

RFU61x

RFID read/write device (UHF)

SICK
Sensor Intelligence.



Described product

RFU610-106xx

Manufacturer

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Original document

This document is an original document of SICK AG.

Conformities

Due to the country-specific approvals for the device, the respective conformance information is type-dependent. For the specific device that you have, see the online type-specific data sheet at:

- www.sick.com/RFU61x

The type designation of your device can be found on the type label.

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1 About this document

1.1 Information on the operating instructions

These operating instructions provide important information on how to use devices from SICK AG.

Prerequisites for safe work are:

- Compliance with all safety notes and handling instructions supplied.
- Compliance with local work safety regulations and general safety regulations for device applications

The operating instructions are intended to be used by qualified personnel and electrical specialists.



NOTE

Read these operating instructions carefully to familiarize yourself with the device and its functions before commencing any work.

The operating instructions are an integral part of the product. Store the instructions in the immediate vicinity of the device so they remain accessible to staff at all times. Should the device be passed on to a third party, these operating instructions should be handed over with it.

These operating instructions do not provide information on operating the machine or system in which the device is integrated. For information about this, refer to the operating instructions of the specific machine.

1.2 Scope

These operating instructions serve to incorporate the device into a customer system. These operating instructions form part of the documentation provided to users. The operating instructions supplement the Quick Start Guide with more detailed and additional information. The Quick Start guide for initial commissioning is enclosed with the devices in printed form. The Quick Start guide can also be downloaded from the following website:

- www.sick.com/RFU61x

The operating instructions provide in-depth information on the **following topics**:

- Interpreting the type code
- Overview of product features and functions of the device
- Scope of delivery of the device: enclosed components, required online access to additional components
- Operation of the device in an ambient temperature range below 0 °C: measures and requirements for mounting and electrical installation
- Applications with spatially distributed systems: measures to prevent possible ground potential equalizing currents
- Overview of all interfaces and connection options for the device
- Wiring the individual interfaces of the device
- Additional functions of the status indicators
- Overview of operating options and available configuration tools for the device
- Measures for eliminating interference

Step-by-step procedures are given for all required actions in the operating instructions.

These instructions apply to all available device variants of the product. Functions specific to special devices are, where necessary, described in additional documents.

More detailed information for identification of the available device type see "Type code", page 13.

The available device variants, and information about the regionally related radio equipment approvals are listed on the online product page:

- www.sick.com/RFU61x

Commissioning is described in the operating instructions using one particular device variant as an example. Commissioning is based on the basic parameter setting of the device. Reading a **transponder on an object** serves as the basis for the simple application.



NOTE

The device approval was granted for a specific region. The region assignment cannot be changed.

- Only use the device in the region for which it has been approved.
 - When reselling the device, inform the buyer of the fixed region assignment.
 - Should the device be passed on to a third party, these operating instructions and the Quick Start Guide should be handed over with it.
 - For country-specific special features in the operation of the device, see "Operating restrictions" in the Quick Start Guide. A printed copy of the Quick Start Guide is supplied with the device. The Quick Start Guide can also be accessed in PDF format on the device product page on the Internet at: www.sick.com/RFU61x.
-

1.3 Explanation of symbols

Warnings and important information in this document are labeled with symbols. Signal words introduce the instructions and indicate the extent of the hazard. To avoid accidents, damage, and personal injury, always comply with the instructions and act carefully.



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.

1.4 Further information

**NOTE**

Further documentation for the device can be found on the online product page at:

- www.sick.com/RFU61x

There, additional information has been provided depending on the product, such as:

- Model-specific online data sheets for device variants, containing technical data, dimensional drawing, and specification diagrams
 - EU declarations of conformity for the product family
 - Certificates of the product family
 - Dimensional drawings and 3D CAD dimension models of the device variants in various electronic formats
 - Quick Start guides for initial commissioning of the device
 - This documentation, available in English and German, and in other languages if necessary
 - Other publications related to the devices described here
 - Publications dealing with accessories
-

**NOTE**

In addition to the existing operating instructions, the use of the RFU parameter description is recommended. This document explains the UHF-RFID-specific parameters of all device variants of the RFU6xx product family at the "Service" user level.

The parameter description supports the user in configuring applications with the SOPAS ET configuration software.

1.5 SICK service

If you require any technical information, our SICK Service will be happy to help. To find your agency, see the final page of this document.

**NOTE**

Before calling, make a note of all type label data such as type code, serial number, etc., to ensure faster processing.

2 Safety information

2.1 Intended use

The RFU61x RFID read/write device is an intelligent ID sensor from the SICK RFU6xx (UHF) product family. Version (working range): Short Range.

The device is used for the automated, fixed identification of wireless-based data cards (transponders) on moving or stationary objects, and for the management of these data cards. The RFU610 base model processes all standard passive transponders in accordance with EPCglobal UHF C1G2 and ISO/IEC 18000-6C in the regional UHF carrier frequency range.

The device works in stand-alone operation. In read mode, the device transmits the results via a host interface to a higher-level computer (e.g. PLC) for further centralized processing. Network operation is possible for coordinating trouble-free readings of devices at close proximity to one another, but without a coordinating summary of the reading results by one of the devices involved.

The compact device contains an antenna integrated in the housing.

The device allows operation within a wide ambient temperature range. For details, see "Technical data", page 61.

The device is primarily designed for use in industrial and logistics areas, and meets the requirements for industrial ruggedness, interfaces and data processing. If necessary, the device can be programmed to implement customer-specific modifications.



NOTE

The USB interface of the device is used in industrial environments only as a service interface for temporary use (e.g. for configuration, troubleshooting). Permanent use in operational use of the system as a host interface is not intended.

SICK AG assumes no liability for losses or damage arising from the use of the product, either directly or indirectly. This applies in particular to use of the product that does not conform to its intended purpose and is not described in this documentation.

2.1.1 Operational restrictions



NOTICE

Operational restrictions!

The frequency band of the device is configured for the specific type and region when delivered. This enables the device to be operated in the respective approved region without interfering with protected frequencies (such as mobile communications).

Operating the device in other regions, however, can interfere with protected frequencies.

- Only use the device in the region for which it has been approved.
 - When reselling the device, inform the buyer of the fixed region assignment.
 - Should the device be passed on to a third party, these operating instructions and the Quick Start Guide should be handed over with it.
 - For further country-specific operating requirements, see the Quick Start Guide, a printed copy of which is enclosed with the device or can be downloaded online (PDF) at:
 - www.sick.com/RFU61x
-

A region consists either of a group of countries or of only one country.

2.1.2 Regulatory notes

Europe: simplified EU declaration of conformity

SICK AG hereby declares that the RFU61x-106xx radio equipment complies with the 2014/53/EU directive. The complete text of the EU declaration of conformity is available at the following web address:

- www.sick.com/RFU61x

2.2 Improper use

Any use outside of the stated areas, in particular use outside of the technical specifications and the requirements for intended use, will be deemed to be incorrect use.

- The device does not constitute a safety component in accordance with the respective applicable safety standards for machines.
- The device must not be used in explosion-hazardous areas, in corrosive environments or under extreme environmental conditions.
- Any use of accessories not specifically approved by SICK AG is at your own risk.



WARNING

Danger due to improper use!

Any improper use can result in dangerous situations.

Therefore, observe the following information:

- Device should be used only in accordance with its intended use.
- All information in these operating instructions must be strictly observed.

2.3 Internet protocol (IP) technology



NOTE

SICK uses standard IP technology in its products. The emphasis is placed on availability of products and services.

SICK always assumes the following prerequisites:

- The customer ensures the integrity and confidentiality of the data and rights affected by its own use of the aforementioned products.
- In all cases, the customer implements the appropriate security measures, such as network separation, firewalls, virus protection, and patch management.

2.4 Limitation of liability

Relevant standards and regulations, the latest technological developments, and our many years of knowledge and experience have all been taken into account when compiling the data and information contained in these operating instructions. The manufacturer accepts no liability for damage caused by:

- Failing to observe the operating instructions
- Incorrect use
- Use of untrained staff
- Unauthorized conversions
- Technical modifications
- Use of unauthorized spare parts, consumables, and accessories

With special variants, where optional extras have been ordered, or owing to the latest technical changes, the actual scope of delivery may vary from the features and illustrations shown here.



NOTE

The product is a programmable device. The respective programmer is therefore responsible for his/her programming work and the resultant operation of the device. The liability and warranty of SICK AG is limited to the device specification (hardware functionality and any programming interfaces) according to the agreed conditions. SICK AG will therefore not be liable, among other things, for any damages resulting from the programming of the product by the customer or third parties.

2.5 Modifications and conversions



NOTICE

Modifications and conversions to the device may result in unforeseeable dangers.

Interrupting or modifying the device or SICK software will invalidate any warranty claims against SICK AG. This applies in particular to opening the housing, even as part of mounting and electrical installation.

2.5.1 Exception: temporarily opening the cover on the device



NOTICE

The user may open the housing only in order to obtain temporary access to the USB interface or the slot for the optional memory card. For this purpose, the corresponding side cover on the device can be opened temporarily.

In open state, the device does not conform to a specified enclosure rating. The device must be protected appropriately against moisture and dust.

- ▶ Operate the device only for a short time without closed cover.
-



NOTE

The USB interface of the device is used in industrial environments only as a service interface for temporary use (e.g. for configuration, troubleshooting). Permanent use in operational use of the system as a host interface is not intended.

For further warranty provisions, see the General Terms and Conditions of SICK AG, e.g. on the delivery note of the device.

2.5.2 Conditions for specified enclosure rating

To ensure compliance with the specified IP67 enclosure rating of the device, the following requirements must be met. If these requirements are not met, the device does not fulfill any specified enclosure rating.

- The joint side cover for the USB interface and the memory card slot is placed against the device and screwed on tight.
- The cables plugged into the electrical M12 and M8 connections must be screwed tight.
- Any M12 and M8 connections that are not being used must be sealed with protective plugs or caps, depending on type. These plugs or caps must be screwed tight (as in the delivery condition).

The same also applies to the EMC requirement (ESD) according to CE.



NOTICE

The type label on the lower side of the device contains a pressure equalizing membrane attached in the middle. If the type label is damaged or removed, the leak tightness of the device can no longer be guaranteed.

Positions of the individual elements see "Device view", page 15



NOTICE

The device can, if necessary, be operated for a short time **without the side cover** to perform the following tasks:

- Inserting or removing the optional memory card
- Temporary use of the USB interface as a servicing interface

During this time, protect the device against moisture and dust.

2.6 Requirements for skilled persons and operating personnel



WARNING

Risk of injury due to insufficient training.

Improper handling of the device may result in considerable personal injury and material damage.

- All work must only ever be carried out by the stipulated persons.

This product documentation refers to the following qualification requirements for the various activities associated with the device:

- **Instructed personnel** have been briefed by the operator about the tasks assigned to them and about potential dangers arising from improper action.
- **Skilled personnel** have the specialist training, skills, and experience, as well as knowledge of the relevant regulations, to be able to perform tasks delegated to them and to detect and avoid any potential dangers independently.
- **Electricians** have the specialist training, skills, and experience, as well as knowledge of the relevant standards and provisions to be able to carry out work on electrical systems and to detect and avoid any potential dangers independently. In Germany, electricians must meet the specifications of the BGV A3 Work Safety Regulations (e.g. Master Electrician). Other relevant regulations applicable in other countries must be observed.

The following qualifications are required for various activities:

Table 1: Activities and technical requirements

Activities	Qualification
Mounting, maintenance	<ul style="list-style-type: none"> ■ Basic practical technical training ■ Knowledge of the current safety regulations in the workplace
Electrical installation, device replacement	<ul style="list-style-type: none"> ■ Practical electrical training ■ Knowledge of current electrical safety regulations ■ Knowledge of the operation and control of the devices in their particular application
Commissioning, configuration	<ul style="list-style-type: none"> ■ Basic knowledge of the Windows™ operating system in use ■ Basic knowledge of the design and setup of the described connections and interfaces ■ Basic knowledge of data transmission ■ Basic knowledge of RFID technology (identification with radio-based data cards) ■ Knowledge of the programming of devices
Operation of the device for the particular application	<ul style="list-style-type: none"> ■ Knowledge of the operation and control of the devices in their particular application ■ Knowledge of the software and hardware environment for the particular application

2.7 Operational safety and particular hazards

Please observe the safety notes and the warnings listed here and in other chapters of this product documentation to reduce the possibility of risks to health and avoid dangerous situations.



WARNING
Electrical voltage!

Electrical voltage can cause severe injury or death.

- Work on electrical systems must only be performed by qualified electricians.
 - The power supply must be disconnected when attaching and detaching electrical connections.
 - The product must only be connected to a voltage supply as set out in the requirements in the operating instructions.
 - National and regional regulations must be complied with.
 - Safety requirements relating to work on electrical systems must be complied with.
-



WARNING
Risk of injury and damage caused by potential equalization currents!

Improper grounding can lead to dangerous equipotential bonding currents, which may in turn lead to dangerous voltages on metallic surfaces, such as the housing. Electrical voltage can cause severe injury or death.

- Work on electrical systems must only be performed by qualified electricians.
 - Follow the notes in the operating instructions.
 - Install the grounding for the product and the system in accordance with national and regional regulations.
-



WARNING
Health hazard as a result of high-frequency electromagnetic radiation!

The **RFU61x-10600**¹⁾ is designed for operation according to ETSI EN 302208. During operation, the human exposure regulations covered by EN 50364 must be observed.

- Limit human exposure to electromagnetic fields. Suitable safety distances must be maintained during both short-term and long-term work in the radiation range of the integrated antenna.
Minimum distances to be maintained between the antenna and the human body during long-term transmission: 10 cm and maximum radiation power of the antenna of 100 mW ERP (20 dBm) pursuant to ETSI.

The **RFU61x-10601**²⁾ satisfies the limit values of the FCC for exposure to radiation in an uncontrolled environment.

- During operation, a safety distance of at least 20 cm must be maintained between the antenna and the human body.
-

2.8 Repairs

Repair work on the device may only be performed by qualified and authorized personnel from SICK AG. Interruptions or modifications to the device by the customer will invalidate any warranty claims against SICK AG.

¹⁾ For regional assignment, see type-specific online data sheet on the Internet at: www.sick.com/RFU61x

²⁾ For regional assignment, see type-specific online data sheet in the Internet at: www.sick.com/RFU61x

3 Product description

3.1 Product ID

3.1.1 Type label

The type label gives information for identification of the device.

The type labels are located on the underside of the device.

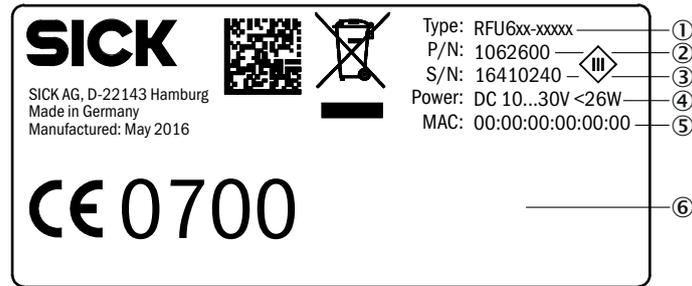


Figure 1: Structure of the type label

The UL certification is dependent on the type. An existing UL certification can be found on the type label.

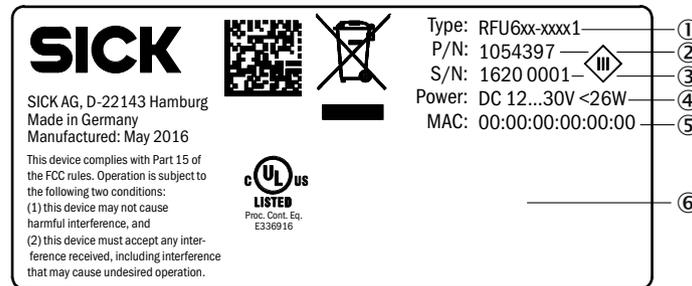


Figure 2: Structure of the type label with UL symbol

- ① Type designation
- ② Part number
- ③ Serial number
- ④ Supply voltage and power consumption
- ⑤ MAC address (placeholder)
- ⑥ Approval-related details (region-specific)

3.1.2 Type code

The devices of the RFU6xx product family are arranged according to the following type code:

RFUxyz-abcde

R	F	U	x	y	z	-	a	b	c	d	e
1	2	3	4	5	6		7	8	9	10	11

Position	Description	Characteristic
1 ... 2	RF (Radio Frequency Identification)	-
3	Frequency band	U: Ultra High Frequency

Position	Description	Characteristic
4 ... 5	Product family or version (working range)	61: ≤0.5 m (Short Range) 62: ≤2 m (Mid Range) 63: ≤10 m (Long Range) 65: ≤10 m (Long Range)
6	Device type	0: Base type (EPCglobal UHF Class 1 Generation 2, ISO/IEC 18000-6C)
7	Internal antenna	0: No integrated antenna 1: With integrated antenna, circularly polarized
8	Connections for external antennas	0: No connection 3: 3 connections 4: 4 connections
9	Electrical connections	1: 1 x male connector, M12, 17-pin, A-coded; 1 x female connector, M12, 4-pin, D-coded 4: Cable 0.9 m with male connector, D-Sub-HD, 15-pin 5: 1 x female connector, M12, 8-pin, X-coded 6: 1 x male connector, M12, 4-pin, A-coded, 1 female connector, M8, 4-pin, coded, 1 x female connector, M12, 8-pin, X-coded
10 ... 11	Country-specific radio equipment approval	00: Europe ... Type-dependent, see type-specific online data sheet at: <ul style="list-style-type: none"> • www.sick.com/RFU61x



NOTE

Not all combinations are possible according to the type code. The available device variants can be found online at:

- www.sick.com/RFU61x

3.2 Product characteristics

3.2.1 Device view

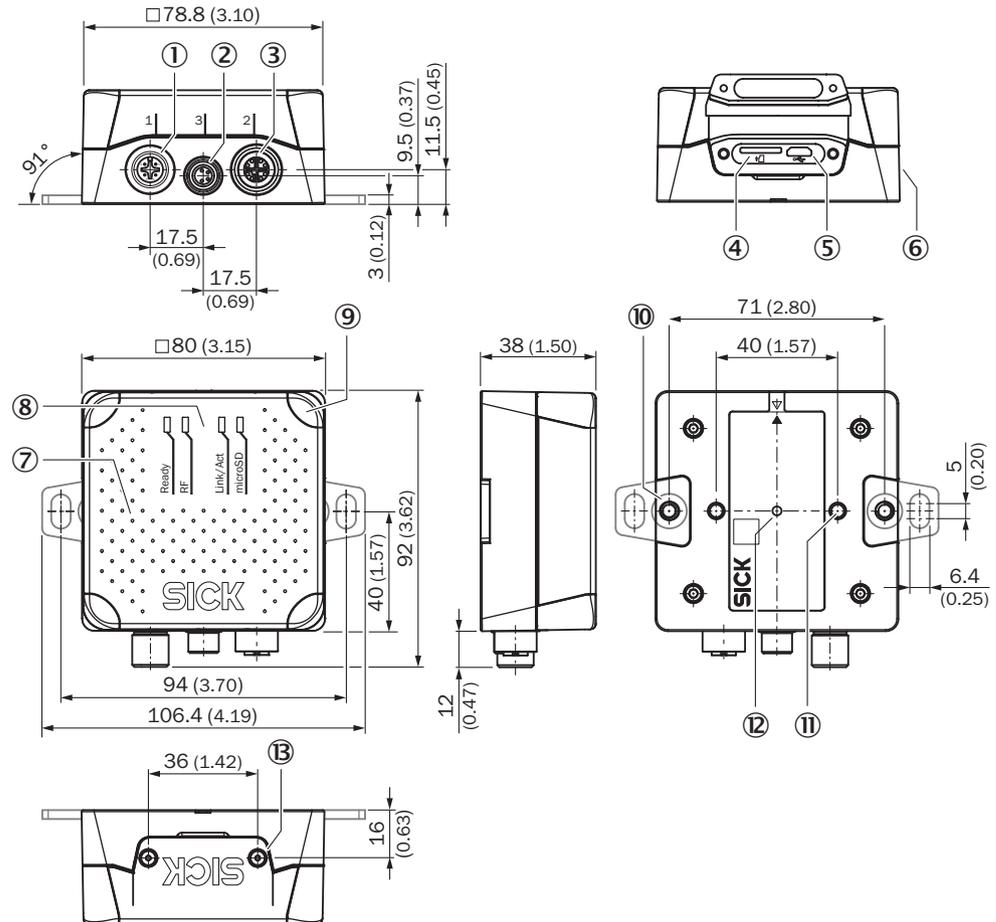


Figure 3: RFU61x-106xx: Structure and dimensions, unit: mm (inch), decimal separator: period

- ① Connection 1: Power (male connector, M12, 4-pin, A-coded)
- ② Connection 3: Trigger (female connector, M8, 4-pin, coded)
- ③ Connection 2: PoE (female connector, M12, 8-pin, X-coded)
- ④ Slot for microSD memory card
- ⑤ “USB” connection (female connector, 5-pin, Micro B type). The USB interface must only be used temporarily as a servicing interface!
- ⑥ Side type label
- ⑦ Optics cover with integrated antenna
- ⑧ 4 x multi-colored LED (status)
- ⑨ 4 x multi-color LED (process feedback)
- ⑩ 2 x M5 threaded mounting holes, 6 mm deep, for attaching the mounting straps
- ⑪ 2 x M5 blind tapped holes, 7 mm deep, for alternative mounting of the device
- ⑫ type label with integrated pressure compensation membrane
- Ⓑ 2 x screw (M2,5 socket screw), captive, for side cover

3.2.2 Working range of the antenna

Sensing range of the reading and writing field

The environment influences the UHF field of the integrated antenna, making it impossible to provide a “clear” demarcation of the sensing range.

- Application-specific reflections can result in both overreaches and “holes” (destructive interferences).
- Other factors that can significantly impact the sensing range include:
 - Quality of the transponder. The quality depends on the antenna gain, the integrated transponder IC and its sensitivity, the reflected energy.
 - Material of the carrier object (plastic, wood, metal)
 - Objects between the device and transponder that can affect the UHF field (items, liquids, people)

In addition to the read results, the RFU device can also output diagnostic data that provide an indication of the write and read quality. This data can be used to achieve optimum read results when setting up the system.

The radiation pattern shown here for the device’s antenna was obtained in a reproducible environment (absorber chamber as a reflection-free space) for illustrative purposes. The diagram may therefore only have limited applicability to your specific application. The diagram shows how the UHF field propagates in a reflection-free space, but cannot be used on-site to draw any conclusions on the likely sensing range in a real application.

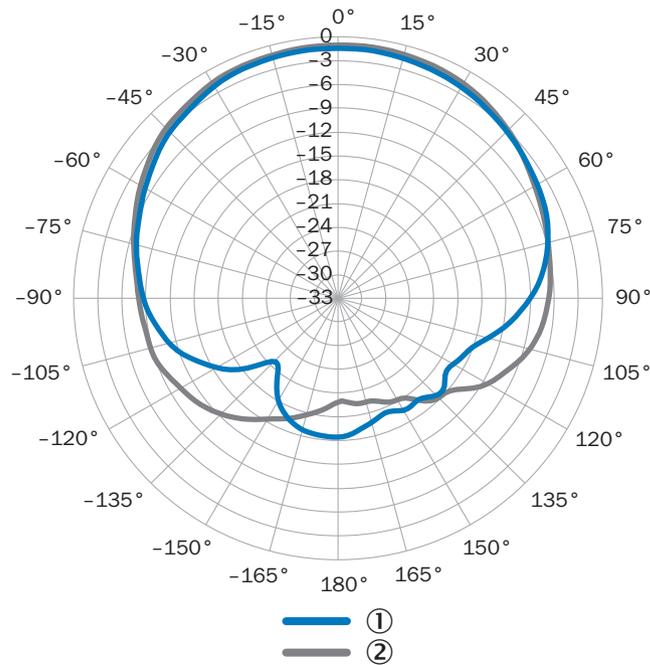


Figure 4: Radiation pattern of the integrated antenna of the RFU61x (typical): Measured antenna gain in dBic at 866.5 MHz, LHCP (left-hand circularly polarized)

- ① Horizontal plane (azimuth)
- ② Vertical plane (elevation)

3.2.3 Scope of delivery

The delivery of the device includes the following components:

Table 2: RFU61x: scope of delivery

No. of units	Component	Notes
1	Device in the version ordered (region assignment)	RFU61x-106xx The M12 and M8 electrical connections sealed with tightly-fastened protective plugs or caps. The joint side cover for the USB interface and the memory card slot is closed and screwed tight.

No. of units	Component	Notes
1	Mounting kit, consisting of <ul style="list-style-type: none"> • 2 x mounting strap • 2 x countersunk head screw with hexagon socket, M5 x 8 	Fastening clamps, protruding after mounting for fastening the device from the front at both sides. Alternatively for mounting from the rear: 2 M5 threaded mounting holes on the rear of the device.
	Printed Quick Start Guide, number of language versions dependent on region.	All available language versions of the Quick Start Guide can also be found online as PDFs at: <ul style="list-style-type: none"> • www.sick.com/RFU61x

The following associated components are not included in the delivery. The components are available on the Internet.

Table 3: RFU61x: Other components

Component	Notes
SOPAS ET configuration software and device description file (*.sdd-file) for the RFU61x	Available online at: <ul style="list-style-type: none"> • www.sick.com/SOPAS_ET
RFU61x operating instructions as PDF in English, French and German. Other languages are available online where applicable.	Available online at: <ul style="list-style-type: none"> • www.sick.com/RFU61x
RFU parameter description as PDF in English and German.	

Accessories

The following accessories for constructing a complete RFID read/write station are not included in the scope of delivery of the device. If required, order accessories separately.

- Read cycle trigger sensor, e.g. photoelectric retro-reflective sensor for object-specific triggering
- Suitable number of transponders depending on the application

3.2.4 Product features and functions (overview)



NOTE

In addition to the existing operating instructions, the use of the RFU parameter description is recommended:

- This parameter description explains the UHF-RFID-specific parameters of all device variants of the RFU6xx product family up to and including the “Service” user level.
- The parameter description supports the user in configuring applications with the SOPAS ET configuration software.

The parameter description is available in English (part no. 8023085) and German (part no. 8023084) as well as other languages if required.

The RFU parameter description can be found on the online product page at:

- www.sick.com/RFU61x

Table 4: Overview of product features and functions of the device

Product feature/function	Characteristic
Security and ease of use	<ul style="list-style-type: none"> • Rugged, compact metal housing, CE marking (Europe) • Automatic self-test at system start • Diagnostic tools for device setup and (remote) device monitoring • Configurable output of the read results including read diagnostics data in two output formats • Operating data request. In the event of an error: output of codified error messages on request • Test string function (heartbeat) can be activated to signal that the device is ready for operation • Future-proof due to firmware update via data interface • Future-proof SOPAS ET configuration software with password-protected configuration mode • SICK AppSpace ready: The device already includes SensorApp for integrating it into existing communication networks • Low power consumption • Wide supply voltage range. Supply via separate power source or PoE. • Large ambient temperature range. For details, see "Technical data", page 61 • Parameter cloning (to back up the configuration data in the internal device memory): <ul style="list-style-type: none"> ◦ By pluggable microSD memory card ¹⁾ externally in the device
Convenient operation/configuration	<ul style="list-style-type: none"> • Configuration (online or offline) using SOPAS ET configuration software • Single Tag ID Wizard (assistant) to help with initial configuration • Configuration and starting of device functions via a web server (SOPASair) or command strings • Optional function blocks for easier integration into PLC programs • PROFINET single port : Configuration via GSD parameterization • Application-specific programming is possible using the SICK AppStudio development environment. You can find further information on the Internet at: www.sick.com/SICK_AppStudio • Status and process feedback indicators via LEDs
Reading Operation Mode	<ul style="list-style-type: none"> • Start/stop operation: For reading one or more transponders during a read cycle.
Read cycle	<ul style="list-style-type: none"> • Start and stop conditions of the read cycle can be configured in the object trigger control: digital input
Radio interface(s)	<ul style="list-style-type: none"> • Integrated antenna
Transponder Processing	<ul style="list-style-type: none"> • Base model RFU610 supports all standard passive transponders that are compatible with EPCglobal UHF Class 1 Generation 2 or ISO/IEC-18000-6C • Reading, writing, and multiple overwriting of the data on the transponders, depending on the application • Within a process chain, the device supplying the data is a partial component for the complete visualization of data
Transponder Management	<ul style="list-style-type: none"> • Decoding of the UII in HEX, BIN and ASCII. Supports GS1 TDS and other industry-specific standards such as VDA55xx.
Data processing	<ul style="list-style-type: none"> • Variable read data output based on event-dependent evaluation conditions • Influencing the output string by filtering and output sorting • Implementation of application-specific data output protocols using the SICK AppStudio development environment (flexible back-end integration)

Product feature/function	Characteristic
Data communication	<p>Host interface</p> <ul style="list-style-type: none"> • Two data output formats configurable. • The output is switchable to different physical or logical interfaces. Parallel operation is possible. For outputting the data to a further-processing computer. <p>Aux interface</p> <ul style="list-style-type: none"> • Fixed data output format. • The output is switchable to different physical or logical interfaces. For the device configuration and diagnostics as well as the transponder access.
Electrical Interfaces	<ul style="list-style-type: none"> • Host interface <ul style="list-style-type: none"> ◦ Ethernet (supported protocols include, amongst others, PROFINET single port). • Aux interface <ul style="list-style-type: none"> ◦ Ethernet, USB ²⁾ • 1 digital input for external trigger sensor • Voltage supply (power or PoE)
Connectivity (Design)	<ul style="list-style-type: none"> • RFU61x-106xx: 2 x M12 male circular connector, 1 x M8 male circular connector, 1 x USB (Micro B type)

1) Optional accessories.

2) USB interface must only be used temporarily as a servicing interface!

3.2.5 Memory card



NOTE

The memory card is an optional accessory and is not included in the scope of delivery.

Functions

The device can execute the following functions on the plug-in microSD memory card:

- **Saving the parameter set (cloning function)**
Semi-automatic, additional storage of the internal parameter set (device configuration data) on an external memory medium. This takes place in the framework of the recommended backup concept for the 4Dpro device parameter sets.
 - This function is initiated by using the “permanent” option to save the internal parameter set, e.g. via the SOPAS ET configuration software.
 - The function is used, among other things, to conveniently transfer the parameter set to a replacement device of the same type in the event of a fault.
 - A MicroSD memory card that can be plugged into the device serves as an optional, external medium
- **Recording of diagnostic read data**
Continuous recording of diagnostic read data after the first manual start, e.g., via SOPAS ET. Recording is resumed after a device restart if the function has been permanently set.
- Other functions on request.

We recommend using an empty memory card when storing a parameter set for the first time (if necessary, use a PC and card reader to check and delete the contents of the card).



NOTE

Only use types approved by SICK to ensure reliable function of the memory card. You can find these as accessories online at:

- www.sick.com/RFU61x

The memory card has no write protection that can be activated.

Indication of operational readiness

The “microSD” optical indicator shows the status of the memory card after installation in the device. It lights up in different colors according to the status, see ["Optical status indicators on the display panel"](#), page 51.



NOTICE

Possible data loss!

When the indicator is green (operational), this does not mean that the device is actually accessing the memory card for reading or writing.

- ▶ Do not remove the memory card or switch off the supply voltage while the following functions are taking place in the device via the SOPAS ET configuration software:
 - Saving the parameter values using the “permanent” option
 - Starting functions that access the memory card (e.g. concurrent logging of data)

Inserting the memory card in the device:



NOTICE

Risk of damage to the memory card!

- ▶ To safely install the memory card, make sure there is no power to the device before you insert it.

Ensure the IP67 enclosure rating of the device is maintained see ["Conditions for specified enclosure rating"](#), page 10.

The card slot on the device is located under the cover foil on the side opposite the electrical connections.

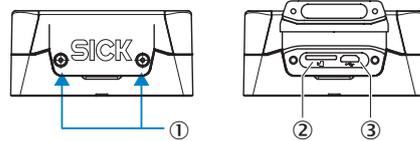


Figure 5: Slot for MicroSD memory card and “USB” connection

- ① 2 x screw, M2.5 hexagon socket
- ② Slot for microSD memory card
- ③ “USB” connection (female connector, 5-pin, Micro B type)

1. Switch off the supply voltage to the device.
2. Loosen both screws on the cover.
3. Carefully fold up the cover.
4. Making sure it is in the correct position, insert the memory card into the slot until it locks into place. When doing so, orient the contacts so that they are facing towards the device and downwards as per the symbol on the device.

5. Screw the cover back on. Recommended tightening torque for the cover screws: 30 Ncm \pm 5 Ncm.
6. Switch on the supply voltage for the device.

Interpretation of the stored parameter set

Once it is switched on, the device automatically detects the presence of a memory card and, depending on the card's content, behaves as follows:

- If the memory card is empty or if does not contain a parameter set that can be interpreted by the device: the device saves its currently valid internal parameter set to the card (provided there is sufficient storage space) and starts with the internal parameter set.
- If the card contains a parameter set that can be interpreted by the device: the device overwrites the currently valid internal parameter set with this external parameter set.

The goal is for the internal parameter set and the parameter set saved externally to always be identical.

Removing the memory card from the device:



NOTICE

Risk of damage to the memory card!

- ▶ To safely remove the memory card while the device is in operation:
 - In SOPAS ET, execute the **Remove SD card** command under **Analysis/SD card** and wait for SOPAS ET to provide confirmation.
 - If this command is not accessible, the memory card can also be removed when there is no power to the device.

4 Transport and storage

4.1 Transport

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



NOTICE

Damage to the product due to improper transport.

- The device must be packaged for transport with protection against shock and damp.
 - Recommendation: Use the original packaging as it provides the best protection.
 - Transport should be performed by trained 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 Unpacking

- Before unpacking, it may be necessary to equalize the temperature to protect the device from condensation.
- Handle the device with care and protect it from mechanical damage.
- Remove the protective caps or protective plugs on the electrical connections immediately before connecting the connecting cable to prevent dirt and moisture from entering.

4.3 Transport inspection

Immediately upon receipt in Goods-in, 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.

4.4 Storage

Store the device under the following conditions:

- Recommendation: Use the original packaging.
- Electrical connections are provided with protective caps and plugs (as they are on delivery).
- Do not store outdoors.
- Store in a dry area that is protected from dust.
- So that any residual damp can evaporate, do not package in airtight containers.
- Do not expose to any aggressive substances.
- Protect from sunlight.
- Avoid mechanical shocks.
- Storage temperature: see "Technical data", page 61.

- Relative humidity: [see "Technical data", page 61.](#)
- For storage periods of longer than 3 months, check the general condition of all components and packaging on a regular basis.

5 Mounting

5.1 Overview of mounting procedure

The procedure for mounting the device is divided into the following steps:

1. Select a suitable mounting location for the device.
The mounting location and position depend on the following factors:
 - Identification task
 - Working range of the device (see ["Working range of the antenna"](#), page 15)
 - Transponder used
 - Environmental influences
2. Mount the device at the intended reading point and temporarily align the device to the object with transponder. Make sure that there is a suitable distance to the object.
3. If required, mount the read-cycle sensor for object-specific triggering.

After the electrical installation is complete and while adjusting the device parameters to suit the application:

4. **Finely** align the device to the object and adjust it.
5. Test for successful reading and writing of the device in operational use of the application.

5.2 Preparation for mounting

5.2.1 Installation requirements

Space requirements

- For the typical space requirements, see the:
 - Dimensional drawing of the device see ["Device view"](#), page 15 and propagation of the UHF field, see ["Working range of the antenna"](#), page 15.

The device does not require any physical or visual contact with the transponders. The device does, however, need to be aligned with the reading space.

Environmental influences

- Comply with technical data, such as the permitted ambient conditions for operation (e.g. approved region, ambient temperature range, ground potential), see ["Technical data"](#), page 61.
- To prevent condensation, avoid exposing the device to rapid changes in temperature.
- To prevent additional external heating of the device, protect the device against sunlight.
- In order to avoid reflections of the UHF waves and any associated physical phenomena, make sure if possible that there are no metal surfaces on the side of the device in the direction of the transponder.
Possible disturbances of the UHF field caused by reflections of the UHF waves are:
 - Overreaches
 - "Holes" (destructive interferences)
- To avoid attenuation of the UHF field by absorption, exclude the following between device and transponder:
 - Electrically conductive material, e.g. liquids (water)
 - Persons or animals

Mounting

- Fasten the device using the 2 fastening clamps supplied or the 2 M5 threaded mounting holes.
- Mount the device where they will not be exposed to shocks or vibration.

5.2.2 Instructions for mounting the device when the ambient temperature can fall below 0 °C

The device can also be operated at low ambient temperatures. For details, see ["Technical data", page 61](#).



NOTE

For the electrical installation procedure, see ["Instructions for electrical installation when the ambient temperature can fall below 0 °C", page 40](#)



NOTICE

Operating the device at the lower limit of the permissible ambient temperature range

The ensure the device can produce the required heating power, do not expose the device to strong air flows (e.g. from a ventilation system).

- ▶ If necessary, take appropriate measures to shield the device from air flows.



NOTICE

If the ambient temperature is below 0 °C, please note:

- **Do not** move the connecting cables to the device

5.2.3 Auxiliary equipment required

- If the two fastening clamps of the enclosed mounting kit do not cover the mounting situation of the application, the customer must provide a suitable mounting device (bracket). The bracket requires sufficient load-bearing capacity, see ["Technical data", page 61](#) and dimensions adapted to the device, see ["Device view", page 15](#).
- 2 M5 screws to attach the device to a bracket if the supplied mounting straps are not used.



NOTE

The screws are for mounting the device on mounting equipment (bracket) supplied by the user. The screw length required depends on the mounting base (wall thickness of the bracket).

When using an optional SICK bracket, the screws for mounting the device on the bracket are included in the scope of delivery.



NOTICE

Risk of damage to the device!

Screws that are not suitable for the length of the threaded mounting holes can damage the device.

- M5 threaded mounting hole for mounting from the rear: screw in screws to a maximum depth of 7 mm!
- M5 threaded mounting holes for mounting strap: Do not exceed the maximum screw-in depth of 6 mm!

- Tool and tape measure

5.2.4 Mounting device

The device can be mounted using the 2 mounting straps (supplied mounting kit part no. 2105772) after attachment on the device from the front or rear. The associated 2 M5 threaded mounting holes for the fastening clamps are each located on the outside of the rear of the device, in the recess, see "Device view", page 15.



Figure 6: Back view RFU61x: device with mounted mounting straps

Alternatively, the device is fastened using the 2 M5 internal threaded mounting holes. The threaded mounting holes are also located on the rear of the device.

Further, optional SICK brackets

The device can be mounted using additional optional SICK brackets, a combination of SICK brackets and elements, or a customer-specific bracket.

SICK offers prefabricated brackets which are optimally suited for mounting the device in a wide range of applications.

Also see on Internet at:

- www.sick.com/RFU61x



NOTE

Dimensional drawings for SICK brackets and, if applicable, mounting instructions can be found online at: www.sick.com

- ▶ To do so, enter the 7-digit part number of the bracket in the search field.

User-supplied brackets

A user-supplied bracket should meet the following requirements:

- Stable mounting device
 - Allow the device to be aligned in the x and y axes.
 - The mounting device must be able to bear the weight of the device, including connecting cables, in a shock-proof manner, see "Technical data", page 61.
 - In mounting situations with strong vibrations, it may be necessary to provide shock mounts.
- For mounting the device according to the dimensional drawing: 2 suitable holes for M5 screws.

5.3 Mounting location

When selecting the mounting location, the following factors are significant:

- Spatial working range of the antenna
- Distance to objects with a transponder
- Influence of the environment on the UHF field produced, for example:
 - Metal surfaces located to the side of and in the vicinity of the device
 - Electrically conductive liquids between the antenna and transponder
 - Persons between the antenna and transponder

5.4 Mounting the device



WARNING

Risk of injury due to damage to the device

For reasons of safety, if a device shows visible signs of damage do not put it into operation, or take it out of operation immediately.

Damage includes, for example, depending on type:

- Housing: cracking, splitting or fracture
- Electrical connections: cracks or detachment from the housing
- Device with cable connection: damage to the cable outlet or cable itself



NOTICE

Risk of damaging the device!

Observe the maximum screw-in depth of the blind tapped holes on the device. Longer screws than the specified screw-in depth damage the device.

- ▶ Use screws of suitable length.

Basic arrangement of the device to the transponders

UHF transponders have dipole antennas and therefore preferential directions within the radiation field of the antenna. The transmitting and receiving performance will be higher or lower depending on the orientation of the dipole antenna of the transponder to the axis perpendicular to the antenna surface. The reading and writing rate and sensing range can therefore be subject to fluctuations.



NOTE

If the dipole antenna of the transponder is oriented lengthwise along the axis perpendicular to the antenna surface, no reading or writing of the transponder will be possible.

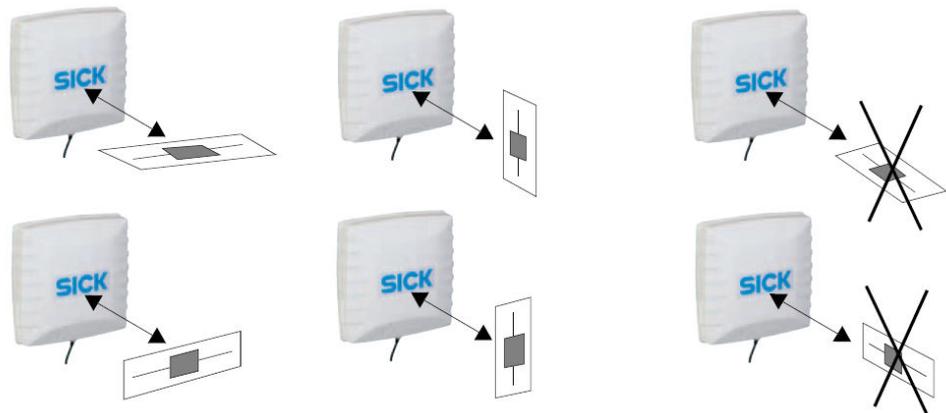


Figure 7: The optimal orientation of the transponder for good writing and reading results is demonstrated here for an external UHF antenna

Mounting and aligning the device



NOTICE

Avoid mutual interference when operating several devices

When the reading/writing ranges of several independently operated devices overlap, this can lead to mutual impairment of the system performance of the devices.

In order to avoid such constellations, the devices each offer Sync mode.

With the Sync Mode, several devices can be synchronized in read/write behavior. For this purpose, the devices must be connected to one another via an Ethernet network. Sync mode then ensures that only one device at a time is performing a read/write operation and therefore communicating over the air interface. One master controls up to three slaves.

1. Prepare the base for mounting the bracket of the device, [see "Preparation for mounting", page 24](#).
Recommendation: Depending on the application it may be possible to use one of the optional SICK brackets. If necessary, perhaps also in combination with other SICK brackets.
2. At the intended reading location, place an object with transponder within the working range of the device (static object only).
3. Mount the device bracket onto the base.
4. Tighten screws through the bracket into the blind tapped holes of the device and slightly tighten.
5. Orient the front side of the device towards the object.
 - Ensure, where possible, that there are no large metal surfaces located in front of the device.
 - If this is unavoidable, do not mount the device in the same plane as the surface but rather at an angle of inclination of approx. 10°.

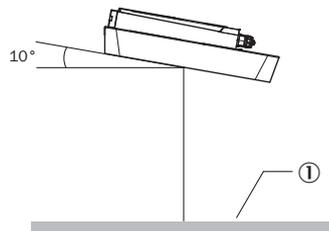


Figure 8: Selected angle of inclination of the device or external antennas when there is a large metal surface in front, e. g. 10°

① Metal surface

6. Tighten the screws.
- ✓ The device is approximately aligned with the object to be detected.
7. Check the general suitability of the alignment for objects of different sizes and varying positions of the transponder in operational use of the application.

5.5 Mounting external components

5.5.1 Mounting the external read cycle trigger sensor

Conveying line

To detect objects with transponders, mount the trigger sensor in suitable proximity to the device in front of the device in the opposite direction to the direction of movement.

**NOTE**

A large selection of photoelectric sensors and accessories (brackets, connecting cables) can be found online at: www.sick.com

6 Electrical installation

6.1 Safety

6.1.1 Notes on electrical installation

Connection work

- **Electrical installation must only be performed by electrically qualified personnel.**
- **Standard safety requirements must be observed when working on electrical systems!**
- All connection work must be performed at ambient temperatures above 0 °C, [see "Ambient data", page 63](#)
- Electrical connections between the device and other devices may only be made or separated in a voltage-free state. Otherwise, there is a risk of damaging the devices.
- Where connecting cables with one end open are concerned, make sure that bare wire ends are not touching (risk of short circuit when the supply voltage is switched on). Wires must be appropriately insulated from each other. This also applies to unused wires.
- The wire cross-sections of the data and, if applicable, switching signal cables must be selected in accordance with the applicable national standards.



NOTE

For additional instructions on operating the device at ambient temperatures below 0 °C, [see "Prerequisites", page 40](#)

Supply voltage

- Connect the device only to the permissible supply voltage, [see "Connecting the supply voltage", page 43](#)
- The wire cross-sections in the supply cable from the user's power system must be selected in accordance with the applicable national standards. When this is being done in Germany, observe the following standards: DIN VDE 0100 (Part 430) and DIN VDE 0298 (Part 4) and/or DIN VDE 0891 (Part 1).
- All circuits connected to the device must be designed as ES1 circuits. The voltage supply or power supply unit must satisfy ES1 requirements in accordance with the currently applicable EN 62368-1, [see "Mechanics and electronics", page 62](#).
- Only switch on the supply voltage to the device, after first:
 - Completing the connection work
 - Carefully checking the wiring work

Data cables



NOTE

Layout of data cables

- Use shielded data cables with twisted-pair wires.
- The possible cable length between the device and host computer depends on:
 - The chosen physical version of the host interface
 - The data transmission rate set in the device
 For further information, see ["Wiring the data interface", page 46](#).
- Implement the shielding design correctly and completely.
- To avoid interference, always use EMC-compliant cables and layouts. This applies, for example, to cables for switched-mode power supplies, motors, clocked drives, and contactors.
- Do not lay cables in parallel with voltage supply cables or motor cables in cable channels over longer distances.

Conditions for specified enclosure rating

To ensure compliance with the specified IP67 enclosure rating of the device, the following requirements must be met. If these requirements are not met, the device does not fulfill any specified enclosure rating.

- The joint side cover for the USB interface and the memory card slot is placed against the device and screwed on tight.
- The cables plugged into the electrical M12 and M8 connections must be screwed tight.
- Any M12 and M8 connections that are not being used must be sealed with protective plugs or caps, depending on type. These plugs or caps must be screwed tight (as in the delivery condition).

The same also applies to the EMC requirement (ESD) according to CE.



NOTICE

The type label on the lower side of the device contains a pressure equalizing membrane. If damaged, water and dust leaks could occur.

Positions of the individual elements see ["Device view", page 15](#)



NOTICE

The device can, if necessary, be operated for a short time **without the side cover** to perform the following tasks:

- Inserting or removing the optional memory card
- Temporary use of the USB interface as a servicing interface

During this time, protect the device against moisture and dust.

6.1.2 Prerequisites for safe operation of the device



WARNING

Risk of injury and damage caused by electrical current!

As a result of equipotential bonding currents between the device and other grounded devices in the system, faulty grounding of the device can give rise to the following dangers and faults:

- Dangerous voltages are applied to the metal housings.
- Devices will behave incorrectly or be destroyed.
- Cable shielding will be damaged by overheating and cause cable fires.

Remedial measures

- Only skilled electricians should be permitted to carry out work on the electrical system.
- If the cable insulation is damaged, disconnect the voltage supply immediately and have the damage repaired.
- Ensure that the ground potential is the same at all grounding points.
- Where local conditions do not meet the requirements for a safe earthing method, take appropriate measures (e.g., ensuring low-impedance and current-carrying equipotential bonding).

The device is connected to the peripheral devices (voltage supply, any local trigger sensor(s), system controller) via shielded cables. The cable shield – for the data cable, for example – rests against the metal housing of the device. The device can be grounded through the cable shield or through a blind tapped hole in the housing, for example.

If the peripheral devices have metal housings and the cable shields are also in contact with their housings, it is assumed that all devices involved in the installation have the **same ground potential**.

This is achieved by complying with the following conditions:

- Mounting the devices on conductive metal surfaces
- Correctly grounding the devices and metal surfaces in the system
- If necessary: low-impedance and current-carrying equipotential bonding between areas with different ground potentials

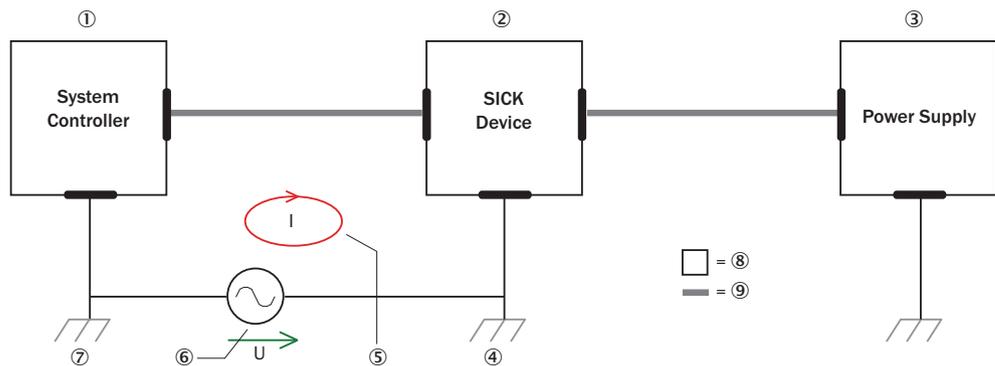


Figure 9: Example: Occurrence of equipotential bonding currents in the system configuration

- ① System controller
- ② Device
- ③ Voltage supply
- ④ Grounding point 2
- ⑤ Closed current loop with equalizing currents via cable shield
- ⑥ Ground potential difference

- ⑦ Grounding point 1
- ⑧ Metal housing
- ⑨ Shielded electrical cable

If these conditions are not fulfilled, equipotential bonding currents can flow along the cable shielding between the devices due to differing ground potentials and cause the hazards specified. This is, for example, possible in cases where there are devices within a widely distributed system covering several buildings.

Remedial measures

The most common solution to prevent equipotential bonding currents on cable shields is to ensure low-impedance and current-carrying equipotential bonding. If this equipotential bonding is not possible, the following solution approaches serve as a suggestion.



NOTICE

We expressly advise against opening up the cable shields. This would mean that the EMC limit values can no longer be complied with and that the safe operation of the device data interfaces can no longer be guaranteed.

Measures for widely distributed system installations

On widely distributed system installations with correspondingly large potential differences, the setting up of local islands and connecting them using commercially available **electro-optical signal isolators** is recommended. This measure achieves a high degree of resistance to electromagnetic interference.

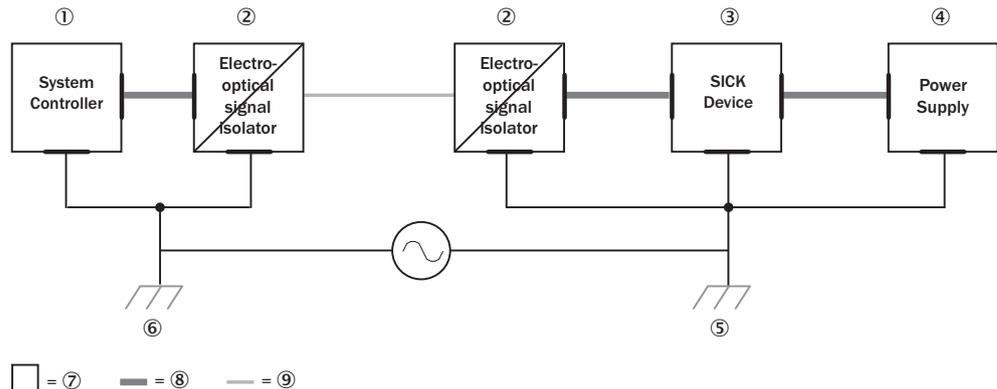


Figure 10: Example: Prevention of equipotential bonding currents in the system configuration by the use of electro-optical signal isolators

- ① System controller
- ② Electro-optical signal isolator
- ③ Device
- ④ Voltage supply
- ⑤ Grounding point 2
- ⑥ Grounding point 1
- ⑦ Metal housing
- ⑧ Shielded electrical cable
- ⑨ Optical fiber

The use of electro-optical signal isolators between the islands isolates the ground loop. Within the islands, a stable equipotential bonding prevents equalizing currents on the cable shields.

Measures for small system installations

For smaller installations with only slight potential differences, insulated mounting of the device and peripheral devices may be an adequate solution.

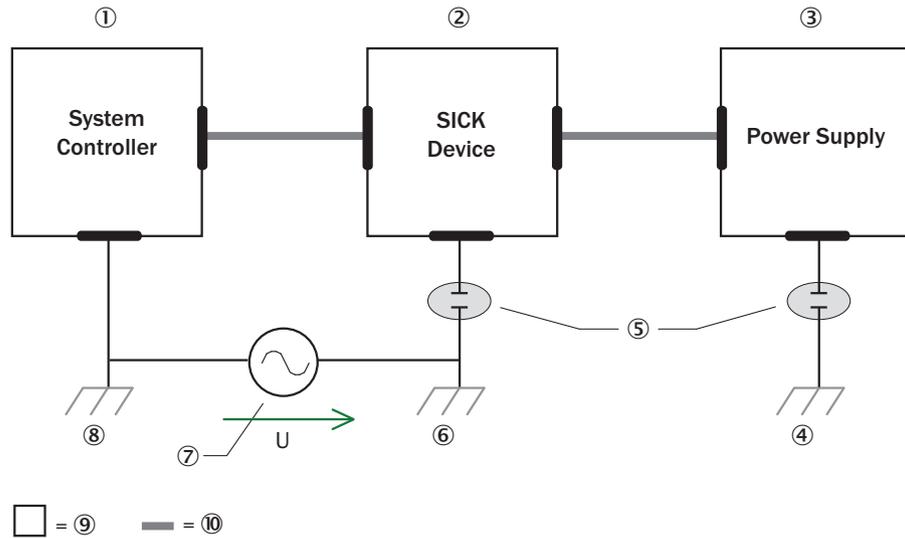


Figure 11: Example: Prevention of equipotential bonding currents in the system configuration by the insulated mounting of the device

- ① System controller
- ② Device
- ③ Voltage supply
- ④ Grounding point 3
- ⑤ Insulated mounting
- ⑥ Grounding point 2
- ⑦ Ground potential difference
- ⑧ Grounding point 1
- ⑨ Metal housing
- ⑩ Shielded electrical cable

Even in the event of large differences in the ground potential, ground loops are effectively prevented. As a result, equalizing currents can no longer flow via the cable shields and metal housing.



NOTICE

The voltage supply for the device and the connected peripheral devices must also guarantee the required level of insulation.

Under certain circumstances, a tangible potential can develop between the insulated metal housings and the local ground potential.

6.2 Wiring instructions



NOTICE

Faults due to incorrect wiring!

Incorrect wiring may result in operational faults.

- Follow the wiring instructions closely.

Pre-assembled cables

**NOTE**

Pre-assembled cables can be found online at:

- www.sick.com/RFU61x

Pre-assembled cables with open cable end at one end**NOTE**

For information on the pin, signal and wire color assignments for the RFU61x see "[Signal assignment of cables with open cable end at one end](#)", page 65, in the appendix.

6.3 Overview of all interfaces and connection options

**NOTE**

The USB interface of the device is used in industrial environments only as a service interface for temporary use (e.g. for configuration, troubleshooting). Permanent use in operational use of the system as a host interface is not intended.

**NOTE**

The numbering of the data interfaces (Aux 1, etc.) in the following block diagrams provides a better overview, but is not shown in configuration tools such as the SOPAS ET configuration software.

6.3.1 RFU61x-106xx (connection: power and Ethernet)

Service operation

The following functions can be executed via one of the three data interfaces (Aux 1, Aux 2 or Host 1):

- Configuration
- Representation of the reading result (detected transponders)
- Transponder access (reading and writing data)
- Reading diagnostics (read result in fixed output format)

For a detailed overview, see "[Use of the data interfaces](#)", page 38.

This is illustrated here for the Aux interface, the Aux port of the Ethernet interface, and alternatively the USB interface.

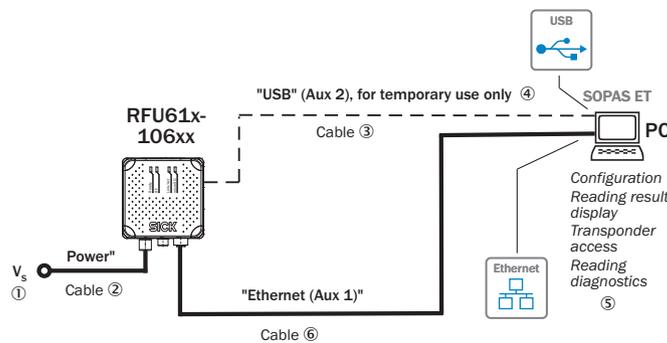


Figure 12: Block diagram RFU61x-106xx (power and Ethernet connection): service operation, e.g. display of read result

- ① Supply voltage V_s
- ② Power adapter cable for connection 1 (female connector, M12, 4-pin, A-coded/flying leads), e.g. part no. 2095607
- ③ USB adapter cable (male connector, USB, Micro-B type/male connector, USB, type A)

- ④ USB, alternative to Ethernet Aux port. The USB interface must only be used temporarily as a servicing interface!
- ⑤ Configuration with SOPAS ET, prepared representation of the read result, transponder access or reading diagnostics
- ⑥ Ethernet adapter cable for connection 2 (male connector, M12, 8-pin, X-coded/male connector, RJ-45, 8-pin), e.g. part no. 6049728

Read operation

In operational use of the application, the device outputs the read result to the further processing computer via the host interface. Select one of two configurable output formats for this purpose. The device can also output the same output format or a second output format in parallel via the Aux interface.

For a detailed overview, see "Use of the data interfaces", page 38.

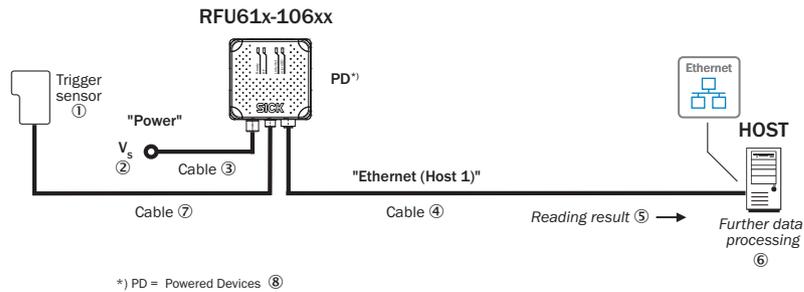


Figure 13: Block diagram RFU61x-106xx (power and Ethernet connection): read operation

- ① Trigger sensor for external read cycle, e.g. GL6 (part no. 1059241)
- ② Supply voltage V_s
- ③ Power adapter cable for connection 1 (female connector, M12, 4-pin, A-coded/flying leads), e.g. part no. 2095607
- ④ Ethernet adapter cable for connection 2 (male connector, M12, 8-pin, X-coded/male connector, RJ-45, 8-pin), e.g. part no. 6049728
- ⑤ Read result (configurable output format 1 or 2)
- ⑥ Data further processing
- ⑦ Trigger connecting cable for connection 3 (male connector, M8, 4-pin/male connector, M8, 4-pin), e.g. part no. 2096347
- ⑧ PD = Energy consumer

6.3.2 RFU61x-106xx (connection: Power over Ethernet)

Service operation

The following functions can be executed via one of the three data interfaces (Aux 1, Aux 2 or Host 1):

- Configuration
- Representation of the reading result (detected transponders)
- Transponder access (reading and writing data)
- Reading diagnostics (read result in fixed output format)

For a detailed overview, see "Use of the data interfaces", page 38.

This is illustrated here for the Aux interface, the Aux port of the Ethernet interface, and alternatively the USB interface.

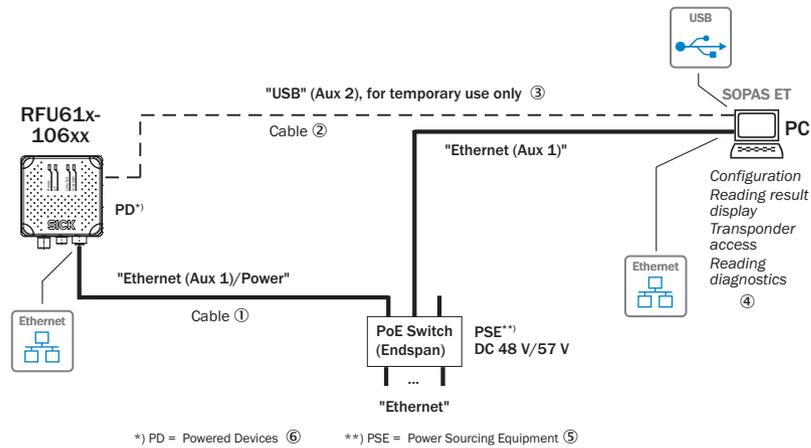


Figure 14: Block diagram RFU61x-106xx (PoE connection): service operation, e.g. display of read result

- ① Ethernet adapter cable (male connector, M12, 8-pin, X-coded/male connector, RJ-45, 8-pin), e.g. part no. 6049728
- ② USB adapter cable (male connector, USB, Micro-B type/male connector, USB, type A)
- ③ USB, alternative to Ethernet Aux port. The USB interface must only be used temporarily as a servicing interface!
- ④ Configuration with SOPAS ET, prepared representation of the read result, transponder access or reading diagnostics
- ⑤ PSE = Energy source
- ⑥ PD = Energy consumer

Read operation

In operational use of the application, the device outputs the read result to the further processing computer via the host interface. Select one of two configurable output formats for this purpose. The device can also output the same output format or a second output format in parallel via the Aux interface.

For a detailed overview, see "Use of the data interfaces", page 38.

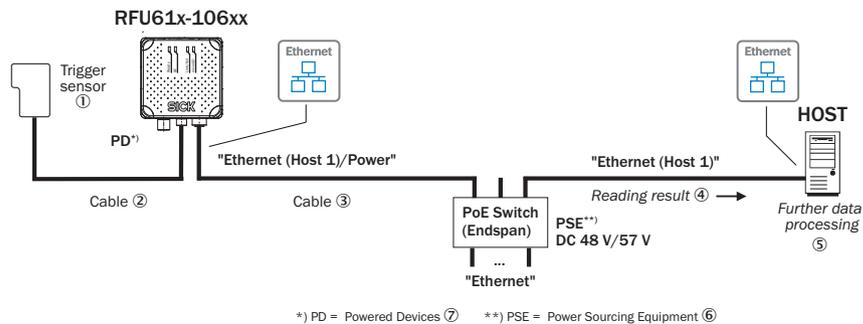


Figure 15: Block diagram RFU61x-106xx (PoE connection): read mode

- ① Trigger sensor for external read cycle, e.g. GL6 (part no. 1059241)
- ② Trigger connecting cable (male connector, M8, 4-pin, coded/male connector, M8, 4-pin, coded), e.g. part no. 2096347
- ③ Ethernet adapter cable (male connector, M12, 8-pin, X-coded/male connector, RJ-45, 8-pin), e.g. part no. 6049728
- ④ Read result (configurable output format 1 or 2)
- ⑤ Data further processing
- ⑥ PSE = Energy source
- ⑦ PD = Energy consumer

6.3.3 Use of the data interfaces

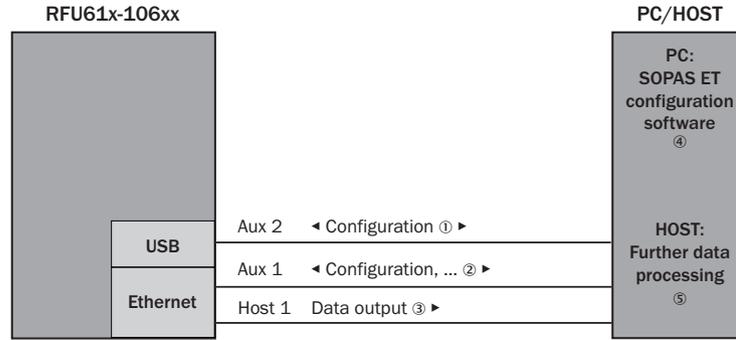


Figure 16: Data interfaces of the RFU61x-106xx and their preferred uses

- ① Service operation: Configuration with SOPAS ET, interface only for temporary use
- ② Service operation: Configuration with SOPAS ET, prepared representation of the read result, transponder access or reading diagnostics
- ③ Read operation: Data output of the read result (configurable output format 1 or 2),
- ④ SOPAS ET configuration software
- ⑤ Data further processing

Table 5: Functions relating to data interfaces

Possible interface →	Host 1	Aux 1	Aux 2
Assignable function ↓	Ethernet	Ethernet	USB ¹⁾
Read result output (configurable format 1 or 2)	●	●	
Reading diagnostics (fixed output format)		●	
With SOPAS ET: Configuration, representation of the read results in the Quickstart display window, transponder access	○	○	○
Configuration with commands	○	○	○ ²⁾
Configuration using web server	○	○	
● = Output of the same function via the interfaces possible at the same time ○ = Access only makes sense via one of the interfaces (risk of collision!)			

¹⁾ The USB interface must only be used temporarily as a servicing interface!

²⁾ Input using the terminal in SOPAS ET (Version 3.3.0 or higher) or other USB-capable terminal programs.



NOTE

- Only one of several available functions can be assigned to each interface.

The logical Aux interface of the device can operate the Aux port of the Ethernet interface, and the USB interface in parallel.

The logical host interface of the device operates the host port of the Ethernet interface.

The data output triggered by means of a command string only occurs, however, at the data interface on which the request was received.

6.4 Pin assignments of electrical connections

6.4.1 Connection: power and Ethernet

6.4.1.1 Connection 1: power

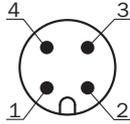


Figure 17: M12 male connector, 4-pin, A-coded

Table 6: Pin assignment of the “Power” connection

Pin	Signal	Function
1	V _s	Supply voltage
2	N.c.	-
3	GND_ext	Primary ground
4	N.c.	-

6.4.1.2 Connection 2: “Ethernet”

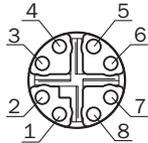


Figure 18: Female connector, M12, 8-pin, X-coded

Table 7: Pin assignment of the “Ethernet” connection

Pin	Signal	Function
1	TD+	Sender+
2	TD-	Sender-
3	RD+	Receiver+
4	RD-	Receiver-
5	PoE-	Supply voltage-
6	PoE-	Supply voltage-
7	PoE+	Supply voltage+
8	PoE+	Supply voltage+

6.4.2 Connection: Power over Ethernet

6.4.2.1 Connection 2: “PoE”

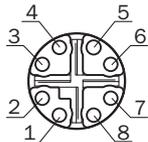


Figure 19: Female connector, M12, 8-pin, X-coded

Table 8: Pin assignment of the “PoE” connection

Pin	Signal	Function
1	TD+	Sender+
2	TD-	Sender-
3	RD+	Receiver+
4	RD-	Receiver-
5	PoE-	Supply voltage-
6	PoE-	Supply voltage-
7	PoE+	Supply voltage+
8	PoE+	Supply voltage+

6.4.3 Connection of external trigger sensor

6.4.3.1 Connection 3: “Trigger”

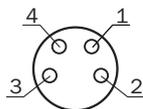


Figure 20: Female connector, M8, 4-pin, coded

Table 9: Pin assignment of the “Trigger” connection

Pin	Signal	Function
1	V _{S trigger}	Supply voltage for external trigger sensor
2	N.c.	-
3	GND	Functional ground
4	Sensor 1	Digital input

6.5 Instructions for electrical installation when the ambient temperature can fall below 0 °C



NOTE

For mounting instructions, see "Instructions for mounting the device when the ambient temperature can fall below 0 °C", page 25

All device variants can also be operated at low ambient temperatures. For details, see "Technical data", page 61

6.5.1 Prerequisites

- Required supply voltage: see "Supply voltage", page 43
- Use SICK standard cables for the specified ambient temperature range, see www.sick.com/RFU61x
- Do not operate the device at ambient temperatures below 0 °C when mounting or connection work is being carried out.
- Perform all connection work only in the ambient temperature range 0 °C to +50 °C. Secure the connecting cables.
- The joint side cover for the USB interface and the memory card slot is screwed tightly onto the device.

- All cables connected to the device must be clamped. Electrical M12 or M8 connections that are not being used must be sealed with screw-on protective elements as in the delivery condition. Protective caps for male connectors or protective plugs for female connectors.
- When operating the device at the lower limit of the permissible ambient temperature range (see "Technical data", page 61), do not expose the device to strong air flows (e.g. ventilation system, wind).

6.5.2 Behavior of the device when switched on

After application of the supply voltage and initialization, the device can immediately be addressed by the SOPAS ET configuration software.

Table 10: Behavior of the device when switched on at low temperatures

Internal temperature of housing	Behavior
Below -25 °C	"Ready" LED continuously flashes orange. Device is not operational because -25 °C is below the specified minimum limit value.
$-25\text{ °C} \dots -20\text{ °C}$	"Ready" LED continuously flashes green (warm-up phase). Device is not operational (communication channel still disabled) until the internal temperature has increased to -20 °C as a result of the heat generated by the electronics. Duration approx. 2 min.
From -20 °C	"Ready" LED permanently lights up green. The device has started regular operation.

1) For Firmware Version V2.02

Once the supply voltage has been applied, the device uses integrated temperature sensors to measure its internal temperature. This is performed by the device while booting.

6.6 Installation steps

6.6.1 Wiring of the device for Quickstart



NOTE

The numbering of the data interfaces (Aux 1, etc.) in the following block diagrams provides a better overview, but is not shown in the SOPAS ET configuration software.

Connection type: power and Ethernet

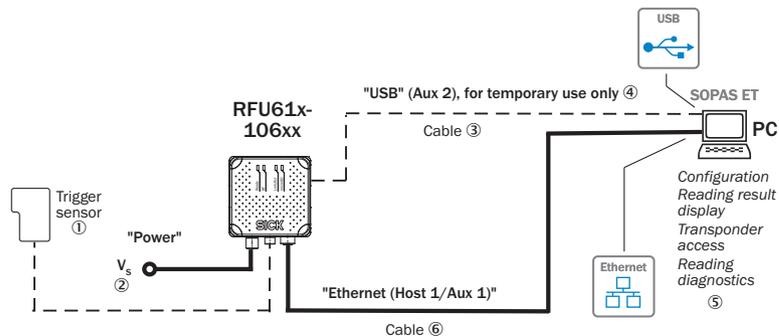


Figure 21: Commissioning: connection block diagram of the RFU61x-106xx (power and Ethernet)

- ① Trigger sensor for external read cycle (optional)
- ② Supply voltage V_s
- ③ Adapter cable (male connector, USB, Micro-B type/male connector, USB, type A)

- ④ USB, alternative to Ethernet Aux port. The USB interface must only be used temporarily as a servicing interface!
- ⑤ Configuration with SOPAS ET, prepared representation of the read result, transponder access or reading diagnostics
- ⑥ Adapter cable (male connector, M12, 8-pin, X-coded/male connector, RJ-45, 8-pin)

Procedure:

1. Connect the communication interface (e.g. Ethernet) of the device directly ⑥ to the PC using a suitable cable.
2. Connect the “Power” connection (male connector, M12, 4-pin, A-coded) to the power source using a suitable cable.

Connection type: Power over Ethernet

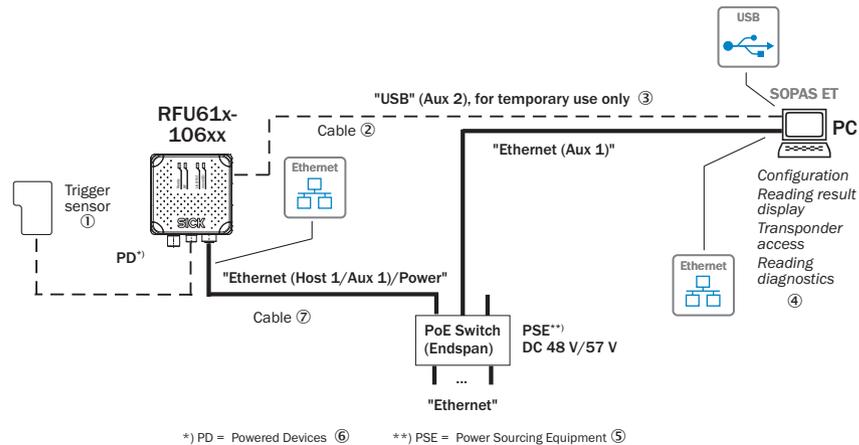


Figure 22: Initial commissioning: connection block diagram RFU61x-106xx (Power over Ethernet)

- ① Trigger sensor for external read cycle (optional)
- ② Adapter cable (male connector, USB, Micro-B type/male connector, USB, type A)
- ③ USB, alternative to Ethernet Aux port. The USB interface must only be used temporarily as a servicing interface!
- ④ Configuration with SOPAS ET, prepared representation of the read result, transponder access or reading diagnostics
- ⑤ PSE = Energy source
- ⑥ PD = Energy consumer
- ⑦ Adapter cable (male connector, M12, 8-pin, X-coded/male connector, RJ-45, 8-pin)

Procedure:

- ▶ Connect the PoE communication interface of the device to the PoE switch using a suitable adapter cable ⑦.

General for both connection types

1. If necessary, connect the trigger sensor for an external read cycle, such as a photoelectric sensor, to the “Trigger” connection. The device offers the “Quickstart” operating mode for demonstrating its operating principle. In this mode, the device automatically triggers a cyclic reading. The operating mode can, for example, be started and terminated with the SOPAS ET configuration software.

**NOTICE**

Quickstart mode is not intended to be used during normal operation. It requires read cycle triggering to be configured in the object trigger control settings in SOPAS ET.

2. Switch on the supply voltage for the device, see "Supply voltage", page 43.
- ✓ After successful initialization, the "Ready" LED illuminates green.
3. Turn on the PC and start Windows.

6.7 Connecting the supply voltage

6.7.1 Note on the supply voltage of the device

**NOTICE****Risk of damage to the device due to reverse polarity of the supply voltage!**

Reversing the polarity of the supply voltage may, under certain circumstances, damage the device due to short circuit currents!

The supply voltage input for the RFID device is designed with internal circuit protection to provide reverse polarity protection. For this purpose, there is a blocking diode in the current path of the positive pole (see figure).

The negative pole of the supply voltage (primary ground, GND_ext) is electrically isolated from the functional ground (GND). The functional earth has a direct galvanic connection to the metal housing of the device for RF-related technical reasons.

Depending on the mounting location of the RFID device and the reference potential of the supply voltage, a reversal of the polarity of the applied supply voltage can lead to the following situation:

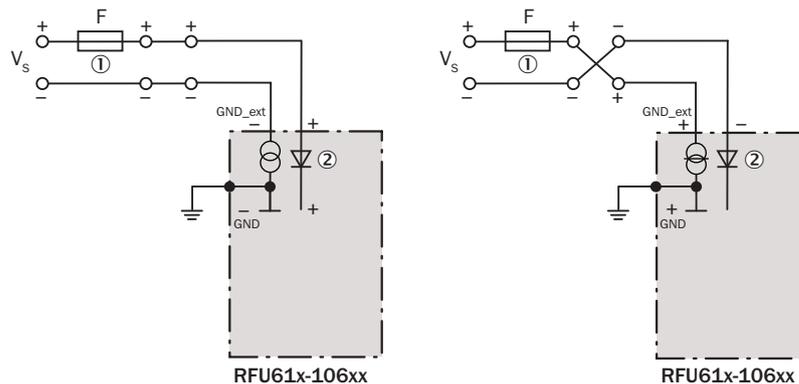


Figure 23: Reversal of the polarity of the supply voltage: no effect on the RFID device (see requirements)

- ① Fuse
- ② Blocking diode

The housing of the RFID device is connected to functional earth.

If the polarity of the supply voltage is reversed, the blocking diode blocks the negative voltage on the positive pole of the RFID device.

6.7.2 Supply voltage

The voltage supply or power supply unit must satisfy ES1 requirements in accordance with the currently applicable EN 62368-1.



NOTE

UL-certified devices (see type label) require a supply voltage according to ES1, EN 62368-1, NEC protection class 2 (UL13010).

The power source must be able to provide the following power outputs when the device is operating at maximum transmitting power:

Table 11: RFU61x: required supply voltage V_S

Device	Supply voltage V_S	Ambient operating temperature	Power source: required power output
RFU61x-106xx	DC 18 V ... 30 V	-25 °C ... +50 °C	At least 6 W
	DC 48 V / 57 V according to PoE technology		

Power supply options

The device offers two voltage supply options:

1. Power and Ethernet: DC 18 V ... 30 V
 - o Connection 1: power
 - o Connection 2: Ethernet
2. Power over Ethernet (PoE): DC 48 V / 57 V according to PoE technology
 - o Connection 1: not assigned
 - o Connection 2: PoE

It is possible to use both variants at the same time. However, it is recommended to select just one variant.

Table 12: Using connection variants at the same time: behavior of the device

Initial situation	Change	Effect
Voltage supply power via connection 1	Additionally, PoE connected to connection 2.	No effect on the device status.
Voltage supply PoE via connection 2	Additionally, power connected to connection 1.	No effect on the device status. Voltage supply with immediate effect via power to connection 1 (dominant).
Voltage supply power via connection 1 (dominant) and PoE via connection 2	Connecting power to connection 1 is isolated.	Device restarts. Voltage supply with immediate effect via PoE to connection 2.



NOTE

The voltage supply via a power supply unit must be capable of buffering a brief power failure of 20 ms.

Protecting the supply cables

To ensure protection against short-circuits and overload in the customer-supplied cables, the wire cross-sections used must be selected and protected in accordance with national regulations.

The following standards must be observed in Germany:

- DIN VDE 0100 (part 430)
- DIN VDE 0298 (part 4) and/or DIN VDE 0891 (part 1)

When the device is supplied via the “Power” connection, fuse the supply voltage DC 18 V to 30 V with a separate 0.8 A slow-blow fuse.

- ▶ Install the fuse in the supply circuit at the start of the supply cable.

6.8 Wiring the digital input

The digital input “Sensor 1” can be used, for example, to start and terminate the read cycle by an external trigger sensor.

a) Supply of the trigger sensor by the device

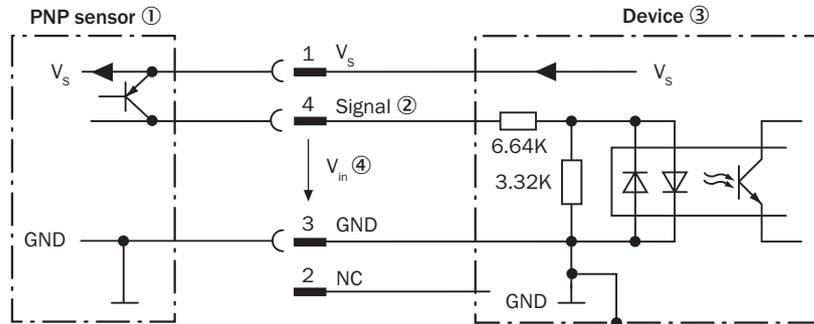


Figure 24: Wiring of digital input “Sensor 1”, supply of trigger sensor by the device

- ① Trigger sensor (PNP sensor)
- ② “Sensor 1” input signal
- ③ Device
- ④ Input voltage V_{in}

b) Supply of the trigger sensor with external voltage

The supply voltage of the device and the supply voltage of the trigger sensor must have the same ground.



NOTICE

In case of external voltage supply of the trigger sensor, the connecting cable part no. 2096347 is not suitable for connecting the trigger sensor to the device.

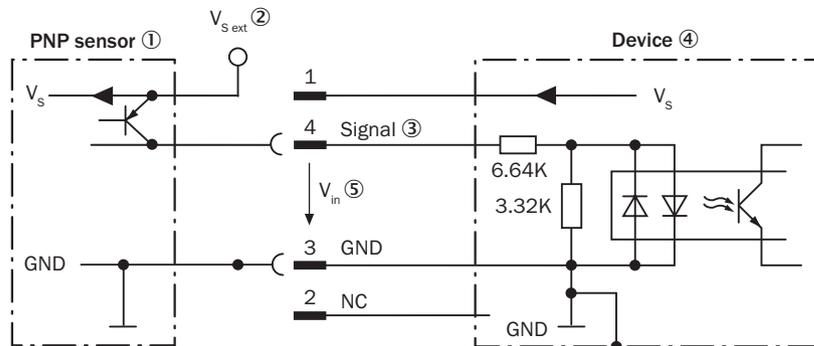


Figure 25: Wiring of digital input “Trigger”, supply of trigger sensor by external voltage

- ① Trigger sensor (PNP sensor)
- ② External voltage $V_{s\ ext}$ for supplying the trigger sensor
- ③ “Sensor 1” input signal
- ④ Device
- ⑤ Input voltage V_{in}

Table 13: Characteristics of “Sensor 1” digital input

Type	Switching

Switching behavior	Power to the input starts the assigned function, e.g. start of the internal reading interval of the device. Default: active high, debounce time: 10 ms (standard)
Features	<ul style="list-style-type: none">• Can be wired with PNP output of a trigger sensor
Electrical values	Low: $V_{in}^{1)} \leq 2 \text{ V}$; $I_{in}^{2)} \leq 0.3 \text{ mA}$ High: $6 \text{ V} \leq V_{in} \leq 32 \text{ V}$; $0.7 \text{ mA} \leq I_{in} \leq 5 \text{ mA}$

1) Input voltage.

2) Input current.

6.9 Wiring the data interface

Wiring the Internet interface

1. Connect the device to the Ethernet interface of the PC via an adapter cable.
2. Set up communication via SOPAS ET configuration software.



NOTE

The Ethernet interface of the device has an Auto-MDIX function. This automatically adjusts the transmission speed as well as any necessary crossover connections.

7 Commissioning

7.1 Overview of the Commissioning Steps

The device is configured using a configuration tool. During initial commissioning, this is normally done using the SOPAS ET configuration software.

Other configuration tools are also available, for example a web server or command strings, depending on the task. For more information, see ["Operating options and configuration tools"](#), page 53.

Procedure

- Install the SOPAS ET configuration software and the required device description file on a PC or laptop.
- Electrically connect the device to the PC or laptop.
- Commission the device with the help of the "Quickstart" function in SOPAS ET using the default factory settings and the similarly named Quick Start Guide, a printed copy of which is enclosed with the device.
- Perform a manual fine adjustment and configuration of the device to optimize the functionality for the specific reading and writing situation on site.
- Test the device for correct functioning in operational use.

7.2 SOPAS ET configuration software

The SOPAS ET configuration software is the standard tool used to configure the device for the specific reading and writing situation on site. The optimal configuration data for the device are permanently saved to the device by the user. The data can also be stored on the PC as a parameter set (project file) for archiving purposes.

The device can also permanently access the parameter set from an optional external storage medium. This makes it easier to replace the device if necessary.

A MicroSD memory card is available for this device. For more information, see ["Initial commissioning"](#), page 49.

7.2.1 Device-related functions of the SOPAS-ET configuration software (overview)



NOTE

The general functions of the software and its user interface are described in the SOPAS ET manual in the SOPAS ET configuration software.

- Selecting the menu language
- Setting up communication with the device
- Password-protected configuration for different operating levels
- ...

The SOPAS ET configuration software provides the following functions, amongst others, relating to the device:

- Quickstart function with continuous read cycle triggering to demonstrate the transponder recognition and data display
- Access to the transponder content (reading and writing)
- Management of device apps (log levels)
- Assistant for targeted configuration of the transponder read operation (Single Tag ID Wizard)
- Recording of device and communication data during operational use via the diagnostics log file output
- System diagnostics

7.2.2 Installing SOPAS ET and the device description file

**NOTE**

Depending on the situation on site, administrator rights may be required on the PC to install the software. The PC must provide a functioning Internet connection.

**NOTE**

The SOPAS ET configuration software, the current system prerequisites for installing the software on the PC, and downloading instructions can be found online at:

www.sick.com/SOPAS_ET

1. Electrically connect one of the data interfaces of the device to the PC.
Recommended: Ethernet or USB interface.
2. Switch on the supply voltage for the device.
3. Start the PC.
4. Download and install the following components as per the instructions on the product page of the software:
 - a) Current version of the SOPAS ET configuration software.
In this case, select the “Complete” option as suggested by the installation wizard.
 - b) Required current device description file (*.sdd) for the device
5. If the installation of the configuration software does not start automatically, run setup.exe in the download folder.
6. Follow the operating instructions to complete the installation.

7.3 Starting the SOPAS ET configuration software and connecting it to the device

1. Start the “SOPAS ET” program option after completing the installation.
Path: Start > Programs > SICK > SOPAS ET Engineering Tool > SOPAS.
By default, the software automatically searches for connected devices via the Ethernet, USB, and IO-Link interface.
 2. Establish a connection between SOPAS ET and the device using the automatically launched wizard. Access via the Ethernet interface.
To do so, select the relevant device in the list of available devices (default Ethernet address: IP address: 192.168.0.1, subnet mask: 255.255.255.0).
- ✓ SOPAS ET establishes communication with the device and loads the associated device description file. The **Quickstart** tab opens.

7.3.1 Quickstart with default settings

The purpose of the “Quickstart” function in the SOPAS ET configuration software is to make it simple and easy to obtain first transponder read results using the device. In this operating mode, the device displays all compatible transponders in its detection range based on the current device settings.

**NOTE**

Quickstart mode is not intended to be used during normal operation. For operational use, set a read cycle using the object trigger control in SOPAS ET.

To use Quickstart, all mounting and electrical installation work must be complete (see the relevant chapters in these operating instructions).



NOTE

The procedure for using the Quickstart function in the SOPAS ET configuration software is described in the device-specific Quick Start Guide. A printed copy of this guide is enclosed with the device, in different language versions depending on the region. The Quick Start Guide can also be found online at:

- www.sick.com/RFU61x

The Quick Start Guide describes the procedure for the device variant RFU61x-10600 (Europe region), for example, based on the basic parameter setting of the device. The permissible ambient temperature range is 0 °C to +50 °C.

For temperatures below 0 °C, see the relevant instructions in the “Mounting” and “Electrical installation” chapters of these operating instructions.

7.4 Initial commissioning

The device is adjusted to the application situation on site using the SOPAS ET configuration software on the PC. The default factory settings of the device are the starting point for this. Their parameter values (configuration data) can be adapted in the working memory of the device for optimization purposes. To do so, the user creates an application-specific parameter set using the SOPAS ET configuration software, or modifies the parameter set at a later time as required. He then loads the current parameter set to the permanent parameter memory of the device.

Memory organization for parameter set

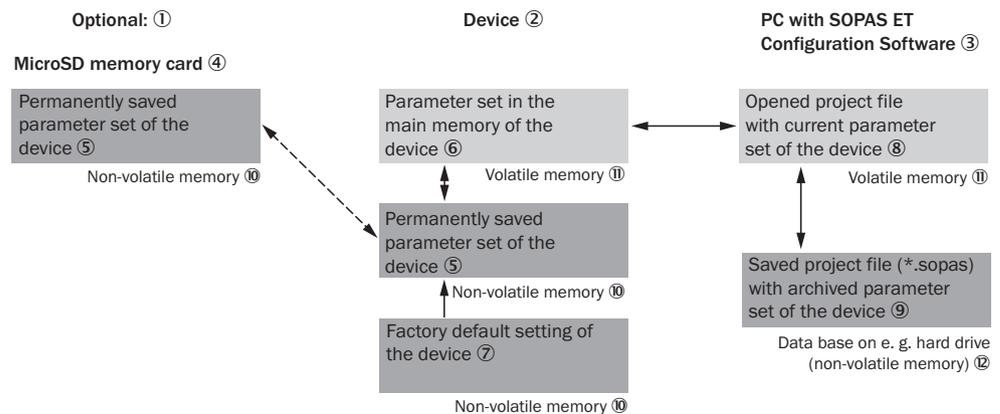


Figure 26: Saving the parameter set and configuration using SOPAS ET

- ① Optional
- ② Device
- ③ PC with SOPAS ET configuration software
- ④ MicroSD memory card
- ⑤ Permanently saved device parameter set
- ⑥ Parameter set in the working memory of the device
- ⑦ Factory-set defaults for the device
- ⑧ Opened project file with current device parameter set
- ⑨ Saved project file (*.sopas) with archived device parameter set
- ⑩ Nonvolatile memory
- ⑪ Volatile memory
- ⑫ Data base on the hard drive (non-volatile memory)



NOTE

As part of a data backup plan, we recommend also saving the current parameter set outside the device memory. This makes it easier, if necessary (device failure, etc.), to restore, to a replacement device of the same type, the current parameter set used to date.

External data backup: option 1

To back up the data outside the device memory, the current parameter set can be **manually** saved to the PC as a project file (*.sopas file with configuration data) thereby archiving the data. This is the generally recommended procedure!

External data backup: option 2

The prerequisite for automatically backing up the current parameter set data outside the device memory is to have an additional, external storage medium. The device can optionally be permanently connected to an external parameter memory for this purpose.

This can be achieved in one of the following ways, depending on the device:

- a) By inserting a microSD memory card with sufficient storage capacity into the device
 - b) By connecting a CDB or CDM connection module to the device. The connection module is equipped with a CMC600 parameter cloning module.
 - c) By connecting the device to a CDF600 fieldbus module and operating it in proxy mode.
 - d) If necessary, by using a combination of a) plus b) or c)
-



NOTE

Only option a) is possible for the RFU61x.

Operating principle

The user saves the current parameter set to the permanent parameter memory of the device using the “permanent” option. The device then **automatically** also saves the parameter set to an external, permanent parameter memory. Depending on the device and configuration, this could be either to a memory card, in the CMC600, in the CDF600 or, when using one of the supported combinations, in both storage media (see above).

At each restart after being switched on, the device automatically loads the compatible parameter set from the external storage medium into its working memory and into its internal, permanent parameter memory. The parameter set is loaded either from a memory card or, depending on the configuration, from the CMC600 or CDF600.

In the event of device failure, for example, this approach enables the device to be quickly and easily replaced with another device of the same type provided the above prerequisites have been met. This is achieved without any loss of configuration data, and without having to connect the PC to the SOPAS ET configuration software.

Memory card



NOTE

Only use types approved by SICK to ensure reliable function of the memory card. You can find these as accessories online at:

- www.sick.com/RFU61x
-

8 Operation

8.1 Operating and status indicators

8.1.1 Optical status indicators on the display panel

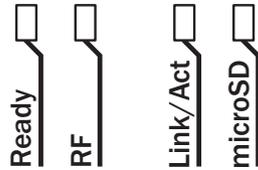


Table 14: RFU61x: Function of the status indicators

Display	LED	Color	Status
Ready	Flashing ¹⁾	Orange	The device is not ready for use: The internal temperature of the device is below -25 °C.
	Flashing ¹⁾	Green	Warm-up phase of the device: Internal temperature of the device between -25 °C and -20 °C. The device starts up regular operation after approx. 1 min.
	Lights up	Green	The device is ready for use.
	Lights up	Red	The device is not ready for use: hardware fault
	Flashing	Green	PROFINET operation (single port):
	Flashing	Red	The LEDs flash cyclically and alternating 4 x red, 1 x green. <ul style="list-style-type: none"> The device attempts to establish a connection to a PLC (IO controller) - or - During operation: the connection between the device and the PLC (IO controller) is interrupted
RF	Lights up	Green	The UHF field is switched on.
	Lights up	Red	Fault: integrated antenna or RF part.
Link/Act	Lights up	Green	Data traffic on the Ethernet interface
microSD	Lights up	Green	The memory card is inserted and ready for operation. <ul style="list-style-type: none"> In this state, the device can either write data to the memory card or read data on the card. If the LED lights up, however, this does not indicate that the device is actually accessing the memory card.
	Lights up	Red	The memory card is inserted. However, the device cannot read data on the memory card. Possible causes: <ul style="list-style-type: none"> The memory card does not contain any data The content is not readable The memory card is defective
	Lights up	Orange ²⁾	A function is started with SOPAS ET which requires a memory card for writing. However, the memory card is not connected.

¹⁾ Flash frequency 1 Hz.

²⁾ Prerequisite: In SOPAS ET, the "SD card required" function has been activated under the "Service" user level.

8.1.2 Optical “process feedback” status indicator

The “Process Feedback” status display operates with four LEDs. The LEDs are located in the corners of the antenna cover. The LEDs operate synchronously when displaying the status.

The behavior of the indicator (color, brightness, activation condition) can be configured by the user. The option is available to choose between two brightness levels for the device in SOPAS ET to adjust the brightness of the process feedback LEDs.

The user can select from the following activation conditions:

- Successful process of transponder handling. The process consists of: triggering and subsequent reading, if applicable also writing of transponder data.
- External SOPAS ET command, script
- A pre-defined or user-defined evaluation condition has occurred.



NOTE

Select the activation condition and brightness using a configuration tool, for example the SOPAS ET configuration software. This indicator can also be deactivated.

Operating mode: Quickstart

This operating mode for detecting transponders in the UHF field is intended for demonstration purposes and for getting familiar with the operation of the device. In this mode, the device automatically generates continuous read cycles. Contrary to normal read operation (object-related read cycle triggering), the status indicator provides continuous feedback on the success of the transponder detection.

Table 15: Function of the “process feedback” status indicator in Quickstart mode

Color	Behavior	Status
Blue	Lights up at half brightness	UHF field available, no transponder in the field
Blue	Flashes at full brightness: Flashing slowly (f = 1.25 Hz)	1 transponder in field
	Flashing quickly (f = 2.5 Hz)	2 transponders in field
	Flashing faster (f = 5 Hz)	More than 2 transponders in field

The color of the indicator, and the brightness of the status indicator in Quickstart mode cannot be modified.



NOTE

Quickstart mode is not intended to be used during normal operation. For operational use, set a read cycle using the object trigger control in SOPAS ET.

Operating mode: Read mode

Table 16: Function of the “process feedback” status indicator in read mode

Color	Behavior	Status
Blue	Lights up for the duration of the in-progress reading interval	Read operation was started by an external or internal trigger source, device has started an internal reading interval (event)
Green	Lights up briefly	Device has ended the internal reading interval. Transponder detected and optionally selected condition(s) met -> Good Read (event)

Color	Behavior	Status
Red	Lights up briefly	Device has ended the internal reading interval. Transponder not detected or optionally selected condition(s) not met -> No Read (event)

Indicator_trigger source during read mode: combination of “Reading Interval/Good Read/No Read” (default)

8.1.3 Operating options and configuration tools



NOTE

In addition to the existing operating instructions, the use of the RFU parameter description is recommended:

- This parameter description explains the UHF-RFID-specific parameters of all device variants of the RFU6xx product family up to and including the “Service” user level.
- The parameter description supports the user in configuring applications with the SOPAS ET configuration software.

The parameter description is available in English (part no. 8023085) and German (part no. 8023084) as well as other languages if required.

The RFU parameter description can be found on the online product page at:

- www.sick.com/RFU61x

The device can be operated and configured in the following 5 ways for specific tasks:

1. SOPAS ET configuration software

- Standard configuration tool for the device
- The configuration software and appropriate device description file are installed on a PC or laptop. These are available online at: www.sick.com/SOPAS_ET
- Password-protected configuration at four different operating levels (user levels):
 - 1 Run (no entry of password required), no configuration possible
 - 2 Maintenance (entry of password required)
 - 3 AuthorizedClient (entry of password required)
 - 4 Service employee (entry of password required)

The two user levels “Run” and “Maintenance” are only password protected if the “Parameterization is password-protected” parameter in SOPAS ET is activated. In the basic setting, logging into the device accesses the “AuthorizedClient” user level and entry of a password is not required in this case.

- Type-dependent access via a local data interface on the device or via the Ethernet network.
- Backup of the parameter set to a location outside the device memory:
 - Manually to a configuration file on the PC, or
 - Semiautomatic on optional MicroSD memory card.
- Access to the device via the Aux or host interface.
- Organization of the device constellation in projects.
- The SOPAS ET configuration software is used for device diagnostics in case of a fault.
- Supported firmware updates for the device.

2. Integrated SOPASair web server

- No installation of configuration software required, an Internet-capable HTML browser is sufficient. Access to the device by entering an IP address.
- No administrator rights required, no firewall restrictions.
- Web server runs directly on the device being contacted (embedded in the firmware).
- Access only via the Ethernet interface and by entering the IP address of the device.

- Access locally on the device or via the network.
- Used to configure a stand-alone device.
- Password-protected configuration at four different operating levels (user levels):
 - 1 Run (no entry of password required), no configuration possible
 - 2 Maintenance (entry of password required)
 - 3 AuthorizedClient (entry of password required)
 - 4 Service (entry of password required)
- Has limited functionality compared to the SOPAS ET configuration software. The functionality of the web server depends on the firmware version of the device.

3. Command strings (telegrams)

- Command strings (CoLa) are used to configure device parameters and trigger device functions (e.g. reading).
- Command strings can be inputted in telegram style at one of the available data interfaces (Aux or host interface) of the device. The telegram response of the device to the command is always sent to the interface on which the telegram was received. In contrast to this, the read result data can be outputted to all data interfaces except for the USB interface.
- The communication between the SOPAS ET configuration software and the device can be monitored and recorded via the terminal emulator in SOPAS ET. Commands can also be sent to the device. For more details on using the terminal, see the SOPAS ET manual.
- Documents listing and describing the available commands strings can be obtained from SICK on request.



NOTICE

Both the command strings and the SOPAS ET configuration software are based on a command language. The command language directly accesses the command interpreter of the device. The command language must therefore be used with care, as the commands received by the device are executed immediately.

Parameter values modified by means of commands are initially only active in the current parameter set in the volatile working memory of the device. To permanently save the modified parameter set, it needs to be copied to the non-volatile parameter memory using the relevant command. This ensures the changes are not lost when the supply voltage to the device is switched off.

Any changes to the parameter values in the device made using command strings will only appear in the SOPAS ET configuration software after the following actions:

- An upload of the current parameter set from the device, or
- A synchronization between the device and SOPAS ET

4. Control software of a PLC controller

- The controller of a fieldbus (e.g. PLC) configures the device. For a PROFINET controller, for example, this is done via PROFINET by means of GSD parameterization. Backup of the parameter set as a configuration file in the PROFINET controller. The controller reconfigures the device at every PROFINET restart.
- Integrating the device into the most important fieldbus systems is made simpler with SICK function blocks for the relevant bus controller. See the “Downloads / Software” section online at:
 - www.sick.com/RFU61x
- Function blocks based on command strings (CoLa).

5. SICK AppStudio development environment

- Used, for example, to implement user-specific data output protocols for the device. Based on functionalities already pre-installed in the programmable device.
- The app programmed using SICK AppStudio is loaded onto the device as a SensorApp.
- More information is available online at: www.sick.com/SICK_AppStudio

9 Maintenance

9.1 Maintenance plan

During operation, the device works maintenance-free.

Depending on the assignment location, the following preventive maintenance tasks may be required for the device at regular intervals:

Table 17: Maintenance plan

Maintenance work	Interval	To be carried out by
Cleaning the front of the device and external antennas e.g. of metal dust	Cleaning interval depends on ambient conditions and climate.	Specialist
Checking screw connections and plug connectors	Interval depends on the place of use, ambient conditions, or operational regulations. Recommended: At least every 6 months.	Specialist
Checking that the unused connections are sealed with protective caps or plugs	Interval depends on ambient conditions and climate. Recommended: At least every 6 months.	Specialist

9.2 Cleaning



NOTICE

Equipment damage due to improper cleaning.

Improper cleaning may result in equipment damage.

- Only use recommended cleaning agents.
 - Never use sharp objects for cleaning.
-
- ▶ If it is dirty (e.g., metal dust), clean the front of the device carefully using a soft, damp cloth (with a mild cleaning agent) in order to achieve the full read and write speed.
 - ▶ The device must be cleaned regularly from the outside to guarantee heat dissipation and therefore operation. Particular attention must be paid to ensure that the cooling ribs are free from dust and dirt. Clean using a dry towel or an industrial vacuum cleaner. Do not use cleaning agents.

10 Troubleshooting

10.1 Overview of Potential Errors and Faults



WARNING

Risk of injury due to damage to the device

For reasons of safety, if a device shows visible signs of damage do not put it into operation, or take it out of operation immediately.

Damage includes, for example:

- Housing: Cracked or broken
- Electrical connections: cracks or detachment from the housing
- Device with fixed cable: Damage to the cable outlet or cable itself

Table 18: Errors and faults

Situation	Error/ fault
Mounting	<ul style="list-style-type: none"> ■ Device poorly aligned to the objects with transponders (e.g. faults due to metal surfaces located next to the device) ■ Damping materials between the device and transponders, e.g. liquids ■ Trigger sensor for read cycle generation incorrectly positioned (e.g. the internal reading interval of the device is started too early or ended too late).
Electrical installation	<ul style="list-style-type: none"> ■ Supply voltage too low or incorrect polarity ■ Data interfaces of the device wired incorrectly ■ Switching inputs or outputs wired incorrectly
Configuration	<ul style="list-style-type: none"> ■ Functions not adapted to local conditions, e.g. parameters for the data interface not set correctly ■ Device limits not observed, e.g. working range of the antenna ■ Settings for the filter or Tag Select not suitably selected ■ Trigger source for read-cycle not selected correctly
Operation	<ul style="list-style-type: none"> ■ Ambient temperature too low or high ■ Read pulse control not suitably configured for the object(s) in the working range. ■ Device faults (hardware/ software)

10.2 Detailed fault analysis

10.2.1 LEDs on the device

The status indicators of the device can alert you to possible errors or faults, [see "Optical status indicators on the display panel", page 51](#). Further information on this can be found in the "System Information" section.

10.2.2 System information

The device reports any errors that occur in a number of ways. Fault output is staggered, allowing for an increasingly detailed level of analysis:

- Communication errors can occur when transmitting telegrams (e.g. commands) to the data interface of the device. The device then returns a fault code on the same data interface.
- For faults that occur during reading, the device writes fault codes in the status log ([see "Status log", page 57](#)).

10.3 Status log

**NOTE**

The status log is retained even after switching the device off and on again.

The device distinguishes between four types of fault:

- Information
- Warning
- Fault
- Critical fault

The device saves only the last five entries for each fault type.

10.3.1 Displaying the Status Log

To display the status log, the SOPAS ET configuration software must be connected with the device online.

1. Connect the SOPAS ET configuration software to the device.
2. In the RFU6xx project tree open: Service > System Status.

10.4 SICK service

If the fault cannot be rectified, the device may be defective.

The device may not be repaired by the user. Interference with or modification of the device will invalidate any warranty claims against SICK AG.

Rapid replacement of a device by the user is, however, possible.

- ▶ Where a fault cannot be rectified, make contact with the SICK Service department. To find your agency, see the final page of this document.

**NOTE**

Before calling, make a note of all type label data such as type designation and serial number to ensure faster telephone processing.

10.5 Repairs

Repair work on the device may only be performed by qualified and authorized personnel from SICK AG. Interruptions or modifications to the device by the customer will invalidate any warranty claims against SICK AG.

10.6 Returns

- ▶ Do not dispatch devices to the SICK Service department without consultation.
- ▶ The device must be sent in the original packaging or an equivalent padded packaging.

**NOTE**

To enable efficient processing and allow us to determine the cause quickly, please include the following when making a return:

- Details of the contact person
 - Description of the application
 - Description of the fault that occurred
-

10.7 Replacing the device

10.7.1 Reusing the current configuration data

The configuration data of the device is combined as a parameter set. The replacement device saves the parameter set to the permanent parameter memory.

The current configuration data of the device to be replaced can be transferred to a replacement device in two ways.

Prerequisites:

- The replacement device is a device of the same type
- The current configuration data for the device to be replaced is accessible in a storage medium outside the device memory

The available options depend on the backup plan chosen by the user back at the time of installation, and the configuration of the device now needing to be replaced.

The first method is performed semi-automatically by the device depending on the setup. The second method is performed manually by the user.

1 **Transfer of the current configuration data using the optional memory card removed from the device to be replaced.**

It is not necessary to connect a PC or laptop with the SOPAS ET configuration software for transfer to the replacement device.

Prerequisite:

If there is sufficient memory capacity on the memory card, the device will have automatically saved the configuration data from the last permanent save operation on the card using the "Permanent" option.

2 **Transfer of the current configuration data by means of a download from the PC or laptop.**

Prerequisite:

The configuration data of the device was stored on the PC or laptop. This took place on completion of configuration of the device that is now to be replaced with the SOPAS ET configuration software after confirmation by the user.



NOTE

Further information [see "Initial commissioning", page 49](#)

10.7.2 Removing the device to be replaced



NOTICE

Risk of damage to the memory card

To avoid damaging a memory card that may be present in the device, make sure there is no power to the device when you remove or insert the memory card.

1. Switch off the supply voltage to the device that is to be replaced.
2. Mark the position and alignment of the device on the bracket or surroundings.
3. Disconnect and remove all connecting cables from the device.
4. Detach the device and remove from the bracket.
5. Backed-up configuration data: if an optional memory card is installed in the device, remove the memory card with the backed-up parameter set. The memory card is located behind the side cover, [see "Device view", page 15](#).

10.7.3 Putting the replacement device into operation

1. Backed-up configuration data: take the optional memory card from the device being replaced and install it in the replacement device of the same type.
2. Mount and align the replacement device (see "Mounting", page 24). When doing so, note the previously applied markings on the bracket or surroundings.
3. Reconnect the connecting cables to the replacement device (see "Electrical installation", page 30).
4. Switch on the supply voltage for the replacement device.
The device starts with the default setting and searches for external memory media with a valid parameter set. If the device detects storage media with a valid parameter set, the device does the following:
 - Only memory card in the device:
the replacement device loads the parameter set on the memory card.The replacement device loads the parameter set into its permanent memory and operates according to the configuration data in the parameter set.
5. If the replacement device does not detect any external storage medium, the device starts with its last permanently stored parameter set. In the case of devices that have not been used before, this corresponds to the factory default setting.
 - ▷ Establish a connection to the replacement device using the SOPAS ET configuration software.
 - ▷ Transfer the configuration data of the device to be replaced, which was previously saved to the PC, by downloading it to the replacement device and permanently storing it there.

11 Decommissioning

11.1 Disposal

If a device can no longer be used, dispose of it in an environmentally friendly manner in accordance with the applicable country-specific waste disposal regulations. Do not dispose of the product along with household waste.



NOTICE

Danger to the environment due to improper disposal of the device.

Disposing of devices improperly may cause damage to the environment.

Therefore, observe the following information:

- Always observe the valid regulations on environmental protection.
 - Separate the recyclable materials by type and place them in recycling containers.
-

12 Technical data



NOTE

The relevant online data sheet for your product, including technical data, dimensional drawing, and connection diagrams can be downloaded, saved, and printed from the Internet:

- www.sick.com/RFU61x

These operating instructions provides additional technical data if required.

12.1 Features

Table 19: Technical data for RFU61x: Features

	RFU61x-106xx
Version (working range)	Short range
Product category	RFID read/write device (UHF) with integrated antenna
Frequency band	UHF (860 MHz ... 960 MHz)
Radio equipment approval (regional assignment)	Depending on type. See type-specific online data sheet at: www.sick.com/RFU61x
Carrier frequency	
Transmission output power	
RFID standard (air interface)	EPCglobal UHF Class 1 Generation 2, ISO/IEC 18000-6 C Labeling in type code: RFU6x0-xxxxx
Modulation	PR-ASK
Connection type	Power and Ethernet or PoE
Sensing range	Typically: 0.5 m ¹⁾
Antenna	Integrated antenna <ul style="list-style-type: none"> • Transmitting power: adjustable • Polarization: circular (LHCP) • Axis behavior: typically 2 dB (ETSI), 3 dB (FCC) • Aperture angle: 110° • Front-to-back ratio: typically > 5 dB
Service functions	Semi-automated saving of parameter data (parameter cloning) outside the device memory: <ul style="list-style-type: none"> • Using insertable microSD memory card ²⁾ in the device
Clock	Network time protocol (NTP), no internal clock
Conformities	Depending on type. See type-specific online data sheet at: www.sick.com/RFU61x
Certificates	Depending on type. See "Downloads" section online at: www.sick.com/RFU61x

1) Sensing range depends on the transponder used and the ambient conditions.

2) Optional accessories.

3) UL-certified if the type label contains the UL logo and the UL conditions are met during device operation. For further information, see "Certification according to UL61010-1", page 65.

12.2 Interfaces

Table 20: Technical data for RFU61x: Interfaces

	RFU61x-106xx
Ethernet	<ul style="list-style-type: none"> • Protocol: TCP/IP • Function: host (data output of the read result) • Function: Aux (service) ¹⁾ • Data transmission rate 10/100 Mbit/s • Services: DHCP, NTP, HTTP/HTTPS
PROFINET	<ul style="list-style-type: none"> • Protocol: PROFINET • Function: host (data output of read result), PROFINET Single Port ²⁾ • Data transmission rate 10/100 Mbit/s
EtherNet/IP™	<ul style="list-style-type: none"> • Protocol: EtherNet/IP™ • Function: host (data output of the read result) • Data transmission rate 10/100 Mbit/s
USB 2.0 ³⁾	<ul style="list-style-type: none"> • Function: Aux (service) ¹⁾
Digital input	<ul style="list-style-type: none"> • Version: physical, switching • V_{in} ⁴⁾ = max. 30 V, I_{in} ⁵⁾ = max. 5 mA. $V_{S\ trigger}$ ⁶⁾ = V_S, $I_{S\ trigger}$ ⁷⁾ = max. 40 mA • Debounce time: adjustable ⁸⁾ • A corresponding trigger sensor (e.g. GL 6) can be connected directly
Optical indicators	<ul style="list-style-type: none"> • 4 RGB LEDs (status indicators) on front top • 4 x RGB LEDs (process feedback) in the four corners of the antenna cover. Display function can be set with pre-defined color assignment ⁸⁾.
Configuration	SOPAS ET configuration software, CoLa commands (telegrams), web server, fieldbus controller (PLC) with additional support by SICK function blocks
Programming	Application-specific programming with SICK AppStudio ⁹⁾ development environment. You can find further information on the Internet at: www.sick.com/SICK_AppStudio

1) For example: Configuration, diagnosis, transponder access or display of the read result.

2) Function blocks for PLC types from different manufacturers are available online at: www.sick.com/RFU61x.

3) The USB interface must only be used temporarily as a servicing interface!

4) Input voltage.

5) Input current.

6) Supply voltage for external trigger sensor

7) Supply current for external trigger sensor

8) For example using the SOPAS ET configuration software.

9) This functionality can be unlocked with the SDK6U SD card. Available online at: www.sick.com

12.3 Mechanics and electronics

Table 21: Technical data for RFU61x: Mechanics/electronics

	RFU61x-106xx
Electrical connection	<ul style="list-style-type: none"> • Connection 1: male connector, M12, 4-pin, A-coded • Connection 2: female connector, M12, 8-pin, X-coded • Connection 3: female connector, M8, 4-pin, coded • USB interface: female connector, 5-pin, Micro B type

	RFU61x-106xx
Supply voltage V_S	ES1 according to EN 62368-1, NEC protection class 2 (UL13010) <ul style="list-style-type: none"> Power and Ethernet: DC 18 V ... 30 V PoE: DC 48 V / 57 V according to PoE technology
Power consumption	<ul style="list-style-type: none"> Operation: 6 W typical ¹⁾ Standby: 3 W typical
Housing	Cast aluminum, plastic (PPS)
Housing color	Black, silver
Side cover	Plastic foil, can be opened for temporary access to USB interface and memory card slot
MTBF	22 years ²⁾
Enclosure rating	IP67 (EN 60529:1991-10/A2:2000-02)
Protection class	III (EN 61140:2006-08)
Safety	EN 62368-1:2014
Weight	Approx. 313 g
Dimensions (L x W x H)	92 mm x 80 mm x 38 mm ³⁾

- 1) At full transmitting power.
2) Continuous operation at an ambient operating temperature of +50 °C.
3) With any protruding connection or fastening elements, see "Device view", page 15.

12.4 Ambient data

Table 22: Technical data for RFU61x: ambient data

	RFU61x-106xx
Electromagnetic compatibility (EMC)	EN 301489-1 V2.1.1 (2017) EN 301489-3 V1.6.1 (2013)
Vibration resistance	IEC 60068-2-6:2007 (10 Hz ... 150 Hz / 5 g sine) IEC 60068-2-64: 2008 (10 Hz ... 500 Hz / 3.5 g RMS)
Shock resistance	IEC 60068-2-27:2008 (30 g / 6 ms / 12 shocks per axis/half sine and 25 g / 6 ms / 200 shocks per axis/half sine)
Ambient temperature	<ul style="list-style-type: none"> Operation: -25 °C ... +50 °C Storage ¹⁾: -40 °C ... +70 °C
Permissible relative humidity	0% ... 90%, non-condensing

- 1) Conditions see "Transport and storage", page 22

12.5 Working range diagram

see "Working range of the antenna", page 15.

12.6 Dimensional drawing

Dimensions see "Device view", page 15.

13 Accessories



NOTE

Accessories and where applicable mounting information can be found online at:

- www.sick.com/RFU61x
-

14 Annex

14.1 EU declaration of conformity / Certificates

The EU declaration of conformity and other certificates can be downloaded from the Internet at:

- www.sick.com/RFU61x

14.2 Certification according to UL61010-1



Several devices in the RFU6xx product family are certified to UL 61010-1; the UL file number is E336916.

The certification is only valid for specific type descriptions on the type label of the respective device, see "Type label", page 13.

Device type RFU61x: see "Features", page 61

UL-certified devices require a supply voltage according to ES1, EN 62368-1, NEC protection class 2 (UL13010).

The IP67 enclosure rating of the device is not checked by UL.

14.3 Signal assignment of cables with open cable end at one end

14.3.1 "Power" connection to customer-specific connection equipment or control cabinet

Adapter cable

Part no. 2095607 (2 m), part no. 2095608 (5 m), part no. 2095609 (10 m), female connector, straight, M12, 4-wire, A-coded, unshielded, suitable for drag chain, deep-freeze compatible

For RFU61x, "Power" connection (male connector, M12, 4-pin, A-coded)

Ambient temperature range:

For mobile installation: -25 °C to +80 °C, for fixed installation: -40 °C to +80 °C

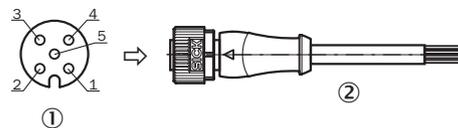


Figure 27: Adapter cable, part no. 2095607 (2 m), part no. 2095608 (5 m), part no. 2095609 (10 m) with one flying lead

① Female connector, straight, M12, 5-pin, A-coded (view from front)

② Illustration may differ

Table 23: Signal assignment of adapter cable with open end

Pin	Signal	Function	Wire color
1	V _S	Supply voltage	Brown
2	Reserved	(Do not use.)	White
3	GND_ext	Primary ground	Blue
4	Reserved	(Do not use.)	Black

Pin	Signal	Function	Wire color
5	N.c.	Not connected	-

Adapter cable

Part no. 2095766 (2 m), part no. 2095767 (5 m), part no. 20956768 (10 m), female connector, angled, M12, 4-wire, A-coded, unshielded, suitable for drag chain, deep-freeze compatible

For RFU61x, "Power" connection (male connector, M12, 4-pin, A-coded)

Ambient temperature range:

For mobile installation: -25 °C to +80 °C, for fixed installation: -40 °C to +80 °C

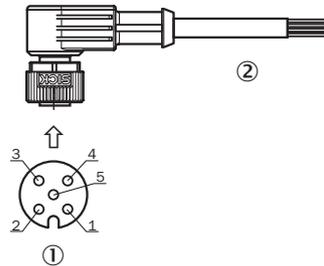


Figure 28: Adapter cable, part no. 2095766 (2 m), part no. 2095767 (5 m), part no. 20956768 (10 m) with one flying lead

- ① Female connector, 90° angle, M12, 5-pin, A-coded (view from front)
- ② Illustration may differ

Table 24: Signal assignment of adapter cable with open end

Pin	Signal	Function	Wire color
1	V _S	Supply voltage	Brown
2	Reserved	(Do not use.)	White
3	GND_ext	Primary ground	Blue
4	Reserved	(Do not use.)	Black
5	N.c.	Not connected	-

14.4 Copyright notices

Open source programs

SICK uses open-source software in the device. This software is licensed by the rights holders using the following licenses among others: the free licenses GNU General Public License (GPL Version2, GPL Version3) and GNU Lesser General Public License (LGPL), the MIT license, zLib license, and the licenses derived from the BSD license.

This program is provided for general use, but WITHOUT ANY WARRANTY OF ANY KIND. This warranty disclaimer also extends to the implicit assurance of marketability or suitability of the program for a particular purpose. More details can be found in the GNU General Public License.

For complete license texts, see www.sick.com/licensetexts

Printed copies of the license texts are also available on request.

14.5 Abbreviations used

Table 25: Abbreviations used

CAN	Controlled Area Network. Field bus protocol based on the CAN bus
------------	--

CDB	Connection Device Basic
CDF	Connection Device Fieldbus
CDM	Connection Device Modular
CE	Communauté Européenne. European Community
CMC	Connection Module Cloning
CMD	Connection Module Display
CMF	Connection Module Fieldbus
CMP	Connection Module Power
CoLa-A	Command Language ASCII (SICK-specific protocol)
CSN	CAN Sensor Network (SICK-specific protocol)
DNS	Domain Name Server
ES1	Electrical Energy Source Class 1
ESD	ElectroStatic Discharge Electrostatic discharge
ETSI	European Telecommunications Standards Institute
EMC	Electromagnetic Compatibility
ERP	Equivalent Radiated Power. Equivalent Radiated Power
EIRP	Equivalent Isotropic Radiated Power. Equivalent isotropic radiated power
FCC	Federal Communications Commission
GSD	General Station Description (for PROFIBUS/PROFINET)
HTML	Hyper Text Markup Language
I	Input
I_{in}	Input current
I_{out}	Output current
I_{s trigger}	Supply current for external trigger sensor
LED	Light Emitting Diode. Light emitting diode
LHCP	Left hand circular polarized. Left-hand circularly polarized
LPS	Limited Power Supply
MAC	Medium Access Control
MTBF	Mean Time Between Failures
MTTF	Mean Time To Failure
MTTR	Mean Time To Repair
O	Output
PD	Powered Devices. Energy consumer
PDF	Portable Document Format
PoE	Power over Ethernet. Voltage supply via Ethernet
PSE	Power Sourcing Equipment. Power source when using PoE
RHCP	Right hand circular polarized. Right-hand circularly polarized
RFID	Radio Frequency Identification
RTF	Rich Text Format (standard document format with format descriptions)
RFU	Radio Frequency Ultra high frequency
SD	Secure Digital
SOPAS ET	SICK Open Portal for Application and Systems Engineering Tool (PC software for Windows for device configuration)
SDD	SOPAS Device Description (device description file)

PLC	Programmable Logic Controller
TCP/IP	Transmission Control Protocol/Internet Protocol
TID	Tag Identifier
UHF	Ultrahighfrequency
UII	Unique Item Identifier
UL	Underwriters Laboratories
USB	Universal Serial Bus
VESA	Video Electronics Standards Association
V_{in}	Input Voltage
V_{out}	Output voltage
V_S	Supply voltage
$V_{S\ ext}$	External supply voltage
$V_{S\ trigger}$	Supply voltage for external trigger sensor

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