OPERATING INSTRUCTIONS

Sensor Integration Gateway - SIG350

EtherCAT®

Integration Products

SICK
Sensor Intelligence.

Described product

SIG – Sensor Integration Gateway
SIG350 - EtherCat®

Manufacturer

SICK AG
Erwin-Sick-Str. 1
79183 Waldkirch
Germany

Legal information

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

Original document

This document is an original document of SICK AG.

Contents

1 About this document

1.1 Further information

NOTE
All the documentation available for the device can be found on the online product page at:

▶ www.sick.de/SIG350

The following information is available for download from this page:

- Type-specific online data sheets for device variants, containing technical data and dimensional drawings
- EU declaration of conformity for the product family
- Dimensional drawings and 3D CAD dimension models in various electronic formats
- These operating instructions, available in English and German, and in other languages if necessary
- Other publications related to the devices described here
- Publications dealing with accessories
- IO-Link driver files and IO-Link Technical Information v1.1

1.2 Explanation of symbols

Warnings and important information in this document are labeled with symbols. The warnings are introduced by signal words that indicate the extent of the danger. These warnings must be observed at all times and care must be taken to avoid accidents, personal injury, and material damage.

DANGER
... indicates a situation of imminent danger, which will lead to a fatality or serious injuries if not prevented.

WARNING
... indicates a potentially dangerous situation, which may lead to a fatality or serious injuries if not prevented.

CAUTION
... indicates a potentially dangerous situation, which may lead to minor/slight injuries if not prevented.

NOTICE
... indicates a potentially harmful situation, which may lead to material damage if not prevented.

NOTE
... highlights useful tips and recommendations as well as information for efficient and trouble-free operation.

2 Safety information

2.1 Intended use

The SIG350 is a remote IO-Link input and output module for connecting a EtherCAT network.

Intended use requires that the device is used industrially indoors without any specific climatic and atmospheric requirements. Operation of the device according to its intended use and enclosure rating IP 67 are only guaranteed if open male and female connectors are sealed with blind plugs. Intended use also includes EMC-compliant electrical installation.

If the product is used for any other purpose or modified in any way, all warranty claims against SICK AG will be void.

NOTE

This document is aimed at the trained specialist personnel. Qualified specialist personnel are persons who are familiar with work such as the installation and operation of the product, and who have the necessary qualifications for this activity. All claims against the manufacturer in respect of warranty and liability shall be invalidated in the event of damage resulting from unauthorized manipulation or incorrect use. The operating entity is responsible for ensuring that the work safety regulations and accident prevention regulations applicable in the specific individual case are observed.

2.2 Improper use

- The device does not constitute a safety-relevant device according to the EC Machinery Directive (2006/42 / EC).
- The device must not be used in explosion-hazardous areas.
- Any other use that is not described as intended use is prohibited.
- Any use of accessories not specifically approved by SICK AG is at your own risk.

The device is not suitable for the following applications (this list is not exhaustive):

- As a safety device to protect persons, their hands, or other body parts
- Underwater
- In explosion-hazardous areas
- Outdoors, without additional protection

NOTICE

Danger due to improper use!

Any improper use can result in dangerous situations.

Therefore, observe the following information:

- ▶ The device should be used only in line with intended use specifications.
- ▶ All information in these operating instructions must be strictly complied with.

2.3 General safety notes

2.3.1 Safety notes

- Read the operating instructions before commissioning.
-  Connection, mounting, and setting may only be performed by skilled person.
- 

Not a safety component in accordance with the EU Machinery Directive.
-  When commissioning, protect the device from moisture and contamination.
- These operating instructions contain information required during the life cycle of the sensor.

2.4 Notes on UL approval

UL Environmental Rating: Enclosure type 1

3 Product description

3.1 General information

The SIG350 IO-Link Master is a gateway for connecting IO-Link devices as well input and/or output signals for data integration into a PLC via EtherCAT. Parallel to the fieldbus communication, the data can also be transmitted to a network via the integrated IIOT interfaces (REST API, MQTT or OPC UA). It is intended for use in industrial environments that require enclosure rating up to IP67.

The module has eight IO-Link Master channels and eight universal digital channels (PNP). The device is connected to an M12 female connector that can be operated either in the Class A or Class B connection type.

In addition, the SIG350 has a powerful user interface that can be accessed either using the SOPAS ET software from SICK or directly via the web interface. This is used to parameterize the SIG350 and the connected devices.

The SIG350 can be commissioned using the following methods

- Engineering tool of the PLC manufacturer
- Integrated web interface
- SICK SOPAS Engineering Tool application
- Dual Talk interface

Parameterization

- Parameterization via EtherNet/IP EtherCAT is performed using the engineering tool of the PLC manufacturer to access the SIG350 directly. Depending on which type of PLC engineering tool is used, parameterization of the SIG350 and the connected devices is done in different ways.
- The integrated web interface of the SIG350 provides direct access for parameterization via a suitable web interface on devices connected to the same Ethernet network as the SIG350.
- It is also possible to connect the SIG350 to the SOPAS Engineering Tool from SICK via Ethernet for parameterization. The SOPAS Engineering Tool application can be downloaded at www.sick.com.
- The SIG350 also has different IIoT interfaces (Dual Talk) that provide direct access for higher-level automation operations.

3.1.1 IO-Link

IO-Link is a standard (IEC 61131-9) that can be used to connect intelligent devices at the sensor and actuator level to an automation system.

The SIG350 complies with IO-Link specification V1.1.3.

Communication

Communication takes place between a master and a device. An IO-Link Master contains one or more ports. One device can be connected per port, which means that IO-Link is point-to-point communication and not a fieldbus. The IO-Link Master forms the interface between the higher-level fieldbus level and the IO-Link system.

IO-Link is functional and enables advanced diagnostics of sensors and actuators or simple and fast parameterization through bidirectional communication. The IO-Link devices are connected to the master via unshielded 3-, 4- or 5-wire standard cables of a maximum length of 20 m.

The SIG350 supports IO-Link communication at the following speeds:

- COM 1 → 4,800 baud
- COM 2 → 28,400 baud
- COM 3 → 230,400 baud

The module automatically selects the communication speed that matches the IO-Link device.

IO-Link modus (IOL)

IO-Link communication (C/Q) is activated at pin 4, so an IO-Link device can be connected.

ISDU (Indexed Service Data Unit) access

The acyclic data allows the device parameters to be written by an IO-Link device or parameters, measured values and diagnostic data to be read by an IO-Link device. The following tasks can be performed: • Parameterization/Configuration of an IO-Link device during operation. • Diagnosis of an IO-Link device by reading out diagnostic parameters. • Execution of IO-Link port functions. • Saving/Restoring of IO-Link device parameters. The data on the IO-Link device is uniquely addressed with index and subindex.

Data storage mode

The data storage mode allows IO-Link devices to be exchanged without any configuration in the event of service. Both the IO-Link Master and the IO-Link device store the device parameters. During data storage, these different parameter data memories are synchronized.

In the event of device replacement, the master writes the stored device parameters to the new device. The application can be restarted without further intervention via a configuration tool or the like.

If the IO-Link Master is replaced, the new master reads the IO-Device parameters from the device and saves them. The “Save and Restore” data storage function must be activated for this purpose. The application can also be restarted here without further intervention via a configuration tool or the like.

The data retention mode is only available for devices that comply with IO-Link version V1.1 and higher.

3.1.2 Dual Talk (IIoT interfaces)

The SIG350 features Dual Talk functionality, which allows the user to address the module from IT networks and integrate it into Internet-of-Things applications.

The SIG350 contains the following interfaces:

- MQTT JSON
- REST API JSON
- OPC UA

REST API

The Representational State Transfer – Application Programming Interface (REST API) is a programmable interface that uses HTTP requests for GET and POST data. This allows access to detailed device information. The format is JSON.

The REST API interface of the SIG350 complies with the JSON Integration for IO-Link standard version V1.0.0 published by the IO-Link community.

MQTT

The MQTT (Message Queuing Telemetry Transport) protocol is an open network protocol for machine-to-machine communication that enables the transmission of telemetric data between devices.

An MQTT client is integrated in the SIG350, which enables the device to publish certain information to an MQTT broker. The format is JSON.

The publication of messages can either take place periodically or be triggered manually.

The MQTT interface of the SIG350 complies with the JSON Integration for IO-Link standard version V1.0.0 published by the IO-Link community.

OPC UA

OPC United Architecture (OPC UA) is a platform-independent standard with a service-oriented architecture for communication in and with industrial automation systems. The OPC UA standard is based on the client-server principle and enables machines and devices to communicate horizontally with each other and vertically with the ERP system or the cloud, regardless of the preferred fieldbus. The SIG350 provides an OPC UA server at field device level, to which an OPC UA client can connect to exchange information securely. The interface complies with the IO-Link Companion specification (version V1.0).

3.1.3 Web interface

The SIG350 has an integrated web interface that provides functions for device configuration and the display of status and diagnostic information via a web interface. The web interface provides an overview of the configuration and status of the device.

The graphical user interface ensures fast and intuitive operation.

The prerequisite for using the web interface is the existence of a valid IP address. This can be set via the rotary switches directly on the device or via the DCP tool. SICK also offers the SOPAS ET engineering tool, which can be used to configure the SIG350.

In the SIG350, IP addressing is preconfigured to **BootP** in the delivery state.

After assigning the IP address, enter http:// followed by the IP address, e.g. http:// 192.168.0.1, in the address bar of your web browser to access the web interface. If the device status page is not displayed, check your browser and firewall settings.

3.2 Operating elements and status indicators

3.2.1 Model structure

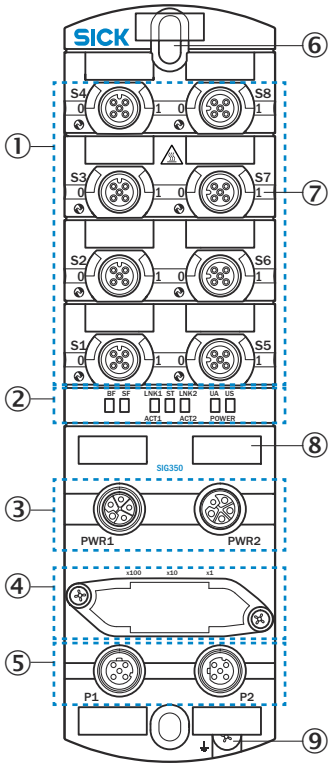


Figure 1: Model structure

① Sensor/Actuator connection (8x): IO-Link port S1 – S8
② LED status indicators for bus and device status
③ Voltage supply (2x): Voltage input (PWR1) and output (PWR2)
④ Rotary switch
⑤ Ethernet connection (2x): Ethernet Port P1 – P2
⑥ Mounting opening
⑦ LED display for IO-Link port S1 – S8 (2x per port)
⑧ Marking labels (removable)
⑨ Connection for functional earth

3.2.2 Status indicators

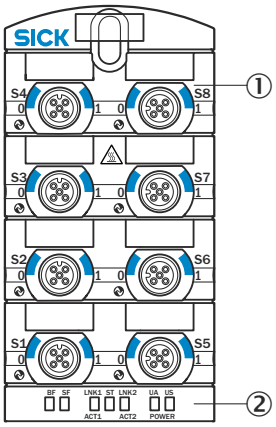


Figure 2: Status indicators

① LED status indicator for IO-Link port S1 – S8:
Each input and output is assigned its own status display:
- Channel 0 corresponds to pin 4
- Channel 1 corresponds to pin 2

② Status indicator for bus and device status
- LED MS = Module status
- LED NS = Network status
- LED LNK1 = Link 1
- LED ACT1 = Activity 1
- LED ST = Status
- LED LNK2 = Link 2
- LED ACT2 = Activity 2
- LED POWER UA = Supply voltage actuator
- LED POWER US = Supply voltage sensor

Table 1: LEDs for IO-Link port S1 – S8

LED	Display	Description
0	Off	Pin 4 is not used/deactivated
	Green	Pin 4 is configured as IO-Link. Communication active.
	Flashing green (1 Hz)	Pin 4 is configured as IO-Link. No communication.
	Flashing green (10 Hz)	Pin 4 is configured as IO-Link, but is in Pre-Operate mode. e.g. discrepancy DeviceID
	Yellow	Pin 4 is configured as a binary signal: 24V - DI visible in process data - DO can be switched via process data
	Red	Pin 4 is configured as DO: Overload/Short-circuit on pin 4
	Flashing red (1 Hz)	Pin 4 is configured as DI or DO: Overload/Sensor supply short-circuit
	Flashing red (2 Hz)	Pin 4 is configured as IO-Link: - Data storage error

LED	Display	Description
1	Off	Pin 2 is not used/deactivated
	Yellow	Pin 2 is configured as a binary signal: 24V - DI visible in process data - DO can be switched via process data
	Red	Pin 2 is configured as DO: Overload/Short-circuit on pin
	Flashing red (1 Hz)	Overload/Sensor supply short-circuit

Table 2: LEDs for bus system and status

LED	Display	Description
MF	Off	Module is switched off
	Red	System error
	Flashing red (1 Hz)	Error in configuration or inconsistent configuration
	Flashing green (1 Hz)	No data exchange standby – module not configured
	Green	Module in operation
NS	Off	Module is switched off
	Red	System error IP address already in use
	Flashing red (1 Hz)	DCP signal service is initiated via bus. At least one connection has timed out.
	Flashing green (1 Hz)	No connection to the master
	Green	Connection to master present
ST	Green	Module operating without errors
	Flashing green (4 Hz)	The operation requested by the position of the rotary switch is performed. Do **not** switch off the device .
	Flashing red (1 Hz)	Invalid rotary switch position. System does not start.
	Red	Initialization error: • Rotary switch operation failed etc. • Hardware problem • No valid configuration

Table 3: LEDs for Ethernet communication

LED	Display	Description
LNK1 + LNK2	Off	No connection to network à Check cable connections
	Green	Connection to network present
ACT1 + ACT2	Off	Module is **not** sending/receiving Ethernet frames à Check cable connections
	Yellow flashing	Module is sending/receiving Ethernet frames

Table 4: LEDs for supply voltage

LED	Display	Description
UA	Off	No voltage: UA < 11 V
	Green	Module operating without errors: 18 V ≤ UA ≤ 30 V
	Red	Undervoltage: 11 V ≤ UA < 18 V
	Flashing red (4 Hz)	Overvoltage: UA > 30 V
US	Off	No voltage: US < 11 V
	Green	Module operating without errors: 18 V ≤ US ≤ 30 V
	Red	Undervoltage: 11 V ≤ US < 18 V
	Flashing red (4 Hz)	Overvoltage: US > 30 V

4 Transport and storage

4.1 Transport

For your own safety, please read and observe the following notes:

NOTE

Damage to the device due to improper transport.

- The device must be packaged for transport with protection against shock and moisture.
- Recommendation: Use the original packaging as it provides the best protection.
- Transport should be performed by specialist staff only.
- The utmost care and attention is required at all times during unloading and transportation on company premises.
- Note the symbols on the packaging.
- Do not remove packaging until immediately before you start mounting.

4.2 Transport inspection

Immediately upon receipt at the receiving work station, check the delivery for completeness and for any damage that may have occurred in transit. In the case of transit damage that is visible externally, proceed as follows:

- Do not accept the delivery or only do so conditionally.
- Note the scope of damage on the transport documents or on the transport company's delivery note.
- File a complaint.

NOTE

Complaints regarding defects should be filed as soon as these are detected. Damage claims are only valid before the applicable complaint deadlines.

4.3 Storage

Store the device under the following conditions:

- Recommendation: Use the original packaging.
- Do not store outdoors.
- Store in a dry, dust-protected place.
- To allow any residual dampness to evaporate, do not package in airtight containers.
- Do not expose to aggressive substances.
- Protect from sunlight.
- Avoid mechanical shocks.
- Storage temperature: see "Technical data", page 71.
- Relative humidity: see "Technical data", page 71.
- For storage periods longer than 3 months, regularly check the general condition of all components and the packaging.

5 Mounting

5.1 Prerequisites

The following requirements must be met when mounting the SIG350:

- Level mounting surface free of mechanical stress.
- Provide suitable earthing.
- Select suitable mounting location with regard to vibration and impact load, temperature and humidity see "General technical data", page 71.
- Protected to prevent the connecting cables from being torn off by personnel or the device.
- For proper installation and improved heat dissipation, keeping a minimum distance of 3 mm between two modules is recommended.
- When using angled plug connectors, a minimum distance of 50 mm must be maintained between two modules.
- Mount modules in such a way that they cannot be used as climbing aids.

NOTE

To ensure IP 67 protection, all unused connections must be covered with sealing caps. These are not included in the scope of delivery and must be ordered separately. Suitable sealing caps can be found at SICK.com (part number 5309189). In addition, connected cables and sealing caps must be fastened with the appropriate torque (see manufacturer's specifications).

5.2 Module mounting

The SIG350 is mounted using two screws (max. M6) and two washers.

The fixing screws and tightening torques depend on the substrate of the mounting location. Always tighten the screws carefully and observe the maximum permissible tightening torque of 3 Nm.

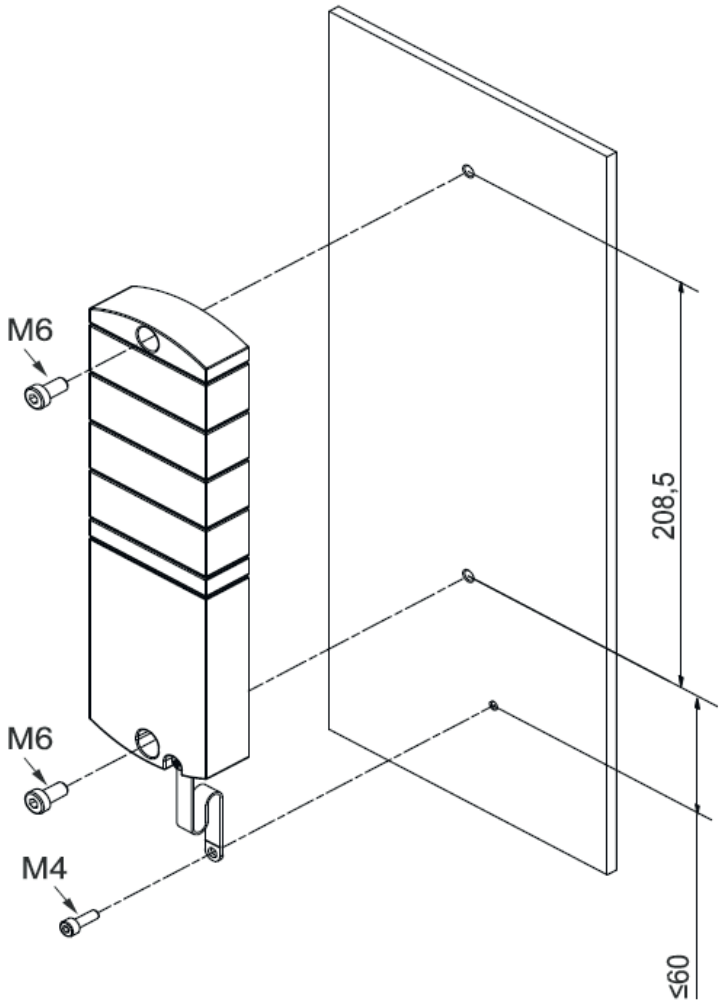


Figure 3: Mounting the module

Mounting

- Position M6 screw in the upper mounting opening and tighten lightly.
- Align housing
- Position another M6 screw in the lower mounting opening and tighten lightly.
- Tighten both screws with a max. tightening torque of 3 Nm.
- Ground module: see "Mounting of functional earth", page 17.

5.3 Mounting of functional earth

The module must be grounded to a metal base via a ground strap. To ensure functional earth, the module must be mounted with conductive screws. The fixing screws and tightening torques depend on the substrate of the mounting location. Always tighten the screws carefully and observe the maximum permissible tightening torque of 1.2 Nm.

NOTE

The ground strap and the associated screws for the functional earth are not included with delivery. This set is available as an accessory (part number 5346121).

Mounting

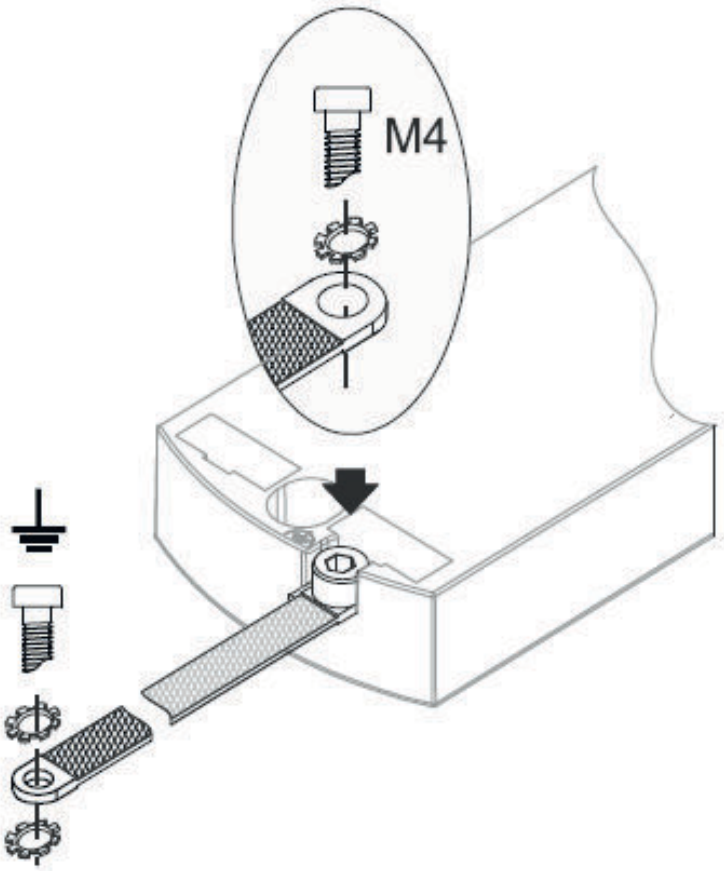


Figure 4: Mounting the ground strap

- Place the ground strap in the opening provided in the housing for functional earth.
- Position washer on ground strap and fasten to module with M4 screw.
- Observe the tightening torque of 1.2 Nm.
- Align ground strap
- Tighten the lower end of the ground strap with another M4 screw and two washers at the mounting location, observing the tightening torque.

5.4 Rotary switch cover

The rotary switches are provided with a cover to ensure IP protection. To operate the rotary switches, the cover must be removed. The cover must then be refitted.

The rotary switch cover is fastened with two M3 screws. The permitted tightening torque is 0.8 Nm.

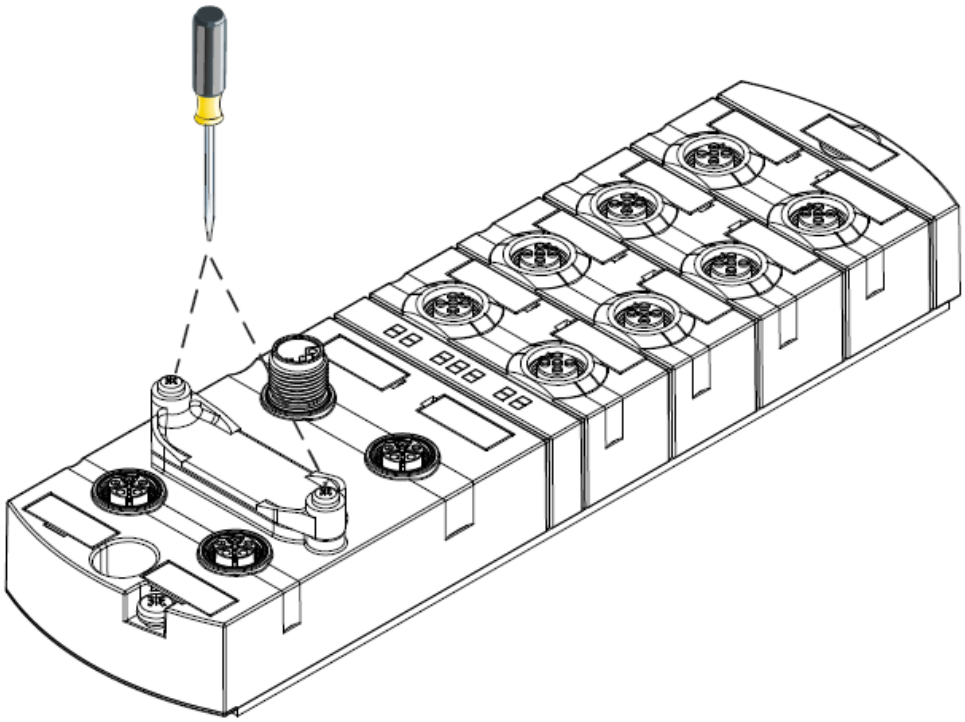


Figure 5: Mounting of rotary switch cover

5.5 Scope of delivery

Included in the scope of delivery of the SIG350:

- SIG350 IO-Link Master module
- Quickstart instructions
- 20 marking labels

NOTE
No screws are included in the scope of delivery.

6 Electrical installation

6.1 Electrical installation

The SIG350 is used in electrical installations. When working on the module or the plant, the safety rules of electrical engineering must be observed.

The following information must be observed, depending on the connection type:

- Switch off the power supply to the device before starting work on it.
- The connection of the network and IO-Link cable of the SIG350 must be voltage-free (U_B = 0 V). Only apply voltage/switch on the voltage supply (U_B > 0 V) once all electrical connections have been established.
- All unused male and female connectors must be sealed with sealing caps to ensure enclosure rating IP 67.
- If possible, each of the sensor/bus and actuator power supplies should be drawn from different sources. The total current of the module must not exceed 16 A.
- In case of separate actuator and sensor supply, always switch on the sensor voltage first and then the actuator voltage to ensure error-free function of the digital inputs and outputs.
- An incorrect supply voltage may result in damage to the device.
- Cables and/or modules damaged by short-circuits can overheat and cause fires. Provide sensible current monitoring or fuse. The fuse protection must be designed for max. 16 A.
- During operation of the module, the device surface may heat up. If necessary, wear suitable thermal gloves.
- Only install cables and accessories that comply with the requirements and regulations for safety, electromagnetic compatibility and, if applicable, telecommunications terminal equipment and the specification requirements.
- Observe the derating when using the product. The ambient temperature and the current have an influence on the heating of the product (see "Derating", page 23)

NOTE

Only operate the product with DC 24 V PELV (Protective Extra-Low Voltage) or SELV (Safety Extra-Low Voltage) voltage sources.

There is a risk of electric shock if this is not observed.

Only use a power supply unit that allows max. 60 V DC or 25 V AC in the event of a fault.

6.2 Pin assignment

NOTE

You will find a large selection of connection cables at www.sick.com

Explanation of the connection diagrams

- DI = Digital input
- DO = Digital output
- FE = Functional earth
- n. c. = Not connected
- Rx+ = Receiver +
- Rx- = Receiver -
- Tx+ = Sender +
- Tx- = Sender –
- US = Sensor voltage
- UA = Actuator voltage

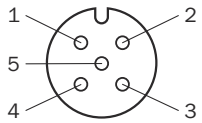
IO-Link ports

Tightening torque = 0.6 Nm

The length of cable of the sensor and actuator lines is generally limited to 30 m.
If an IO-Link connection is active, the length of cable is limited to max. 20 m.

Table 5: IO-Link ports (S1 – S8): M12 female contact, A-coded, port class A/B

PIN	IO-Link port class A	IO-Link port class B1[1)]
Pin 1	L + (U_S+)	L + (U_S+)
Pin 2	DI/DO	2L + (U_A+)
Pin 3	L - (U_S-)	L - (U_S-)
Pin 4	IO-Link/DI/DO	IO-Link/DI/DO
Pin 5	L - (U_S-)	L - (U_S-)



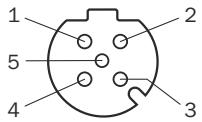
1) No galvanic separation

Ethernet ports

Tightening torque = 0.6 Nm

Table 6: Ethernet ports (P1 – P2): M12 female contact, D-coded

PIN	Description
Pin 1	Tx +
Pin 2	Rx +
Pin 3	Tx -
Pin 4	Rx -
Pin 5	n. c.



Supply ports

US: 18 ... 30 V DC

UA: 18 ... 30 V DC

Tightening torque = 0.6 Nm

Table 7: Power ports (PWR1 – PWR2): M12 male connector/female contact, L-coded

PIN	Description
Pin 1	+24 V DC US
Pin 2	0 V
Pin 3	0 V
Pin 4	+24 V DC UA
Pin 5	GND

PIN	Description

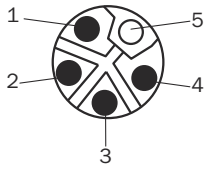


Figure 6: PWR1

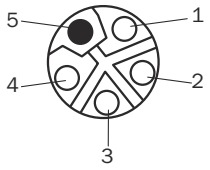


Figure 7: PWR2

6.3 Supply concept

CAUTION

Product damage when the permissible leakage current is exceeded.

Product damage and/or damage to other connected products if the maximum permissible leakage current is exceeded.

In addition, observe the derating, i.e. the maximum current depending on the ambient temperature.

Voltage supply

The 24 V voltage supply is fed in via port PWR1. The maximum current carrying capacity of the module is 16 A. The module has two supply lines, which are **not galvanically isolated**:

- Supply line 1 (US) connects 1L+ (pin 1) to L- (pin 3).
- Supply line 2 (UA) connects 2L+ (pin 4) to L- (pin 2).

Subsequent modules can be supplied with power via the PWR2 port. This leakage current must be taken into account when designing the supply. The total leakage current is limited to 16 A.

Sensor supply

The devices connected to the module are supplied via IO-Link ports S1 – S8. When designing the supply, the requirements of the connected sensors and actuators must be taken into account. The maximum current for the supply of all connected devices is limited to 10 A.

The maximum current per port is <= 4 A. The upper limit for the current on the individual pins of IO-Link ports S1-S8 is:

Table 8: Current carrying capacity of the pins on IO-Link ports S1 – S8

PIN	Current carrying capacity
1 (US)	<=2 A
2 (UA)	<=2 A
4 (UA)	<=2 A

6.4 Derating

Observe the derating when using the SIG350. The ambient temperature and the current have an influence on the heating of the module.

The product provides temperature and current readings that you can display via the web interface or read out via Dual Talk interfaces.

The following figure shows the maximum permissible current (I) that may be drawn by the device, depending on the ambient temperature (T):

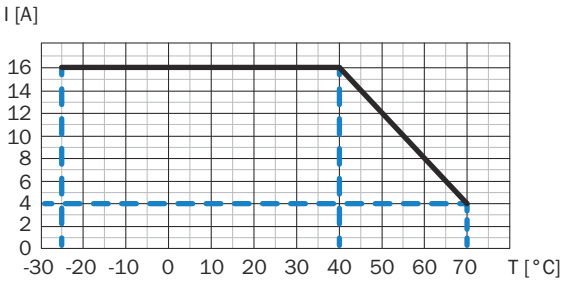


Figure 8: Derating sensor current US/actuator current UA

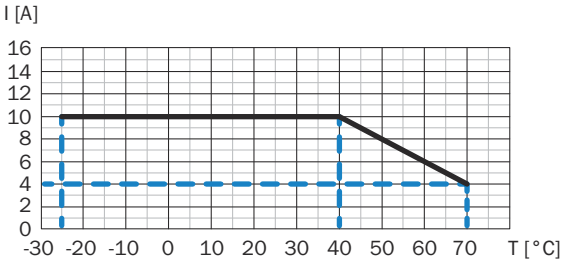


Figure 9: Derating total current IO-Link ports (total current S1 – S8)

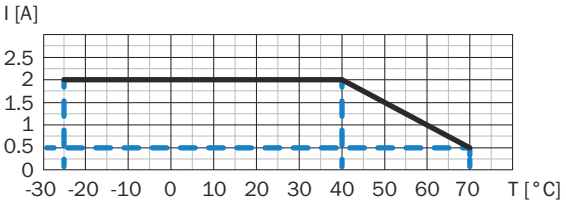


Figure 10: Derating current per sensor supply and output (per pin 1, 2, and 4 at IO-Link port S1 – S8)

7 Commissioning

When the supply voltage is switched on for the first time, the SIG350 starts with the factory settings.

To enable parameterization, the module must be configured to suit the network environment. For this purpose, various preparatory measures must be taken before parameterization can be started.

7.1 IP address

The module requires an IP address so that it can be addressed via the Ethernet network.

NOTE
When delivered, the SIG350 has the default IP address:
192.168.0.1
and the subnet mask
255.255.255.0
The name when delivered is **sig350**.

NOTE
The SIG350 does not have an IP address when delivered and is in **BootP** mode.

The SIG350 supports the following methods for IP address assignment:

1 BootP
2 DHCP
3 Static

BootP

Protocol for assigning the IP address.

DHCP is deactivated by default. To activate DHCP, open the web browser and change the address mode from static to DHCP. As soon as DHCP is activated, the IO-Link Master attempts to obtain an address from a DHCP server. When a new IP address is assigned by a DHCP server, the module immediately switches to the new IP address. Alternatively, DHCP can also be activated via the rotary switches.

DHCP

The SIG350 IO-Link Master supports the Dynamic Host Configuration Protocol for assigning IP addresses.
DHCP is deactivated by default. To activate DHCP, open the web browser and change the address mode from static to DHCP.
As soon as DHCP is activated, the IO-Link Master attempts to obtain an address from a DHCP server. When a new IP address is assigned by a DHCP server, the module immediately switches to the new IP address.
Alternatively, DHCP can also be activated via the rotary switches.

Static

The module has rotary switches with which the last octet of the IP address can be adjusted manually. In the Ethernet configuration area of the web interface, the default IP address can also be changed statically.

7.2 MAC address

Each device has a uniquely assigned MAC address that cannot be changed by the user. The assigned MAC address is printed on the module.

7.3 Rotary switch

The SIG350 has three rotary switches on the lower side of the SIG350 with which various settings can be made manually. These include setting the last octet of the IP address, but also performing a factory reset.

In the delivery state, the rotary switches are set to: 000.

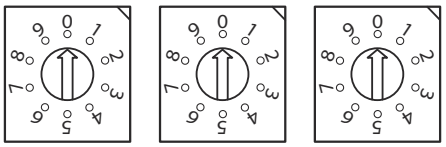


Figure 11: Rotary switch position in delivery state

To change settings in the module using the rotary switches, proceed as follows:

1 Set the rotary switch to the desired position.
2 Disconnect the module from the voltage supply.
3 Supply the module with voltage again.
4 Wait at least 10 seconds until the settings are loaded.

The new settings are then accepted and saved in the module.

Exception:

The procedure is different for rotary switch setting **979** (factory settings):

1 Disconnect the module from the voltage supply.
2 Set the rotary switch to position 979.
3 Supply module with voltage.
4 Wait at least 2 minutes until the settings are loaded.
5 Disconnect the module from the voltage supply again.
6 Set the rotary switch to position 000 or another desired position.
7 Reconnect the module to the voltage supply.

NOTE

The previously saved settings for fieldbus protocols are not affected by this position. Communication is then started if the switches are left in this position.

However, setting the positions to the previous state is recommended.

Table 9: Meaning of rotary switch settings

X100	X10	X1	Description
0	0	0	Delivery state The default network configuration is used: - BootP active When the IP address is changed, the last saved address is used.
0	0	1	Manual IP address With switch settings 0-0-1 ... 2-5-4, a fixed IP address can be set manually: The last octet of the preset IP address is set here (default: 192.168.0.xxx).
...	...	...	
2	5	4	

X100	X10	X1	Description
2	5	5	DHCP mode activated.
8	8	8	IP address reset A standard IP address is used. If the IP address was changed with other methods (e.g. web interface), the IP address will be reset to default IP address 192.168.0.1 when the master reboots.
9	1	1	Safe mode This mode is used to deactivate the Dual Talk services. The safe mode deactivates: - Web interface - OPC UA - MQTT - REST API The previously saved settings for fieldbus protocols are not affected by this position, so communication will start even if you leave the switches in this position. However, setting the positions to the previous state is recommended.
9	1	3	Deactivation of WebUI and REST API
9	7	9	Factory reset The device performs a factory reset. This also resets the network parameters to the default values. No communication is possible in this operating mode. The IP address is deleted and the device is in **BootP** mode.

7.4 Data security

Proper project and other planning is an important prerequisite for ensuring the confidentiality, availability and integrity of data.

EtherCAT products are intended for use in local networks. Observe the following notes when using EtherCAT products in your plant:

- Do not connect control components and control networks to an open network such as the Internet or an office network.
- Protect the control components and control networks with the use of a firewall.
- Close all services not required by your application (see "Rotary switch", page 25) to reduce the risk of cyber attacks and thus increase cyber security.
- Restrict physical and electronic access to all automation components to an authorized group of persons.
- To reduce the risk of unauthorized persons gaining access to your system, be sure to change the default passwords and IP addresses before initial commissioning.

8 Operation

8.1 EtherCAT integration

The SIG350 can exchange process data and parameters via EtherCAT. For this purpose, the IO-Link Master must be connected to a suitable programmable logic controller (PLC). The IO-Link Master is mapped as a modular device in the project planning software. The data modules of the inputs/outputs, the IO-Link ports, and any additional modules are presented in the project planning software on the basis of slots. Slots that are not in use can be left empty.

8.1.1 Project planning in Twin CAT

The configuration and system integration are described using an example in which the IO-Link Master is connected to a Beckhoff TwinCAT controller with the “TwinCAT® System Manager (Version 3)”. When using other controllers and project planning software, refer to the relevant documentation.

8.1.1.1 Adding SIG350 to the project

8.1.1.2 Slot configuration

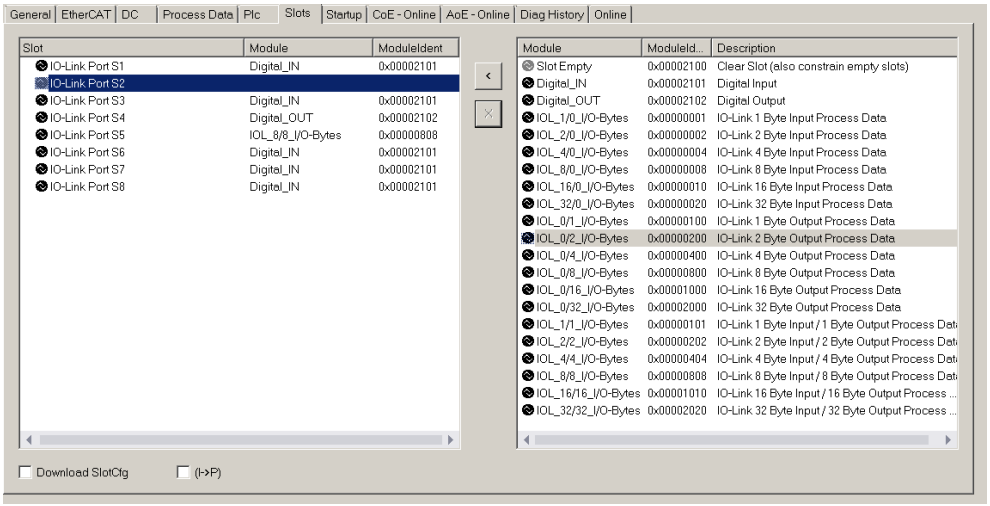
The ports are configured by selecting the corresponding slot module. The slot selection basically determines the configuration of pin 4. The behavior of pin 2 is configured via the corresponding CoE object, see REF.

8.1.1.2.1 IO-Link port

The IO-Link module slot is selected based on the process data length of the connected IO-Link device to be transmitted or received, whereby there are various combinations with input and output process data. The following options are available for the length: 1, 2, 4, 8, 16, 32 bytes.

IO-Link modules are structured according to the following schema:

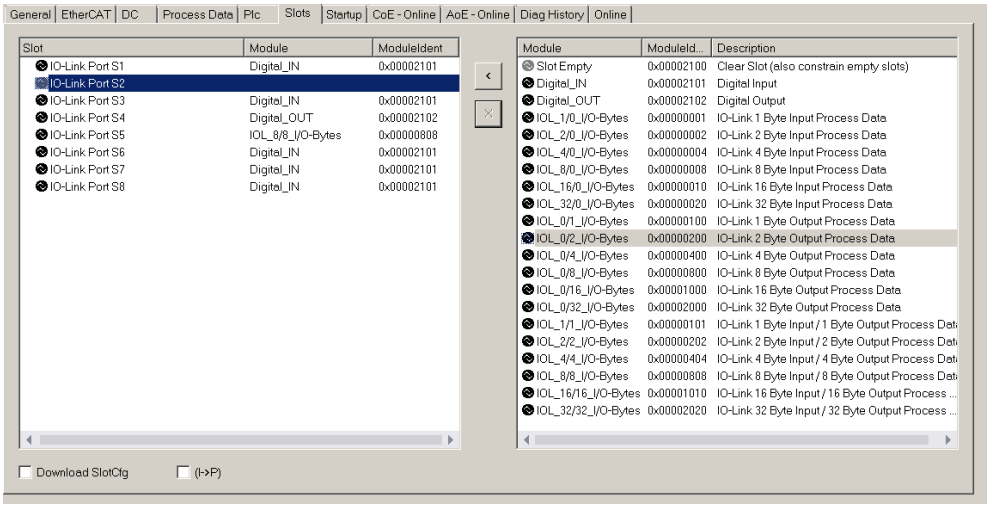
Description	
IOL_x/y_I/O bytes	The number of pieces of process data used for the IO-Link module. The number should be greater than or equal to the length of the process data of the IO-Link module. x: Input data length in bytes y: Output data length in bytes
Digital IN	Input pin 4
Digital OUT	Output pin 4
Slot empty	If pin 4 is not used on the corresponding slot



In addition to the configuration via slot module, the port configuration can still be changed via configuration object 0x2000 additional start-up parameters, see REF.

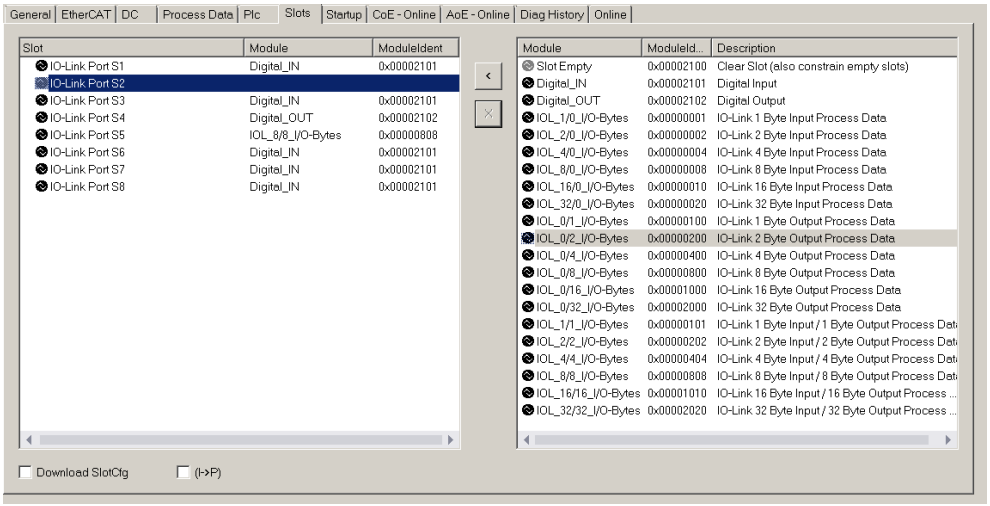
8.1.1.2.2 Digital input (pin 4)

Follows the selection of the configuration of pin 4 as digital input via the corresponding slot module:



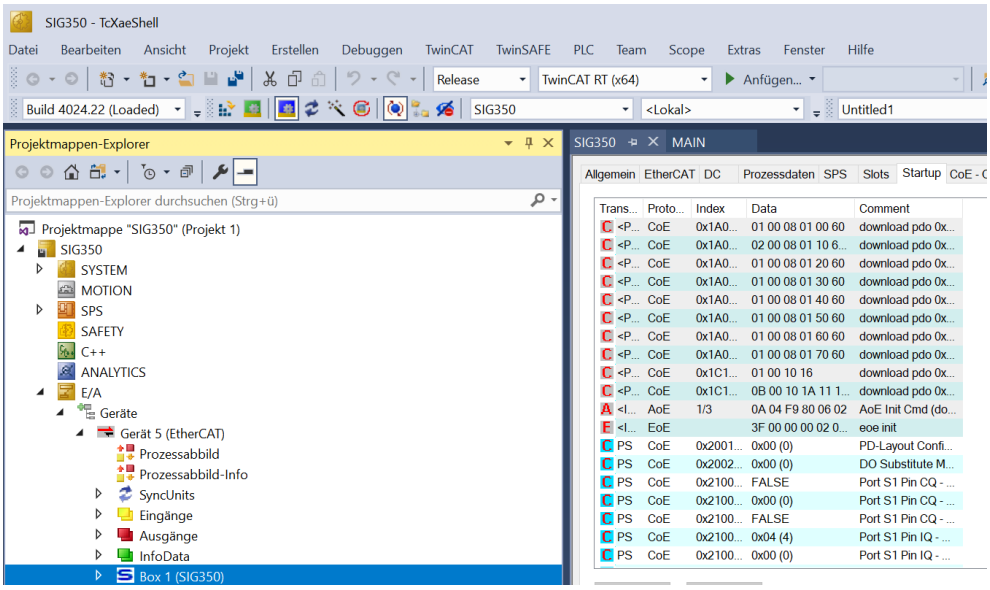
8.1.1.2.3 Digital output (pin 4)

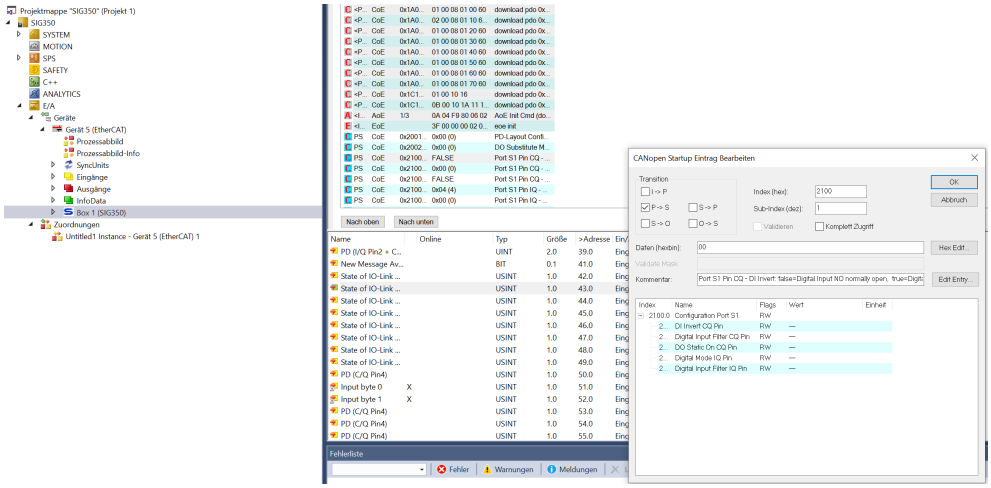
Follows the selection of the configuration of pin 4 as digital output via the corresponding slot module:



8.1.1.2.4 Start-up parameters

You can preconfigure the IO-Link ports and the outputs in the “Startup” tab. You can edit the entry by selecting it and then calling up the context menu. The entries are transferred when the configuration is overwritten. You also have the option of activating the validation for an IO-Link port. This allows you to check whether a particular device is connected.





8.1.1.2.5 Process data

The process data for digital inputs and outputs on pin 4 and pin 2 have the following structure:

Table: DI/DO structure (port-based)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	S4DI2	S4DI4	S3DI2	S3DI4	S2DI2	S2DI4	S1DI2	S1DI4
1	S8DI2	S8DI4	S8DI2	S8DI4	S8DI2	S8DI4	S8DI2	S8DI4

Table: DI/DO structure (pin-based)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	S8DI4	S7DI4	S6DI4	S5DI4	S4DI4	S3DI4	S2DI4	S1DI4
1	S8DI2	S7DI2	S6DI2	S5DI2	S4DI2	S3DI2	S2DI2	S1DI2

The process data for digital channels or IO-Link devices on pin 4 have the following structure:

Table 5: Process data assignment for digital channels or IO-Link devices

Input/Output area								
Byte 0	Byte 1	Byte 2						Byte 31
Process data byte 0	Process data byte 1	Process data byte 2						Process data byte 31

8.1.1.3 Object directory

The SIG350 has the following objects:

Table: Standard objects

Index	Subin-dex	Name	Data type	Acce ss	Description
0x100 0	0	Device type	UINT3 2	RO	Device type

Index	Subin-dex	Name	Data type	Acce ss	Description
0x100 1	0	Error register	UINT3 2	RO	Error Register Object Bit 0 = 1: Generic error Bit 1 = 1: Current error Bit 2 = 1: Voltage error Bit 3 ... 6: Reserved Bit 7 = 1: Internal module error
0x100 8	0	Device name	STRIN G	RO	SIG350-0006AP100
0x100 9	0	Hardware ver-sion	STRIN G	RO	V2.0.0
0x100 A	0	Software version	STRIN G	RO	V1.0.0
0x101 8	0	Identity object	RECOR D	RO	Number of last subindex
	1	Vendor ID	UINT3 2	RO	Vendor ID of EtherCAT slave device manu-fac- turer
	2	Product code	UINT3 2	RO	Product code of the EtherCAT slave
	3	Revision number	UINT3 2	RO	Revision number of theEtherCAT slave con- tains a consecutive number, starting at 1
	4	Serial number	UINT3 2	RO	Serial number of EtherCAT slave • The high word (bits 31-16) contains a consecutive number • The upper byte of the low word (bits 15-8) contains the manufacturing week • The lower byte of the low word (bits 7-0) contains the manufacturing year
0x10F 3	0	Diagnosis his-tory	RECOR D	RO	Number of last subindex
	1	Max messages	UINT8	RO	Number of messages which can be stored (64)
	2	Newest mes-sage	UINT8	RO	Subindex of newest message (6...69)

Index	Subin-dex	Name	Data type	Acce ss	Description
	3	Newest acknowl-edged message	UINT8	RW	**Overwrite Mode (SI5, bit 4 = 0):** Read = 0: When the message queue is overwritten, the slave sets SI3 to 0. Writing = 0: The slave clears all messages, i.e. resets SI2, SI3, SI4 and SI5 bit 5* Writing = 1...5: The slave returns SDO abort with code 0x06090032 (value of parameter written too low) Writing = 6..69: SI3 = written value (without checking)** Writing > 69...255 The slave returns SDO abort with code 0x06090031 (value of parameter written too high). **Acknowledge Mode (SI5, bit 4 = 1):** Read = 0: No messages have been acknowledged so far Read != 0: Subindex of latest acknowledged diagno-sis message (6-69) Writing = 0: All acknowledged messages will be deleted Writing = 1...5: The slave returns SDO abort with code 0x06090032 (value of parameter written too low) Writing = 6...69: Messages are acknowledged*** Writing > 69...255: The slave returns SDO abort with code 0x06090031 (value of parameter written too high)
	4	New messages available	BOOL	RO	Overwrite Mode: 0: newest message was read 1: newest message was not read Acknowledge mode: 0: no unacknowledged message 1: diagnosis messages are available which can be acknowledged (SI2 !=SI3)

Index	Subin-dex	Name	Data type	Acce ss	Description
	5	Flags	UINT16	RW	Flags to control sending and storing of diagno- sis messages Bit 0: Enable Emergency sending 0: default if device does not support emergen- cy sending 1: new diagnosis messages shall be sent as emergency message Bit 1: Disable info messages 0: Info messages are stored in the diagno-sis message queue (default) 1: Info messages will not be stored in the diag- nosis message queue Bit 2: Disable warning messages 0: Warning messages are stored in the diag- nosis message queue (default) 1: Warning messages will not be stored in the diagnosis message queue Bit 3: Disable error messages 0: Error messages are stored in the diagnosis message queue (default) 1: Error messages will not be stored in the di- agnosis message queue Bit 4: Mode selection for diagnosis history han- dling 0: Overwrite Mode: old messages are overwrit- ten by new ones when buffer is full 1: Acknowledge mode: New messages only overwrite messages which were acknowl-edged before Bit 5: Overwrite/Discard Information (read only) In Overwrite mode: 1: unacknowledged messages have been overwritten (= buffer overrun) (SI3 is set to 0, too) In Acknowledge mode: 1: message buffer is full with acknowl-edged messages and a new message is dis-carded Bit 6.-15: reserved

Index	Subin-dex	Name	Data type	Acce ss	Description
	6...69	Diagnosis mes-sage	STRIN G	RO	Diagnosis message buffer. Depending on SI1 the EtherCAT slave can store up to 64 messages; the first message is stored in subindex 6, the second in subindex 7 and so on. When the queue is full, the EtherCAT slave shall overwrite subindex 6 and so on, so the latest maximum messages (SI1) shall always be accessible by the EtherCAT master.
0x10F 8	0	Time stamp object			Local time stamp of device in ns since startup

Table: DI/DO configuration object

Index	Subin-dex	Name	Data type	Acce ss	Description
0x200 1	0	PD Layout Con-figu-ration			
0x200 2	0	DO Substitute Configuration	RECOR D	RO	Number of last subindex
	1	DO Substitute Mode			
0x21n 0 n: 0...7 (S1... S8)	0	Configuration Port Sn	RECOR D	RO	Number of last subindex
	1	DI Invert CQ Pin			
	2	Digital Input Fil-ter CQ Pin			
	3	DO Static On CQ Pin			
	4	Digital Mode IQ Pin			
	5	Digital Input Fil-ter IQ Pin			

Table: IO-Link port configuration object

Index	Subin-dex	Name	Data type	Access	Description
0x80n0 n: 0...7 (S1... S8)	0				Number of last subindex
	4	Device ID	UINT32	RW	Expected device ID of the IO-Link device connected to the IO-Link port (unsigned integer 32) Example: SIG100 = 8389010
	5	Vendor ID	UINT32	RW	Expected manufacturer ID of the IO-Link device connected to the IO-Link port (unsigned integer 16) Example: Manufacturer ID SICK AG = 26
	32	IO-Link revi-sion	UINT8	RW	Version of the implemented IO-Link specification According to version 1.0 of IO-Link specification Bit 0...3: Minor Rev Bit4...7: Major Rev
	33	Frame capa-bility	UINT8	RW	Information about implemented options in relation to frames and physical configuration of an IO-Link device, e.g. SPDU supported. According to version 1.0 of IO-Link specification Bit 0: SPDU Bit 1: Type1 Bit 2...6: reserved Bit 7: PHY1
	34	Cycle time	UINT8	RW	Cycle time given to the IO-Link Master The IO-Link Master sends all data to the IO-Link device according to this configured cycle time. This value is transmitted in IO-Link format as "Min Cycle Time". This is a performance feature of the device and it is determined by its device function. According to version 1.0 of IO-Link specification Bit 0...5: Multiplier Bit 6..7: Time Base IO-Link cycle time (is only considered in port mode IOL_Manual) Cycle time = multiplier * time base Bit 0 – 5 | Multiplier Bit 7 | 6 | Time base 0 | 0 | 0.1 ms 0 | 1 | 6.4 ms 1 | 1 | 32 ms
	35	Offset time	UINT8	RW	Time between start of cycle and point in time when process data is processed on the device. This value is transmitted in IO-Link format as “Offset Time”. According to version 1.0 of IO-Link specification Bit 0...5: Multiplier

Index	Subin-dex	Name	Data type	Access	Description
0x80n1		Serial num-ber			

Table: IO-Link Device Information

Index	Subindex	Name	Data type	Access	Description
0x90n0	0				
	4				See 0x8000.4
	5				See 0x8000.5
	32				See 0x8000.32
	33				See 0x8000.33
	34				See 0x8000.34
	35				See 0x8000.35
	36				See 0x8000.36
	37				See 0x8000.37
0x90n1	0	Serial number	STRING	R	Serial number

Table: IO-Link communication status

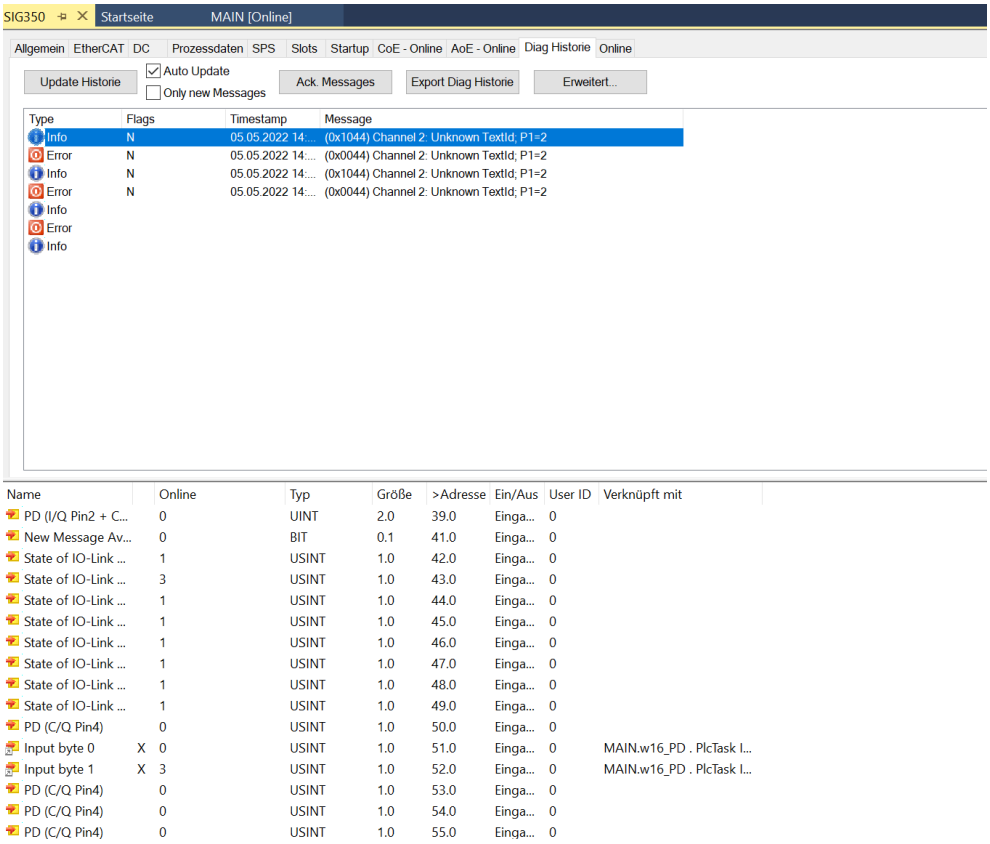
Index	Subin-dex	Name	Data type	Access	Description
0xA0n0	0	IO-Link Diag-nosis data Port Sn	RECOR D	R	Number of last subindex
	1	IO-Link state	UINT8	R	State of the IO-Link Master (state machine of IO-Link Port)
	2	Lost frames	UINT8	RW	Counter of lost IO-Link telegrams. Reset counter during startup. The entry may be writeable to reset the entry value.

Table: IO-Link Device status

Index	Subindex	Name	Data type	Access	Description
0xF100	0	Device status	UINT8	R	Number of last subindex
	1...8				

8.1.1.4 Diagnostics

NOTE: Configuration contains slots with sensor. But sensor not connected -> Error.



8.1.2 Function blocks

8.1.2.1 SICK function block

With the **Function Block Factory** digital software service, SICK is providing a unique possibility of generating specific PLC function blocks that go far beyond the range of performance of Siemens function blocks. Further information about the exchanged data and the connected devices is available here.

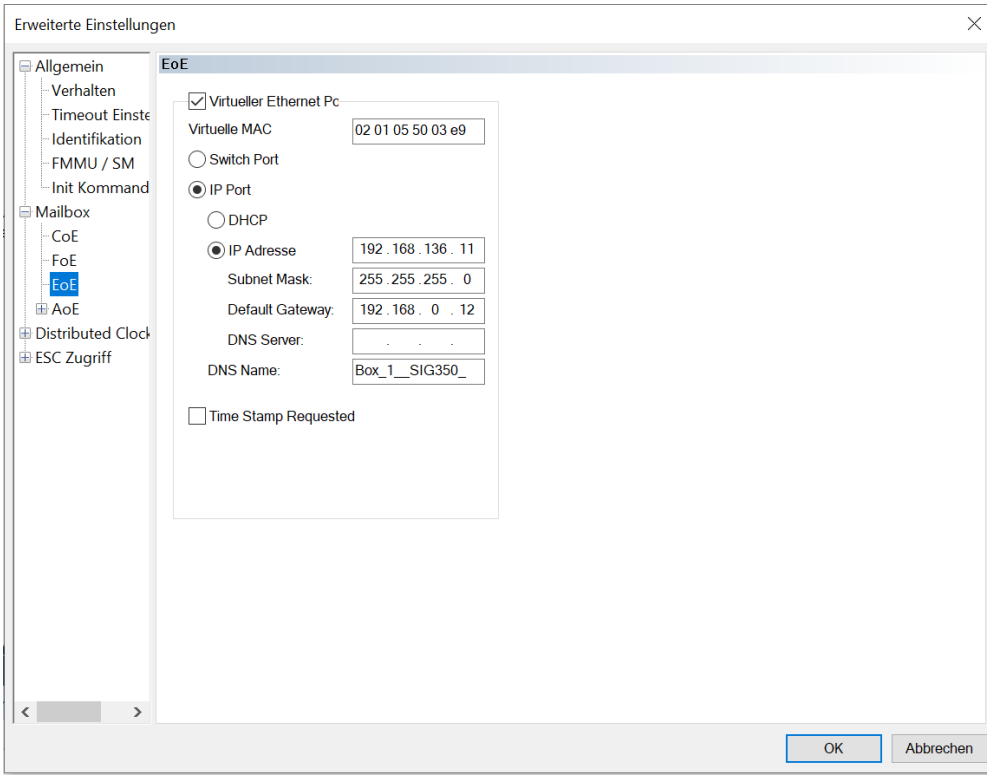
Function blocks for any IO-Link device (manufacturer-independent) can be generated individually via the Function Block Factory. These function blocks are fully tested and documented. They considerably facilitate and accelerate PLC programming and prevent errors. This can save time and money in production processes.

Additional information on the Function Block Factory from SICK can be found on the homepage:

www.sick.com/functionblockfactory

8.1.3 Ethernet over EtherCAT (EoE)

The SIG350 supports Ethernet over EtherCAT. For this purpose, a valid DNS name and a valid IP address must be entered as shown in the following figure:



8.2 Dual Talk

8.2.1 Communication via REST-API

The SIG350 provides a REST API with JSON data format for accessing the data of the connected devices. These operating instructions provide an overview of the available device functions and the access mechanisms.

The REST API interface corresponds to the standard of the IO-Link community, which was defined in the document “JSON Integration for IO-Link” with version 1.0.0 (as of March 2020, part number 10.2020).

8.2.1.1 General description of the interface

The REST API is a client-server interface and enables the client to request data from the server via defined resources. The REST API is stateless, which means that no information about the connection status and no information about the server or client is required.

The operation is based on HTTP methods. Common HTTP methods are GET, POST, PUT and DELETE. For the SIG350, the GET and POST request methods are particularly relevant, where the request and response data is represented in JSON format. JSON, or JavaScript Object Notation, is a minimal, visually readable format for structuring data. It is mainly used to transmit data between a server and a web application as an alternative to XML.

Table 10: HTTP methods

HTTP method	Description
GET	Requests the specified data from the server (= data is only read and not changed)
POST	The payload is transmitted to the server (= write data)

HTTP method	Description
DELETE	Deletes the specified resources on the server (= data is deleted)

8.2.1.2 API documentation

The current documentation (also called Open API) of the API interface can be downloaded at www.sick.de/SIG350. This document defines all available variables and methods of the API interface of the SIG350.

The OPEN API documentation is in JSON/YAML format and can be used with appropriate software tools such as Swagger, Postman or Insomnia.

8.2.1.3 API structure

Request

To request data, a command must be sent to the server, in this case the SIG350. This command is structured in HTTP format:

URL schema: http://[IP-Adresse]/[BasePath]/[Resource]

- The IP address corresponds to the valid IP address of the module. The default IP address of the SIG350 is **192.168.0.1**. If necessary, the default address has already been changed via the PLC or the web interface.
- The **BasePath** is defined in the standard of the IO-Link community: **/iolink/v1**
- The resource is used to address the corresponding parameter which is to be read or written:

E.g.: /masters/{masterNumber}/ports/{portNumber}/configuration

An overview of the available variables and methods can be found in section XXX and in the standard of the IO-Link community.

Thus, an example URL for reading the port configuration of port S3 is as follows:

http://192.168.0.1/iolink/v1/masters/1/ports/3/configuration

NOTE

The {masterNumber} variable is always 1, because the SIG350 gateway has only one master.

Response

For each request, the SIG350 responds with status information and data or only status information if no data is available. Depending on the request, this response can contain several pieces of information. In case of an error, the corresponding error code (see section XXX) is returned.

The response corresponds to the following format:

{

“name1”: value1

“name2”: value2

“name...”: value...

}

- The **“name”** corresponds to the name of the object: e.g. Vendor ID
- The **“value”** corresponds to the value of the object: e.g.: 26

Thus, an example response is as follows:

{

“Vendor ID”: 26

“Device ID”: 8389238

“deviceAlias”: Flow_control_1

}

NOTE
No specific response time can be guaranteed for the use of the REST API interface since the HTTP requests are based on a standard TCP mechanism. The response time also depends on the system environment and system load. When using the web UI at the same time, the response time increases.

8.2.1.4 Available variables and methods

The SIG mainly supports the GET and POST methods. For selected variables, the DELETE function is also supported.

All API calls are executed synchronously. This means that every request is followed by a response. A minimum response time cannot be defined for the REST API commands, as this is also dependent in particular on the system environment and load used.

The following gives an overview of the available variables and methods. Detailed information and examples can be downloaded in the Open API documentation via the SICK website, see www.sick.com.

REST API resources

Table 11: Overview of REST API HTTP resources

Resource	Description
/gateway	Addressing the gateway
/masters	List of all available master variables and identification information
/master/{masterNumber}	Addressing of a specific master
/master/{masterNumber} /ports	List of all available ports at a specific master including port number, status information and deviceAlias
/master/{masterNumber} /ports/{portNumber}	Addressing of a specific port connection at a specific master
/devices	Addressing of all connected devices at all masters
/devices/{deviceAlias}	Addressing a specific device via the device name

/gateway

Additional resources are defined for the individual HTTP methods:

Table 12: Gateway Resource overview `(/iolink/v1/gateway)`

Resource	HTTP Method	Description
/identification	GET	Read out of identification data (e.g. MAC address or serial number of the device)
/capabilities	GET	Information on device functions
/configuration	GET	Read out of device or Ethernet configuration (e.g. DHCP or IP address)

Resource	HTTP Method	Description
/configuration	POST	Writing of device or Ethernet configuration

/masters

In principle, more than one IO-Link Master can be addressed via a gateway. The different masters are numbered consecutively in the request, starting with 1 for the first master.

NOTE

The {masterNumber} variable is always 1, because the SIG350 gateway has only one master.

Further resources are also available here:

Table 13: Overview of the master resource `(/iolink/v1/masters/1)`

Resource	HTTP Method	Description
/capabilities	GET	Read out of functions of the specific IO-Link Master (e.g. the number of ports or the maximum voltage supply)
/identification	GET	Read out of identification data of the specific IO-Link Master (e.g. vendor ID, serial number or firmware version)
/identification	POST	Writing of identification data of the specific master (e.g. LocationTag, functionTag)

/masters/{masterNumber}/ports

With the following resources, additional information of the individual ports at a specific master can be called up:

Table 14: Overview of the port resource `(/iolink/v1/masters/1/ports)`

Resource	HTTP Method	Description
/capabilities	GET	Read out of functions of the specific port (e.g. port type or max. voltage supply)
/status	GET	Read out of current status of a specific port (e.g. deactivated or the IO-Link version of the connected IO-Link device)
/configuration	GET	Read out of configuration of a specific port (e.g. cycle time or deviceAlias of the connected IO-Link device)
/configuration	POST	Writing of configuration on a specific port (e.g. deviceAlias)
/datastorage	GET	Read out of Data Storage object
/datastorage	POST	Writing of Data Storage object

/devices

The connected devices are addressed via the deviceAlias. If no deviceAlias is defined, then the default value (e.g. master1port6) is used.

Example:

An IO-Link device with deviceAlias “sensor34” is connected to port 6. The addressing is performed with the request

```
GET/iolink/v1/devices/sensor34/identification
```

However, if no deviceAlias is defined and thus the default value is used, then the request changes as follows:

`GET/iolink/v1/devices/master1port6/identification`

The description master1port6 therefore stands for the sixth port on the first master.

All connected devices are listed via the `GET /iolink/v1/devices` request.

The following resources can be used to call up additional information on the connected devices:

Table 15: Gateway Resource overview (`/iolink/v1/device`)

Resource	HTTP Method	Description
/capabilities	GET	Read out of device information of the connected device (e.g. min. cycle time)
/identification	GET	Read out of device identification data
/identification	POST	Writing of device identification data
Process data		
/processdata/value	GET	Read out of process data (input and output data) of a specific IO-Link device
/processdata /getdata/value	GET	Read out of process input data of a specific IO-Link device
/processdata /setdata/value	GET	Read out of process output data of a specific IO-Link device
/processdata/value	POST	Writing of process output data on a specific IO-Link device
Parameter values		
/parameters /{index}/value	GET	Read out of parameter values of a specific device by means of the index
/parameters /{index}/subindices /{subindex}/value	GET	Read out of parameter values of a specific device by means of the index and subindex
/parameters /{index}/value	POST	Writing of a parameter value using the index
/parameters /{index}/subindices /{subindex}/value	POST	Writing of a parameter value using the index and subindex
Events		
/events	GET	Read out of all events for a specific device

/vendor

Table 16: Vendor-specific JSON settings (`/iolink/v1/vendor/masters/{masternumber}`)

Resource	HTTP Method	Description
/diagnostics /value	GET	Read out of average value of the master
/ports/{portnumber}/ statistics/current	GET	Read out of minimum and maximum current values at the specific port
/ports/{portnumber}/ statistics/voltage	GET	Read out of minimum and maximum voltage values at the specific port
/ports/{portnumber}/ statistics/temperature	GET	Read out of minimum and maximum temperature values at the specific port

Resource	HTTP Method	Description
/ports/{portnumber}/ diagnostics /current	GET	Read out of actual current values at the specific port
/ports/{portnumber}/ diagnostics /voltage	GET	Read out of actual voltage values at the specific port
/ports/{portnumber}/ diagnostics /temperature	GET	Read out of actual temperature values at the specific port

8.2.1.5 Status code and error messages

Errors may occur when processing HTTP requests. Several errors are defined.

The following rules apply to troubleshooting:

- If multiple errors occur while processing the request, only the first detected error is responded to.
- If no REST API commands are available, error 103 is returned.

Error messages are structured as follows:

{

“code”: 102,

“message”: “Internal communication error”

}

The following table provides an overview of the possible error codes:

Table 17: Error messages

Error code	HTTP code	Message	Note
General error			
101	500	Internal server error	This error can occur with any request
102	500	Internal communication error	This error can occur with any request
103	404	Operation not supported	This error is returned if the requested function does not exist.
104	400	Action locked by another client	Fieldbus controller or another participant blocks access
105	501	IODD feature not supported	SIG350 does not support IODDs
106	501	MQTT feature not supported	
150	403	Permission denied	Access is not allowed. Check access rights in the configuration. This error can occur with any request.
JSON parsing error			
201	400	JSON parsing failed	Error while parsing the incoming JSON value
202	400	JSON data value invalid	Error while parsing a specific JSON value, such as an incorrect IP address
203	400	JSON data type invalid	E.g.: data type string instead of number
204	400	Enumeration value unknown	
205	400	JSON data value out of range	Exceeds the minimum or maximum value

Error code	HTTP code	Message	Note
206	400	JSON data value out of bounds	An array/string was accessed whose maximum length was exceeded.
207	400	deviceAlias is not unique	
208	400	POST request without content	
Error during resource access			
301	404	Resource not found	E.g. incorrect URL
302	404	masterNumber not found	
303	404	portNumber not found	
304	404	deviceAlias not found	
305	400	Query parameter name invalid	
306	400	Query parameter value invalid	
307	400	Port is not configured to IO-Link	E.G.: IOLINK_MANUAL or IOLINK_AUTOSTART mode
308	404	IO-Link device is not accessible	E.g. not connected or communication error
309	404	IO-Link parameter not found	
310	404	IO-Link parameter access not supported by the device	
311	400	IO-Link parameter access error	The additional “iolinkErrorCode” and “iolinkErrorMessage” fields contain the IO-Link error code and the event text from the ErrorTypes table.
312	404	IO-Link parameter name is not unique	Please use the format [Name]_[Index].
DataStorage error			
401	400	Data storage mismatch	No match between configured device and data from data memory. Check device ID.
Processing error in the process data			
501	400	I/Q is not configured as DIGITAL_OUTPUT	Writing process data on I/Q is not possible
502	400	C/Q is not configured as DIGITAL_OUTPUT	Writing process data on C/Q is not possible
503	400	IO-Link device has no output process data	
Error in the payload			
701	400	Data set incomplete	
702	400	Data set not applicable	The entire data set is denied
703	400	Data set combination incompatible	The entire data set is denied

8.2.2 MQTT client

The SIG350 provides a MQTT interface with JSON data format for accessing the data of the IO-Link Master and of the connected devices. These operating instructions provide an overview of the available messages and the access mechanisms.

8.2.2.1 General description

The MQTT (Message Queuing Telemetry Transport) protocol is an open network protocol for machine-to-machine communication that enables the transmission of telemetric data between devices. The built-in MQTT client allows the device to publish a specific set of information to an MQTT broker.

Messages are published once after the device is started and then when the corresponding value is changed. However, the sending of the message does not take place immediately, but cyclically, every 5 seconds. In addition to the payload, so-called topics are also transmitted in the messages. This allows for mapping and hierarchical identification.

The data structure of the messages is in JSON format and is directly oriented on the schema of the REST API (see "API structure", page 39).

Quality of Service cannot be configured and is set to “At most once”, i.e. messages are only sent once without confirmation from the client or broker.

If the connection is lost, a **Last Will** is sent with the following message:

Table 18: Last Will message

Topic	Message
EXIT	“Publisher”: “Offline”

The MQTT functions are activated in the delivery state. The MQTT client can be deactivated either via the web interface or directly via the rotary switches.

8.2.2.2 Messages – topics

The following gives an overview of the available messages. The composition of the topics is based on the REST API schema and is composed as follows:

{client head topic}/[BasePath]/[Domain]/{Parameter}

- The **{clientHeadTopic}** variable can be assigned via the WebUI. The MAC address is used as the default value.
- The **BasePath** is oriented on the REST API standard and is defined at: /**iolink/v1**
- Via [**Domain**]/{**Parameter**}, the respective message is identified:
  e.g.: /masters/**{masterNumber}**/ports/**{portNumber}**/configuration
- The payload of the message is formatted equivalent to the REST API and can be taken from the OPEN API document, see "Available variables and methods", page 40 or www.sick.com.

Table 19: MQTT topics

Domain	Topic	Description
gateway	{clientHeadTopic}/iolink/v1/gateway/identification	Read out of identification data (e.g. MAC address or serial number of the device)
	{clientHeadTopic}/iolink/v1/gateway/capabilities	Information on device functions
	{clientHeadTopic}/iolink/v1/gateway/configuration	Read out of device or Ethernet configuration (e.g. DHCP or IP address)

Domain	Topic	Description
masters	{clientHeadTopic}/iolink/v1/masters/{masterNumber}/identification	Read out of identification data of the specific IO-Link Master (e.g. vendor ID, serial number or firmware version)
	{clientHeadTopic}/iolink/v1/masters/{masterNumber}/capabilities	Read out of functions of the specific IO-Link Master (e.g. the number of ports or the maximum voltage supply)
	{clientHeadTopic}/iolink/v1/masters/{masterNumber}/diagnostics/configuration	Diagnostics configuration (e.g. max./min. voltage, temperature, current)
	{clientHeadTopic}/iolink/v1/masters/{masterNumber}/diagnostics/value	Average value of supply voltage, temperatures and total current
ports	{clientHeadTopic}/iolink/v1/masters/{masterNumber}/ports/{portNumber}/capabilities	Read out of functions of the specific port (e.g. port type or max. voltage supply)
	{clientHeadTopic}/iolink/v1/masters/{masterNumber}/ports/{portNumber}/status	Read out of current status of a specific port (e.g. deactivated or the IO-Link version of the connected IO-Link device)
	{clientHeadTopic}/iolink/v1/masters/{masterNumber}/ports/{portNumber}/configuration	Read out of configuration of a specific port (e.g. cycle time or deviceAlias of the connected IO-Link device)
	{clientHeadTopic}/iolink/v1/masters/{masterNumber}/ports/{portNumber}/diagnostics/configuration	Configuration of current limitation
	{clientHeadTopic}/iolink/v1/masters/{masterNumber}/ports/{portNumber}/diagnostics/current	Read out of actual current values at the specific port
	{clientHeadTopic}/iolink/v1/masters/{masterNumber}/ports/{portNumber}/diagnostics/voltage	Read out of actual voltage values at the specific port
	{clientHeadTopic}/iolink/v1/masters/{masterNumber}/ports/{portNumber}/diagnostics/temperature	Read out of actual temperature values at the specific port
	{clientHeadTopic}/iolink/v1/masters/{masterNumber}/ports/{portNumber}/statistics/current	Read out of minimum and maximum current values at the specific port
	{clientHeadTopic}/iolink/v1/masters/{masterNumber}/ports/{portNumber}/statistics/voltage	Read out of minimum and maximum voltage values at the specific port
	{clientHeadTopic}/iolink/v1/masters/{masterNumber}/ports/{portNumber}/statistics/temperature	Read out of minimum and maximum temperature values at the specific port
mqtt	{clientHeadTopic}/iolink/v1/mqtt/configuration	Information on MQTT configuration
	{clientHeadTopic}/iolink/v1/mqtt/connectionstatus	MQTT connection status
devices	{clientHeadTopic}/iolink/v1/devices/master1port1/processdata/value	Read out of process data (input and output data) of a specific IO-Link device
	{clientHeadTopic}/iolink/v1/devices/master1port1/processdata/getdata/value	Read out of process input data of a specific IO-Link device
	{clientHeadTopic}/iolink/v1/devices/master1port1/processdata/setdata/value	Read out of process output data of a specific IO-Link device
	{clientHeadTopic}/iolink/v1/devices/master1port1/events	Read out of all events for a specific device

8.2.3 Description of OPC UA Server

8.2.3.1 Data model

The SIG350 has an OPC UA interface. OPC UA is a platform-independent standard with a service-oriented architecture for communication in and with industrial automation systems.

The SIG350 module provides an OPC UA server at field device level, to which an OPC UA client can connect to exchange information.

The OPC UA device model is based on the general device specification:

OPC 10000-100: OPC Unified Architecture

Part 100: Devices

Release 1.03.1

2021-12-07

https://reference.opcfoundation.org/DI/docs/

In addition, the IO-Link Companion specification is implemented with the exception that all functionality related to the IODD is not supported by the SIG350.

OPC 30120: OPC Unified Architecture for IO-Link

IO-Link: OPC Unified Architecture

Release 1.0

2018-12-01

https://reference.opcfoundation.org/IOLink/docs/

Basically, device access in OPC UA is done via objects and thus follow an object-oriented approach. Parts of an object can be **variables**, **methods** or **events**. The structure and content of objects are each described by corresponding data types, which are defined either specific to profiles or devices. Objects can be derived from several base classes and inherit the corresponding properties in the form of **attributes** and **references**.

- **Attributes** provide information about the object and essentially enable access to the payload.
- **References** describe the hierarchical arrangement of the object in the device model and the relationship to other objects.

All object data types are derived from the UANode base class and thus have properties (attributes) that enable access in the OPC UA address space via “nodes”. For example, the “NodeId” attribute can be used to access the instance of individual objects, since this allows them to be uniquely identified, see "Access to process data", page 54.

More information and a detailed, comprehensive description of OPC UA can be found at **https://reference.opcfoundation.org/**.

8.2.3.2 Commissioning with UA Expert

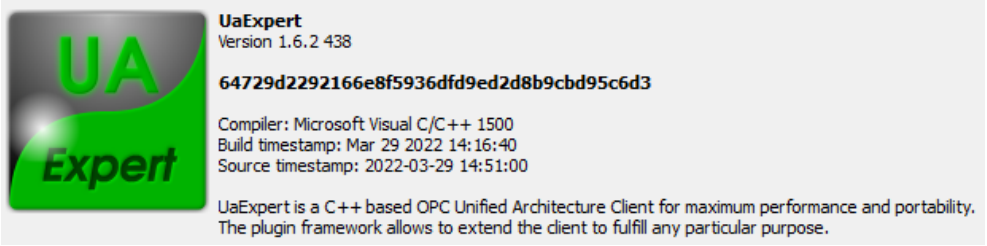


Figure 12: UA Expert

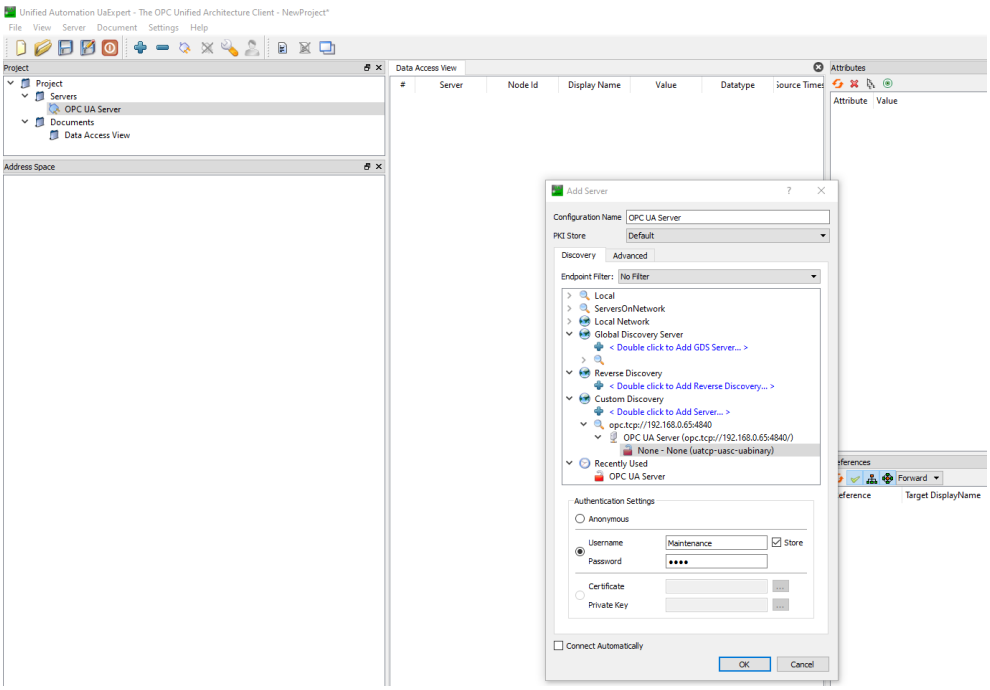


Figure 13: Entry of IP address with port

- Entry of IP address with port (default 4840)
- If necessary, log in with the appropriate user authorization
- Establishing a connection

Then the device model of the connected device is automatically loaded and displayed accordingly.

- **DeviceSet:** Serves as entry point for accessing the device instance, thus enabling, for example, the reading of configuration parameters or IO-Link process data.
- **Server:** Access to the basic functions of the OPC UA server.

For the sake of clarity, only an excerpt of the corresponding server objects is listed here.

Table 20: Server objects

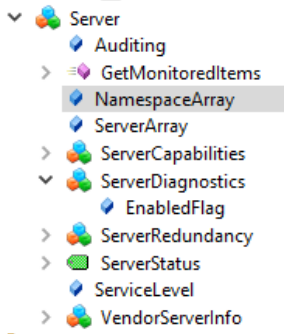
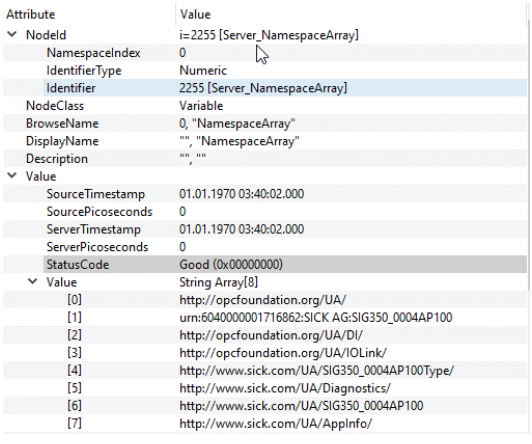
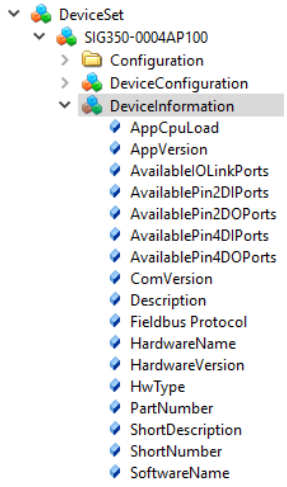
Browser name/Hierarchy	Class	Description
0, “NamespaceArray” 	Variable	Shows all implemented namespaces in the address range. This is particularly important for accessing device objects. Access is granted the NodeId, which is composed of the NamspaceIndex and a numeric identifier. Example: 

Table 21: DeviceInformation object

Browser name/Hierarchy	Class	Description
7, “AppInfo” 	Object	Enables the read out of device information, e.g.: device version, part number, etc.

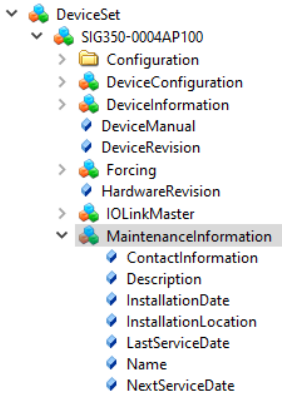
Browser name/Hierarchy	Class	Description
7, “MaintenanceInformation” 	Object	Reading and writing of additional maintenance information, e.g. description text, date of commissioning, etc.

Table 22: IO-Link Master object

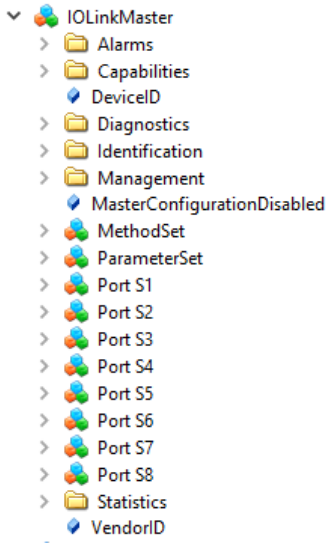
	Browser name	Class	Description
	3, “Alarms”	Object	Reading of errors and warnings
	3, “Capabilities”	Object	Number of ports Maximum current consumption
	3, “DeviceID”	Variable	DeviceID
	2, “Diagnostics”	Object	Diagnostic information on current consumption, voltage and temperature
	2, “Identification”	Object	Master Type, Location and Faction Tag
	3, “MasterConfigurationDisabled”	Variable	Not used
	2, “MethodSet”	Object	Methods for rebooting the device and resetting the statistics
	2, “ParameterSet”	Object	Variable collection of all master variables
	3, “Port00” ... 3, “Port07”	Object	Access point to the port objects and variables.
	3, “Statistics”	Object	Measured minimum and maximum current, temperature, voltage. IO-Link WakeupCount, FrameOkCount and RetryCount.
	3, “VendorID”	Variable	ManufacturerID

Table 23: IO-Link Port object

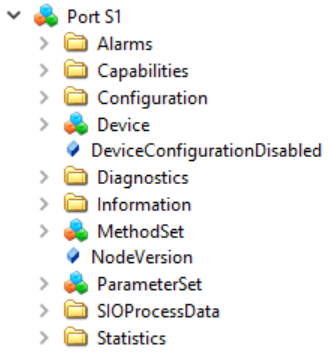
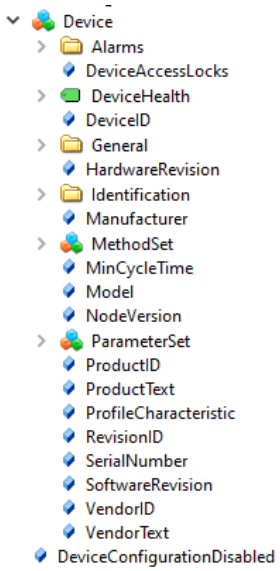
	Browser name	Class	Description
	3, “Alarms”	Object	Reading of errors and warnings
	3, “Capabilities”	Object	Pin 2 support. Maximum current consumption Port-Class.
	3, “Configuration”	Object	Reading of port configuration. DeviceID, VendorID, cycle time, pin 2 configuration, Port mode, validation and backup.
	3, “Device”	Object	Access point to the device objects and variables.
	3, “DeviceConfigurationDisabled”	Variable	Not used
	2, “Diagnostics”	Object	Diagnostic information on current consumption, voltage and temperature
	3, “Information”	Object	Used cycle time, baud rate, status and connection quality.
	2, “MethodSet”	Object	Method for setting the configuration
	0, “NodeVersion”	Variable	Version of the OPC UA port object
	2, “ParameterSet”	Object	Variable collection
	3, “SIOProcessData”	Object	Pin 2 and pin 4 assignment
	3, “Statistics”	Object	Measured minimum and maximum current, temperature, voltage. IO-Link WakeupCount, FrameOkCount and RetryCount.

Table 24: IO-Link Device object

	Browser name	Class	Description
	3, “Alarms”	Object	Reading of errors and warnings
	3, “DeviceAccess-Locks”	Variable	DeviceAccesslock
	2, “DeviceHealth”	Variable	Device state
	3, “DeviceID”	Variable	DeviceID
	3, “General”	Object	Reading and writing of proc-ess data, ISDUs. System com-mands, function and location tags Reset of IO-Link device
	2, “HardwareRevision”	Variable	Hardware version
	2, “Identification”	Object	Identification parameters, e.g. device and VendorID, tags, serial number
	2, “Manufacturer”	Variable	Manufacturer
	2, “MethodSet”	Object	Collection of all device methods
	3, “MinCycleTime”	Variable	Minimum cycle time
	2, “Model”	Variable	Product name
	0, “NodeVersion”	Variable	Version of the OPC UA device object
	2, “ParameterSet”	Object	Variable collection
	3, “ProductID”	Variable	Part number
	3, “ProductText”	Variable	Device text
	3, “ProfileCharacteris-tic”	Variable	Supported profiles
	3, “RevisionID”	Variable	IO-Link protocol version
	2, “SerialNumber”	Variable	Serial number
	2, “SoftwareRevision”	Variable	Firmware version
	3, “VendorID”	Variable	VendorID
	3, “VendorText”	Variable	Manufacturer text

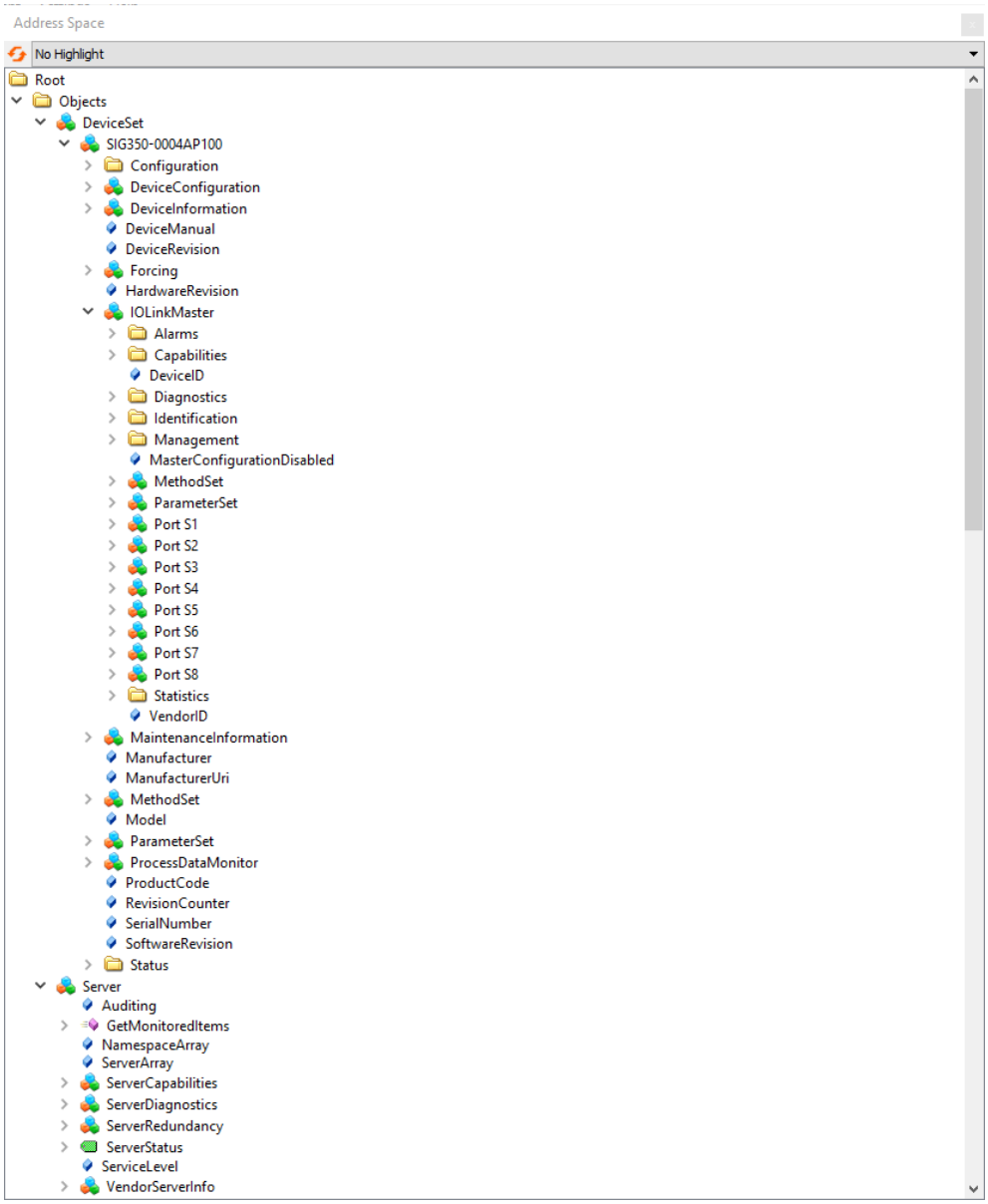


Figure 14: Path

8.2.3.3 Access to process data

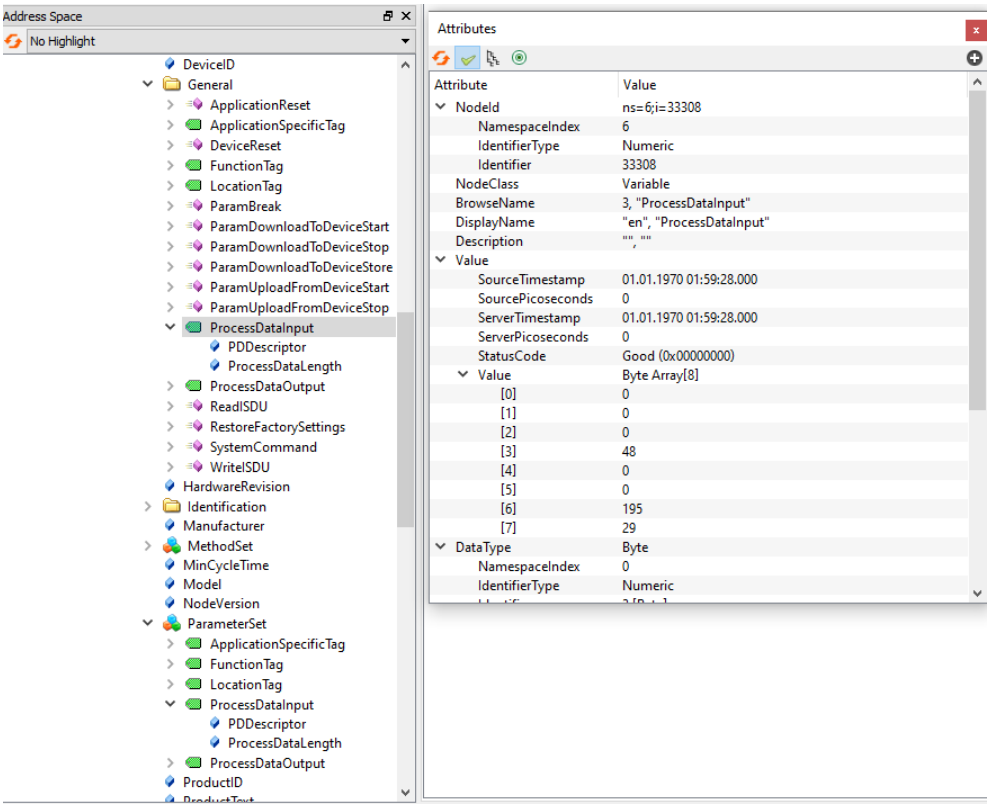


Figure 15: Access to process data

8.3 Web interface

The SIG350 can be accessed via the integrated web interface. The IP address of the SIG350 must be known for this purpose.

The current IP address can be read out via the SOPAS engineering tool.

When delivered, the default IP address of the SIG350 is: 192.168.0.1.

To access the integrated SIG350 web interface, enter the IP address of the SIG350 in the address line of the web browser.

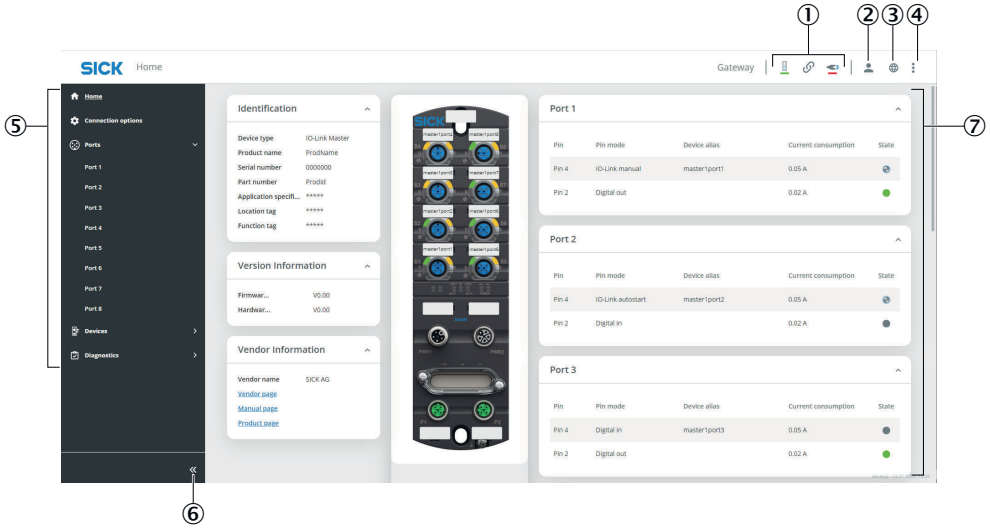
NOTE
When using the web interface and the fieldbus communication at the same time, the response time increases.

NOTE
The SIG350 only supports HTTP, but not the HTTPS protocol.

NOTE
To change settings, it is necessary to log in with a certain user level, see "Logging user in and out", page 61.

8.3.1 Web interface structure

The integrated web interface has the following structure:

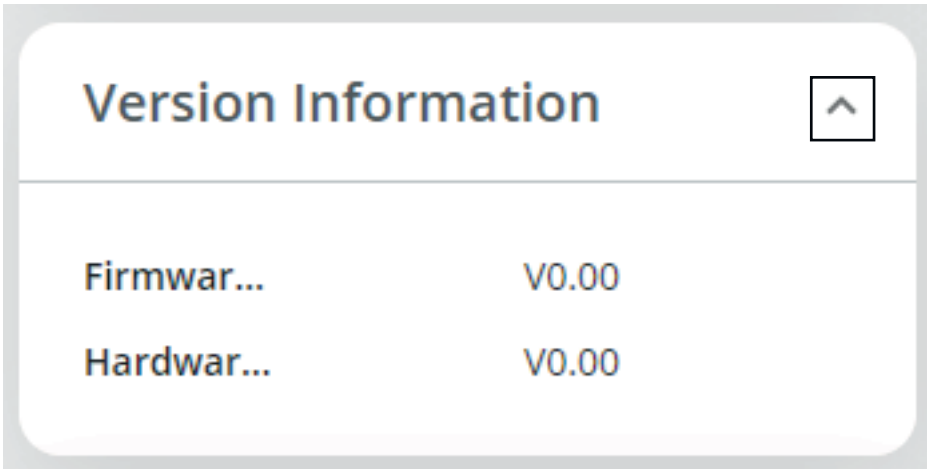


- Connection status
- User management
- Language options (German/English)
- Main menu
- Overview of the different tabs
- Show/Hide tab navigation
- Page contents

Each tab has corresponding tiles that provide different information.

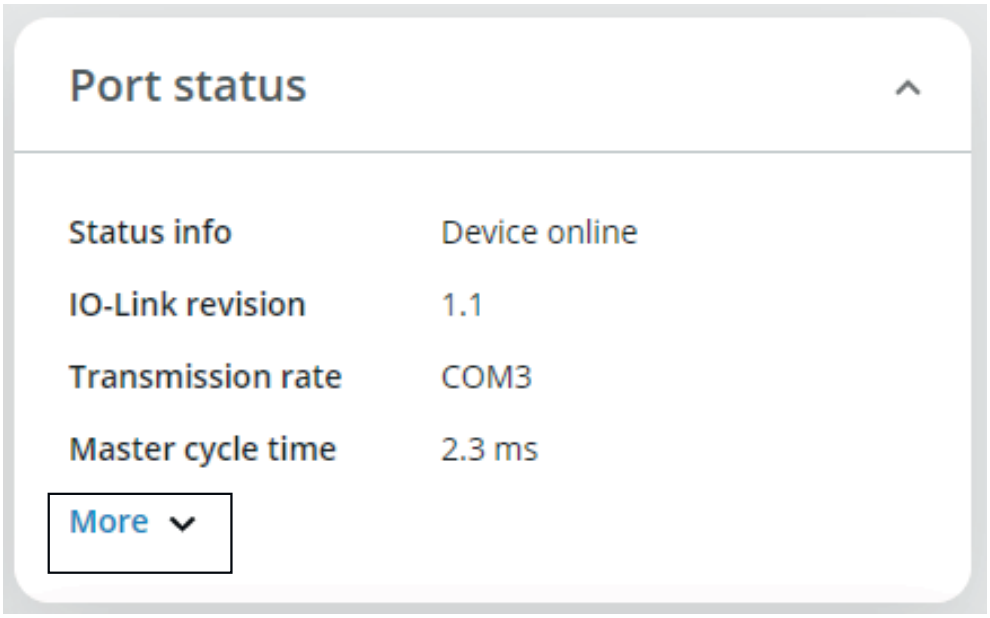
These tiles can be reduced or expanded, e.g. to improve the overview on small monitors.

To do so, click on the Expandable icon in the title bar of the corresponding tile:

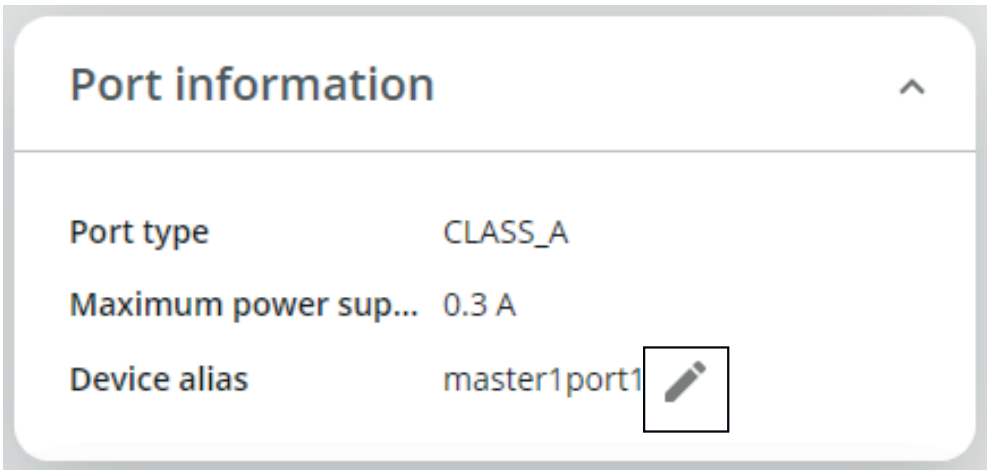


If there an extensive amount of content, the default view of the information tile is set to the essential information. At the bottom of the tile, the term “More” indicates that additional information is available.

To make this information visible, the tile view can be expanded by clicking on Expandable:



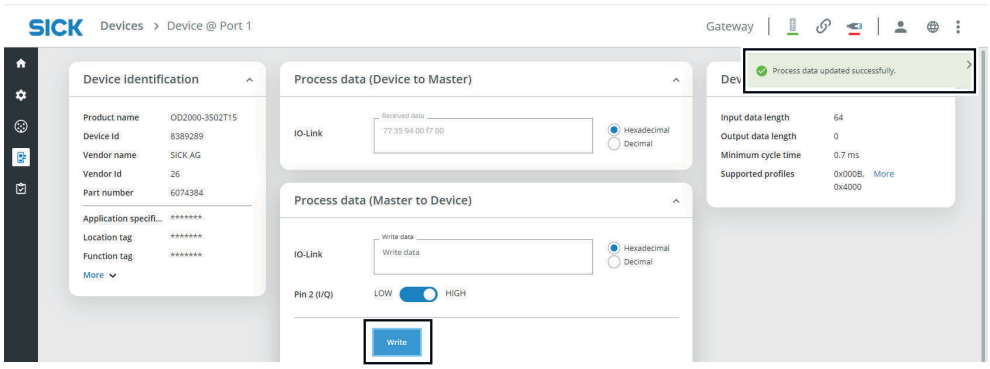
For some parameterization functions, it may be necessary to activate the edit option first. These functions are marked by a pencil. The corresponding entry can be changed by clicking on the pencil:



When configurations are changed in the module, these changes are implemented immediately. Manual saving of changes is not required.

However, there are some functions that require the changes made to be actively transmitted to the module. This is represented by a blue button directly below the corresponding input area.

This is necessary, for example, when writing process data to the device. Whether the process was successful is reported back directly via a message at the upper right edge of the web interface. This message disappears automatically after a few seconds.



“Communication status” menu bar

An overview of the connection status of the SIG350 is integrated in the menu bar

Different statuses are displayed:

1 Gateway

The green display symbolizes that the SIG350 itself is active.

2 Device connection

Ethernet communication with device active

Ethernet communication with device interrupted

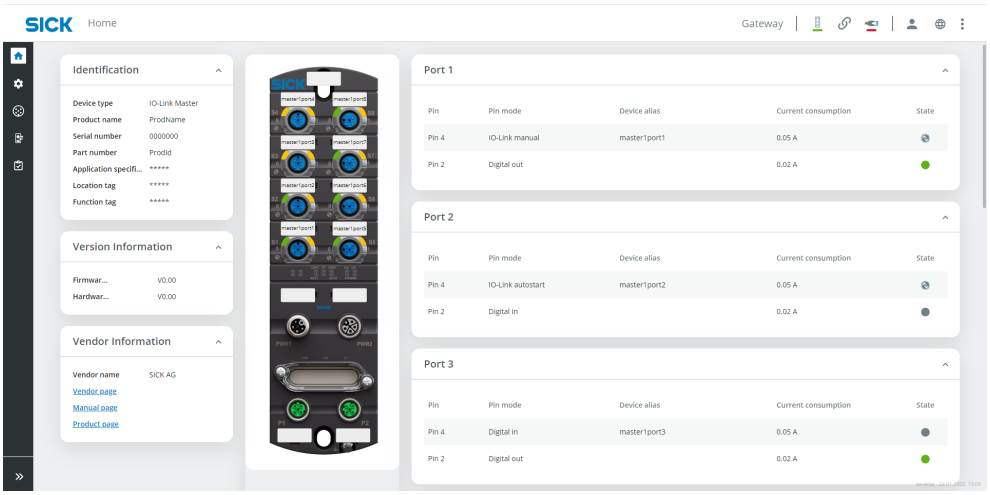
3 Controller connection

The green display symbolizes that the SIG350 is connected to a controller and that data is being exchanged.

If there is no active connection to a controller, a red display appears here.

“Home” tab

The Home page is the start page for the SIG350. It provides an overview of the current module status and device function.



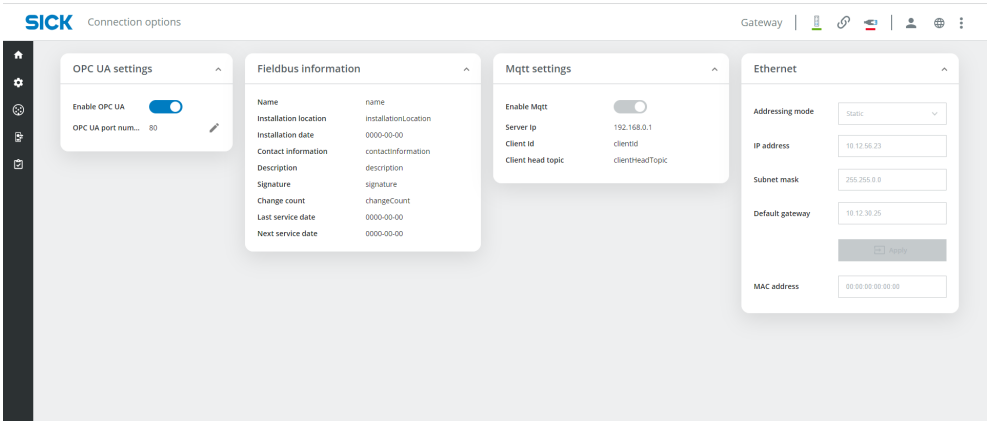
This page is divided into three areas.

- In the left area the identification data, information about the firmware and software versions as well as the vendor information of the module are displayed.
- In the middle there is a compact image of the SIG350, which shows for each port the deviceAlias and the light behavior of the corresponding LEDs. The corresponding light behavior indicates how the respective port is configured (details see "Status indicators", page 11)
- The parameterization of the individual ports is clearly displayed on the right side. In addition to the settings of pin 2 and pin 4, the deviceAlias, the current consumption and the communication status can also be read out. This overview corresponds to the configuration as it has been made on the “Ports” tab.

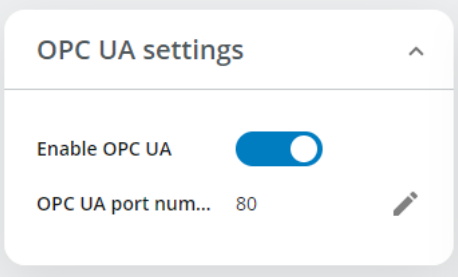
NOTE
Note that the LED displays do not work in real time.

“Connection options” tab

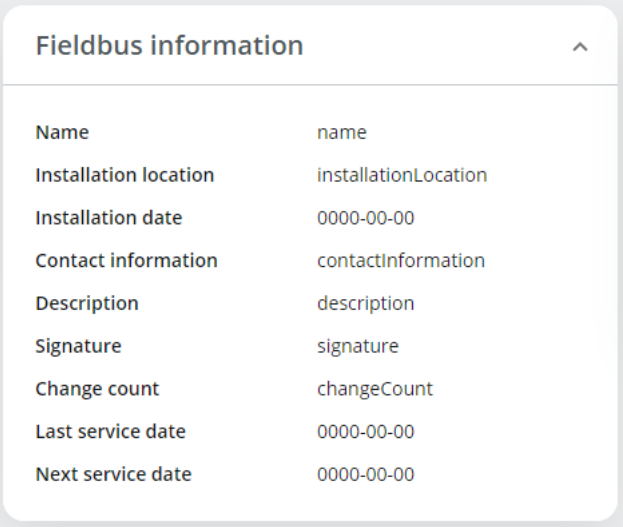
On the “Connection options” tab, the Ethernet settings such as the IP address or the subnet mask can be changed. In addition, additional fieldbus information is displayed.



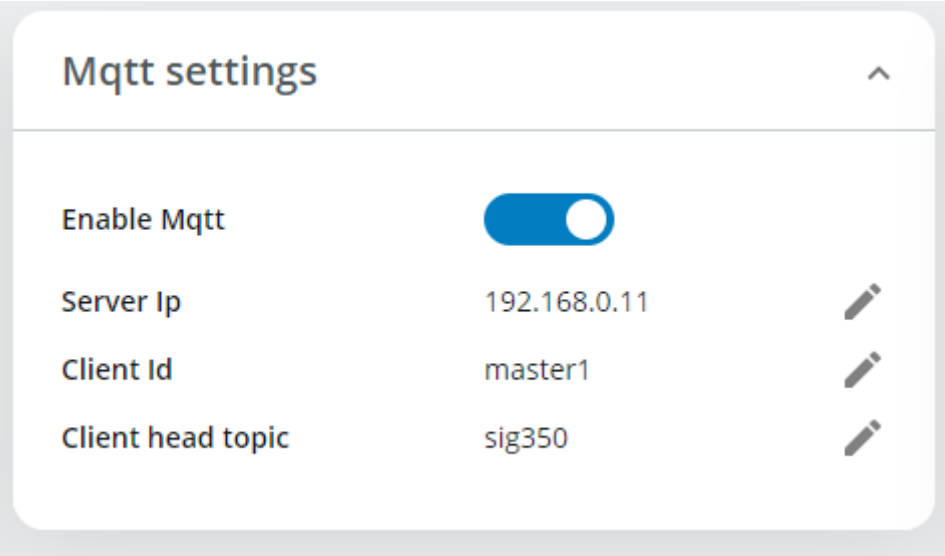
NOTE
To activate the Ethernet parameter changes, the device must be switched off and on once.



The OPC UA server is activated and configured via the corresponding settings. It is possible to restrict the writing of ISDUs and process data via OPC UA. The port can also be configured.



Using the fieldbus information, the user can store additional data in the device or read them out from the device. These are basically identification and maintenance parameters.



It is possible to activate communication via the MQTT settings. For this reason, the server IP must be entered according to the Ethernet adapter of the MQTT broker. In addition, a client ID must be assigned, which should be unique per broker.

Note

NOTE
The MQTT client ID may only consist of alphanumeric characters ([a-z][A-Z][0-9]).

“Ports” tab

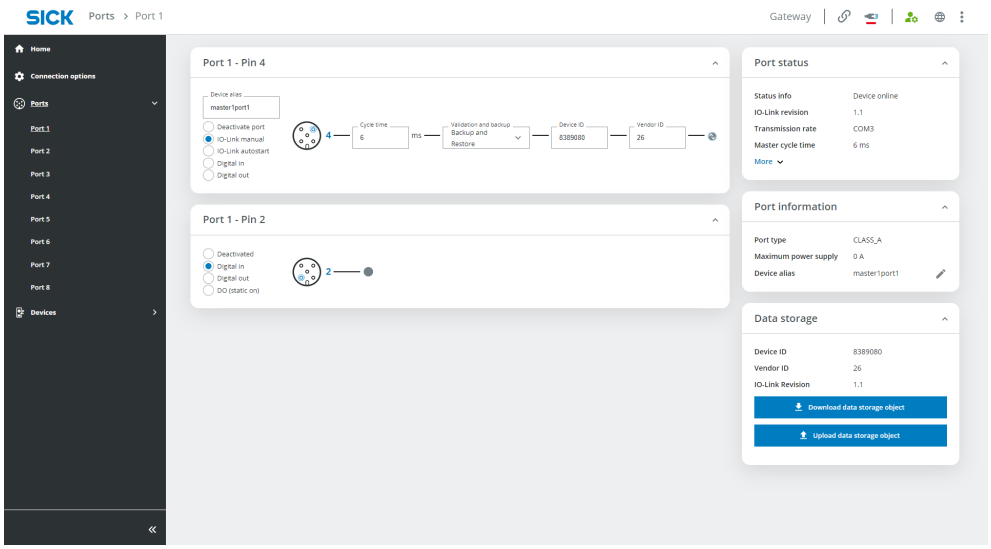
Settings for connection ports S1 to S8 can be changed in the “Ports” tab. There is a separate subpage for each port of the SIG350.

The setting for pin 4 and pin 2 can be made individually on each bottom side. For example, the minimum cycle time or the port designation (deviceAlias) can be changed here.

The Data Storage function can be configured for Restore or Backup + Restore according to the desired use case. If data storage is to be used, Device ID and Vendor ID must be set.

In addition, further information on the port status, such as communication status, but also diagnostic data of the respective pins with regard to current and voltage and temperature, is displayed.

If the Data Storage function has been activated, the complete contents of the data storage container of a port can be transmitted from one SIG350 to a second SIG350. For this purpose, the “Download data storage object” button for downloading from one SIG350 and the “Upload data storage object” button for uploading to the second SIG350 can be used. The exchange format is JSON.



“Devices” tab

On the Devices tab, the device-specific information of the connected IO-Link device is displayed. There is a separate subpage for each port of the SIG350.

On each subpage, both the process data and the parameter data can be read out or configured.

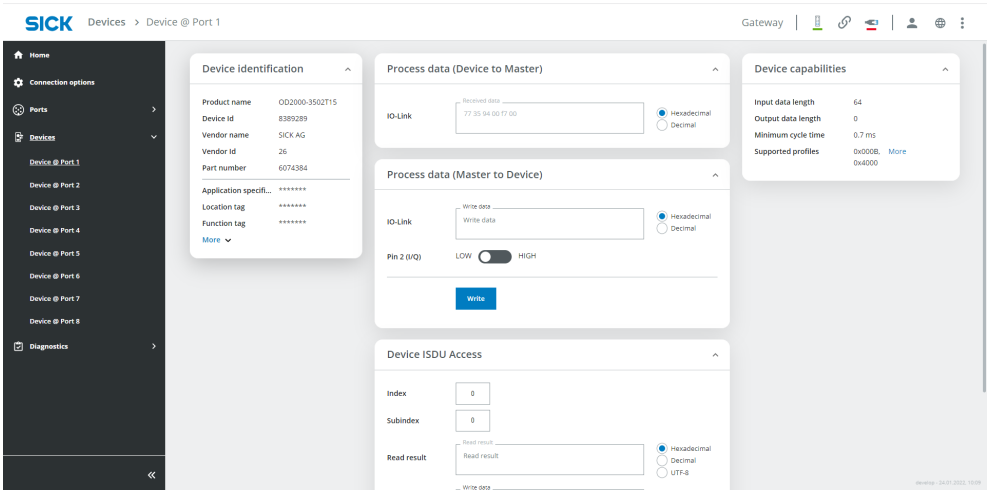
IO-Link data can be read from the connected device (Device to Master), but commands can also be issued to the connected device (Master to Device). Process data from or to the IO-Link device is transported cyclically via the fieldbus.

For parameter data, it is necessary that these are explicitly requested by the master. They are transmitted acyclically.

Using the ISDU (Index Service Data Unit), access is made via the corresponding index number and subindex number.

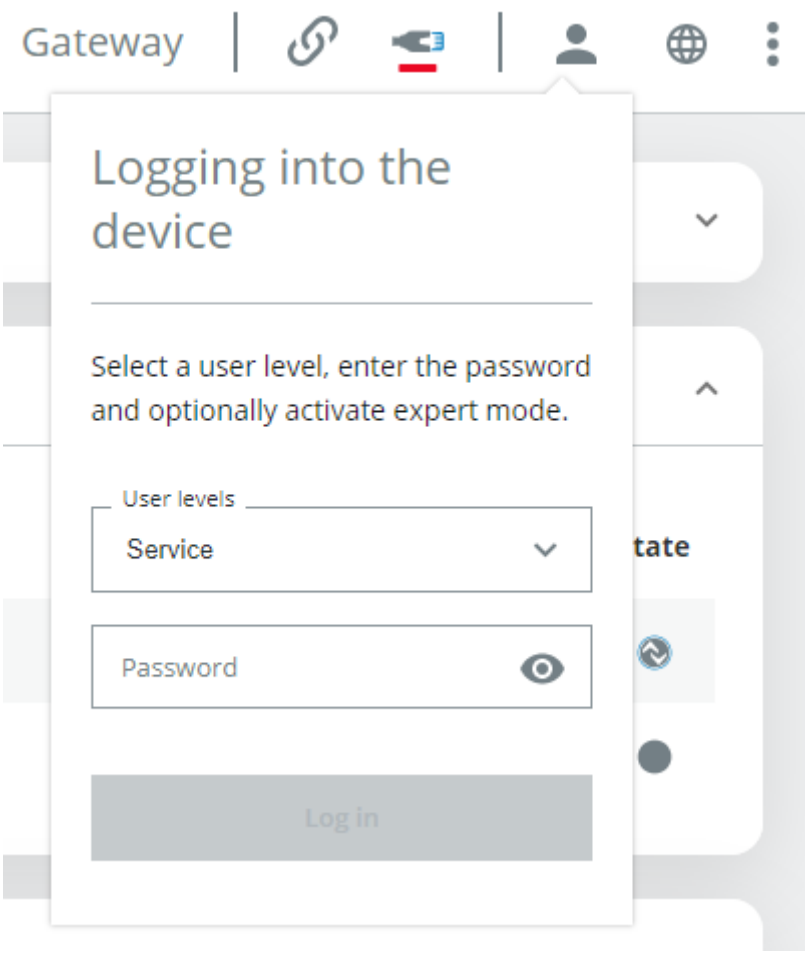
NOTE
The available process data and index number are provided by the manufacturer of the IO-Link device in the data sheet.

NOTE
If the individual underside for the ports remains empty, then either no IO-Link device is physically connected to the SIG350 or the connected device is not an IO-Link device.



8.3.2 Logging user in and out

To change settings, you must log in at the Maintenance user level (read and write access). By default, you are logged in at the Run (read-only) user level, where you can only view data and parameterization. If you want to change the user, you have to click on the user icon in the top right corner of the menu bar and select the desired user name in the dialog.



If a user other than “Run” is selected, the corresponding password must also be entered.

Note

Saving the user in a web browser may depend on the cookie settings.

When logging in for the first time, you will be prompted to change the default password. In the interest of cybersecurity, it is strongly recommended that you create a new, different password. Please remember this password. If you have forgotten your password, it cannot be reset. Please contact your SICK service partner for what to do in this case.

Table 25: User and default passwords

User	Default password	Role description
Operator	No password required	Reading parameterization
Maintenance	Main	Reading and writing parameterization
Service	Service level	Performing advanced settings like firmware updates.

8.3.3 Forgotten password

If an individually created password has been forgotten, the default passwords can be restored with the aid of a factory reset using the corresponding rotary switch combination on the device.

8.3.4 Data Storage

The “Data Storage” function makes it much easier to replace defective IO-Link devices. This means that the entire parameter set of the device, e.g. switching point, additional logic or teach-in settings, is stored centrally in the SIG350. When a connection is made to a compatible device, this stored parameter set is written to the device and it behaves like the replaced device. There are two different use cases, which are described in the following:

“Backup + Restore” application case:

Parameters are read and written in both directions (from the IO-Link Master to the device and vice versa). This mode is predominantly used for commissioning, i.e. changes to the device parameterization triggered by a teach-in, for example, are automatically uploaded and stored in the data memory object of the SIG350. Device replacement is also supported, e.g. the parameterization is automatically copied to the new device if a device has to be replaced.

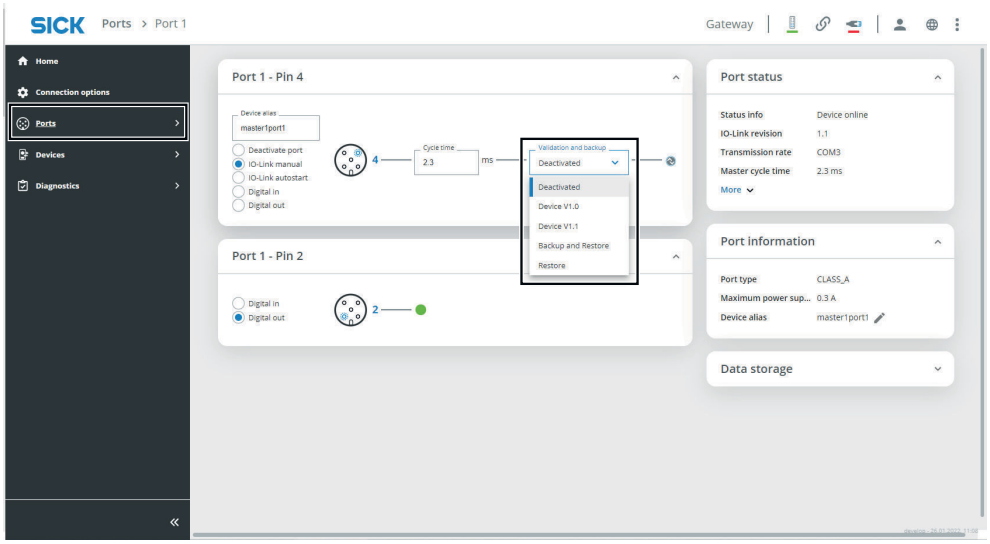
“Restore” application case:

In this mode, the parameterization of the connected IO-Link device is saved and frozen. These parameters cannot be changed by the device, i.e. a teach-in directly at the device is ignored. The replacement of defective devices is also possible. This requires a certain degree of device compatibility. For this reason, the Device ID and Vendor ID must be specified.

8.3.4.1 Example use

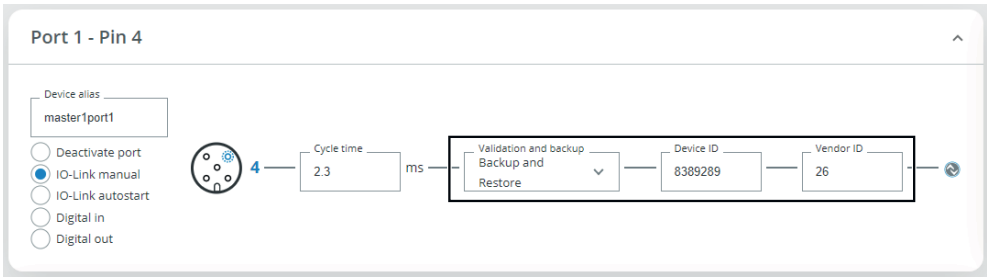
The “Data Storage” function of the SIG350 IO-Link Master enables easy replacement of defective IO-Link sensors. The following example shows step-by-step how the SIG350 can be used to commission a new IO-Link device so that a replacement device is automatically parameterized according to the original device.

- Start the web interface and navigate to the “Ports” tab. Select the desired function with the “Validation and backup” button. This setting is only available for pin 4, as the Data Storage function is restricted to IO-Link communication.

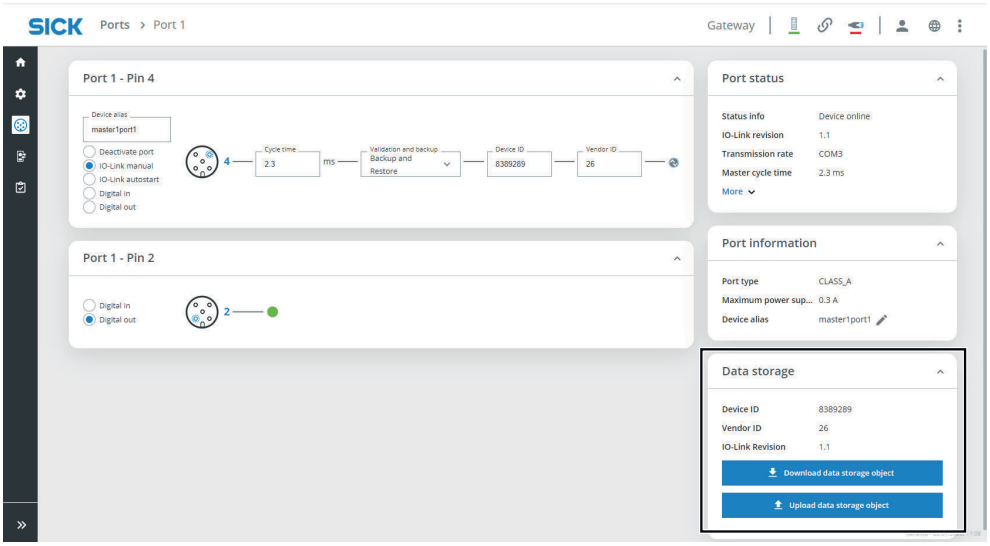


- As soon as the “Backup and Restore” or “Restore” selection has been activated, additional buttons appear which serve to validate the connected device.

The Device ID and Vendor ID must correspond to the data of the connected device. This data is checked in the event of device replacement and an error message is returned in the event of deviating data.



- In addition, the “Data storage” function tile appears. This function allows download or upload of records with the stored information from the device. The data format is JSON.



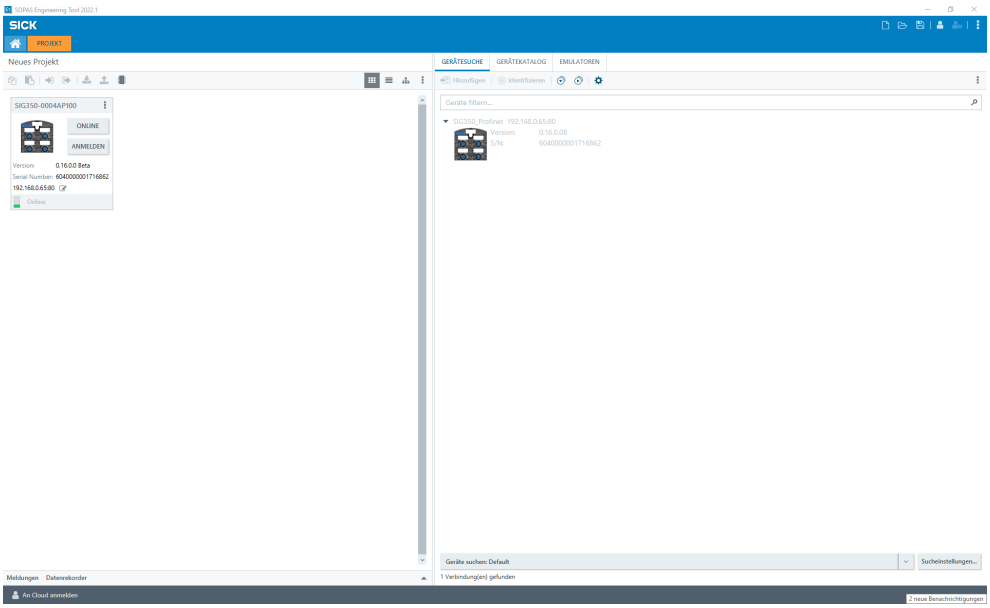
- It enables the new master to read out and save the configuration data stored in the device when the IO-Link Master module is replaced.

To use the Data Storage, the Vendor ID and Device ID of the connected device must be entered in the validation settings.

8.4 SOPAS Engineering Tool

With the aid of the SOPAS Engineering Tool, the SIG350 can be called up on a computer running Microsoft Windows. This is particularly helpful if the IP address of the SIG350 is not known.

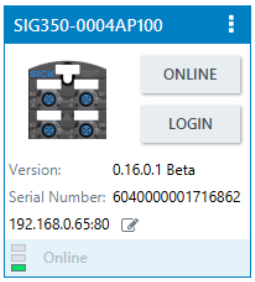
Connect the SIG350 to your computer via Ethernet and start SOPAS ET. When starting the program, the Ethernet interface is always scanned for connected devices and devices found appear in the Device Search on the right side of the interface. Double clicking on the result or dragging and dropping the module makes it possible to add the module as a new project on the left side. Devices that are already in the project are grayed out in the search results.

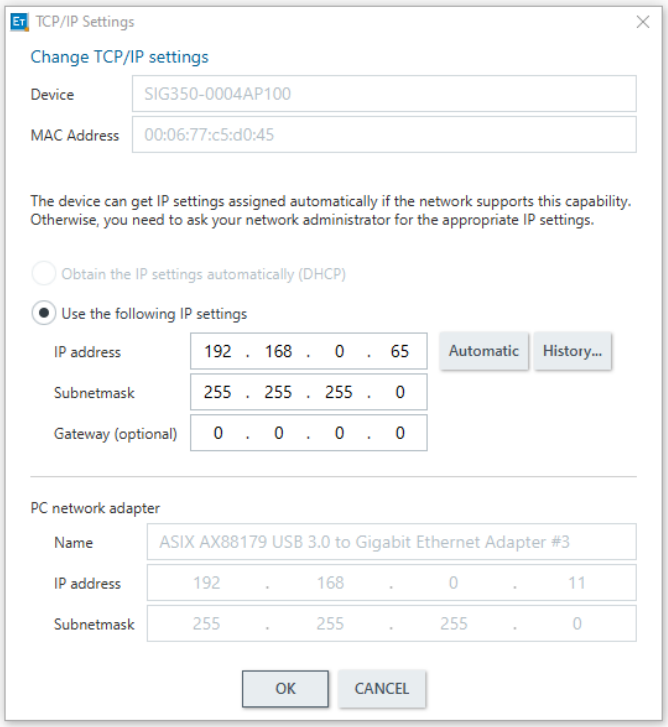


If the device status appears as offline in the project icon, then the SIG350 must first be switched online. Click on the offline button to do so.

The IP address of the SIG350 is displayed in the project tile. It can be changed by clicking on the pencil icon. A window appears with the TCP/IP settings in which changes can be made.

A restart of the device is then required, which is automatically performed by the device.





To parameterize the SIG350, double-click on any point on the project icon. The device window opens, in which all device parameters are displayed. This device window is identical to the contents of the web interface (see "Web interface structure", page 54). Here the parameterization can be carried out, parameters can be loaded into or from the device or parameter values can be observed.

NOTE

The user login is not done via SopasET directly, but via the device interface (see "Logging user in and out", page 61). The Import/Export parameter is not supported.

9 Troubleshooting

Various problems can occur when using the SIG350.

If you have problems, SICK Technical Support is available to help. Contact your SICK Service partner in this case.

However, a large number of problems can be identified and fixed independently with the help of the following tips:

- With section 9.4, make sure the LEDs are not reporting problems
- Check that the network IP address, subnet mask and gateway are configured correctly.
- Make sure that the IP address programmed in the IO-Link Master matches the unique, reserved, configured IP address assigned by the system administrator.
- Make sure that you use the correct cable types on the correct connections and that all cables are firmly connected.
- Disconnect the IO-Link device from the master and reconnect it. Possibly the master had not correctly identified the connected device.
- Restart the IO-Link Master.
- Check whether the Data Storage function has been activated correctly.
- Reset the module to factory settings (see "Reset to factory settings", page 67)
- Update the firmware of the module (see "Updating firmware", page 67)

9.1 Reset to factory settings

In some cases it is helpful to reset the module to the factory settings. To do this, use either the web interface or the corresponding rotary switch position.

By resetting to the factory settings, all parameterizations made are lost and must be carried out again.

We recommend creating a backup before resetting to the factory settings. As soon as the module has been reset to factory settings, all parameterizations made are deleted and cannot be restored. A backup can save considerable effort in the event of an error.

Changes to settings in the web interface require maintenance or service rights. If these are not available, the Settings tab is grayed out and cannot be edited.

9.2 Device restart

In some cases it is necessary to restart the module. To do this, either use the web interface or switch the voltage supply off and on.

9.3 Updating firmware

To ensure that the device is up to date, the firmware of the SIG350 can be updated. Use the web interface to do this.

The appropriate firmware file for the corresponding module variant is required. The firmware file can be obtained from SICK support if required and always comprises a .zip file.

Changes to settings in the web interface require maintenance or service rights. If these are not available, the Settings tab is grayed out and cannot be edited.

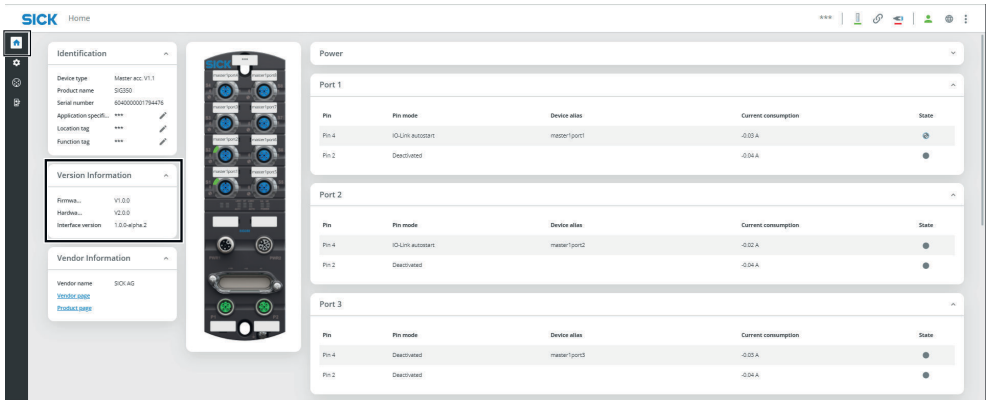
NOTE

Never perform a firmware update during operation of the system in which the module is installed. The plant must first be shut down properly or brought into a safe operational status before any firmware update.

Performing an update

The firmware version used on the module can be found via the web interface. To do this, access the web interface via the IP address of the module.

You will find the currently used firmware version on the home page.



The following steps are necessary to perform a firmware update:

- Change user level to **Service**. Password: **servicelevel**
- Open the main menu in the menu bar and select the **Deviceà Update firmware** function
- Upload file: Clicking on the “Select file” button opens a dialog window where you can select the location of the .zip file. Clicking on OK saves the file in the flash memory of the module.
- At the end of the process, a status message appears with the result of the update. If the result is positive, a module restart is required to permanently save the firmware from the flash memory to the module. The module performs this restart automatically. Manual restart is not required.
- During this restart, the new firmware is loaded on the device. As a result, the firmware version displayed on the Home page is updated.

9.4 Fault diagnosis

Basically, the error state of the device is signaled by the individual LEDs, see 3.2.2.

Protocol-specific errors can be found in the respective sub-section.

- Profinet: see "Configuration"
- REST API: see "API structure", page 39

10 Disassembly and disposal

The SIG350 must be disposed of in line with applicable country-specific regulations. When disposing of them, you should try to recycle them (especially the precious metals).

Note

Disposal of batteries, electrical and electronic devices
· In accordance with international regulations, batteries, rechargeable batteries and electrical and electronic devices must not be disposed of with household waste.
· The owner is required by law to dispose of these devices at the appropriate public collection points at the end of their service life.

· This symbol on the product, its packaging or in the document indicates that a product is subject to the specified regulations.

11 Maintenance

Sensor Integration Gateways from SICK are maintenance-free.

We recommend performing the following on a regular basis:

- Clean device
- Check screw connections and plug connections

No modifications may be made to devices.

Subject to change without notice. The specified product features and technical data do not constitute a written warranty.

12 Technical data

12.1 General technical data

Mechanical data

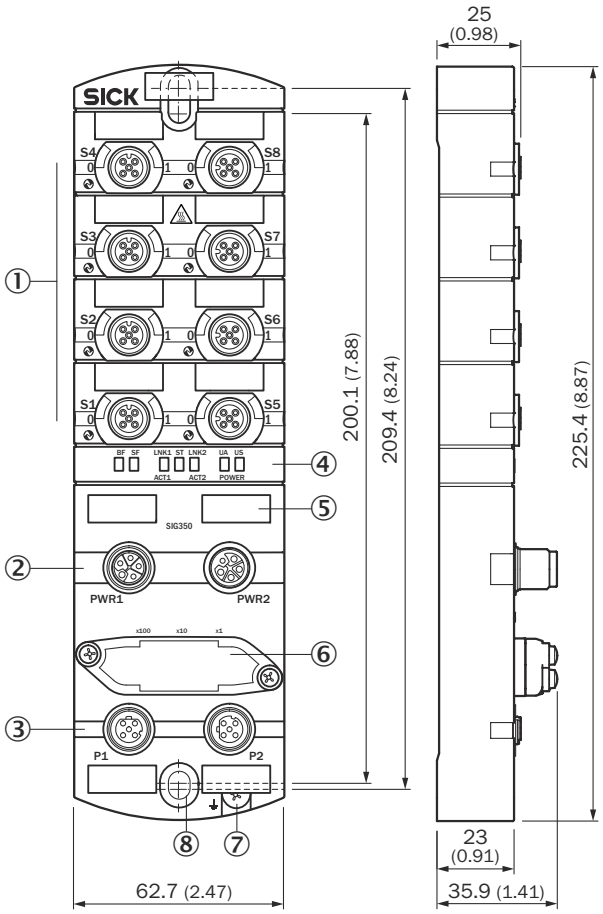


Figure 16: Dimensional drawing

Mechanical data

Table 26: Mechanical data

Housing material	Plastic (Valox 553)
Enclosure rating as per IEC 60529	IP 67 (only with connected cables)[1)]
Dimensions (L x W x H)	225 mm x 63 mm x 37.4 mm
Mounting type	2-hole screw mounting
Weight	486 g

1) If the appropriate cables are not connected to all ports, the free ports must be screwed tight with sealing plugs (part number 5309189) to ensure IP protection.

Operating conditions

NOTE EMC

This equipment is not intended for use in residential areas and may not provide adequate protection against radio reception in these environments.

Table 27: Operating conditions

Operating temperature	-25 °C ... +70 °C[1]
Storage temperature	-40 °C ... +80 °C[1]
EMC	EN 61000-6-2:2016 EN 61000-6-4:2020
Impact load	EN 60068-2-27

1) Permissible relative humidity 0% ... 95% (non-condensing)

Electrical data

Table 28: Electrical data

Voltage supply UA	18 ... 30 V DC[1]	
Voltage supply US	18 ... 30 V DC[1]	
Voltage supply (PWR1 and PWR2)	Current consumption	≤ 180 mA @ 24 V[2]
	Max. current carrying capacity	≤ 16 A, US[3] ≤ 16 A, UA[3]
Port (S1-S8)	Pin 1 max. supply current	2 A
	Pin 2 max. supply current (DO)	2 A
	Pin 4 max. supply current (DO)	2 A
	Max. current carrying capacity per port	4 A
	Max. current carrying capacity of all IO-Link ports (S1-S8)[4]	10 A
	Input characteristics	EN 61131-2 type 1 + type 3
Protection class	III[5]	

1) Each for US and UA, typ. supply voltage 24 V DC
2) Without load, sensors and outputs switched off
3) ≤ +40 °C (see "Derating", page 23).
4) Max. current per port includes both the output current (pin 4 and pin 2, if applicable) and the current consumption of the connected device (pin 1).
5) When using a SELV or PELV power supply unit

EtherCAT

Table 29: EtherCAT

Transmission rate	100 Mbit/s
Maximum distance between NodeMax Length of cable	100 m
Process data (implicit connection)	Depending on selected assemblies, minimum cycle time: 1 ms
Max. process input data	328 byte
Max. process output data	262 byte
Asynchronous data (explicit connection)	Manufacturer-specific classes per module
Observed standard	IEEE802.3u (100Base-Tx)
Max. number of connections	3
Ethernet connections	2
CIP services	DLR, QoS
EDS file	Available at www.sick.com

Ethernet

Table 30: Ethernet

Ethernet interface	2x100 Base-Tx (with switch)
Cable type according to IEEE 802.3	Min. STP CAT 5 /ST CAT 5e
Data transmission rate	100 Mbit/s
Max. cable length	100 m
Flow control	Half duplex/Full duplex (IEEE 802.33x-Pause)
Open TCP ports	80 (HTTP)
	1883 (MQTT)
	2122 (SOPAS)
	4840 (OPC UA) 44818 (Ethernet/IP Encapsulation messages based on TCP Explicit messaging)
	50111 (Open for 30 seconds after power up)
Open UDP ports	68 (DHCP Client)
	161 (SNMP Server)
	2222 (implied messages IO)
	30718 (CoLa scan receiver)
	30719... 30738 (CoLa scan sender: if a port is blocked by the application, the next port is used).
	34964 (Profinet RPC Endpointmapper)
	44818 (Ethernet/IP Encapsulation messages based on UDP)
	49152 (Profinet RPC Device Server)
MQTT version	V3.1.1

Additional information:

Table 31: Additional information

Max. number of I/Os that can be connected:	104 E/As (8 + 8x6x2 combined with SIG100)
Max. number of I/O-Link signals that can be connected:	8
Ethernet ports:	2
Max. switching frequency:	50 Hz

IO-Link

Table 32: IO-Link

Specification	V1.0.0 ... V1.1.3
Connection class	Class A Class [1]
Transmission rate	COM1 / COM2 / COM3
Min. IO-Link cycle time	1 ms
Detection of transmission rate	Automatic

[1] Class B is achieved by using pin 2 as output for the voltage supply. Freely configurable per port, no galvanic separation between US and UA.

13 Annex

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Australia
Phone +61 (3) 9457 0600
1800 33 48 02 – tollfree
E-Mail sales@sick.com.au

Austria
Phone +43 (0) 2236 62288-0
E-Mail office@sick.at

Belgium/Luxembourg
Phone +32 (0) 2 466 55 66
E-Mail info@sick.be

Brazil
Phone +55 11 3215-4900
E-Mail comercial@sick.com.br

Canada
Phone +1 905.771.1444
E-Mail cs.canada@sick.com

Czech Republic
Phone +420 234 719 500
E-Mail sick@sick.cz

Chile
Phone +56 (2) 2274 7430
E-Mail chile@sick.com

China
Phone +86 20 2882 3600
E-Mail info.china@sick.net.cn

Denmark
Phone +45 45 82 64 00
E-Mail sick@sick.dk

Finland
Phone +358-9-25 15 800
E-Mail sick@sick.fi

France
Phone +33 1 64 62 35 00
E-Mail info@sick.fr

Germany
Phone +49 (0) 2 11 53 010
E-Mail info@sick.de

Greece
Phone +30 210 6825100
E-Mail office@sick.com.gr

Hong Kong
Phone +852 2153 6300
E-Mail ghk@sick.com.hk

Hungary
Phone +36 1 371 2680
E-Mail ertekesites@sick.hu

India
Phone +91-22-6119 8900
E-Mail info@sick-india.com

Israel
Phone +972 97110 11
E-Mail info@sick-sensors.com

Italy
Phone +39 02 27 43 41
E-Mail info@sick.it

Japan
Phone +81 3 5309 2112
E-Mail support@sick.jp

Malaysia
Phone +603-8080 7425
E-Mail enquiry.my@sick.com

Mexico
Phone +52 (472) 748 9451
E-Mail mexico@sick.com

Netherlands
Phone +31 (0) 30 229 25 44
E-Mail info@sick.nl

New Zealand
Phone +64 9 415 0459
0800 222 278 – tollfree
E-Mail sales@sick.co.nz

Norway
Phone +47 67 81 50 00
E-Mail sick@sick.no

Poland
Phone +48 22 539 41 00
E-Mail info@sick.pl

Romania
Phone +40 356-17 11 20
E-Mail office@sick.ro

Russia
Phone +7 495 283 09 90
E-Mail info@sick.ru

Singapore
Phone +65 6744 3732
E-Mail sales.gsg@sick.com

Slovakia
Phone +421 482 901 201
E-Mail mail@sick-sk.sk

Slovenia
Phone +386 591 78849
E-Mail office@sick.si

South Africa
Phone +27 10 060 0550
E-Mail info@sickautomation.co.za

South Korea
Phone +82 2 786 6321/4
E-Mail infokorea@sick.com

Spain
Phone +34 93 480 31 00
E-Mail info@sick.es

Sweden
Phone +46 10 110 10 00
E-Mail info@sick.se

Switzerland
Phone +41 41 619 29 39
E-Mail contact@sick.ch

Taiwan
Phone +886-2-2375-6288
E-Mail sales@sick.com.tw

Thailand
Phone +66 2 645 0009
E-Mail marcom.th@sick.com

Turkey
Phone +90 (216) 528 50 00
E-Mail info@sick.com.tr

United Arab Emirates
Phone +971 (0) 4 88 65 878
E-Mail contact@sick.ae

United Kingdom
Phone +44 (0)17278 31121
E-Mail info@sick.co.uk

USA
Phone +1 800.325.7425
E-Mail info@sick.com

Vietnam
Phone +65 6744 3732
E-Mail sales.gsg@sick.com

Detailed addresses and further locations at **www.sick.com**

SICK AG | Waldkirch | Germany | www.sick.com

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