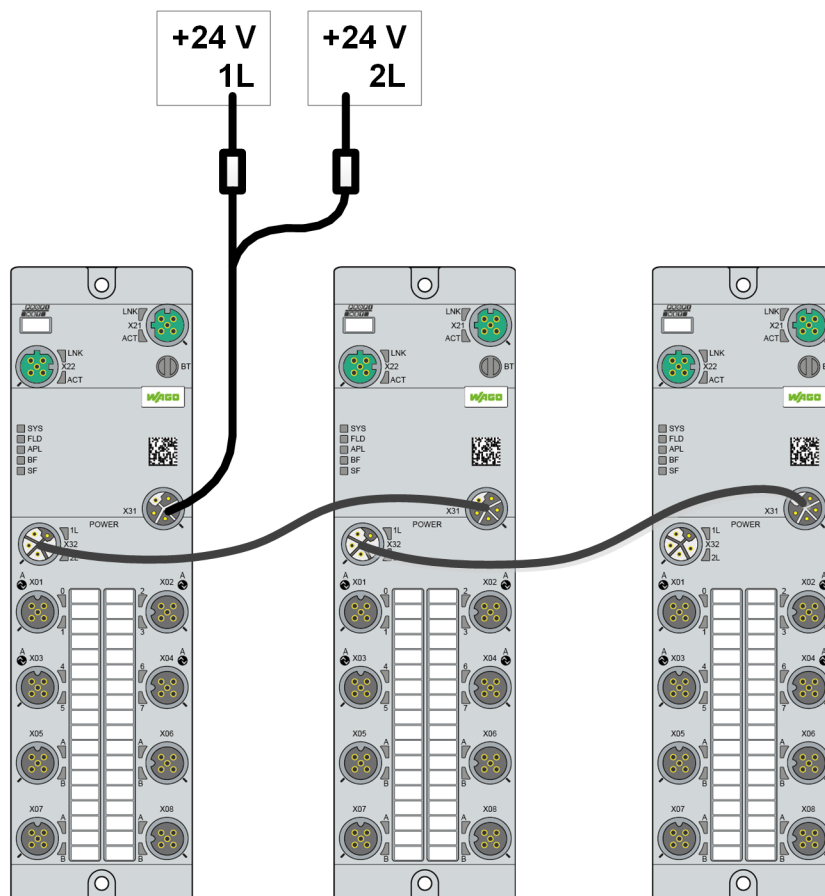


Figure 9: Example of Feeding in and Passing on the Supply Voltages

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.

6.9 Connection Examples

Example of a Single Power Supply

This example considers a single 765-2102/100-000 module where no additional devices are powered through its PWR OUT connection (X32).

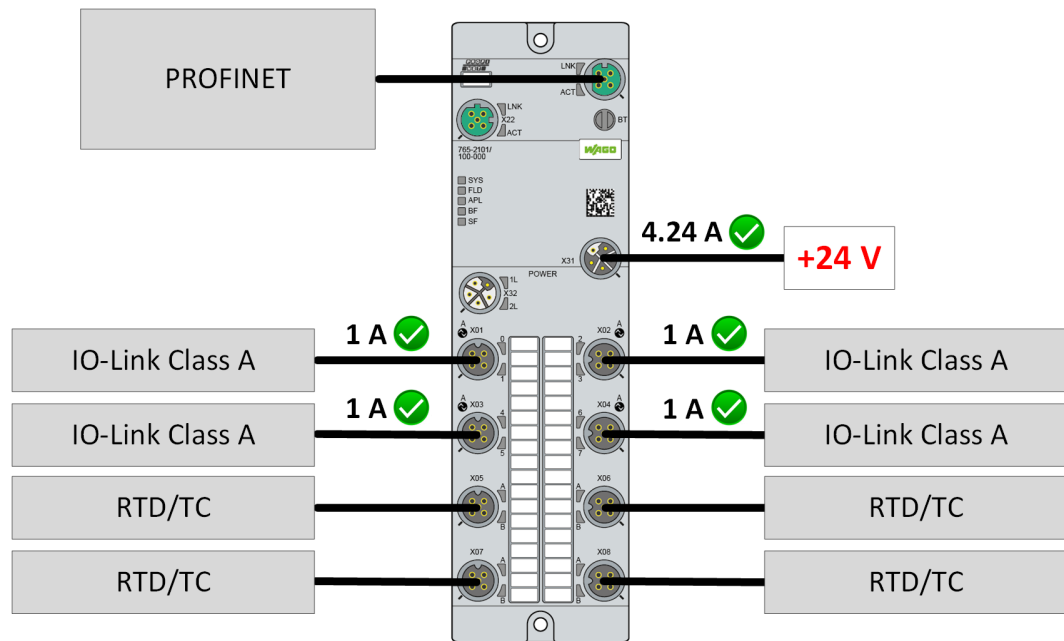


Figure 10: Connection Example with Single Power Supply

One IO-Link Class A device with max. current consumption of 1 A is connected to connections X01 through X04 of the module, and one analog sensor with max. current consumption of 0.01 A is connected to connections X05 through X08 of the module. The module's current consumption is 0.2 A.

Current consumption of supply cable 1: $4.0 \text{ A} + 0.04 \text{ A} + 0.2 \text{ A} = 4.24 \text{ A}$

The current consumption of 4.24 A is below the maximum permissible value of 16 A per supply cable.

For UL applications, the maximum permissible value for the sum of the two supply lines is 12 A.

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 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 $16 \text{ A} - 4.24 \text{ A} = 11.76 \text{ A}$ for supply cable 1 and $16 \text{ A} - 0 \text{ A} = 16 \text{ A}$ for supply cable 2.

For UL applications, the maximum permissible current feedthrough is $12 \text{ A} - 4.24 \text{ A} = 7.76 \text{ A}$ 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 765-2102/100-000 IO-Link Master and a 765-1701/200-000 IO-Link Hub. The two products are connected via IO-Link.

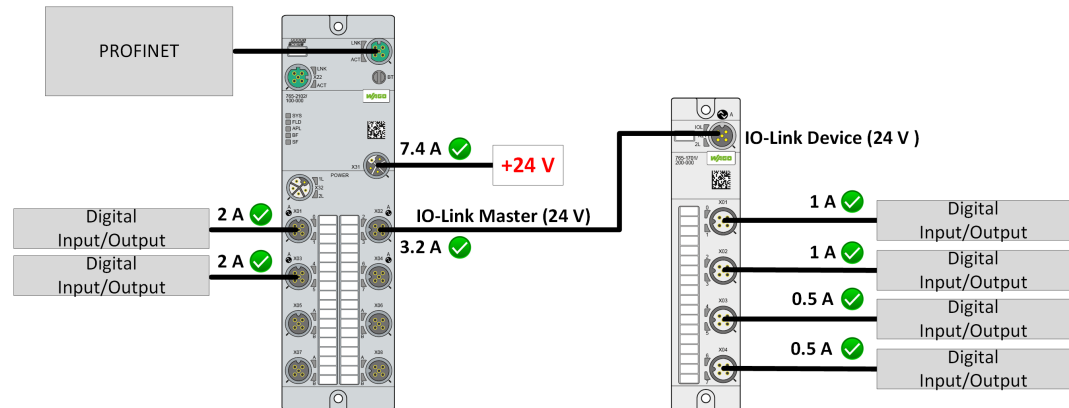


Figure 11: Power Supply Group with 765-2102/100-000 – Connection Example 1

Three devices are connected to the 765-2102/100-000 module:

- On port X02: the 765-1701/200-000 IO-Link Hub
- On port X01: one digital input/output with max. current consumption of 2 A (on pin 1)
- On port X03: 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 current consumption of 1 A (on pin 1)
- On port X02: one digital input/output with current consumption of 1 A (on pin 1)
- On port X03: one digital input/output with current consumption of 0.5 A (on pin 1)
- On port X04: one digital input/output with 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 draws its operating voltage from the 765-2102/100-000 IO-Link master, port X02 (pin 1) of the module has a load of 3.2 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 is therefore permissible.

Ports X01 and X03 of the IO-Link master each have a load of 2 A, which corresponds to the maximum load capacity of 4 A and is therefore permissible.

Connection Example 2

Now we will 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 765-2102/100-000 product must be considered.

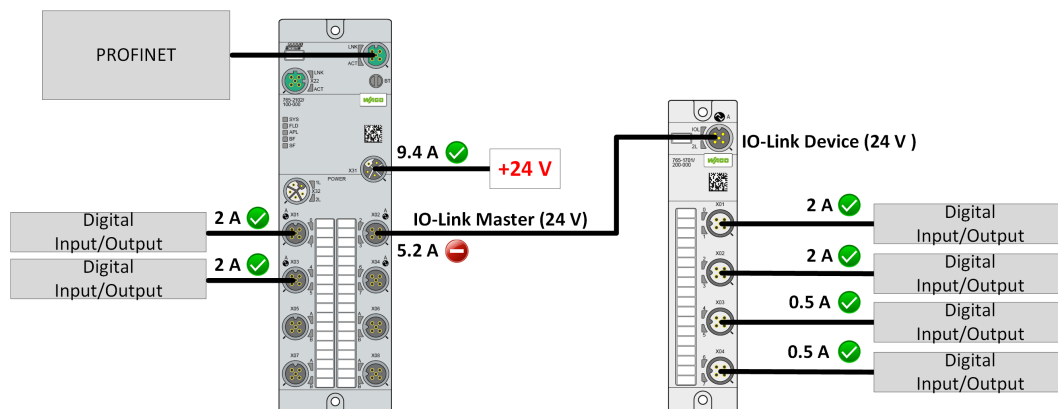


Figure 12: Power Supply Group with 765-2102/100-000 – Connection Example 2

To do so, we consider port X02 of the 765-2102/100-000 module:

This has a load of 5.2 A (= 2 A + 2 A + 0.5 A + 0.5 A + 0.2 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 765-2102/100-000 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 \[p. 24\]](#).
- ➔ 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.

Supply Cable and Power Supply (M12)

Take the current load capacities into account. See [🔗 Design of the Power Supply \[► 118\]](#).

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 \[► 31\]](#)).

You can find examples for calculating the maximum permissible current feedthrough under [🔗 Connection Examples \[► 155\]](#).

9.2 Connecting Cables

The tightening torques given in section [🔗 Connection Technology \[► 24\]](#) apply to the plugable 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):

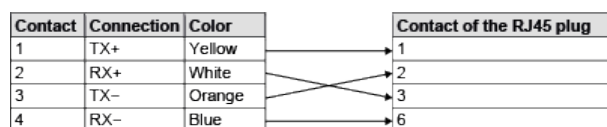


Figure 13: RJ45 Pin Assignment

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 un-crossed).

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:

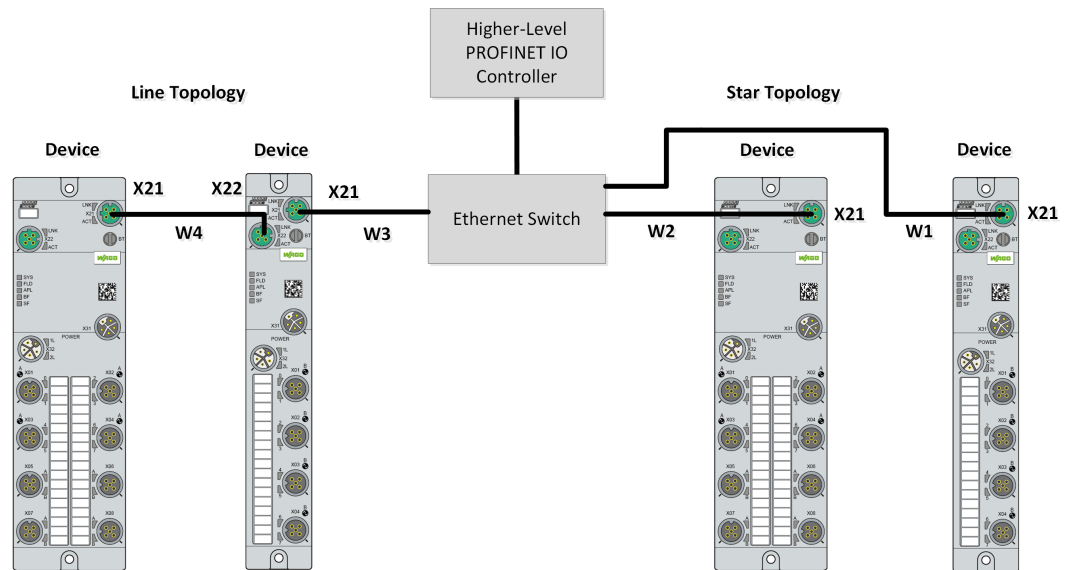


Figure 14: Network Topology (Module Appearance May Differ)

9.4 Connect 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 \[► 118\]](#).

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.

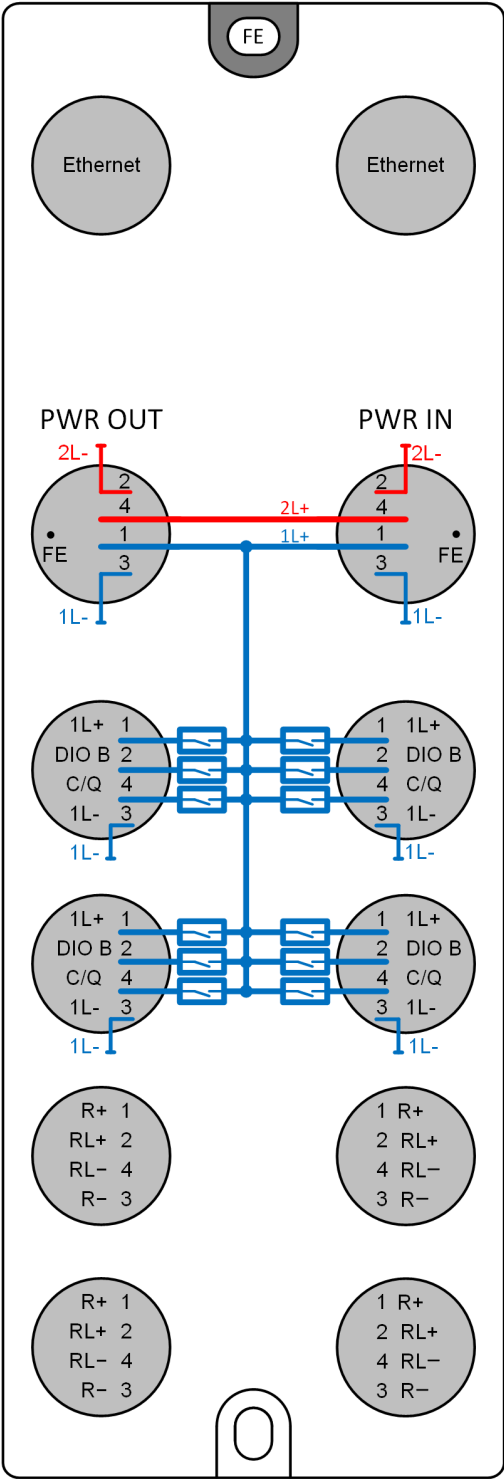


Figure 15: Schematic Circuit Diagram of the Power Supply

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 Einstellen einer IP-Adresse

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 obtain 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 [Aids \[p. 154\]](#)).
- You can read out the IP address with the WAGO I/O Field app. If the module has not yet been assigned an IP address, you can use the WAGO I/O Field app to set the station name (as described below) so the PROFINET IO controller can set the IP address when PROFINET starts up.

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 that is set in the product appears.
- Click **Scan for Devices**.
A dialog appears with a list of products found on the local network:

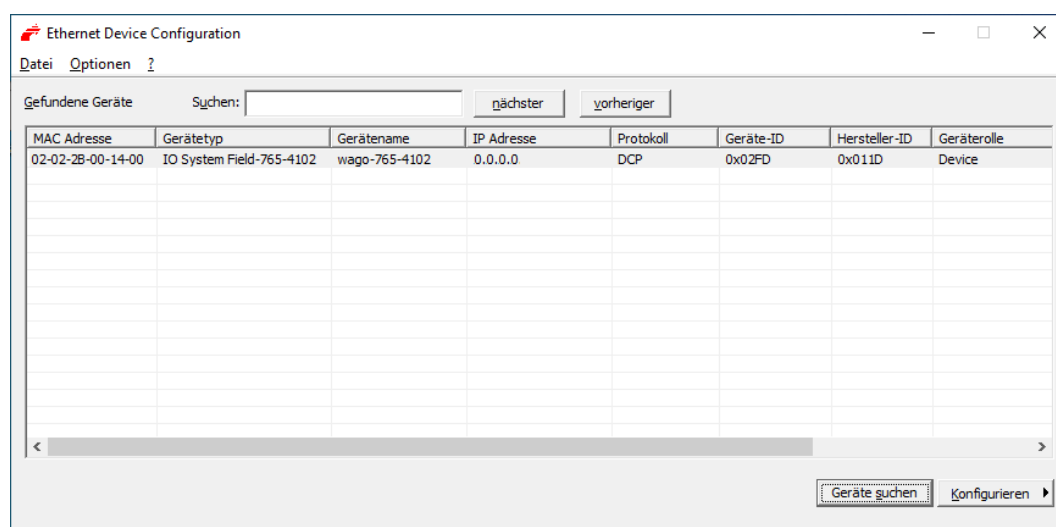


Figure 16: List of Products Found on Local Network

- 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.

Setting the Station Name with the “WAGO I/O Field App” Software

1. Use the “WAGO I/O Field App” software to scan the code on the module or enter the code in the app.
 2. Click **Connect Bluetooth** in the software and hold the mobile device near the module so the light signal sent from the mobile device can establish a *Bluetooth*® connection to the module.
 3. Select **Connected device** from the menu or tap on the picture of the module to open the settings.
 4. Under **Name of Station**, enter a name for the module.
 5. Click **Save**.
- ➔ The module can now be identified by the “Name of Station” via PROFINET.

The PROFINET IO controller can now set the IP address when PROFINET starts up. Alternatively, you can use the PROFINET engineering tool to set the IP address of the module, since the module can be identified by the “Name of Station.”

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 \[► 109\]](#).

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 765-2102/100-000 Vxyz (xyz = placeholder for the firmware version)

Name: 4AI RTD/TC + 4PORT IOL-A FLD PN DC 24V 2.0A

10.2.1.2 PROFINET-Stationsnamen und IP-Adresse konfigurieren

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 \[► 150\]](#).

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 \[► 126\]](#).

10.3 Parameterization

The following tools are described below:

- [WAGO Webserver I/O Field \[► 169\]](#)
- [WAGO IO-Link Configurator \[► 210\]](#)
- [WAGO App I/O Field \[► 211\]](#)
- [OPC UA Server \[► 211\]](#)

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 WAGO Webserver I/O Field User Interface

The screenshot displays the WAGO Webserver I/O Field user interface. On the left is a sidebar menu with the following items: **Dashboard** (selected), License, Device settings, Extended settings, Port X01, Port X02, Port X03, Port X04, General AI settings, AI-Port X05, AI-Port X06, AI-Port X07, AI-Port X08, and Sign in. The main content area is titled "WAGO Webserver I/O Field" and contains the following sections:

- observer connected** (role: Observer)
- Device information**
 - Vendor name: WAGO GmbH & Co. KG
 - Vendor address: Hansastr. 27, 32423 Minden, Germany
 - Vendor phone: +49 571-887-0
 - Vendor URL: www.wago.com
 - Description: 4 AI-RTD/TC, 4 IOL-A FLD PN 24VDC 2.0A
 - Item no.: 765-2102/100-000
 - Hardware name: 4 Port AI RTD/TC + 4 Port IOL Class A
 - Software name: PROFINET Device
 - Unique item ID: (375)UN31564010260603192+00000000
- Device version**
 - Hardware revision: 1
 - Software version: V1.2.3
 - Webpage version: V1.1.3
- Maintenance information**
 - Name
 - Installation location
 - Contact information
 - Description
 - Installation date
 - Last service date
 - Next service date
- Device measurement values**
 - Mean temperature: 35.8 °C

On the right side of the interface, there is a technical drawing of the device showing its physical ports and connectors, including X01 through X08, X21, X22, and X31.

Figure 17: "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 185: 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 line 1L)

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 \[► 240\]](#).

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 186: 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"
Function tag	Printable ASCII string, max. 64 characters	Application-specific function tag for identification of the connected IO-Link master. Example: "Code reading"

Table 187: 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 188: 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 189: 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 190: 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 191: 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 192: 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 \[► 176\]](#)
- [Ports konfigurieren \[► 177\]](#)
- [Reading IP Parameters \[► 181\]](#)
- [Storing Maintenance Information \[► 181\]](#)
- [Firmware aktualisieren \[► 182\]](#)
- [Resetsetting the Module to the Factory Settings \[► 184\]](#)
- [Managing Users \[► 185\]](#)
- [Logging Users On and Off \[► 186\]](#)

- [🔗 Forcing Digital Inputs and Outputs \[► 187\]](#)
- [🔗 Forcing for IO-Link Ports \[► 189\]](#)
- [🔗 Forcing for Analog Inputs \[► 188\]](#)

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:
IOLMErrorCode(<error code of the IO-Link master>):
IOLDErrorCode(<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 Ports konfigurieren

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

Table 193: Port Configuration Settings for IO-Link Devices

Name	Type	Description
Port mode (pin 4)	Drop-down menu	Port operating mode (configuration of pin 4)

Name	Type	Description
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	IQ behavior of the port (configuration of pin 2)
Validation and backup	Drop-down menu	Validation and backup settings for device check when replacing devices
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 194: "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.

Selection Option	Description
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.
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.

Configure Pin 2 (I/Q)

The behavior of pin 2 (I/Q) can be selected from the **IQ behavior** drop-down menu. For your IO-Link class A device, the following configuration options are available for using pin 2 as a digital input or output:

Table 195: "IQ Behavior" Drop-Down Menu – Configuration of Pin 2 (I/Q) for IO-Link Class A Devices

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

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 the "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 196: 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

Selection Option	Description
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 performs the backup (creates the data storage) once after the port is configured and the IO-Link device connects correctly for the first time if no data storage data exists in the IO-Link master. Parameters in the IO-Link device can be changed via a port configuration tool (PCT) or teach-in functionalities, which update the backup. The saved parameters are restored the next time the device starts up.
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 performs the backup (creates the data storage) once after the port is configured and the IO-Link device connects correctly for the first time if no data storage data exists in the IO-Link master. The saved parameters are restored the next time the device starts up.

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 0xFFFFFFFF. 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.

Updating the Data Storage with "Backup and Restore"

In the "Type compatible to device V1.1, backup and restore" operating mode, the IO-Link master performs the backup (creates the data storage) once after the port is configured and the IO-Link device connects correctly for the first time.

If parameters in the IO-Link device change and you want to save these changes in the IO-Link master's data storage, a new backup is necessary. For a new backup, the IO-Link master's existing data storage must be updated. This can be done in one of the following ways:

- Use a port configuration tool (PCT) like WAGO IO-Link Configurator to update the parameters in the IO-Link device so these parameters are stored in the IO-Link master's data storage.
- Execute the teach-in function on the IO-Link device. The IO-Link device prompts the IO-Link master to update the data storage.

Manually Deleting the Data Storage for "Backup and Restore" and "Restore Only"

In the "Type compatible to device V1.1, backup and restore" and "Type compatible to device V1.1, restore only" operating modes, the IO-Link master performs the backup (creates the data storage) once after the port is configured and the IO-Link device connects correctly for the first time.

If you want to delete the data storage from the IO-Link master of a port, you can do so manually by switching the port operating mode.

The IO-Link master can only be configured if the module is not exchanging data cyclically with the controller.

To manually delete the data storage, proceed as follows:

1. Write down the values for VendorID, DeviceID and port cycle time.
2. Remove the IO-Link device from the port.
3. Change the **Port mode (Pin 4)** operating mode to **Digital Input, normally open**.
4. Click **Apply** to change the operating mode.
 - ⇒ The IO-Link master deletes its data storage.
5. Change the **Port mode (Pin 4)** operating mode to **IOL_MANUAL**.
6. Set **Validation and Backup** to **Type compatible to device V1.1, backup and restore** or **Type compatible to device V1.1, restore only**.
7. Enter the values for **Vendor ID**, **Device ID** and **Port cycle time**.
8. Click **Apply** to change the operating mode.
9. Connect the correct IO-Link device to the port.
 - ➔ The IO-Link master saves a backup (data storage) the next time the device starts up.

10.3.1.4.3 Reading IP Parameters

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

Table 197: "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** 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 198: 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
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** tab.
3. Modify the relevant fields.
4. Click the **[Apply]** button.
➔ The changes take effect.

10.3.1.4.5 Firmware aktualisieren

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

NOTICE

No data communication during firmware update!

Data communication and data processing do not occur during a firmware update. The product receives no input data and outputs no output data.

- Put your system in a safe state before performing a firmware update!

Note**Update process overwrites firmware**

The firmware can only be loaded into the module. The update process overwrites the firmware saved in the module.

If you want to downgrade the module to its previous state after the firmware update, make sure that you have the corresponding firmware file.

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, 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 the **[Update]** button.
 - ⇒ The firmware is transferred and updated in the module. A bar indicates the progress as a percentage. Wait until the new firmware version appears in the Webserver.
 - ⇒ A message indicates that the module will be restarted once you complete the firmware update by clicking **OK** and will have 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_SystemField_765_XXXXXXX_Vxyz.zip` is transferred to the module. 2. An internal reset is triggered.
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 Resetting 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 199: 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 200: Assignment of Rights to Roles

Right/Function	Admin	Specialist	Maintenance	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 201: 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."

Each of the four ports (X01 ... X04) 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 Analog Inputs

On this page, you can force the process value and the status word for one or more AI ports.

To access the forcing functionality for the analog inputs via the Webserver, you must be logged in there with specialist or administrator rights.

You can find a description of and more information on the forcing function and explanations of terms in [🔗 Forcing \[► 108\]](#).

Table 202: Control Elements (AI Forcing)

Item	Description
AI forcing enable	Off: The forcing functionality for analog inputs is disabled.
	On (checked): The forcing functionality for analog inputs is enabled.
Show values in hexadecimal	Off: Input format for input data = decimal representation
	On (checked): Input format for input data = hexadecimal representation
Force	Clicking force enables or disables the forcing functionality for all AI ports. Alternatively, you can enable/disable the forcing functionality for each AI port individually.
Status value	Input field for the status word in hexadecimal format; see table 🔗 Status word [► 36] Status Word.

Item	Description
Input value	Input field for the process value The input depends on the signal type setting. If Show values in hexadecimal is not checked, you can enter the temperature value (unit: m°C, m°F or mK), the resistance value (unit: mΩ), the percentage for the potentiometer (unit: m%) or the voltage value (unit: μV). The module's firmware converts the value entered into the process value. If Show values in hexadecimal is checked, you can enter the process value. The firmware transfers the process value without conversion.
Apply	Transfers the entered values for an AI port.

To perform forcing, proceed as follows:

1. From the Webserver main menu (left), select the **AI Forcing** menu item.
2. Check the "AI forcing enable" box at the top.
 - ⇒ Unless another user is already accessing it, access to the forcing functionality is now enabled. The screen shows the AI ports with status word and input value.
3. Check the "Show values in hexadecimal" box to select the input format for the input data.
4. In the **force** column, check the box for the AI port you want to force.
5. Enter the status word.
6. Enter the input value.
7. Click **[Apply]**.
 - ➔ The values are transferred.

As soon as you no longer need the forcing functionality, uncheck the "AI forcing enable" box.

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.

10.3.1.4.11 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 \[► 108\]](#).

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 subslot 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 Configuration** [[▶ 190](#)]
-  **NTP Settings** [[▶ 194](#)]
-  **Power-on Delay** [[▶ 195](#)]
-  **Bluetooth konfigurieren** [[▶ 196](#)]
-  **Load Management** [[▶ 198](#)]
-  **Testing the Radio Technology** [[▶ 201](#)]

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 203: 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 204: 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 205: 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 206: 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 207: 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 208: 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
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 209: 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

Parameter Group	Parameter	Description
	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.

Only ports X01 to X04 support the power-on delay. The module only uses the 1L supply voltage.

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 210: 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

Parameter	Description	Value Range
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 Bluetooth konfigurieren

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 211: 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.
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 212: 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
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 213: 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

Parameter	Description
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 214: 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 215: 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 216: 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

Channel No.	Frequency	Channel No.	Frequency	Channel No.	Frequency	Channel No.	Frequency
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 217: 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 218: 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 [p. 202] ."
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

10.3.1.6 Making General Settings for Analog Inputs

The general settings for analog inputs contain a parameter for setting the input filter and for setting the temperature unit; these apply the same way to AI ports X05 to X08

The input filter is used to suppress interfering mains frequency signal components. The frequency depends on the location of use and can be adjusted for the module.

The unit for temperature measured values can be set for the module.

Table 219: Parameters for General Settings (Analog Inputs)

Parameter	Default	Value Range	Description
Input filter frequency (in Hz)	50 Hz	10 Hz	The input filter is switched on for the module. The mains frequency is 10 Hz
		50 Hz	The input filter is switched on for the module. The mains frequency is 50 Hz (e.g., Europe).
		60 Hz	The input filter is switched on for the module. The mains frequency is 60 Hz (e.g., USA).
		400 Hz	The input filter is switched on for the module. The mains frequency is 400 Hz
Temperature unit	Celsius (m°C)	Celsius (m°C)	The unit of temperature measured values for all AI ports is degrees Celsius.
		Fahrenheit (m°F)	The unit of temperature measured values for all AI ports is degrees Fahrenheit.
		Kelvin (mK)	The unit of temperature measured values for all AI ports is Kelvin.

10.3.1.7 Configuring Analog Input Ports

The **Channel Parameters**, **Scaling** and **Calibration** tabs allow you to view and set the port's parameters for one of the module's analog inputs. The **Process data** tab shows the process value and status of the analog input.

10.3.1.7.1 Channel Parameters

The **Channel Parameters** tab provides the following functions:

- Viewing and setting parameters, such as the measurement range for the analog input
- Enabling/disabling the scaling function (user scaling)
- Enabling/disabling the calibration function (user calibration)
- Enabling/disabling diagnostic functions

The settings are valid for one analog input port.

Analog Input

Table 220: Analog Input (Channel Parameters)

Parameter	Default	Value Range	Description
Signal type	RTD 2-wire	Port disabled	Port is disabled. Use this setting if no sensor is connected to the port. The process data value is 0x7FFF.
		RTD 2-wire	The AI port operates using 2-wire connection technology.
		RTD 3-wire	The AI port operates using 3-wire connection technology.
		RTD 4-wire	The AI port operates using 4-wire connection technology.
		Resistance	The AI port operates using 2-wire connection technology for resistance measurement (resistors and PTC). The AI port operates using 3-wire connection technology to connect a potentiometer.
		Thermocouple	The AI port operates using 2-wire connection technology and a thermocouple.
		Voltage	The AI port operates using 2-wire connection technology for voltage measurement.

Parameter	Default	Value Range	Description
Measuring range	Pt100	Pt100 Pt200 Pt500 Pt1000 Ni100 Ni120 Ni200 Ni500 Ni1000 Ni1000 (TK5000)	For the "RTD 2-wire," "RTD 3-wire" or "RTD 4-wire" signal type, you can select one of the following temperature sensors: Pt100 Pt200 Pt500 Pt1000 Ni100 Ni120 Ni200 Ni500 Ni1000 Ni1000 (TK5000)
Measuring range (continued)	0 ... 250 Ω	0 ... 250 Ω 0 ... 500 Ω 0 ... 1 k Ω 0 ... 2 k Ω 0 ... 4 k Ω PTC Potentiometer	For the "Resistance" signal type, you can select one of the following resistance values, a PTC or a potentiometer: 0 ... 250 Ω 0 ... 500 Ω 0 ... 1 k Ω 0 ... 2 k Ω 0 ... 4 k Ω PTC Potentiometer
Measuring range (continued)	Type B	Type B Type C Type E Type J Type K Type N Type R Type S Type T	For the "Thermocouple" signal type, you can select one of the following types: Type B Type C Type E Type J Type K Type N Type R Type S Type T
Measuring range (continued)	± 30 mV	± 30 mV ± 60 mV ± 120 mV ± 250 mV ± 500 mV ± 1000 mV ± 2000 mV	For the "Voltage" signal type, you can select one of the following voltage measurement ranges: ± 30 mV ± 60 mV ± 120 mV ± 250 mV ± 500 mV ± 1000 mV ± 2000 mV

Parameter	Default	Value Range	Description
Lower user defined limit	-32768	-32768 ... 32767	Lower user limiting value If the signal falls below this limiting value, the module sends a diagnostic message if the diagnostic function is enabled ("Diagnosis user underrange"). Always enter the value in the two's complement format. If the "magnitude/sign" number format is used, the firmware converts the value. Section ▢ Process Image [p. 34] contains tables with the value ranges of the process data for each signal type and the two's complement number format.
Upper user defined limit	32767	-32768 ... 32767	Upper user limiting value If the signal exceeds this limiting value, the module sends a diagnostic message if the diagnostic function is enabled ("Diagnosis user overrange"). Always enter the value in the two's complement format. If the "magnitude/sign" number format is used, the firmware converts the value.
Resolution	0.1	0.1	The resolution for temperature values is 0.1 °C (°F or K) per digit.
		0.01	The resolution for temperature values is 0.01 °C (°F or K) per digit.
Compensation resistance	0	0 ... 65535	Compensation resistance: line resistance value that needs to be taken into account in the calculation of the measured values for 2-wire RTD measurement; unit: mΩ

Control Flags

Table 221: Control Flags (Channel Parameters)

Parameter	Default	Value Range	Description
Scaling	Off	Off	The scaling function is switched off.
		On (checked)	The scaling function (user scaling) is switched on. The Scaling tab is enabled.
Calibration	Off	Off	The calibration function is switched off.
		On (checked)	The calibration function (user calibration) is switched on. The Calibration tab is enabled. If the scaling function is enabled, the firmware first executes the user calibration and then the user scaling on the process value.
Show values in hexadecimal	Off	Off	Shows the lower and upper user limiting value in decimal format
		On (checked)	Shows the lower and upper user limiting value in hexadecimal format with prefix 0x
Smoothing	Deactivated	Deactivated	Smoothing for the analog value is disabled.
		Weak	Weak smoothing for the analog value is enabled.
		Medium	Medium smoothing for the analog value is enabled.
		Strong	Strong smoothing for the analog value is enabled.
Number format	Two's complement	Two's complement	Representation of the process data value: two's complement
		Magnitude/sign	Representation of the process data value: magnitude/sign

Diagnostics

Table 222: Diagnostics (Channel Parameters)

Parameter	Default	Value Range	Description
Channel diagnosis	On	Off	PROFINET channel diagnostics are switched off, i.e., no diagnostic alarms are triggered.
		On (checked)	PROFINET channel diagnostics are switched on. In addition, switch on the diagnostic alarms that the module should send in the event of an error.
Diagnosis overflow	On	Off	"Overflow" diagnostics are switched off.
		On (checked)	"Overflow" diagnostics are switched on. PROFINET channel diagnostics ("Channel diagnosis" parameter) must be switched on.
Diagnosis underflow	On	Off	"Underflow" diagnostics are switched off.
		On (checked)	"Underflow" diagnostics are switched on. PROFINET channel diagnostics ("Channel diagnosis" parameter) must be switched on.
Diagnosis overrange	On	Off	"Measurement underrange" diagnostics are switched off.
		On (checked)	"Measurement underrange" diagnostics are switched on. PROFINET channel diagnostics ("Channel diagnosis" parameter) must be switched on.
Diagnosis underrange	On	Off	"Measurement overrange" diagnostics are switched off.
		On (checked)	"Measurement overrange" diagnostics are switched on. PROFINET channel diagnostics ("Channel diagnosis" parameter) must be switched on.
Diagnosis user overrange	On	Off	"User limiting value overrange" diagnostics are switched off.
		On (checked)	"User limiting value overrange" diagnostics are switched on. PROFINET channel diagnostics ("Channel diagnosis" parameter) must be switched on.
Diagnosis user underrange	On	Off	"User limiting value underrange" diagnostics are switched off.
		On (checked)	"User limiting value underrange" diagnostics are switched on. PROFINET channel diagnostics ("Channel diagnosis" parameter) must be switched on.
Wire break diagnostics	On	Off	"Wire break" diagnostics are switched off.
		On (checked)	"Wire break" diagnostics are switched on. PROFINET channel diagnostics ("Channel diagnosis" parameter) must be switched on.
Diagnosis internal error	On	Off	"Internal error" diagnostics are switched off.
		On (checked)	"Internal error" diagnostics are switched on. Examples of internal errors: "ADC defective" and CRC error PROFINET channel diagnostics ("Channel diagnosis" parameter) must be switched on.

10.3.1.7.2 Scaling

On the **Scaling** tab, you can view and set the offset value and gain factor (user scaling). The settings are valid for one AI port.

User scaling serves to adjust the process values. Using user scaling changes the desired accuracy of the process value resolution, but does not fundamentally limit it. User scaling is optional.

Performing user scaling requires values for "Gain" and "Offset." The scaling gain indicates the gain factor. The scaling offset indicates the y axis offset. When these two values are entered, the result is a scaled process value. The following general scaling equation applies:

$$y2 = y1 \times (\text{gain}/16384) + \text{offset}$$

Where:

- $y1$ = unscaled process value
- $y2$ = scaled process value, resolution: $1/16384$

The $y1$ value (unscaled process value) serves as the input value for the user scaling. If user scaling is switched off, the $y1$ value is carried over unchanged to $y2$.

Flags

Table 223: Flags (Scaling)

Parameter	Factory Setting	Value Range	Description
Show values in hexadecimal	Off	Off	Shows the offset value and gain factor in decimal format.
		On (checked)	Shows the offset value and gain factor in hexadecimal format and the prefix 0x

Process Data

Table 224: Process Data (Scaling)

Parameter	Description
Signal type	Indicates the signal type setting
Number format	Indicates the number format setting: two's complement or magnitude/sign
Process value	Shows the process value in hexadecimal representation and the converted value in decimal representation with unit
Status	Shows the status in hexadecimal format; see table .

User Scaling

Table 225: User Scaling

Parameter	Factory Setting	Value Range	Description
Offset	0	-32768 ... 32767	The offset value causes a zero offset of the process value (shift along the Y axis).
Gain	10000	-30000 ... 30000	Gain factor applied to the process data value. A value of 10000 corresponds to a gain factor of 1.0000. A value of 20000 corresponds to a gain factor of 2.0000.

10.3.1.7.3 Calibration

On the **Calibration** tab, you can enable the module's calibration function to calibrate the analog input. The calibration is valid for one AI port.

The module contains a factory calibration. The module can be recalibrated (user calibration) to correct for long-term drift or to optimize accuracy in a thermally steady state. User calibration is optional.

Flags

Table 226: Flags (Scaling)

Parameter	Factory Setting	Value Range	Description
Show values in hexadecimal	Off	Off	Shows the offset value and gain factor in decimal format
		On	Shows the offset value and gain factor in hexadecimal format with prefix 0x.

Calibration Process

Table 227: Calibration Process

Parameter	Description
Lower limit	Input field for the lower limit; the input depends on the signal type setting. The default setting is the minimum scale value.
Calibrated off-set	Shows the offset; default: 0 During the calibration process, the software shows the gradual approximation to the offset. Once the calibration process is complete, it shows the offset determined by the calibration.
Offset calibration	Displays the Start button to start offset calibration. During the calibration process, "running" appears. First apply the reference voltage or current to the analog input and then start the calibration process.
Upper limit	Input field for the upper limit; the input depends on the signal type setting. The default setting is the maximum scale value.
Calibrated gain	Indicates the gain factor; default: 10000 During the calibration process, the software shows the gradual approximation to the gain factor. Once the calibration process is complete, it shows the gain factor determined by the calibration.
Gain calibration	Displays the Start button to start the gain factor calibration. During the calibration process, "running" appears. First apply the reference voltage or current to the analog input and then start the calibration process.

Table 228: Temperatures for Adjustments

	Optimal Temperature for Offset Adjustment	Optimal Temperature for Gain Adjustment
RTD	~ Cold junction temperature	~ Maximum scale value
TC	~ Minimum scale value	~ Maximum scale value

Performing Calibration

Calibration is performed individually for each channel. Proceed as follows to perform the calibration:

- ✓ The module must be installed in its final installation environment, and a settling time of approximately two hours must have passed.
 - ✓ A low-noise, high-precision calibrator must be available. The accuracy of the calibrator must be 10 times higher than that of the module that is to be calibrated.
 - ✓ A suitable calibrator must be able to apply a test voltage or test current at the measuring point.
 - ✓ The calibrator must be connected with short, shielded cables.
 - ✓ All cables from the module to the system must be disconnected.
 - ✓ There must be no air drafts, compensation cables or additional contact points.
 - ✓ If an RTD is used: It must be possible to generate precisely known temperatures at the measuring point (block calibrator) or determine them with a reference thermometer.
 - ✓ If a TC is used: The final measurement sensor must be connected. TC contact points must not yet be welded and must be connected to a calibrator that is as exact as possible. This calibrator defines the accuracy that is to be achieved. On the calibrator, an offset value must be set at which no voltage is generated at the connection point (typically the cold junction temperature), or an offset value must be set at which the sensor itself does not yet output any significant voltage (e.g., 600 °C for B types).
1. In the navigation, select the AI port for which you want to perform the calibration.
 2. Open the **Channel Parameters** tab.

3. For **Measuring range**, set the signal type.
4. Under **Control flags**, mark "Calibration."
5. Click **[Apply]**.
6. Open the **Calibration** tab.
7. For voltage inputs, apply the reference voltage of the lower scale value indicated by the "Lower limit" field to the AI port.
8. If the applied reference voltage has a different value than the "Lower limit" field, enter this value in the "Lower limit" field. The unit for voltage values is μV .
9. Click **[Start]**.
 - ⇒ Calibration starts: **Offset calibration** shows "running."
 - ⇒ **Calibrated offset** gradually approaches the reference value.
 - ⇒ Once the process is complete, **Calibrated offset** displays "done."
10. For voltage inputs, apply the reference voltage of the maximum scale value indicated by the "Upper limit" field to the AI port.
11. If the applied reference voltage has a different value than the "Upper limit" field, enter this value in the "Upper limit" field. The unit for voltage values is mV and for current values μV .
12. Click **[Start]**.
 - ⇒ Calibration starts: **Gain calibration** indicates "running."
 - ⇒ **Calibrated gain** gradually approaches the reference value.
 - ⇒ As soon as the process is complete, **Gain calibration** displays "done."
13. Click **[Save]** to save the calibration values.
 - ➔ Calibration is complete.

10.3.1.7.4 Displaying Analog Process Data

On the **Process data** tab, you can view the process value of the analog input and the status word.

Process Value and Status

Table 229: Process Data

Parameter	Description
Signal type	Indicates the signal type setting
Process value	Shows the process value in hexadecimal representation and the converted value in decimal representation with unit
Status	Shows the status in hexadecimal format; see table (values).

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 App I/O Field

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.

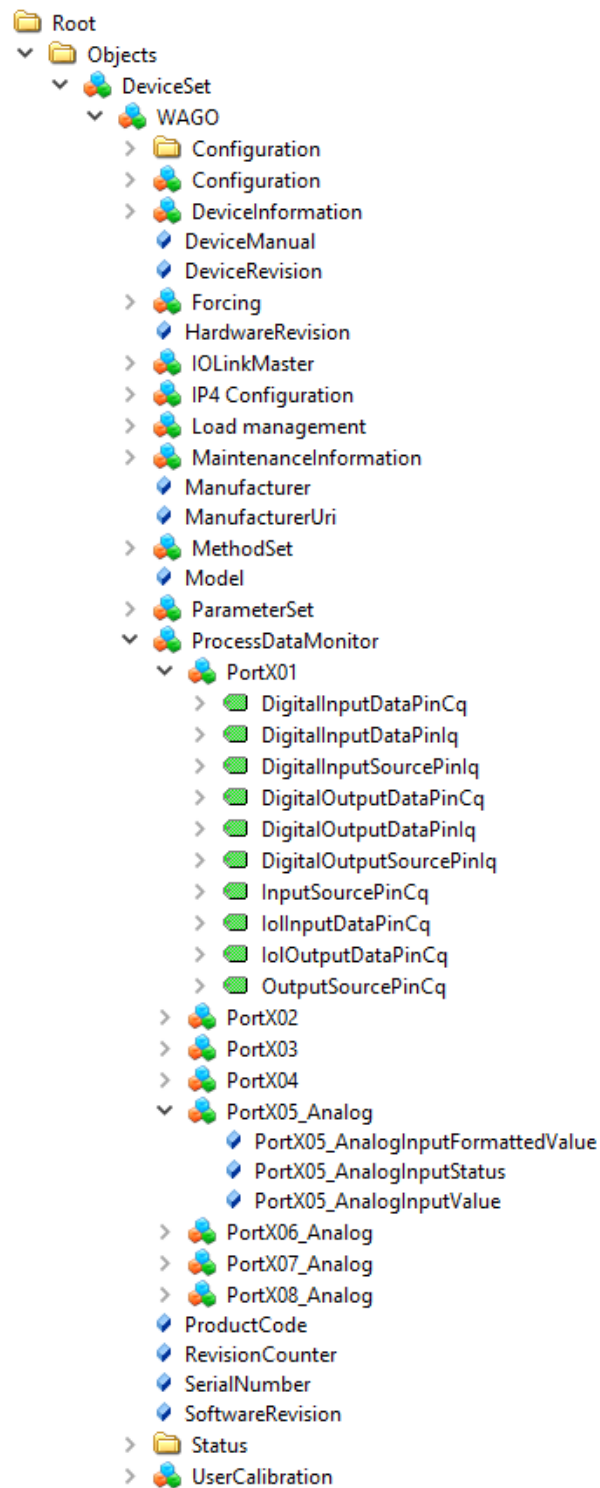


Figure 18: OPC UA: Device Information Model

10.3.4.1 Parameterizing the Product via OPC UA

10.3.4.1.1 Identifying Devices

The device provides nodes for device identification. For example, the OPC UA client can read out the version of the device firmware used in the `SoftwareRevision` node. The path to this node is:

```
Root > Object > DeviceSet > [device name]
```

Table 230: Identify Devices

Node Name	Node Class	Access	Description
Manufacturer	Variable	Read	Device manufacturer
ManufacturerUri	Variable	Read	URL of the device manufacturer
Model	Variable	Read	Short name of the device
ProductCode	Variable	Read	Product code of the device: "765-xxxx/xxxx-xxxx"
RevisionCounter	Variable	Read	Hardware version of the device
SerialNumber	Variable	Read	Serial number of the device
SoftwareRevision	Variable	Read	Revision/version of the device firmware

10.3.4.1.1.1 Reading Out the Name of Station

The OPC UA server provides a node with the `NameOfStation` that the module uses in the PROFINET IO network.

The path to this node is:

```
Root > Object > DeviceSet > [device name] > DeviceInformation >
NameOfStation
```

Table 231: Identifying Devices

Node Name	Node Class	Access	Description
NameOfStation	Variable	Read	The NameOfStation that the module uses in the PROFINET IO network. The NameOfStation can be set with the PROFINET DCP service.

10.3.4.1.1.2 Reading the Unique Item Identifier

The OPC UA server provides a node with the Unique Item Identifier (UII).

The path to this node is:

```
Root > Object > DeviceSet > [device name] > DeviceInformation >
Unique Item ID
```

Table 232: Unique Item ID

Node Name	Node Class	Access	Description
Unique Item ID	Variable	Read	Unique item ID of the module.

10.3.4.1.2 Geräteparameter konfigurieren

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.

Ports X01 to X04

The path to this node is:

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

The following table lists device-specific configuration parameters.

Table 233: 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.

Ports X05 to X08

The path to this node is:

```
Root > Object > DeviceSet > [Device name] > Configuration > AnalogConfiguration
```

The following table lists device-specific configuration parameters.

Table 234: Device-Specific Configuration Parameters (AI Ports)

Node Name	Node Class	Access	Default	Description
FilterFrequency	Variable	reading	1	Input filter 0: The input filter is switched on for the module. The mains frequency is 10 Hz 1: The input filter is switched on for the module. The mains frequency is 50 Hz (e.g., Europe). 2: The input filter is switched on for the module. The mains frequency is 60 Hz (e.g., USA). 3: The input filter is switched on for the module. The mains frequency is 400 Hz
TempUnit	Variable	reading	0	Unit for temperature measured values 0: The unit of temperature measured values for all AI ports is degrees Celsius. 1: The unit of temperature measured values for all AI ports is degrees Fahrenheit. 2: The unit of temperature measured values for all AI ports is Kelvin.

10.3.4.1.3 Setting Port Parameters

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

Ports X01 to X04

The path to this node is:

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

The following table lists port-specific configuration parameters.

Table 235: 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
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

Ports X05 to X08

The path to this node is:

```
Root > Object > DeviceSet > [Device name] > Configuration >  
AnalogConfiguration > PortXX_Analog
```

The following table lists port-specific configuration parameters.

Table 236: Port-Specific Configuration Parameters (Part 1)

Node Name	Node Class	Access	Default	Description
Enable user calibration	Variable	Read	0	User calibration 0: user calibration disabled 1: user calibration enabled
Offset user calibration	Variable	Read	0	User calibration offset Value range: -32768 ... 32767
Gain user calibration	Variable	Read	10000	Gain factor for user calibration Value range: -30000 ... 30000

The path to this node is:

Root > Object > DeviceSet > [Device name] > Configuration >
AnalogConfiguration > PortXX_Analog > Configuration

The following table lists port-specific configuration parameters.

Table 237: Port-Specific Configuration Parameters (Part 2)

Node Name	Node Class	Access	Default	Description
NumberFormat	Variable	reading	0	Representation of the process data value 0: two's complement 1: magnitude/sign
PortSignalType	Variable	reading	64	Signal type setting 0: disabled 32: RTD-2W Pt100 33: RTD-2W Pt200 34: RTD-2W Pt500 35: RTD-2W Pt1000 36: RTD-2W Ni100 37: RTD-2W Ni120 38: RTD-2W Ni200 39: RTD-2W Ni500 40: RTD-2W Ni1000 41: RTD-2W Ni1000-TK5000
PortSignalType (continued)	Variable	reading	64	64: RTD-3W Pt100 65: RTD-3W Pt200 66: RTD-3W Pt500 67: RTD-3W Pt1000 68: RTD-3W Ni100 69: RTD-3W Ni120 70: RTD-3W Ni200 71: RTD-3W Ni500 72: RTD-3W Ni1000 73: RTD-3W Ni1000-TK5000
PortSignalType (continued)	Variable	reading	64	96: RTD-4W Pt100 97: RTD-4W Pt200 98: RTD-4W Pt500 99: RTD-4W Pt1000 100: RTD-4W Ni100 101: RTD-4W Ni120 102: RTD-4W Ni200 103: RTD-4W Ni500 104: RTD-4W Ni1000 105: RTD-4W Ni1000-TK5000

Node Name	Node Class	Access	Default	Description
PortSignalType (continued)	Variable	reading	64	128: R 0-250 129: R 0-500 130: R 0-1k 131: R 0-2k 132: R 0-4k 133: PTC 134: Potentiometer
PortSignalType (continued)	Variable	reading	64	160: TC type B 161: TC type C 162: TC type E 163: TC type J 164: TC type K 166: TC type N 167: TC type R 168: TC type S 169: TC type T
PortSignalType (continued)	Variable	reading	64	160: TC type B 161: TC type C 162: TC type E 163: TC type J 164: TC type K 166: TC type N 167: TC type R 168: TC type S 169: TC type T
PortSmoothing	Variable	reading	0	Smoothing for the analog value 0: disabled 1: weak 2: medium 3: strong
PortTempResolution	Variable	reading	0	Resolution for temperature values 0: 0.1 °C (°F or K) per digit 1: 0.01 °C (°F or K) per digit
PortWireCompensation	Variable	reading	0	Compensation resistance value in mΩ
UserScalActive	Variable	reading	0	User scaling status 0: User scaling disabled for this port 1: User scaling enabled for this port
UserScalOffset	Variable	reading	0	User scaling offset Value range: –32768 ... 32767
UserScalGain	Variable	reading	10000	User scaling gain factor Value range: –30000 ... 30000

The path to this node is:

Root > Object > DeviceSet > [Device name] > Configuration >
AnalogConfiguration > PortXX_Analog > Diagnostics > Configuration

The following table lists port-specific configuration parameters.

Table 238: Port-Specific Configuration Parameters (Diagnostics)

Node Name	Node Class	Access	Default	Description
SetChannelDiagnostics	Variable	reading	True	False: PROFINET channel diagnostics are switched off, i.e., no diagnostic alarms are triggered. True: PROFINET channel diagnostics are switched on.
SetMeasuringRangeUnderflow	Variable	reading	True	False: "Measurement overrange diagnostics" are switched off. True: "Measurement overrange diagnostics" are switched on. PROFINET channel diagnostics ("SetChannelDiagnostics" parameter) must be switched on.
SetMeasuringRangeOverflow	Variable	reading	True	False: "Measurement overrange diagnostics" are switched off. True: "Measurement overrange diagnostics" are switched on. PROFINET channel diagnostics ("SetChannelDiagnostics" parameter) must be switched on.
SetLowerUserLimitUnder-shot	Variable	reading	True	False: "Lower user limiting value underrange" diagnostics are switched off. True: "Lower user limiting value underrange diagnostics" are switched on. PROFINET channel diagnostics ("SetChannelDiagnostics" parameter) must be switched on.
SetUpperUserLimitExceeded	Variable	reading	True	False: "User limiting value overrange" diagnostics are switched off. True: "User limiting value overrange" diagnostics are switched on. PROFINET channel diagnostics ("SetChannelDiagnostics" parameter) must be switched on.
SetUnderflow	Variable	reading	True	False: "Underflow" diagnostics are switched off. True: "Underflow" diagnostics are switched on. PROFINET channel diagnostics ("SetChannelDiagnostics" parameter) must be switched on.
SetOverflow	Variable	reading	True	False: "Overflow" diagnostics are switched off. True: "Overflow" diagnostics are switched on. PROFINET channel diagnostics ("SetChannelDiagnostics" parameter) must be switched on.
SetInternalError	Variable	reading	True	False: "Internal error" diagnostics are switched off. True: "Internal error" diagnostics are switched on. Examples of internal errors: "ADC defective" and CRC error PROFINET channel diagnostics ("SetChannelDiagnostics" parameter) must be switched on.
SetLowerUserLimitValue	Variable	reading	-32768	Lower user limiting value Value range: -32768 ... 32767 Lower user limiting value must be less than upper user limiting value.
SetUpperUserLimitValue	Variable	reading	32767	Upper user limiting value Value range: -32768 ... 32767

Node Name	Node Class	Access	Default	Description
SetWirebreak	Variable	reading	True	False: "Wire break" diagnostics are switched off. True: "Wire break" diagnostics are switched on. PROFINET channel diagnostics ("SetChannelDiagnostics" parameter) must be switched on.

10.3.4.1.4 Portprozesswerte lesen

The OPC UA server provides nodes with process data.

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.

Ports X01 to X04

The OPC UA server provides nodes for the IO-Link process data, as well as for digital inputs and outputs if these are used.

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 239: 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: ProcessDataInput)
ProcessDataLength	Variable	Read	Length of input process data (node: ProcessDataOutput)
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
```

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

Table 240: 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

Alternative Paths to Process Data

The OPC UA server provides alternative nodes for the IO-Link process data, as well as for digital inputs and outputs if these are used. Some nodes provide information on the source of the process value.

The path to this node is:

```
Root > Object > DeviceSet > [Device name] > ProcessDataMonitor > PortXX
```

Table 241: IO-Link Process Data and Digital Inputs and Outputs

Node Name	Node Class	Access	Description
DigitalInputSourcePinIq	Variable	Read	Information on the source of the process value of the pin 2 digital input 0 = pin 2 is not configured as a digital input 1 = process value of pin 2 3 = process value set by forcing function
DigitalInputDataPinIq	Variable	Read	Process value of digital input pin 2 with value "true" or "false" Requirement: Pin 2 must be configured as a digital input.
DigitalOutputSourcePinIq	Variable	Read	Information on the source of the process value of the pin 2 digital output 0 = pin 2 is not configured as a digital output 1 = process value of controller 2 = substitute value 3 = process value set by forcing function
DigitalOutputDataPinIq	Variable	Read	Process value of digital output pin 2 with value "true" or "false" Requirement: Pin 2 must be configured as a digital output.
InputSourcePinCq	Variable	Read	Information on the source of the process value of pin 4 0 = pin 4 is not configured 1 = process value of pin 4 3 = process value set by forcing function
DigitalInputDataPinCq	Variable	Read	Process value of digital input pin 4 with value "true" or "false" Requirement: Pin 4 must be configured as a digital input.
IoInputDataPinCq	Variable	Read	Received IO-Link process data; the node is a byte string with up to 32 bytes. Requirement: Pin 4 must be configured as IO-Link.
OutputSourcePinCq	Variable	Read	Information on the source of the process value of pin 4 0 = pin 4 is not configured 1 = process value of controller 2 = substitute value 3 = process value set by forcing function

Node Name	Node Class	Access	Description
DigitalOutputDataPinCq	Variable	Read	Process value of digital output pin 4 with value "true" or "false" Requirement: Pin 4 must be configured as a digital output.
IoOutputDataPinCq	Variable	Read	IO-Link process data sent. The node is a byte string with up to 32 bytes. Requirement: Pin 4 must be configured as IO-Link.

Ports X05 to X08

The OPC UA server provides nodes for the process data and for the status word of the analog inputs.

The path to this node is:

```
Root > Object > DeviceSet > [Device name] > ProcessDataMonitor > PortXX_Analog
```

Table 242: Process Data

Node Name	Node Class	Access	Description
PortXX_AnalogInput-Value	Variable	Read	Process value of the analog input channel; the value depends on the signal type setting. Section Process Image [p. 34] contains tables with the value ranges of the process data for each signal type.
PortXX_AnalogInput-FormattedValue	Variable	Read	Converted process value of the analog input channel
PortXX_AnalogInput-Status	Variable	Read	Status word; see table .

10.3.4.1.5 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 `SumCurrent1L` 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 243: 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 244: 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 245: 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

10.3.4.1.6 Reading Port Measured Values

Ports X01 to X04

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

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

```
Root > Object > DeviceSet > [Device name] > IOLinkMaster > Diagnostics > PortXX > Current
```

The following table lists port-specific current measured values.

Table 246: Port-Specific Current Measured Values

Node Name	Node Class	Access	Description
CurrentPin1	Variable	Read	Current measured on pin 1, unit: mA
CurrentPin2	Variable	Read	Current measured on pin 2, unit: mA
CurrentPin4	Variable	Read	Current measured on pin 4, unit: mA

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

```
Root > Object > DeviceSet > [Device name] > IOLinkMaster > Diagnostics > PortXX > Temperature
```

The following table lists port-specific temperature measured values.

Table 247: Port-Specific Temperature Measured Values

Node Name	Node Class	Access	Description
TemperaturePin1	Variable	Read	Temperature measured on pin 1, unit: °C
TemperaturePin2	Variable	Read	Temperature measured on pin 2, unit: °C
TemperaturePin4	Variable	Read	Temperature measured on pin 4, unit: °C

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

Root > Object > DeviceSet > [Device name] > IOLinkMaster > Diagnostics > PortXX > Voltage

The following table lists port-specific voltage measured values.

Table 248: Port-Specific Voltage Measured Values

Node Name	Node Class	Access	Description
VoltagePin1	Variable	Read	Voltage measured on pin 1, unit: mA
VoltagePin2	Variable	Read	Voltage measured on pin 2, unit: mA
VoltagePin4	Variable	Read	Voltage measured on pin 4, unit: mA

10.3.4.1.7 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 249: 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 0 = Diagnostics is inactive. 1 = Diagnostics is active.

10.3.4.1.8 Reading Statistics

Ports X01 to X04

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 250: 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
	MinCurrentPin4	Variable	Read	Minimum current on pin 4
Temperature	MaxTemperaturePin1	Variable	Read	Maximum temperature on pin 1 since the value was reset; unit: °C
	MaxTemperaturePin2	Variable	Read	Maximum temperature on pin 2 since the value was reset; unit: °C
	MaxTemperaturePin4	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

Measurement	Node Name	Node Class	Access	Description
	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

10.3.4.1.9 NTP Client Configuration

The OPC UA server provides nodes for configuring the NTP client in the module. These nodes configure the behavior of the module as an NTP client and for configuration of the NTP server's IP address so the module can retrieve the date and time from an NTP server. Changes to the NTP server or NTP client settings are not applied until the module restarts.

The path to this node is:

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

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

Table 251: NTP Server Settings

Node Name	Node Class	Access	Default	Description
NtpServerIp	Variable	Read/ write	0.0.0.0	IP address of the NTP server The NTP client uses the IP address setting to retrieve the time from an NTP server. A value of 0.0.0.0 disables the function. Example: NTP server ptbtime1.ptb.de of the German Physikalisch-Technische Bundesanstalt (PTB) in Braunschweig with IP address 192.53.103.108
NtpFallbackIp	Variable	Read/ write	0.0.0.0	IP address of the NTP server (fallback) Optional additional IP address if the NTP server cannot be reached via the IP address in the NtpServerIp node. A value of 0.0.0.0 disables the function. Example: Substitute NTP server (optional) for the NTP server ptbtime2.ptb.de of the German Physikalisch-Technischen Bundesanstalt in Braunschweig with IP address 192.53.103.104

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

Table 252: 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.

Node Name	Node Class	Access	Default	Description
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
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 Note: The "NTP Initialization Interval" value must be less than or equal to the "NTP Update Interval" value.

10.3.4.1.10 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 "forcing function." From the product's point of view, there must be only one external instance that uses the forcing function. Therefore, the OPC UA client must first obtain a Force ID from the product and send this Force ID with each forcing function call. If the Force ID is incorrect, the product does not execute the forcing 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:

Ports X01 to X04:

- InputSimulationPin2
- InputSimulationPin4
- OutputPin2
- OutputPin4
- IoLinkInputSimulation
- IoLinkOutput

Ports X05 to X08:

- AnalogInputSimulation

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 reenale the Force function.

10.3.4.1.11 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.

10.3.4.1.11.1 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.

10.3.4.1.11.2 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.

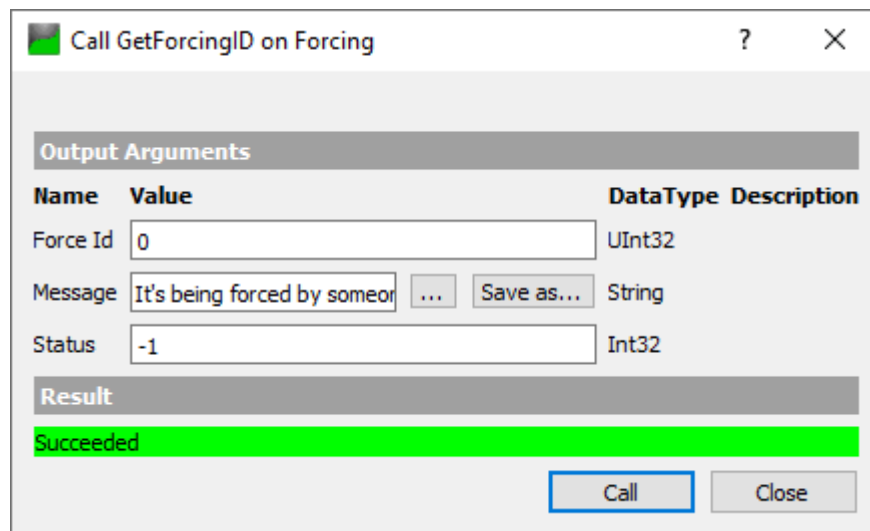


Figure 19: GetForcingID Method: Unsuccessful

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.

10.3.4.1.11.3 Simulating Digital Inputs

The `InputSimulationPin2` method simulates the input value of pin 2 of one or more ports. 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 253: 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 254: Output Arguments of the InputSimulationPin Method

Output Arguments	Description
Status and Message	0: forcing digital outputs successful
	-1: forcing digital outputs failed

10.3.4.1.11.4 Forcing Digital Outputs

The OutputPin2 method sets the output value of pin 2 of one or more ports. 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 255: 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.

Input Arguments	Description
	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 256: Output Arguments of the OutputPin Method

Output Arguments	Description
Status and Message	0: forcing digital outputs successful
	-1: forcing digital outputs failed

10.3.4.1.11.5 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 257: 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

Input Arguments	Description
	Example: 0102030405060708090A0B0C0D0E0F10 1112131415161718191A1B1C1D1E1F20

Description of the Output Arguments

Table 258: Output Arguments of the IoLinkInputSimulation Method

Output Arguments	Description
Status and Message	0: Forcing IO-Link successful -1: Forcing IO-Link failed

10.3.4.1.11.6 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 259: 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 260: Output Arguments of the IoLinkOutput Method

Output Arguments	Description
Status and Message	0: Forcing IO-Link successful
	-1: Forcing IO-Link failed

10.3.4.1.11.7 Simulating Analog Input Data

The AnalogInputSimulation method simulates the analog 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 call 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 AI port must be configured.

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_Analog > AnalogInputSimulation**.
2. In the context menu, select **Call**.
 - ⇒ The **Call AnalogInputSimulation on PortX** window appears.
3. Enter the **Force ID**, check **Force Enable**, check **Use raw values** and enter the **Force Status** and **Force Data** (see the description of the input arguments below).
4. Click **[Call]**.
 - ⇒ If the method call was successful, the analog input data is transmitted to the controller.
 - ⇒ If the method call was unsuccessful, then "-1" appears under Status.

Description of the Input Arguments

Table 261: Input Arguments of the AnalogInputSimulation Method

Input Arguments	Description
Force ID	Here the OPC UA client must use the Force ID that the OPC UA client had received after calling the GetForcingId method.
Force Enable	False: Simulation is disabled for this port. True: Simulation is enabled for this port.
Use raw values	False: The current measured value (in μA) or voltage measured value (in mV) is entered for "Force Data." The firmware converts the value entered into the process data value ("raw value"). It is not necessary to enter the unit (μA or mV). True: The "Force Data" is entered as the process data value ("raw value")
Force Status	For entering the status word
Force Data	For entering the process value (with sign) Note the "Use raw value" setting when entering the process value.

Description of the Output Arguments

Table 262: Output Arguments of the AnalogInputSimulation Method

Output Arguments	Description
Status and Message	0: Forcing analog successful
	-1: Forcing analog failed

10.3.4.1.11.8 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 263: 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 264: Output Arguments of the DisableForcing Method

Output Arguments	Description
Status and Message	0: forcing IO-Link successful
	-1: forcing IO-Link failed

10.3.4.1.12 Einschaltverzögerung konfigurieren

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.

Only ports X01 to X04 support the power-on delay. The module only uses the 1L supply voltage.

The path to this node is:

Root > Object > DeviceSet > [device name] > Configuration > PowerOnDelayConfiguration.

Table 265: Power-On Delay

Node Name	Node Class	Access	Default	Description
PowerOnDelay-Activation	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.

10.3.4.1.13 Load Management

On the **Load Management** tab, you can configure the limiting values for the current, temperature and voltage statistics and read out the statistical values for overruns/underruns for each port.

The module supports the load management function on ports X01 to X04.

10.3.4.1.13.1 Limiting Value Configuration

Only ports X01 to X04 support limit 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 266: 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
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.

10.3.4.1.13.2 Port-Specific Statistics

Only ports X01 to X04 support port-specific statistics.

The OPC UA server provides nodes with statistical values for each port and for individual pins.

The path to this node 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 267: 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
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 this node 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 268: 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

Node Name	Node Class	Access	Description
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 \[p. 226\]](#) describes the nodes of the OPC UA server for configuring the NTP client.

11 Diagnostics

11.1 Diagnostics via Indicators

Power Supply Status

The 1L and 2L LEDs indicate the status of the supply voltages.

Table 269: 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
	Off	Off	No 2L supply voltage

System Status

The SYS LED indicates the status of the system (product).

Table 270: 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

During the first 5 seconds after the module starts up, the FLD LED indicates whether the module is using the factory settings or already has an assignment (NameOfStation and/or IP address).

Table 271: LED (during module startup)

LED	Color	State	Description
FLD	Duo LED, green/yellow (yellow = simultaneously red and green)		
	OFF	Off	–
	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 lights up for 5 seconds during module startup: The module is using the factory settings.

The FLD LED indicates the status of the field-side functions.

Table 272: 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 273: APL LED

LED	Color	State	Description
APL	Duo LED, red/green/yellow (yellow = simultaneously red and green)		
	Off	Off	LED with no function

PROFINET IO-Device Status

The BF and SF LEDs indicate the status of the PROFINET IO-Device.

Table 274: 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 275: 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 LNK and ACT LEDs indicate the ETHERNET status.

Table 276: 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		
	Yellow	Flickering (load-dependent)	The module is sending/receiving ETHERNET frames
	Off	Off	The module is not sending/receiving ETHERNET frames

Table 277: 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 278: 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) and 6 (port X04) indicate the status of the IO-Link Master or digital input/output channel A.

LEDs 1 (port X01), 3 (port X02), 5 (port X03) and 7 (port X04) indicate the status of the digital input/output channel B.

Table 279: IO-Link Port Status (Class A)

LED	Color	State	Description
0, 2, 4, 6 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
	Green	Flashing 2 Hz	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, 7 IO-Link Port Channel B	Duo LED, yellow/red (yellow = simultaneously red and green)		
	Yellow	On	Status of digital input/output channel B: 1
	Off	Off	Status of digital input/output channel B: 0

LED	Color	State	Description
(pin 2)	Red	On	Overload, short circuit (pin 2 and pin 3)
	Red	Flashing 1 Hz	Overload, sensor supply short circuit (pin 1 and pin 3)

Table 280: AI Port Status

LED	Color	State	Description
A Channel Status	Green LED		
	Green	On	Analog channel ready for operation
	OFF	Off	Analog channel not ready for operation
B Channel Error	Red LED		
	Red	On	Channel error: Measurement range under-flow, measurement range overflow, wire break, short circuit
	OFF	Off	No channel error

11.2 Diagnostics via PROFINET

11.2.1 General Alarms

Table 281: General Alarms

number	Alarm	Description	Remedy
265 (0x0109)	Short circuit on pin 4	Short circuit detected on pin 4	Eliminate short circuit
266 (0x010A)	Short circuit on pin 2	Short circuit detected on pin 2	Eliminate short circuit
267 (0x010B)	Short circuit on L+ (pin 1)	Short circuit detected on L+ (pin 1)	Check cable connection on pin 1
272 (0x0110)	Overcurrent L+	Overcurrent detected on L+ (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	Fix 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

number	Alarm	Description	Remedy
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
285 (0x011D)	Analog port error	Error detected on analog port.	Check analog port, e.g., check cabling and signal values
4102 (0x1006)	Wire break	Wire break detected	The sensor connection is interrupted. Check the installation and, if applicable, the connected sensor.
4103 (0x1007)	Measurement over-range	Measurement range overflow detected	The process value of the analog input exceeds the measurement range. Check the configured analog input and, if applicable, the connected sensor.
4104 (0x1008)	Measurement under-range	Measurement range underflow detected	The process value of the analog input is below the measurement range. Check the configured analog input and, if applicable, the connected sensor.
4112 (0x1010)	Port parameterization incorrect	The port parameterization data is incorrect.	Check the settings for consistency with one another.
4374 (0x1116)	Underflow	Underflow occurred	The process value of the analog input is below the measurement range. Check the configured analog input and, if applicable, the connected sensor.
4375 (0x1117)	Overflow	Overflow occurred	The process value of the analog input is above the measurement range. Check the configured analog input and, if applicable, the connected sensor.
4383 (0x111F)	Internal error	Internal error occurred	Hardware defect or optional firmware error. Contact WAGO Support.
4480 (0x1180)	Input filter frequency setting incorrect	The analog port setting "Input filter frequency" is outside the valid value range.	Correct the setting.
4481 (0x1181)	Temperature unit setting incorrect	The analog port setting "Temperature unit" is outside the valid value range.	Correct the setting.
4482 (0x1182)	Incorrect signal type setting	The analog port setting "Signal type" is outside the valid value range.	Correct the setting.
4483 (0x1183)	Incorrect number format setting	The analog port setting "Number format" is outside the valid value range.	Correct the setting.
4484 (0x1184)	Incorrect user limiting values	The settings for the upper and lower user limiting value of the analog port are inconsistent.	Check the settings against one another.
4485 (0x1185)	User scaling: incorrect gain setting	The analog port setting "Gain" is outside the valid value range.	Correct the setting.

number	Alarm	Description	Remedy
4486 (0x1186)	Incorrect connection type and sensor type setting	The analog port setting "Connection type and sensor type" is outside the valid value range.	Correct the setting.
4487 (0x1187)	Incorrect smoothing setting	The analog port setting "Smoothing" is outside the valid value range.	Correct the setting.
4488 (0x1188)	Incorrect resolution setting	The analog port setting "Resolution" is outside the valid value range.	Correct the setting.
4608 (0x1200)	Firmware update critical error GM1_TIME-OUT_STARTUP	Firmware update critical error GM1_TIMEOUT_STARTUP	Switch the device off and on again. If the problem persists, please contact support.
4609 (0x1201)	Firmware update critical error GM2_TIME-OUT_STARTUP	Firmware update critical error GM2_TIMEOUT_STARTUP	Switch the device off and on again. If the problem persists, please contact support.
4610 (0x1202)	Firmware update critical error SM2BFL1_ERROR_STARTUP	Firmware update critical error SM2BFL1_ERROR_STARTUP	Switch the device off and on again. If the problem persists, please contact support.
4611 (0x1203)	Firmware update critical error GM3_TIME-OUT_STARTUP	Firmware update critical error GM3_TIMEOUT_STARTUP	Switch the device off and on again. If the problem persists, please contact support.
4612 (0x1204)	Firmware update error SM2APP1_ERROR_STARTUP	Firmware update error SM2APP1_ERROR_STARTUP	Switch the device off and back on, or try again to update it. If the problem persists, please contact support.
4624 (0x1210)	Critical error in communication GM1_TIME-OUT_RUNTIME	Critical error in communication GM1_TIMEOUT_RUNTIME	Switch the device off and on again. If the problem persists, please contact support.
4640 (0x1220)	Firmware update critical error GM1_TIME-OUT_BFLUPD	Firmware update critical error GM1_TIMEOUT_BFLUPD	Switch the device off and on again. If the problem persists, please contact support.
4641 (0x1221)	Firmware update critical error GM2_TIME-OUT_BFLUPD	Firmware update critical error GM2_TIMEOUT_BFLUPD	Switch the device off and on again. If the problem persists, please contact support.
4642 (0x1222)	Firmware update critical error GM2_TIME-OUT_BFLUPD	Firmware update critical error GM2_TIMEOUT_BFLUPD	Switch the device off and on again. If the problem persists, please contact support.
4643 (0x1223)	Firmware update critical error GM3_TIME-OUT_BFLUPD	Firmware update critical error GM3_TIMEOUT_BFLUPD	Switch the device off and on again. If the problem persists, please contact support.
4644 (0x1224)	Firmware update critical error SM2BFL2_ERROR_BFLUPD	Firmware update critical error SM2BFL2_ERROR_BFLUPD	Switch the device off and on again. If the problem persists, please contact support.
4645 (0x1225)	FW update warning BEGIN_ERROR_BFLUPD	Firmware update warning BFLGEN_ERROR_BFLUPD	In the event of an error during the firmware update, please forward the code to Support.
4646 (0x1226)	FW update warning PI_ERROR_BFLUPD	Firmware update warning PI_ERROR_BFLUPD	In the event of an error during the firmware update, please forward the code to Support.

number	Alarm	Description	Remedy
4647 (0x1227)	FW update warning TI_ERROR_BFLUPD	Firmware update warning TI_ERROR_BFLUPD	In the event of an error during the firmware update, please forward the code to Support.
4648 (0x1228)	Firmware update warning FI_ERROR_BFLUPD	Firmware update warning FI_ERROR_BFLUPD	In the event of an error during the firmware update, please forward the code to Support.
4656 (0x1230)	Firmware update critical error GM1_TIMEOUT_APPUPD	Firmware update critical error GM1_TIMEOUT_APPUPD	Switch the device off and on again. If the problem persists, please contact support.
4657 (0x1231)	Firmware update critical error GM2_TIMEOUT_APPUPD	Firmware update critical error GM2_TIMEOUT_APPUPD	Switch the device off and on again. If the problem persists, please contact support.
4658 (0x1232)	Firmware update critical error SM2BFL1_ERROR_APPUPD	Firmware update critical error SM2BFL1_ERROR_APPUPD	Switch the device off and on again. If the problem persists, please contact support.
4659 (0x1233)	Firmware update critical error GM3_TIMEOUT_APPUPD	Firmware update critical error GM3_TIMEOUT_APPUPD	Switch the device off and on again. If the problem persists, please contact support.
4660 (0x1234)	Firmware update critical error SM2APP_ERROR_APPUPD	Firmware update critical error SM2APP_ERROR_APPUPD	Switch the device off and on again. If the problem persists, please contact support.
4661 (0x1235)	FW update warning BEGIN_ERROR_APPUPD	Firmware update warning BFLGEN_ERROR_APPUPD	In the event of an error during the firmware update, please forward the code to Support.
4662 (0x1236)	FW update warning PI_ERROR_APPUPD	Firmware update warning PI_ERROR_APPUPD	In the event of an error during the firmware update, please forward the code to Support.
4663 (0x1237)	FW update warning TI_ERROR_APPUPD	Firmware update warning TI_ERROR_APPUPD	In the event of an error during the firmware update, please forward the code to Support.
4664 (0x1238)	FW update warning FI_ERROR_APPUPD	Firmware update warning FI_ERROR_APPUPD	In the event of an error during the firmware update, please forward the code to Support.
4848 (0x12F0)	FW update error BFLUPD_REP_CNT_EXPIRED_UPD	Firmware update error BFLUPD_REP_CNT_EXPIRED_UPD	Switch the device off and back on, or try again to update it. If the problem persists, please contact support.
4849 (0x12F1)	FW update error AP-PUPD_REP_CNT_EXPIRED_UPD	Firmware update error AP-PUPD_REP_CNT_EXPIRED_UPD	Switch the device off and back on, or try again to update it. If the problem persists, please contact support.
4850 (0x12F2)	FW update error INVALID_PACKAGE_UPD	Firmware update error INVALID_PACKAGE_UPD	Please try to update the device again with a different update package. If the problem persists, please contact support.
6158 (0x180E)	P24 (class B) missing or has undervoltage	Supply voltage 2L missing or undervoltage	Check the supply voltage on connections 2L+ (pin 2) and 2L- (pin 5) of port X0[P]. P corresponds to the associated port number.

number	Alarm	Description	Remedy
6159 (0x180F)	Short circuit on P24 (class B)	Short circuit detected on 2L	Check the cable connection, wiring and load on connections 2L+ (pin 2) and 2L- (pin 5) of port X0[P]. P corresponds to the associated port number.
7936 (0x1F00)	1L power 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)	1L power overload	Overload in supply line 1L The total current in supply line 1L has exceeded the upper limiting value	Eliminate overload
7940 (0x1F04)	2L power overload	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 "Channel Error (PROFINET)" is 38146 (0x9502).

The following table lists the numbers of the IO-Link master diagnostic alarms.

Table 282: IO-Link Master Diagnostic Alarms

Channel Error	Extended Channel Error Type	Description	Remedy
38146 (0x9502)	6143 (0x17FF)	Process data discrepancy	Check the submodule configuration and make sure that it covers full the extent input data and at least the extent of the output data of the IO-Link device if possible. If it is not possible to cover the full extent of the input data, enable the input fraction if applicable.
38146 (0x9502)	6144 (0x1800)	No device connected or communication aborted	Check the IO-Link port. Ensure that the device is properly connected to the corresponding C/Q (pin 4), 1L+ (pin 1) and 1L- (pin 3) connections on port X0[P]. P corresponds to the associated port number. In addition, check the cable connection and, if necessary, check whether device is defective.
	6145 (0x1801)	Error during startup parameterization	Check the port configuration performed as part of the IO-Link proxy configuration.
	6146 (0x1802)	Incorrect VendorID (Inspection Level mismatch)	Check the "Manufacturer ID" setting in the port configuration. Make sure that the setting corresponds to the manufacturer of the connected device.
	6147 (0x1803)	Incorrect DeviceID (Inspection Level mismatch)	Check the "Device ID" setting in the port configuration. Make sure that the setting corresponds to the connected device's type.
38146 (0x9502)	6148 (0x1804)	Short circuit at C/Q	Check the cable connection, wiring and load at connection C/Q (pin 4) of port X0[P]. P corresponds to the associated port number.
	6149 (0x1805)	PHY overtemperature	Check the ambient temperature and the load of the IO-Link master.
	6150 (0x1806)	Short circuit at L+	Check the cable connection, wiring and load on connection 1L+ of port X0[P]. P corresponds to the associated port number.
	6151 (0x1807)	Overcurrent at L+	Check the power supply on connection 1L+ (pin 1) and the load on connection C/Q (pin 4) of port X0[P]. P corresponds to the associated port number.
38146 (0x9502)	6152 (0x1808)	Device event overflow	Contact the device manufacturer.

Channel Error	Extended Channel Error Type	Description	Remedy
	6153 (0x1809)	Backup inconsistency – storage overflow	The backup storage range, with a maximum of 2048 octets, is not sufficient to store the device parameters.
	6154 (0x180A)	Backup inconsistency – identity error	Ensure that the current data storage is associated with the connected device. If necessary, replace the device, or initiate a new data storage upload for the currently connected device.
	6155 (0x180B)	Backup inconsistency – unspecified data storage error	Repeat the procedure. If the error persists, contact the device manufacturer.
38146 (0x9502)	6156 (0x180C)	Backup inconsistency – upload error	Errors occurred during device parameterization upload. Repeat the procedure. If the error persists, contact the device manufacturer.
	6157 (0x180D)	Parameter inconsistency – download error	Errors occurred during device parameterization download. Repeat the procedure. If the error persists, contact the device manufacturer.
	6158 (0x180E)	P24 (class B) missing or has undervoltage	Check the supply voltage on connections 2L+ (pin 2) and 2L– (pin 5) of port X0[P]. P corresponds to the associated port number.
	6159 (0x180F)	Short circuit on P24 (class B)	Check the cable connection, wiring and load on connections 2L+ (pin 2) and 2L– (pin 5) of port X0[P]. P corresponds to the associated port number.
38146 (0x9502)	6160 (0x1810)	Short circuit at I/Q	Check the cable connection on pin 2.
	6161 (0x1811)	Short circuit at C/Q	Check the cable connection, wiring and load at connection C/Q (pin 4) of port X0[P]. P corresponds to the associated port number.
	6162 (0x1812)	Overcurrent on I/Q	Check the cable connection, wiring and load on the I/Q (pin 2) connection of port X0[P]. P corresponds to the associated port number.
	6163 (0x1813)	Overcurrent on C/Q	Check the cable connection, wiring and load on connection C/Q (pin 4) of port X0[P]. P corresponds to the associated port number.
38146 (0x9502)	7936 (0x1F00)	1L power undervoltage	Power supply on 1L below voltage limit
	7937 (0x1F01)	1L power overvoltage	Power supply to 1L above voltage limit
	7938 (0x1F02)	Device overtemperature	Device temperature exceeds limiting value

Channel Error	Extended Channel Error Type	Description	Remedy
	7939 (0x1F03)	1L power overload	Total current on 1L current bar exceeds limiting value
38146 (0x9502)	7940 (0x1F04)	2L power overload	Total current on 2L current bar exceeds limiting value
	7941 (0x1F05)	Device undertemperature	Device temperature has fallen below limiting value
	7942 (0x1F06)	2L power undervoltage	Power supply on 2L below voltage limit
	7943 (0x1F07)	2L power overvoltage	Power supply to 2L above voltage limit
38146 (0x9502)	7944 (0x1F08)	Force mode is active	Force mode is active (caused by Web client or OPCUA client).
	7945 (0x1F09)	1L power failure	1L power failed
	7946 (0x1F0A)	2L power failure	2L power failed
	7947 (0x1F0B)	Power-on delay start	Start of the power-on delay sequence
	7950 (0x1F0E)	Invalid I/Q behavior setting	Setting the class B pin 2 configuration (0x0030) requires the IQ behavior in the IO-Link port configuration to have a value of 0. The IO-Link port configuration has been adjusted automatically.
38146 (0x9502)	24576 (0x6000)	Invalid cycle time	Check the "Port Cycle Time" setting in the port configuration. Modify it if necessary, or replace the connected IO-Link device.
	24577 (0x6001)	Revision error (incompatible protocol version)	Check the "Validation and Backup" setting in the port configuration. Make sure that the selected IO-Link version (V1.x) corresponds to that of the connected device.
	24578 (0x6002)	ISDU batch failed	Fix the parameter inconsistencies.

11.2.3 Process Alarms

Process Alarms (Completion Notifications)

The following table describes process alarms with completion Notifications.

Table 283: 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.	-

Number	Alarm	Description	Corrective Action
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 284: 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 error	Replace IO-Link device
38144 (0x9500)	20496 (0x5010)	Component malfunction	Repair or replace
	20497 (0x5011)	Loss of non-volatile memory data	Check batteries
	20498 (0x5012)	Batteries too weak	Replace batteries
38144 (0x9500)	20736 (0x5100)	General power supply error	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

Channel Error	Extended Channel Error Type	Description of the Malfunction on the Connected IO-Link Device	Corrective Action on the Connected IO-Link Device
	20754 (0x5112)	Error in additional power supply	Check tolerance
38144 (0x9500)	24576 (0x6000)	Device software error	Check firmware version
	25376 (0x6320)	Parameter error	Use data sheet and check values
	25377 (0x6321)	Missing parameter(s)	Check parameter(s)
	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 error	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 needed	Cleaning
	3137 (0x0C41)	Maintenance needed	Refill
	3138 (0x0C42)	Maintenance needed	Replace 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
	3239 (0x0CA7)	Overcurrent on port X04 pin 4	Check load Check pin 4 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
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
	3258 (0x0CBA)	Signal transmitter error	Signal transmitter error / probe fell off Device status = 3 (function test)
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
	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
38145 (0x9501)	3582 (0x0DFE)	Test event 1	Test event, 1st device status = 1 (maintenance required)
	3583 (0x0DFF)	Test event 2	Test event, 2nd device status = 1 (maintenance required)

Process Alarms (Analog Channel)

The following table describes process alarms of an analog channel.

Table 285: Process Alarms (Analog Channel)

number	Alarm	Description	Remedy
4116 (0x1014)	User upper limit exceeded	Upper user limiting value overrun	Check setting or measured value
4117 (0x1015)	User lower limit underrun	Lower user limiting value underrun	Check setting or measured value

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 \[► 184\]](#).

12.2 Firmware-Update/-Downgrade

The module's firmware can be updated. Use the WAGO I/O Field Webserver to do so.

For information on the implementation, see [🔗 Firmware aktualisieren \[► 182\]](#).

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 286: M12 protective caps

Item No.	Product
756-8102	M12 protective cap; for unused sockets
756-8103	M12 protective cap; for unused connector plugs

System wiring components can be found at [🔗 www.wago.com](http://www.wago.com).

For cold junction compensation, use the pluggable connector with item number 756-9207/050-000.

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 by slot and subslot: The PROFINET IO controller addresses the IO-Link master by slot 1 and subslot 1. The **Port** parameter addresses the port to which the IO-Link device is connected.

Table 287: Addressing the IO-Link Port by the Slot and Subslot

Slot/Subslot	IO-Link Port
1 / 1	Ports 1 ... 4 (the Port parameter determines the exact port).
1 / 2	Port 1
1 / 3	Port 2
...	...
1 / 4	Port 4

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:

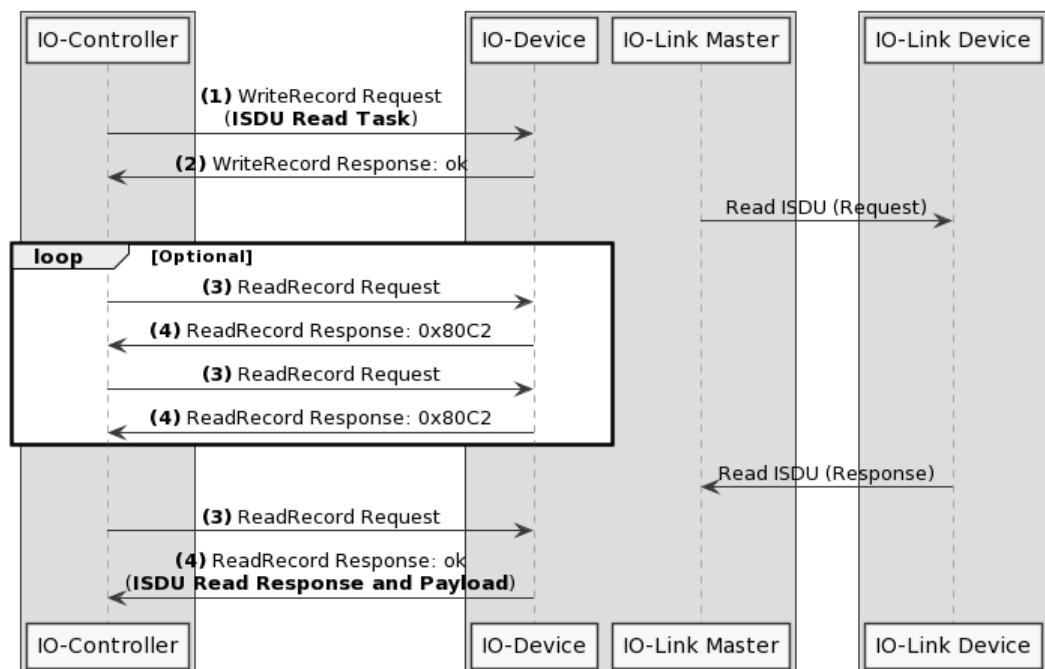


Figure 20: ISDU Read Process

(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 288: 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 289: 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 290: 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:

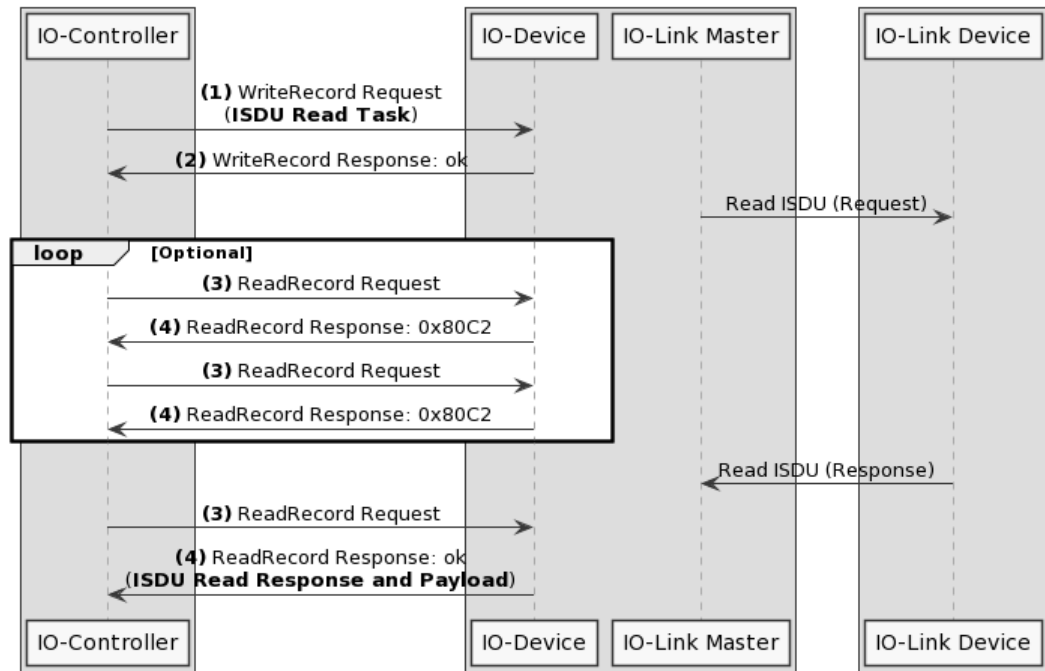


Figure 21: ISDU Write Process

(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 291: 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
7	IOL_Subindex	Object subindex of the IO-Link device to be written to.	Unsigned8	[0x00...0xFF]

Offset	Parameter Name	Description	Type	Value
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 292: 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 293: 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 294: 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
2	Error code	IO-Link error codes	Unsigned8
3	Additional Code	Additional IO-Link error codes (Additional Code)	Unsigned8

Port Errors

Table 295: 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 296: 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.
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.

Error code	Additional Code	Event	Error Name Description
0x80	0x21	Service temporarily unavailable – local control	SERV_NOTAVAIL_LOCCTRL 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_VALGTLIM 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_VALLTLIM 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.
0x80	0x41	Inconsistent parameter set	PAR_SETINCONSIST This error type is used if a block parameter transfer ends 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).

Error code	Additional Code	Event	Error Name Description
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 297: "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.
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 298: 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 299: 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 300: 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 301: 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 302: Connector Diagnosis Level – Data (Index 0x0103, Slot 2, Subslots 5 ... 11)

Parameter Name	Type	Values	Description	Unit
IOverCurrentPin1	INT32	0 <= IOverCurrentPin1 <= 4000 (→ 4 A)	Warning level for current upper limit on pin 1 0: monitoring not enabled	mA
IUnderCurrentPin1	INT32	0 <= IUnderCurrentPin1 <= 4000 (→ 4 A)	Warning level for current lower limit on pin 1 0: monitoring not enabled	mA
IOverCurrentPin2	INT32	0 <= IOverCurrentPin2 <= 2400 (→ 2.4 A) Recommendation: 2000 (→ 2 A)	Warning level for current upper limit on pin 2 0: monitoring not enabled	mA

Parameter Name	Type	Values	Description	Unit
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 ≤ IOverCurrentPin4 ≤ 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 303: 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 304: 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
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 305: 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 306: 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
ulMinTemperatureDuration	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
ulMaxTemperatureDuration	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
ulMinVoltagePin1Duration	uint32	0 ... 4294967295 (0xFFFFFFFF)	Duration of the lower limiting value underrun 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
ulMinVoltagePin2-Count	uint32	0 ... 4294967295 (0xFFFFFFFF)	Counter for the lower limiting value underruns for the voltage on pin 2 since the last reset.	Counter
ulMaxVoltagePin2-Count	uint32	0 ... 4294967295 (0xFFFFFFFF)	Counter for the upper limiting value overruns for the voltage on pin 2 since the last reset.	Counter
ulMinVoltagePin2Duration	uint32	0 ... 4294967295 (0xFFFFFFFF)	Duration of the lower limiting value underrun 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
ulMinVoltagePin4-Count	uint32	0 ... 4294967295 (0xFFFFFFFF)	Counter for the lower limiting value underruns for the voltage on pin 4 since the last reset.	Counter
ulMaxVoltagePin4-Count	uint32	0 ... 4294967295 (0xFFFFFFFF)	Counter for the upper limiting value overruns for the voltage on pin 4 since the last reset.	Counter

Parameter Name	Type	Values	Description	Unit
ulMinVoltagePin4Duration	uint32	0 ... 4294967295 (0xFFFFFFFF)	Duration of the lower limiting value underrun 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
ulMinCurrentPin1-Count	uint32	0 ... 4294967295 (0xFFFFFFFF)	Counter for the lower limiting value under-runs for the current on pin 1 since the last reset.	Counter
ulMaxCurrentPin1-Count	uint32	0 ... 4294967295 (0xFFFFFFFF)	Counter for the upper limiting value overruns for the current on pin 1 since the last reset.	Counter
ulMinCurrentPin1Duration	uint32	0 ... 4294967295 (0xFFFFFFFF)	Duration of the lower limiting value underrun 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
ulMinCurrentPin2-Count	uint32	0 ... 4294967295 (0xFFFFFFFF)	Counter for the lower limiting value under-runs for the current on pin 2 since the last reset.	Counter
ulMaxCurrentPin2-Count	uint32	0 ... 4294967295 (0xFFFFFFFF)	Counter for the upper limiting value overruns for the current on pin 2 since the last reset.	Counter
ulMinCurrentPin2Duration	uint32	0 ... 4294967295 (0xFFFFFFFF)	Duration of the lower limiting value underrun 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
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 overruns for the current on pin 4 since the last reset.	Counter
ulMinCurrentPin4Duration	uint32	0 ... 4294967295 (0xFFFFFFFF)	Duration of the lower limiting value underrun 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 307: 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 308: 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
IMinCurrentPin1	int32	IMinCurrentPin1 ≥ 0	Minimum measured current on pin 1 since the last reset	mA
IMaxCurrentPin1	int32	IMaxCurrentPin1 ≤ 4000 (→ 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 (→ 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 (→ 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
ullTimestampMinVoltagePin1	uint64	-	Timestamp of minimum voltage on pin 1	s/ns
ullTimestampMax-VoltagePin1	uint64	-	Timestamp of maximum voltage on pin 1	s/ns
ullTimestampMinVoltagePin2	uint64	-	Timestamp of minimum voltage on pin 2	s/ns

Parameter Name	Type	Values	Description	Unit
ullTimestampMax-VoltagePin2	uint64	-	Timestamp of maximum voltage on pin 2	s/ns
ullTimestampMinVoltagePin4	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
ullTimestampMaxCurrentPin1	uint64	-	Timestamp of maximum current on pin 1	s/ns
ullTimestampMinCurrentPin2	uint64	-	Timestamp of minimum current on pin 2	s/ns
ullTimestampMaxCurrentPin2	uint64	-	Timestamp of maximum current on pin 2	s/ns
ullTimestampMinCurrentPin4	uint64	-	Timestamp of minimum current on pin 4	s/ns
ullTimestampMaxCurrentPin4	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 309: 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 310: 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
lTemperature	INT32	lTemperature ≤ 1050 → 105 °C	Device temperature in 0.1 °C increments	0.1 °C
lVoltagePin1	INT32	lVoltagePin1 ≥ 15500 → 15.5 V lVoltagePin1 ≤ 34000 → 34 V	Voltage measured on pin 1	mV
lVoltagePin2	INT32	lVoltagePin2 ≥ 15500 → 15.5 V lVoltagePin2 ≤ 34000 → 34 V	Voltage measured on pin 2	mV

Parameter Name	Type	Values	Description	Unit
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 311: 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 312: 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)
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 313: 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 314: 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)
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 765-2102/100-000 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/765-2102/100-000.

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 Operal Description

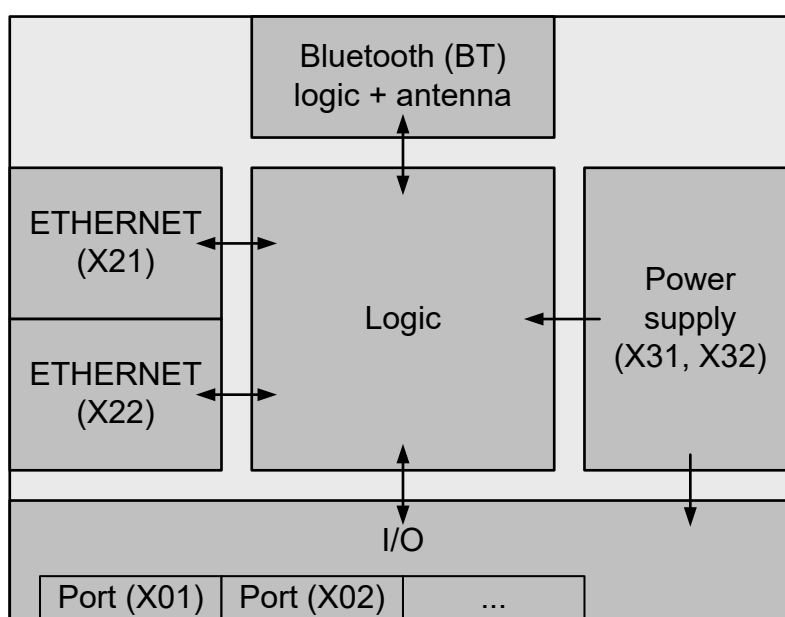
Product Description

The product 765-2102/100-000 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 315: 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 316: 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 317: Voltage Ranges

Power source	24 VDC PELV (Protective Extra Low Voltage) or SELV (Safety Extra Low Voltage)
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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