OPERATING INSTRUCTIONS

# InspectorP64x/65x

## 2D Vision

SICK
Sensor Intelligence.

### Described product

InspectorP64x Flex

InspectorP65x Flex

InspectorP65x DynamicFocus

### Manufacturer

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

### Legal information



### Original document

This document is an original document of SICK AG.

# Contents

# 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 before starting any work on the device, in order to familiarize yourself with the device and its functions.

The instructions constitute an integral part of the product and are to be stored 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 in which the device is integrated. For information about this, refer to the operating instructions of the particular machine.

## 1.2 Scope

These operating instructions serve to incorporate the device into a customer system. Instructions are given by stages for all actions required.

These instructions apply to all available device variants of the product. More detailed information on identifying the available device type see "Type code", page 11.

Available device variants are listed on the online product page:

- www.sick.com/inspectorp64x
- www.sick.com/inspectorp65x

Various device variants are used as examples for commissioning, based on the default parameter settings for the relevant device.

## 1.3 Explanation of symbols

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

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

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

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

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

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

## 1.4 Further information

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

▶ www.mysick.com

The following information is available for download there:

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

### 1.4.1 Documents on request

Overview of command strings for the sensor.

## 1.5 Customer service

If you require any technical information, our customer service department will be happy to help. To find your representative, 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 InspectorP6xx is a programmable vision sensor for industrial use for tasks which require high-resolution images at long distances. The program for individual use is created by SICK and HDevelop using SICK AppStudio.

The device is programmed on a PC by using the development environment software SICK AppSpace. Depending on the application, a browser-based, graphical user interface (HMI) can be created, which provides opportunities defined by the application developer to influence an application at operator level. The device offers various interfaces for controlling, programming, and operating purposes, which can be activated as necessary via development environments, control systems (programmable logic controllers), or applications. However, configuration, programming, and control requires various technical skills, depending on how the device is connected and used.

The devices are primarily designed for use in industrial and logistics areas, and they meet the requirements for industrial ruggedness, interfaces and data processing. They are not safety components as per the Machinery Directive 2006/42/EC. They are not intended and not permitted to be used in areas with explosive atmospheres, in corrosive environments, or in extreme ambient conditions.

## 2.2 Incorrect 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.

If the device is to be used under other conditions or in different environments, then the manufacturing service may issue an operating license in consultation with the customer and in exceptional cases.

## 2.3 IP technology

**NOTE**

SICK uses standard IP technology in its products. The emphasis is placed on availability of products and services. SICK always assumes that the integrity and confidentiality of the data and rights affected by the use of the aforementioned products will be ensured by the customer. In all cases, appropriate security measures, such as network separation, firewalls, virus protection, and patch management, must be taken by the customer on the basis of the situation in question.

## 2.4 Limitation of liability

Applicable standards and regulations, the latest state of technological development, and our many years of knowledge and experience have all been taken into account when assembling 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 by untrained personnel
- 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.

### 2.4.1 Programmable device

The InspectorP6xx is a programmable device.

Therefore the respective programmer is responsible for his/her programming performance and the resulting working principle 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.

Therefore, SICK AG is not liable, among other things, for damages that are caused by programming of the customer or third parties.

## 2.5 Modifications and conversions

**NOTICE**
Modifications and conversions to the device and/or the installation 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.

Before technical modifications to and expansions of the device, the prior written approval of the manufacturer must be obtained.

## 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.

The operating instructions state the following qualification requirements for the various areas of work:

- **Instructed personnel** have been briefed by the operating entity 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 assigned 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:

| Activities | Qualification |
|---|---|
| Mounting, maintenance | ■ Basic practical technical training<br>■ Knowledge of the current safety regulations in the workplace |
| Electrical installation, device replacement | ■ Practical electrical training<br>■ Knowledge of current electrical safety regulations<br>■ Knowledge of device control and operation in the particular application concerned (e.g. conveying line) |
| Commissioning, configuration, programming | ■ Basic knowledge of the Windows™ operating system in use<br>■ Basic knowledge of the design and setup of the described connections and interfaces<br>■ Basic knowledge of data transmission<br>■ Knowledge of the programming of image-processing systems and network components |
| Operation of the device for the particular application | ■ Knowledge of device control and operation in the particular application concerned (e.g. conveying line)<br>■ Knowledge of the software and hardware environment for the particular application concerned (e.g. conveying line) |

*Table 1: Activities and technical requirements*

## 2.7 Hazard warnings and operational safety

### 2.7.1 Operational safety and particular hazards

Please observe the safety notes and the warnings listed here and in other chapters of these operating instructions to reduce the possibility of risks to health and avoid dangerous situations.

**CAUTION**

**Optical radiation: Laser class 1**

The accessible radiation does not pose a danger when viewed directly for up to 100 seconds. It may pose a danger to the eyes and skin in the event of incorrect use.

- ▶ Do not open the housing. Opening the housing will not switch off the laser. Opening the housing may increase the level of risk.
- ▶ Current national regulations regarding laser protection must be observed.

**CAUTION**

**LED risk group 1**

The accessible beam from the illumination unit (RG 1) does not represent a risk due to the normal restrictions imposed by human behavior.

**LED risk group 2**

The accessible beam from the illumination unit (RG 2) does not represent a risk due to aversion responses to very bright light sources and the perception of heat.

**For both types of beams**

It is not possible to entirely rule out temporary, disorienting optical effects on the human eye (e.g., dazzle, flash blindness, afterimages, impairment of color vision, photosensitive epilepsy), particularly in conditions of dim lighting. No safety precautions are required.

Comply with the latest version of the applicable regulations on photobiological safety of lamps and lamp systems as well as on laser protection.

If the product is operated in conjunction with external illumination systems, the risks described here may be exceeded. This must be taken into consideration by users on a case-by-case basis.

**CAUTION**

If any operating or adjusting devices other than those specified here are used or other methods are employed, this can lead to dangerous exposure to radiation. Damage to the eyes is possible.

- If the product is operated in conjunction with external illumination systems, the risks described here may be exceeded. This must be taken into consideration by users on a case-by-case basis.
- Do not look into the light source when it is switched on.
- Comply with the latest version of the applicable regulations on photobiological safety of lamps and lamp systems as well as on laser protection.

For internal illumination, only units provided by SICK for that purpose may be used.

## 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.

# 3 Product description

## 3.1 Product ID

### 3.1.1 Type label

The type label gives information for identification of the sensor.

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

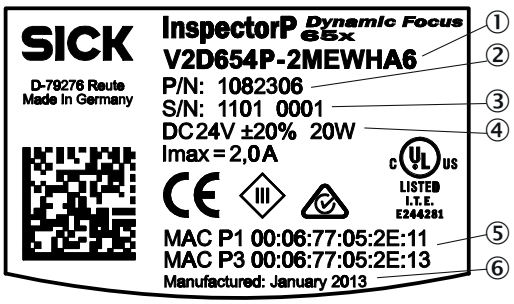



*Figure 1: Type label design for the sensor*

① Type code
② Product information number
③ Serial number
④ Power consumption
⑤ MAC addresses
⑥ Date of manufacture

### 3.1.2 Type code

| V | 2 | D | 6 | x | x | P | - | x | M | x | x | x | x | x |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | | 8 | 9 | 10 | 11 | 12 | 13 | 14 |

| Position | Description |
|---|---|
| 1 ... 5 | **Product family**<br>V2D6xx InspectorP6xx |
| 6 | **Image sensor resolution**<br>2: for InspectorP642: 1.7 megapixels (1,600 px x 1,088 px)<br>2: for InspectorP652: 2.1 megapixels (2,048 px x 1,088 px)<br>4: 4.2 megapixels (2,048 px x 2,048 px) |
| 7 | **Function**<br>P: Programmable |
| 8 | **Generation** |
| 9 | **Image sensor type**<br>M: Monochrome |
| 10 | **Lens unit type**<br>E: Electrical focus (dynamic, auto, teach-auto)<br>C: C-mount thread |
| 11 | **Illumination**<br>R: Red/Amber<br>W: White<br>B: Blue<br>X: No illumination unit installed |

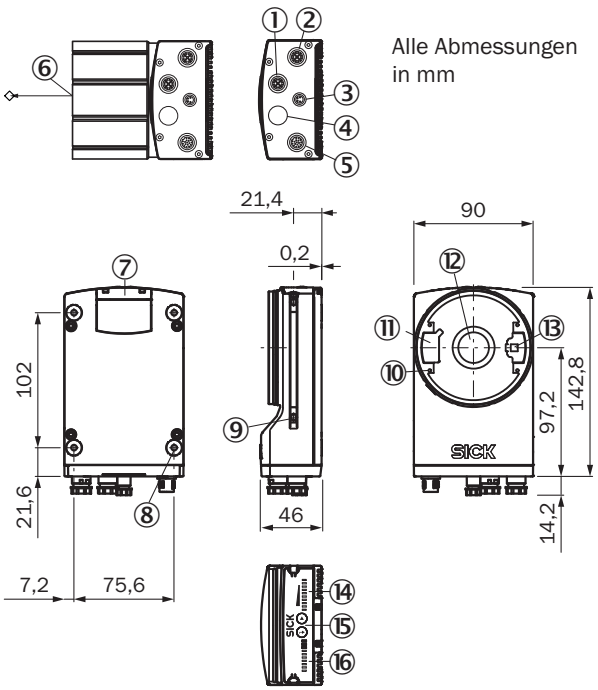
| Position | Description |
|---|---|
| 12 | **Focal length (lens unit)**<br>H: 54 mm<br>K: 40 mm<br>X: No lens installed |
| 13 | **Connection variants**[1)]<br>A: Connection variant 1<br>F: Connection variant 2<br>H: Connection variant 3 |
| 14 | **IP protection class and front screen**<br>5: IP 65: Plastic front screen<br>6: IP 65: Glass front screen |

1) see "Connections and pin assignment", page 34

## 3.2 Product characteristics

### 3.2.1 Device view

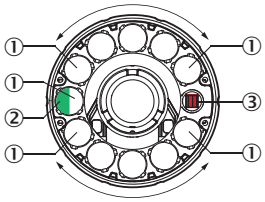
**InspectorP64x/65x Flex dimensional drawing**




① Connection P1, function and design dependent on type
② Connection P3, function and design dependent on type
③ Connection X2, function and design dependent on type
④ Connection P2, function and design dependent on type
⑤ Connection X1, function and design dependent on type
⑥ Reference point for working distance (center of front screen) from InspectorP64x/65x Flex to object
⑦ Black cover for the micro SD memory card slot
⑧ M5 blind tapped holes, 5 mm deep (4 x), for mounting the InspectorP64x/65x Flex
⑨ Optics protective hood for lens unit and integrated illumination
⑩ Sliding nut M5, 5.5 mm deep (2 x), pivoting, for an alternative method of mounting the InspectorP64x/65x Flex
⑪ Feedback LED, green

⑫ Ring light (11 x LEDs)
⑬ Lens unit
⑭ Outlet opening for light beam from aiming laser
⑮ Bar graph display (10 x LEDs)
⑯ Function button (2 x)
⑰ LEDs for status display (10 x 2 levels)

### Integrable illumination unit (option)




① Illumination via 11 LEDs
② Feedback LED, green (pass), briefly generates a light spot on the object within the field of view after a successful analysis (default)
③ Opening in the illumination for the aiming laser for alignment, the red laser LEDs can be switched off and generates a red cross on the object within the field of view

## 3.2.2 Status indicators and functions


① Return pushbutton
② Arrow pushbutton

### Status indicators on the first display level

| Display | LED | Color | Status |
|---|---|---|---|
| **Ready** | | Green | Sensor ready |
| | | Red | Hardware or software error |
| **Result** | | Green | Analysis successful |
| | | Red | Analysis unsuccessful |
| **Light** | | Green | Illumination on, internal trigger active |
| **Funct** | | Green | Function can be defined by user |
| | | Yellow | Function can be defined by user |
| | | Blue | Function can be defined by user |
| | | Red | Function can be defined by user |

= illuminated, = flashing

### 3.2.3 Product features and functionality

The InspectorP6xx is a vision sensor which is well-suited for a wide variety of industrial tasks thanks to its programmable interface.

Convenient functions such as function buttons, auto-setup, aiming laser, an acoustic feedback signal, and a green feedback LED reduce the amount of work required for training and installation.

The microSD memory card can be used to store images or backup copies of parameters. Thanks to SICK's 4Dpro feature, the InspectorP6xx can be integrated into numerous industrial networks.

### 3.2.4 SICK AppSpace

The SICK AppSpace ecosystem reveals new paths leading to solutions for customer-specific applications and consists of software tools and programmable sensors or devices, such as the InspectorP6xx. The SICK AppStudio SDK is used for developing sensor apps on programmable SICK devices. Its user interface for machine operators can be created individually as a web GUI. The SICK AppManager software tool supports the service in the field in the simple distribution and management of sensor apps.

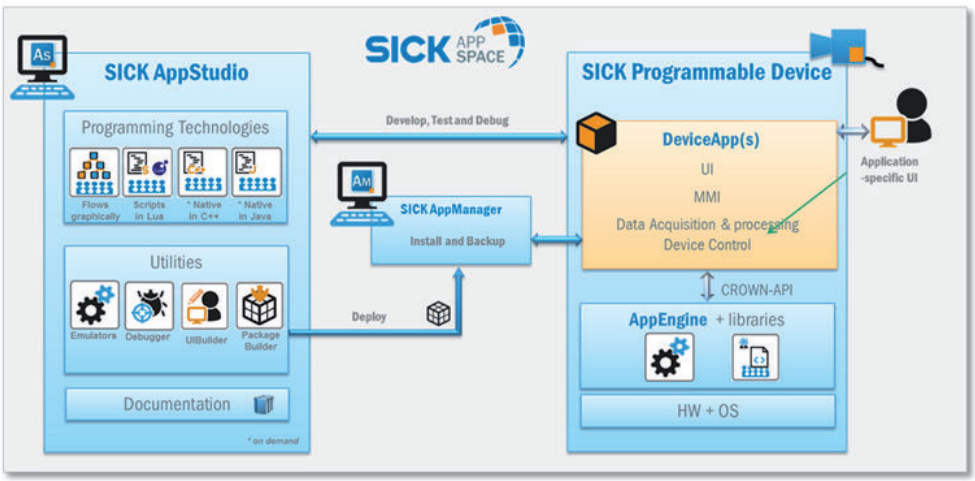



*Figure 2: SICK AppSpace*

Detailed instructions on the SICK AppStudio as well as programming the InspectorP6xx can be found supportportal.sick.com.

# 4 Transport and storage

## 4.1 Transport

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

**NOTE**

**Damage to the device due to improper transport.**

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

## 4.2 Transport inspection

Immediately upon receipt 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.

## 4.3 Storage

Store the device under the following conditions:

- Recommendation: Use the original packaging.
- 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 71.
- Relative humidity: see "Technical data", page 71.
- 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 mounting of the device is divided into the following steps:

- Mount the device.
- Align the device with the object.
- Connect the device to interfaces and supply voltage.
- Adjust the device.

## 5.2 Scope of delivery

Depending on the device version and the accessories ordered, the scope of delivery will include the listed items:

- The version of the camera housing ordered, with a C-mount threaded connection (InspectorP6xx Flex) **or** InspectorP65x DynamicFocus (incl. pre-mounted lens)
- Two sliding nuts, M5
- Light inlet and electrical connections fitted with protective caps/plugs.
- SW 2 hexagon key for opening and closing the cover of the micro SD card slot and mounting the integrable illumination unit from the optic kit (InspectorP6xx Flex)
- SICK lens cloth

### Accessories

Accessories, such as the optic kit, brackets, and connecting cables, are only supplied if ordered separately

## 5.3 Optic kit scope of delivery

*Figure 3: Optic kit*

The optic kit is an accessory which can be optionally ordered for the InspectorP6xx Flex product family and is mounted on the C-Mount threaded connection of the camera housing.

**NOTE**
The IP protection class IP65 can only be guaranteed with the optic protective hood (can also be ordered individually).

The following components are included in the scope of delivery of the optic kit:

- Application-specific lens unit
- Application-specific VI83I illumination unit (ring light), luminous field appropriate for focal distance of lens
- Two spacers, one with a plated-through connection for the electrical connection
- Screws: 4 x M2, 5 x 6 mm, 4 x M2, 5 x 12 mm, all screws have a hexagon cylinder head, SW 2
- IP65 optics protective hood with screw thread and viewing window

## 5.4 Preparation for mounting

### 5.4.1 Mounting requirements

**NOTICE**
**Radio interference may occur when the device is used in residential areas!**
Only use the device in industrial environments (EN 61000-6-4).

- Typical space requirement: See type-specific dimensional drawing and field of view diagram
- Comply with technical data, such as the permitted ambient conditions for operation (e.g., temperature range, EM interference emissions, ground potential), see "Technical data", page 71
- To prevent condensation, avoid exposing the device to rapid changes in temperature
- Protect from direct sunlight
- Ensure that there is good heat transfer from the device, in particular at high ambient temperatures (e.g., via the bracket to the mounting base or ensure that the back of the device is a sufficient distance from the wall of a housing)
- Only to be mounted using the threaded mounting holes provided for this purpose or the sliding nuts.
- Shock and vibration-free mounting
- Clear view of the objects to be detected

**Equipment required**

- Mounting device (bracket) with sufficient load-bearing capacity and suitable dimensions
- Two or four M5 screws for mounting on a mounting device supplied by the customer. Screw length is dependent on the mounting base (wall thickness of the bracket)
  When using an optional SICK bracket, the screws for mounting are included with delivery.
- Tool and tape measure

### 5.4.2 Mounting the device

The device is mounted using threaded mounting holes (M5) or sliding nuts.

The threaded mounting holes are located on the rear of the device.

The sliding nuts can each be inserted into a slot on the side of the housing.

SICK offers prefabricated brackets which are optimally suited for mounting the device in a wide range of applications (www.sick.com).

**User-supplied brackets**

A user-supplied bracket must meet the following requirements:

- Alignment of the device in the x and y axes can be adjusted
- The mounting device must be able to bear the weight of the device and connecting cables free of vibrations
- In mounting situations with strong vibrations, shock mounts may need to be provided
- Mounting options must be available for the 4 threaded mounting holes or the two sliding nuts

## 5.5 Mount the optics

**NOTE**
This mounting step is only required if the optional optics accessory has been included in the order for a programmable vision sensor of the InspectorP6xx Flex product family. This does not apply for the Dynamic Focus type.

### 5.5.1 Mounting the lens and illumination unit

**NOTICE**
**Possible impairment of image quality!**
Dust and fingerprints on optical boundary surfaces can reduce image quality and may also affect the decoding performance of the device.

- When mounting the optics accessories, always ensure that the environment is free of dust.
- Do not touch the image sensor (CMOS) in the light inlet opening of the sensor or the glass lenses at either end of the lens unit.

**NOTE**
When mounting the optics accessories on the camera housing, always ensure that there is no power to the system.

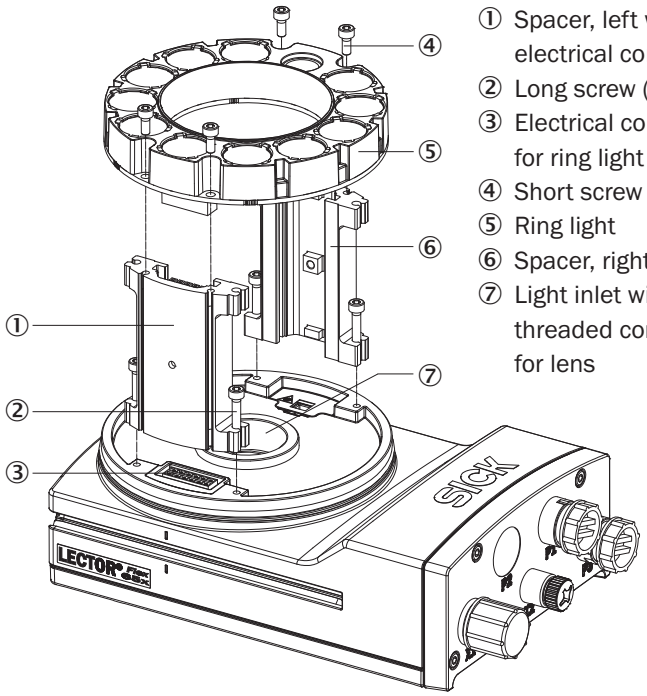
**Mount the optics**

1. Place the camera housing on a nonslip base.
2. Remove the protective cap from the round light inlet.
3. If necessary, carefully insert the filter (optional) and spacer disk into the light inlet.
4. Screw the lens unit into the C-mount thread. This will also lock the optional filter in place at the same time (if applicable).

**Mounting the illumination unit**

**NOTICE**
**Risk of damage due to electrostatic discharge!**
Electrostatic discharge from the human body may damage parts of the illumination unit or the camera housing.
The illumination variants for lenses with a focal distance of 12 mm or 16 mm do not feature any plastic lenses in front of the LEDs in the round recesses.

- Do not insert your fingers into the recesses.
- Do not touch the open contacts of the electrical connection for the illumination unit on the camera housing.




① Spacer, left with electrical connection
② Long screw (4 x)
③ Electrical connection for ring light
④ Short screw (4 x)
⑤ Ring light
⑥ Spacer, right
⑦ Light inlet with threaded connection for lens

1. Peel off the white protective sticker on the camera housing that covers the electrical connection ③ for the illumination unit.
2. Take two pairs of long screws and screw them into the threaded mounting holes to attach each spacer (① and ⑥) to the correct side of the camera housing.
3. Use the 4 short screws to attach the illumination unit ⑤ to the two spacers.
4. Manually preset the sharpness and aperture of the lens unit.
5. Mount the optics protective hood.

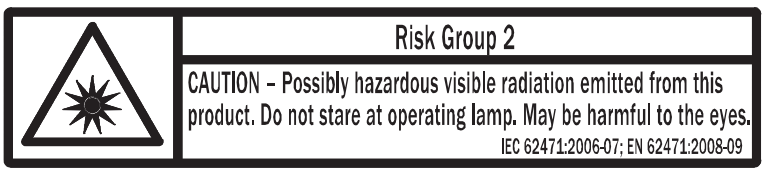
### 5.5.2 Attaching the warning label

Devices and illumination units (VI83) equipped with LEDs in risk group RG 2 feature the following warning label.

The warning label is located on the exterior of the housing of the devices. For the illumination units, the warning label is located on the outer ring.

Integrable illumination unit types in risk group RG 2 that are to be mounted by the user are accompanied by an additional black and yellow warning label for RG 2 optical radiation.

Attach the additional warning label to the outside of the protective optics cover in a clearly visible location. When the protective optics cover is mounted, the warning label on the illumination unit is hidden.




1. Affix the illumination unit to the device housing.
2. Manually adjust the sharpness and mask settings of the lens unit and check using the live image in SICK AppStudio.
3. Attach the protective optics cover and screw it tight.

4. Attach the warning label to the protective optics cover near the light outlet so that it is clearly visible.
5. If the device itself is integrated into machinery, for example, in a way which obscures the warning label attached, additional, clearly visible labels should be attached to the machinery close to where the light is emitted.

For commissioning using SICK AppStudio see "Programming the device with SICK AppStudio", page 64.

## 5.6 Mounting location

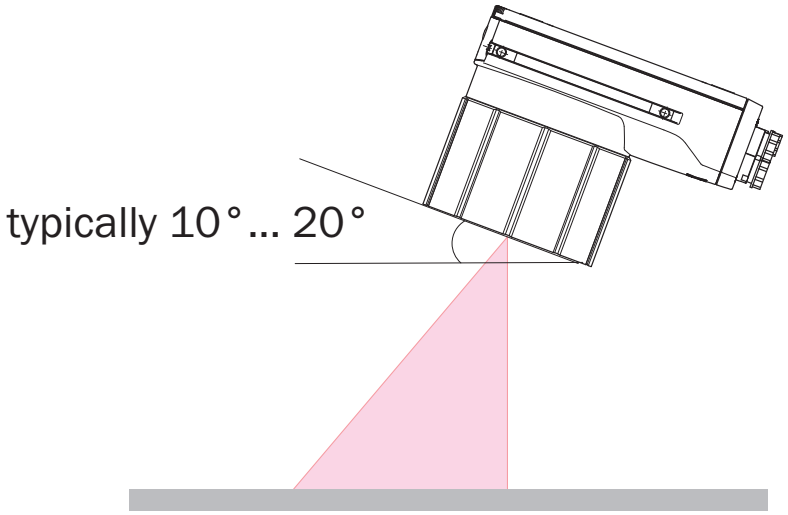
### 5.6.1 Working distance

Depending on the device type, the maximum working distance is between 50 mm and 2,200 mm.

The field of view is produced depending on the focus position, focal length of the lens, and the working distance. The necessary working distance can be determined based on the field of view diagram (see "Field of view diagrams", page 21).

### 5.6.2 Mounting bracket and reflection prevention

In order to avoid reflections from the surfaces to be scanned, the device is tilted so it is perpendicular to the surface.



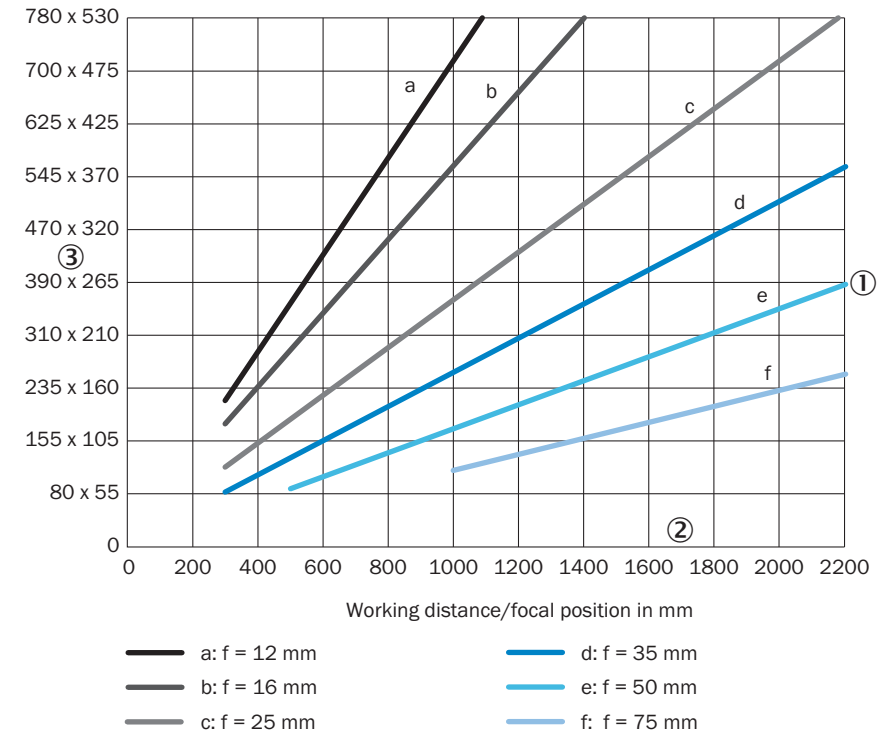

Typical values are between 10° and 20°.

Depending on the application, an angle of between 0° (bright field light) and 45° (dark field light) may be advisable.

### 5.6.3 Field of view diagrams

#### InspectorP64x Flex

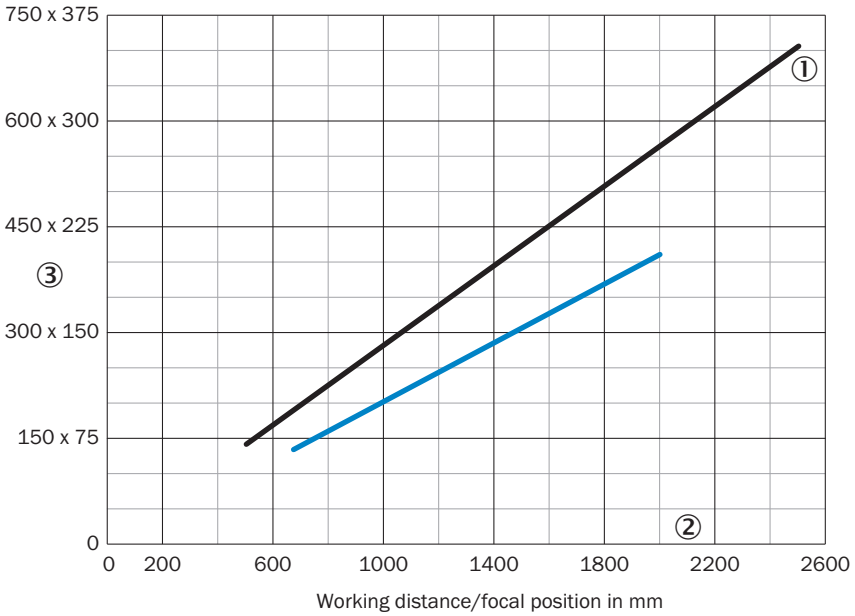
Field of view in mm²




① Lens focal length
② Working distance in mm
③ Field of view in mm²

### InspectorP652 Dynamic Focus

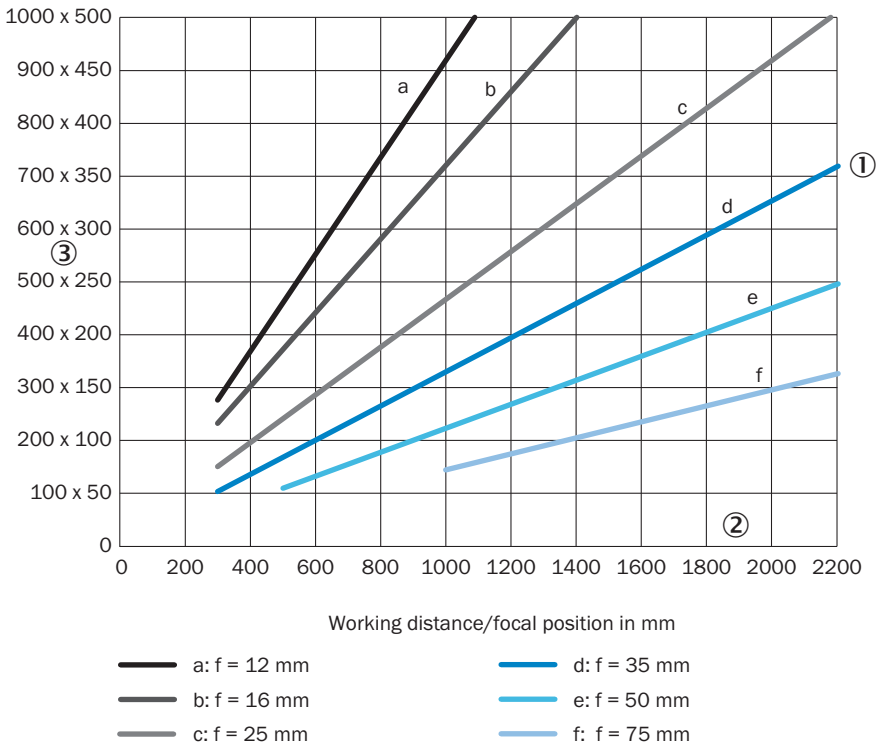
Field of view in mm²




① Lens focal length
② Working distance in mm
③ Field of view in mm²

### InspectorP652 Flex

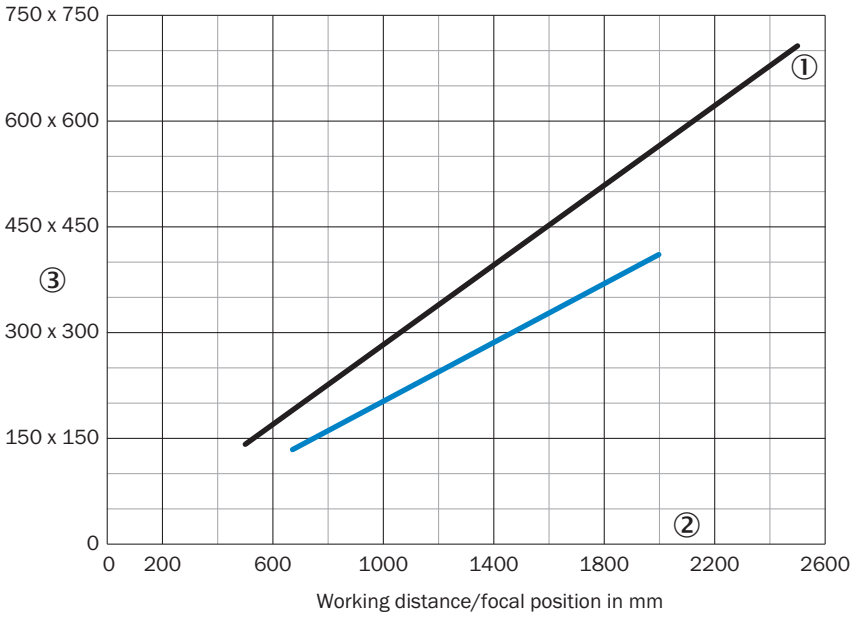
Field of view in mm²




① Lens focal length
② Working distance in mm
③ Field of view in mm²

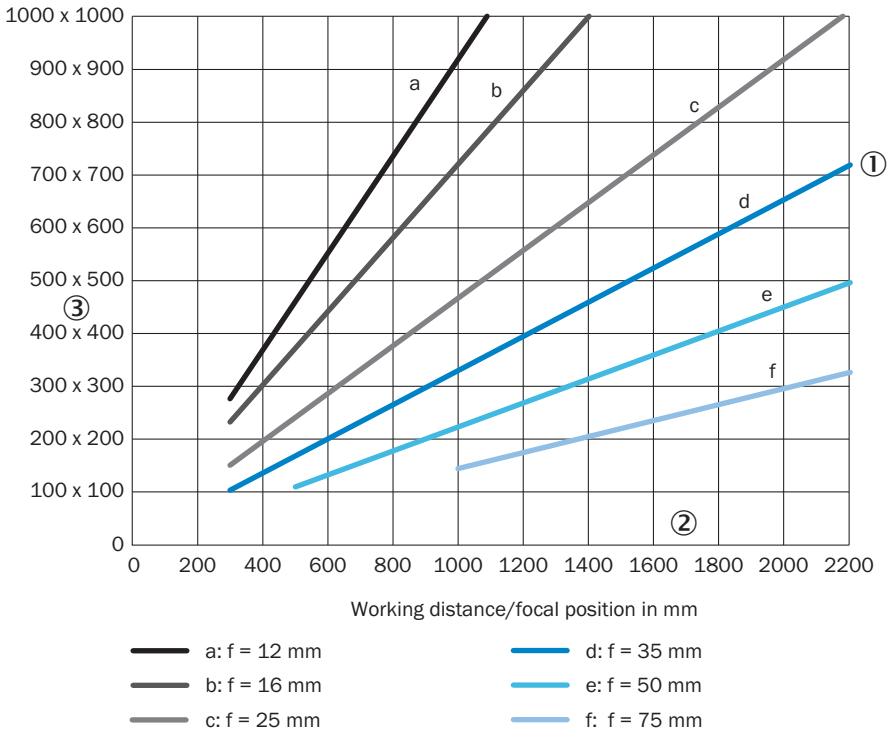
### InspectorP654 Dynamic Focus

Field of view in mm²




① Lens focal length
② Working distance in mm
③ Field of view in mm²

### InspectorP654 Flex




① Lens focal length
② Working distance in mm
③ Field of view in mm²

## 5.7 Mounting the device

### Mounting the device

Mount the device on a bracket using M5 screws. To do this, either use all 4 threaded mounting holes on the rear of the device or, alternatively, use the two M5 sliding nuts in the lateral slots.

Insert the screws into the threaded mounting holes/sliding nuts by a maximum of 5 mm.

Alternatively, attach the SICK bracket that has been ordered separately (e.g., mounting bracket) to the device using the two sliding nuts.

### Aligning the device plus inspection window with the object

Remember to consider the shape and alignment of the field of view in front of the device.


① InspectorP654 with 4.2 mpx image sensor

② InspectorP652 with 2.1 mpx image sensor
③ InspectorP642 with 1.7 mpx image sensor
④ Field of view

The device must be aligned taking into account the field of view (see "Field of view diagrams", page 21) and the application conditions (see "Mounting requirements", page 17).

# 6 Electrical installation

## 6.1 Security

### 6.1.1 Notes on electrical installation

**NOTICE**
**Equipment damage due to incorrect supply voltage!**

An incorrect supply voltage may result in damage to the equipment.

The device may only be powered using a voltage source that meets the following requirements:

- SELV (EN 60950-1) or ES-1 (EN 62368-1)
- LPS (EN 60950-1 or EN 62368-1)

**NOTICE**
**Equipment damage or unpredictable operation due to working with live parts!**

Working with live parts may result in unpredictable operation.

- Only carry out wiring work when the power is off.
- Only connect and disconnect electrical connections when the power is off.

- **The electrical installation must only be performed by electrically qualified personnel.**
- **Standard safety requirements must be met when working on electrical systems!**
- Only switch on the supply voltage for the device when the connection tasks have been completed and the wiring has been thoroughly checked.
- When using extension cables with open ends, ensure that bare wire ends do not come into contact with each other (risk of short-circuit when supply voltage is switched on!). Wires must be appropriately insulated from each other.
- Wire cross-sections in the supply cable from the customer's power system must be designed in accordance with the applicable 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).
- Circuits connected to the device must be designed as SELV circuits (SELV = Safety Extra Low Voltage).
- Protect the device with a separate fuse at the start of the supply circuit.

**NOTE**
**Layout of data cables**

- Use screened data cables with twisted-pair wires.
- Implement the screening design correctly and completely.
- To avoid interference, e.g. from switching power supplies, motors, clocked drives, and contactors, always use cables and layouts that are suitable for EMC.
- Do not lay cables over long distances in parallel with power supply cables and motor cables in cable channels.

The IP 67 enclosure rating for the device is only achieved under the following conditions:

- The cables plugged into the M12 and M8 connections are screwed tight.
- Any electrical connections that are not being used must be fitted with protective caps/plugs that are screwed tight (as in the delivery condition).
- The black cover of the USB interface must be closed and lie flush on the device.

If this is not done, the device does not fulfill any specified IP enclosure rating!

### 6.1.2 Wiring notes

**NOTICE**

**Faults due to incorrect wiring.**

Incorrect wiring may result in operational faults.

- For data transmission, use only screened cables with twisted-pair wires.
- Follow the wiring notes precisely.

**NOTE**

Preassembled cables can be found online at:

- ▶ www.sick.com/inspectorp64x
- ▶ www.sick.com/inspectorp65x

All electrical connections of the device are configured as round connectors . The IP65 protection class is only achieved with screwed plug connectors or cover caps.

Please observe the following wiring notes:

- A correct and complete cable shielding design is required for trouble-free data transmission.
- The cable shield must be connected at both ends in the control cabinet and at the device. The cable shield of the pre-assembled cables is connected to the knurled nut and thus also to a large area of the device housing.
- The cable shield in the control cabinet must be connected to a large area of the signal ground (see figure 7).
- Appropriate measures must be taken to prevent equipotential bonding currents flowing through the cable shield.
- During installation, pay attention to the different cable groups. The cables are grouped into the following 4 groups according to their sensitivity to interference or radiated emissions.
  - Group 1: Cables very sensitive to interference, such as analog measuring cables
  - Group 2: Cables sensitive to interference, such as sensor cables, communication signals, bus signals
  - Group 3: Cables which are a source of interference, such as control cables for inductive loads, motor brakes
  - Group 4: Cables which are powerful sources of interference, such as output cables from frequency inverters, welding system power supplies, power cables
  - ▷ Cables in groups 1, 2 and 3, 4 must be crossed at right angles see figure 4
  - ▷ Cables in groups 1, 2 and 3, 4 must be routed in different cable channels or metallic separators must be used see figure 5 and see figure 6. This applies particularly where cables of devices with a high level of radiated emission, such as frequency converters, are laid parallel to sensor cables.

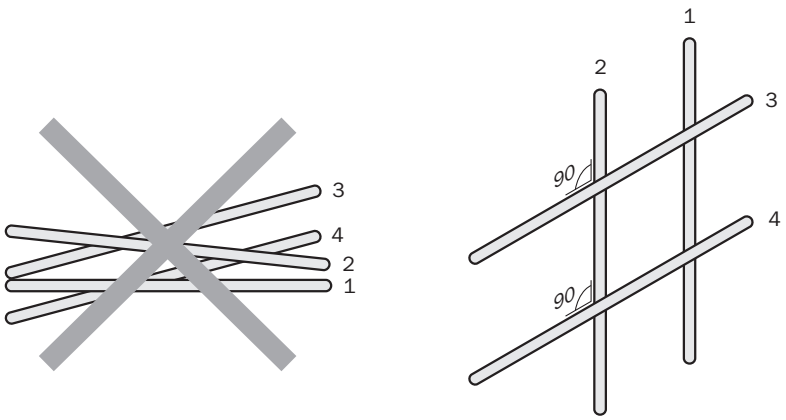



*Figure 4: Cross cables at right angles*

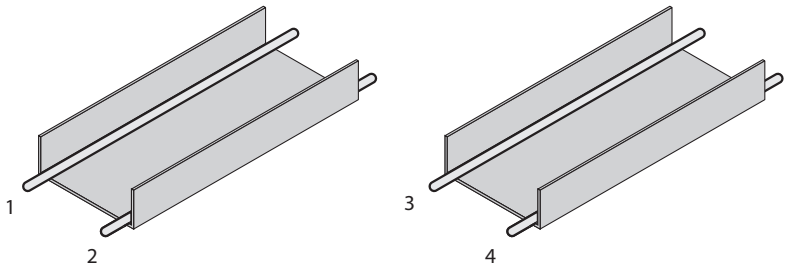



*Figure 5: Ideal laying – Place cables in different cable channels*

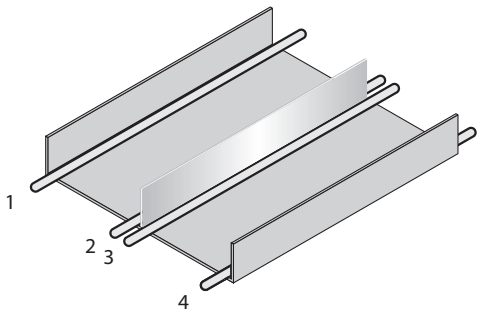



*Figure 6: Alternative laying – Separate cables with metallic separators*

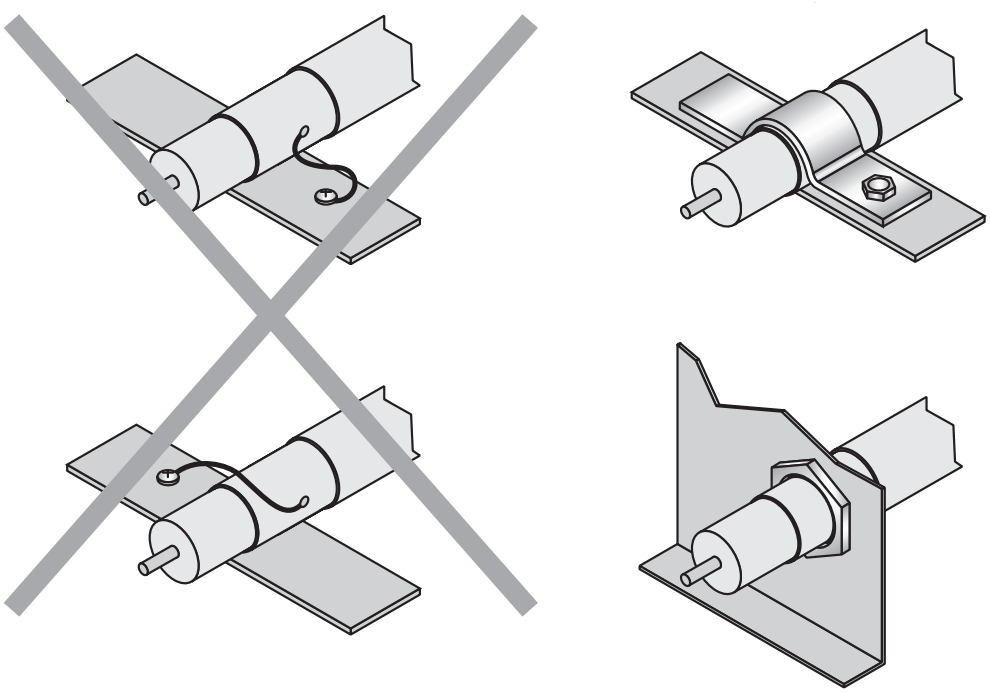


*Figure 7: Make an extensive and low-impedance ground connection of the cable shield in the control cabinet.*

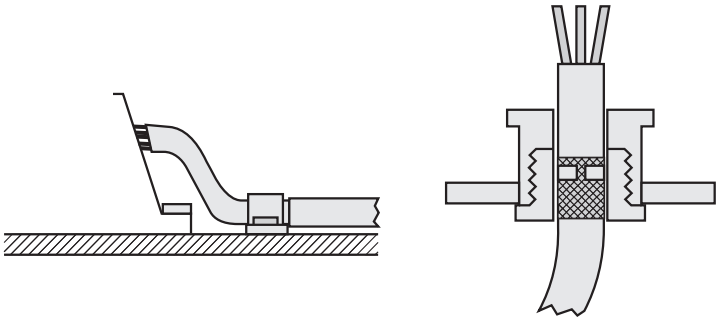


*Figure 8: Shield connection in plastic housings*

### 6.1.3 Prerequisites for the safe operation of the device in a system

**WARNING**
**Risk of injury and damage caused by electrical current!**

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

- Metal housings are vulnerable to dangerous currents
- 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.
- ▶ Ensure that the ground potential is the same at all grounding points.
- ▶ If the cable insulation is damaged, disconnect the voltage supply immediately and have the damage repaired.
- ▶ Where local conditions are unfavorable and therefore do not meet conditions for a safe grounding method (same ground potential at all grounding points), take measures in accordance with the following formats.

The device is designed and tested for electrical safety in accordance with EN 60950-1. It is connected to the peripheral devices (voltage supply, any local trigger sensor(s), PLC) via shielded cables. The cable shield – for the data cable, for example – rests against the metal housing of the SICK device. The device can either be grounded through the cable shield or through one of the threaded mounting holes.

If the peripheral devices have metal housings and if the cable shields also lie on 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
- Correct grounding of the devices/metal surfaces in the system.
- If necessary: low-impedance and current-carrying equipotential bonding between areas with different ground potentials

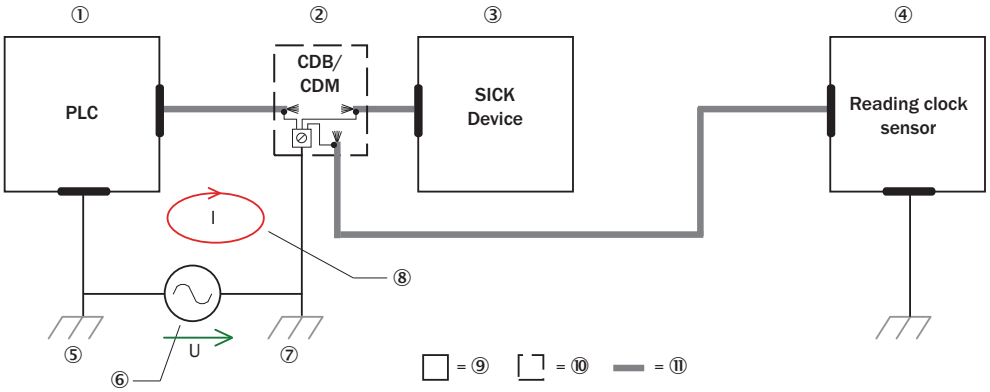



*Figure 9: Occurrence of equipotential bonding currents in the system configuration*

① PLC (programmable logic controller)
② CDB/CDM connection module
③ SICK device
④ Trigger sensor (e.g., photoelectric sensor)
⑤ Grounding point 1

⑥ Ground potential difference
⑦ Grounding point 2
⑧ Closed current loop with equalizing currents via cable shield
⑨ Metal housing
⑩ Plastic housing
⑪ 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; this can be dangerous. 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 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 while at the same time complying with all the requirements of EN 60950-1.

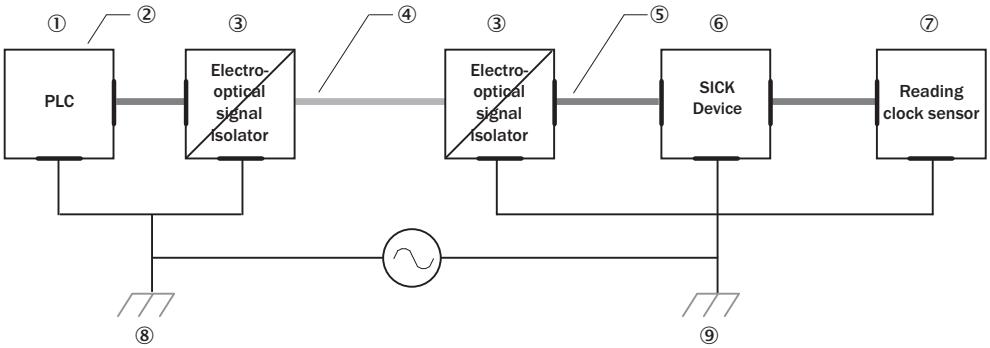



*Figure 10: Prevention of equipotential bonding currents in the system configuration by the use of electro-optical signal isolators*

① PLC (programmable logic controller)
② Metal housing
③ Electro-optical signal isolator
④ Optical fiber
⑤ Shielded electrical cable
⑥ SICK device
⑦ Trigger sensor (e.g., photoelectric sensor)
⑧ Grounding point 1
⑨ Grounding point 2

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 SICK device and of peripheral devices may be a sufficient solution.

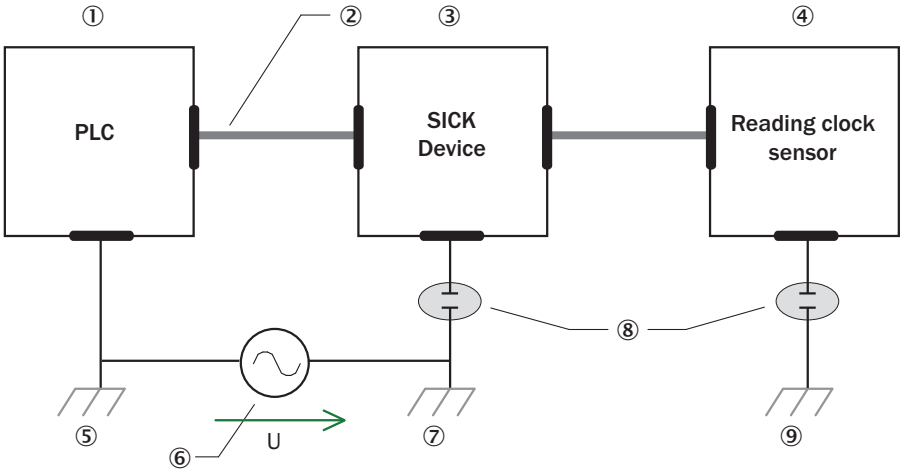



*Figure 11: Prevention of equipotential bonding currents in the system configuration by insulated mounting of the device*

① PLC (programmable logic controller)
② Shielded electrical cable
③ SICK device
④ Trigger sensor (e.g., photoelectric sensor)
⑤ Grounding point 1
⑥ Ground potential difference
⑦ Grounding point 2
⑧ Insulated mounting
⑨ Grounding point 3

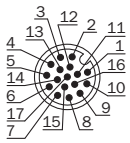
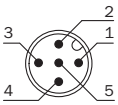
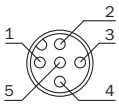
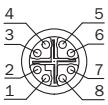
Even in the event of large differences in the ground potential, ground loops are effectively prevented. As a result, equalizing currents can no longer flow via the cable shields and metal housing.

**NOTICE**

The power supply for the SICK 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 Connections and pin assignment

| Pin | Power/ SerialData/CAN/IO | CAN IN | CAN OUT | USB | Triggering of external illumination | GB Ethernet | Ethernet |
|---|---|---|---|---|---|---|---|
| |  17-pin M12 male connector, A-coded |  5-pin M12 male connector, A-coded |  5-pin M12 female connector, A-coded |  4-pin M8 female connector |  3-pin M8 female connector |  8-pin M12 female connector, X-coded |  4-pin M12 female connector, D-coded |
| 1 | GND | Shield | Shield | +5 V | Sensor 1 | TRD0_P | TX+ |
| 2 | DC 24 V ± 20% | DC 24 V ± 20% | DC 24 V ± 20% | Data- | – | TRD0_N | RX+ |
| 3 | CAN L | GND | GND | Data+ | Result 4 | TRD1_P | TX- |
| 4 | CAN H | CAN H | CAN H | GND | SensGND | TRD1_N | RX- |
| 5 | TD+ (RS-422), Host | CAN L | CAN L | – | – | TRD3_P | – |
| 6 | TD- (RS-422), Host<br>TxD (RS-232), Host | – | – | – | – | TRD3_N | – |
| 7 | TxD (RS-232), Aux | – | – | – | – | TRD2_P | – |
| 8 | RxD (RS-232), Aux | – | – | – | – | TRD2_N | – |
| 9 | SensGND | – | – | – | – | – | – |
| 10 | Sensor 1 switching input | – | – | – | – | – | – |
| 11 | RD+ (RS-422), Host | – | – | – | – | – | – |
| 12 | RD– (RS-422), Host<br>RxD (RS-232), Host | – | – | – | – | – | – |
| 13 | Result 1 switching output | – | – | – | – | – | – |
| 14 | Result 2 switching output | – | – | – | – | – | – |
| 15 | Sensor 2 switching input | – | – | – | – | – | – |
| 16 | Result 3 switching output | – | – | – | – | – | – |
| 17 | Result 4 switching output | – | – | – | – | – | – |

## 6.3 Connection diagrams

### Connection principle

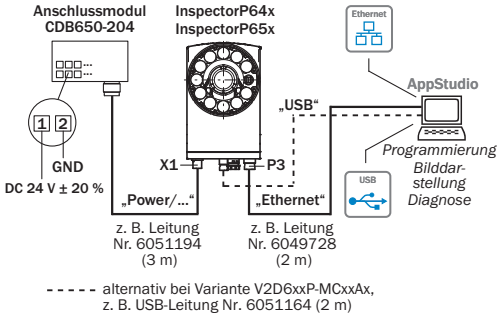



*Figure 12: General connection principle*

### Wiring without SICK connection module

When using customer-specific connection units, the wiring principle for the signals can be found in the connection diagrams for the connection module CDM420-0006, see "Connecting the InspectorP6xx to the CDM420-0006", page 36.

### 6.3.1 Connecting the InspectorP6xx to the CDB650-204

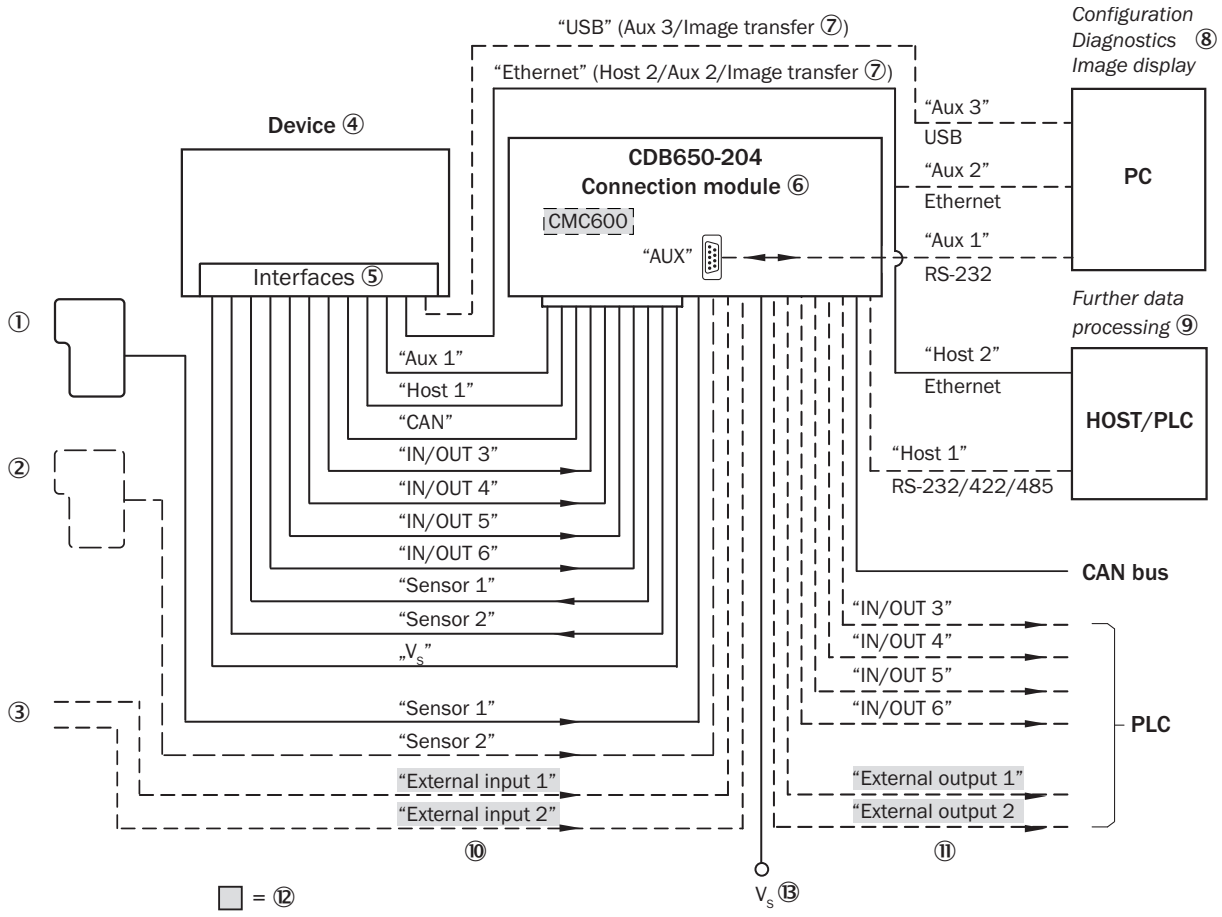



*Figure 13: Connection of the device to peripherals via CDB650-204*

① Start/Stop trigger (e.g. photoelectric sensor)
② Application-dependent alternative stop trigger (e.g. photoelectric sensor) or travel increment (incremental encoder)
③ Other functions
④ Device
⑤ Interfaces
⑥ Connection module
⑦ Image transmission
⑧ Configuration, diagnostics and image display
⑨ Further data processing
⑩ External switching inputs
⑪ External switching outputs
⑫ Parameter cloning module CMC600 is required to be able to use the additional external switching inputs and outputs of the device (highlighted in gray)
⑬ Supply voltage $V_S = U_V$

### 6.3.2 Connecting the InspectorP6xx to the CDM420-0006

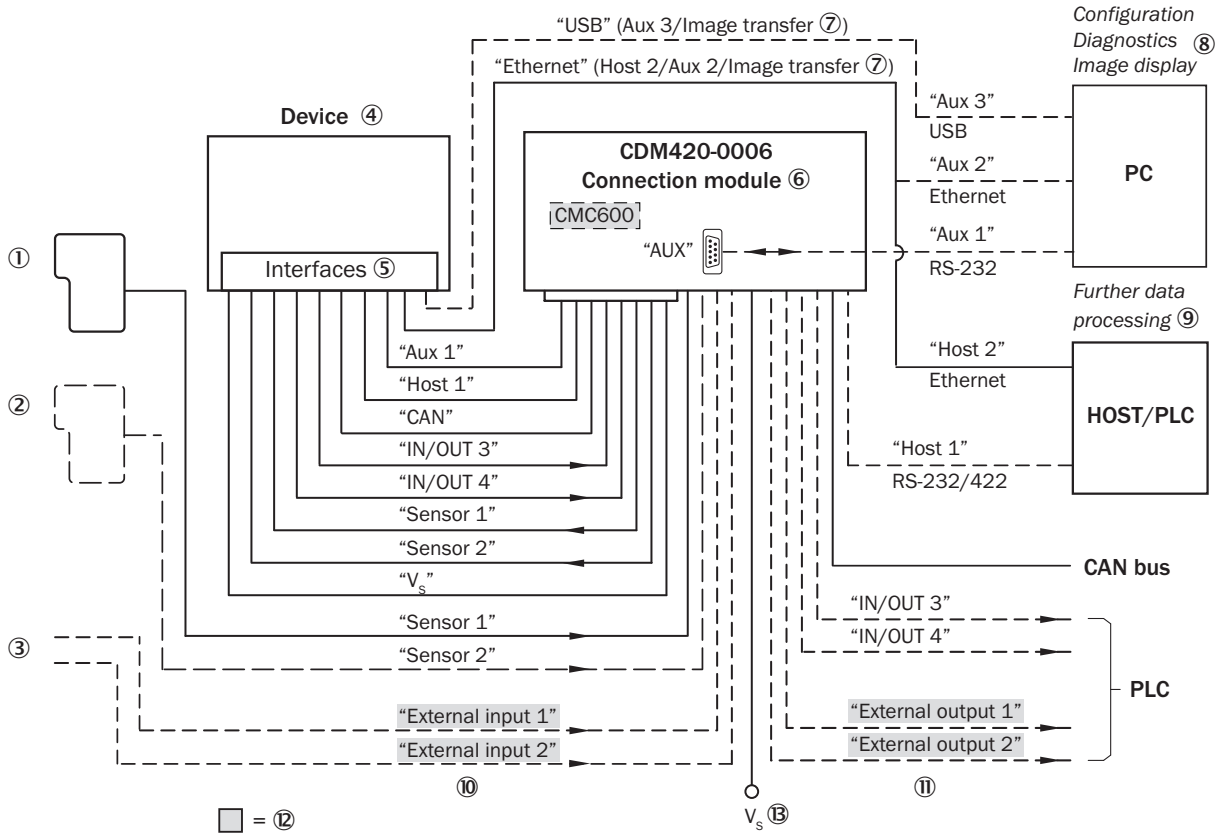



*Figure 14: Connection of the device to peripherals via CDM420-0006 (overview)*

① Start/Stop trigger (e.g. photoelectric sensor)
② Application-dependent alternative stop trigger (e.g. photoelectric sensor) or travel increment (incremental encoder)
③ Other functions
④ Device
⑤ Interfaces
⑥ Connection module
⑦ Image transmission
⑧ Configuration, diagnostics and image display
⑨ Further data processing
⑩ External switching inputs
⑪ External switching outputs
⑫ Parameter cloning module CMC600 is required to be able to use the additional external switching inputs and outputs of the device (highlighted in gray)
⑬ Supply voltage $V_S = U_V$

## 6.4 Connecting the device

### 6.4.1 Connecting the supply voltage

The device must be connected to a power supply unit with the following properties:

- Supply voltage DC 24 V ± 20% (stabilized safety extra low voltage SELV (EN 60950-1) or ES-1 (EN 62368-1) LPS (EN 60950-1 or EN 62368-1))
- Electricity source with at least 30 W power
- Additional 0.5 W output power when using the optional CMC600 parameter memory module in the CDB650-204/CDM420-0006 connection module

### Protecting the supply cables

To ensure protection against short-circuits/overload in the customer's supply cables, the conductor cross sections used must be appropriately selected and protected.

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)

The infeed of the supply voltage is carried out using the connection module; for more on this, see:

| Connection module | Interface | Reference |
|---|---|---|
| CDB650-204 | Supply voltage | page 41 |
| CDM420-0006 | Supply voltage | page 53 |

The connection module CDB650-204 has a 3 A fuse (slow-blow), the CDM420-0006 has a 2 A fuse (slow-blow) in the circuit after switch S1.

## 6.4.2 Wiring the data interface

### Wiring the Ethernet interface

1. Connect the sensor to the Ethernet connection of the PC via the adapter cable.
2. Set up communication via SICK AppStudio.

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

### Wiring the serial data interfaces

The maximum data transmission rate for the serial interface depends on the cable length and on the type of interface. The following recommendations apply:

| Interface type | Data transmission rate | Distance to the target computer (Host) |
|---|---|---|
| RS-232 | Up to 19.2 kBd<br>38.4 kBd ... 57.6 kBd<br>115.2 kBd ... 500 kBd | Max. 10 m<br>Max. 3 m<br>Max. 2 m |
| RS-422[1)] | Up to 38.4 kBd<br>38.4 kBd ... 57.6 kBd<br>57.6 kBd ... 500 kBd | Max. 1200 m<br>Max. 500 m<br>Max. 10 m |

1) For RS-422-suitable cable and corresponding cable termination as per specification

**NOTICE**
**Risk of damage to the internal interface modules!**
If the serial data interfaces are wired incorrectly, then electronic components in the device may get damaged.

- ▶ Observe the information on wiring.
- ▶ Carefully check the wiring prior to switching on the device.

If the wiring is carried out via a connection module:

| Connection module | Data interface | Reference |
|---|---|---|
| CDB650-204 | RS-232 | page 42 |
| | RS-422 | page 42 |
| CDM420-0006 | RS-232 | page 54 |
| | RS-422 | page 54 |

**Termination of the RS-422 data interface**

Termination can be implemented in the CDB650-204/CDM420-0006 connection module via switches.

Additional information on this can be found in the operating instructions for the relevant module.

### 6.4.3 Wiring the CAN interface

If the wiring of the CAN interface is carried out via a connection module:

| Connection module | Data interface | Reference |
|---|---|---|
| CDB650-204 | CAN | page 44 |
| CDM420-0006 | CAN | page 56 |

### 6.4.4 Wiring digital switching inputs

**Physical switching inputs on the device**

The two physical switching inputs “Sensor 1” and “Sensor 2” as well as IN/OUT 3 ... 6 can be used for starting and/or ending the trigger or for feeding an incremental signal.

The switching inputs “Sensor 1” and “Sensor 2” as well as IN/OUT 3 ... 6 are available with the adapter cable (17-pin M12 female connector/15-pin D-Sub HD male connector) in combination with the CDM420.

When using the M12 adapter cable (17-pin M12 female connector/17-pin M12 male connector) in combination with the CDB650 or when using the cable with one open end (17-pin M12 female connector/open end), the switching inputs “Sensor 1” and “Sensor 2” and IN/OUT 3 ... 6 are available.

**Extension: additional logical switching inputs in the device in the case of physical “external” switching inputs on the optional connection module**

Thanks to the optional CMC600 parameter memory module in combination with the CDB650-204 or CDM420-0006 connection module, the two external switching inputs “External input 1” and “External input 2” on the relevant terminals in the connection module are additionally available.

**NOTE**
These two external switching inputs are not suitable for time-critical applications.

If the wiring of the inputs is carried out via a connection module:

| Connection module | Switching input | Reference |
|---|---|---|
| CDB650-204 | Sensor 1 and Sensor 2 | page 45 |
| | External input 1 (“Ext. in 1”) and External input 2 (“Ext. in 2”)[1] | page 47 |
| | Configurable switching inputs IN 3 ... 6 | page 50 |
| CMD420-0006 | Sensor 1 and Sensor 2 | page 57 |
| | External input 1 (“AUX. in 1”) and External input 2 (“AUX. in 2”)[1] | page 59 |
| | Configurable switching inputs IN 3 and 4 | page 50 |

1 Function planned

### 6.4.5 Digital IN/OUT

**Physical switching outputs on the device**

The four physical switching outputs “IN/OUT 3 ... 6” can be allocated independently of each other with various functions for the output of the result status. If the allocated event occurs in the analysis process, then the corresponding switching output is live after the end of the trigger for the selected pulse duration.

Switching outputs IN/OUT 3 ... 4 are available at the adapter cable (17-pin, M12 female connector/15-pin D-Sub HD male connector) in combination with the CDM420.

When using the M12 adapter cables (17-pin, M12 female connector/17-pin M12 male connector) in combination with the CDB650 or when using the cable with the open end (17-pin, M12 female connector/open end), switching outputs IN/OUT 3 ... 6 are available.

**Extension: additional logical switching inputs in the device in the case of physical “external” switching inputs on the optional connection module**

Thanks to the optional CMC600 parameter memory module in combination with the CDB650-204 or CDM420-0006 connection module, the two external switching outputs “External output 1” and “External output 2” on the relevant terminals in the connection module are additionally available.

**NOTE**
These two external switching outputs are not suitable for time-critical applications.

If the wiring of the outputs is carried out via a connection module:

| Connection module | Output signal switching device | Reference |
|---|---|---|
| CDB650-204 | IN/OUT 3 ... 6 (RES/OUT 1 ... 4) | page 49 |
| | External output 1 (“Ext. Out 1“) and External output 2 (“Ext. Out 2“)[1] | page 50 |
| CDM420-0006 | IN/OUT 3 ... 4 | page 61 |
| | External output 1 (“AUX. Out 1“) and External output 2 (“AUX. Out 2“)[1] | page 62 |

1 Function planned

**NOTE**
Capacitive loads on the switching outputs have an effect on the switch-on and switch-off behavior. The maximum capacity of 100 nF is a limit value.

## 6.5 CDB650-204 wiring connection module

### 6.5.1 Wiring overview for InspectorP63x ... 65X (one switching input in use)

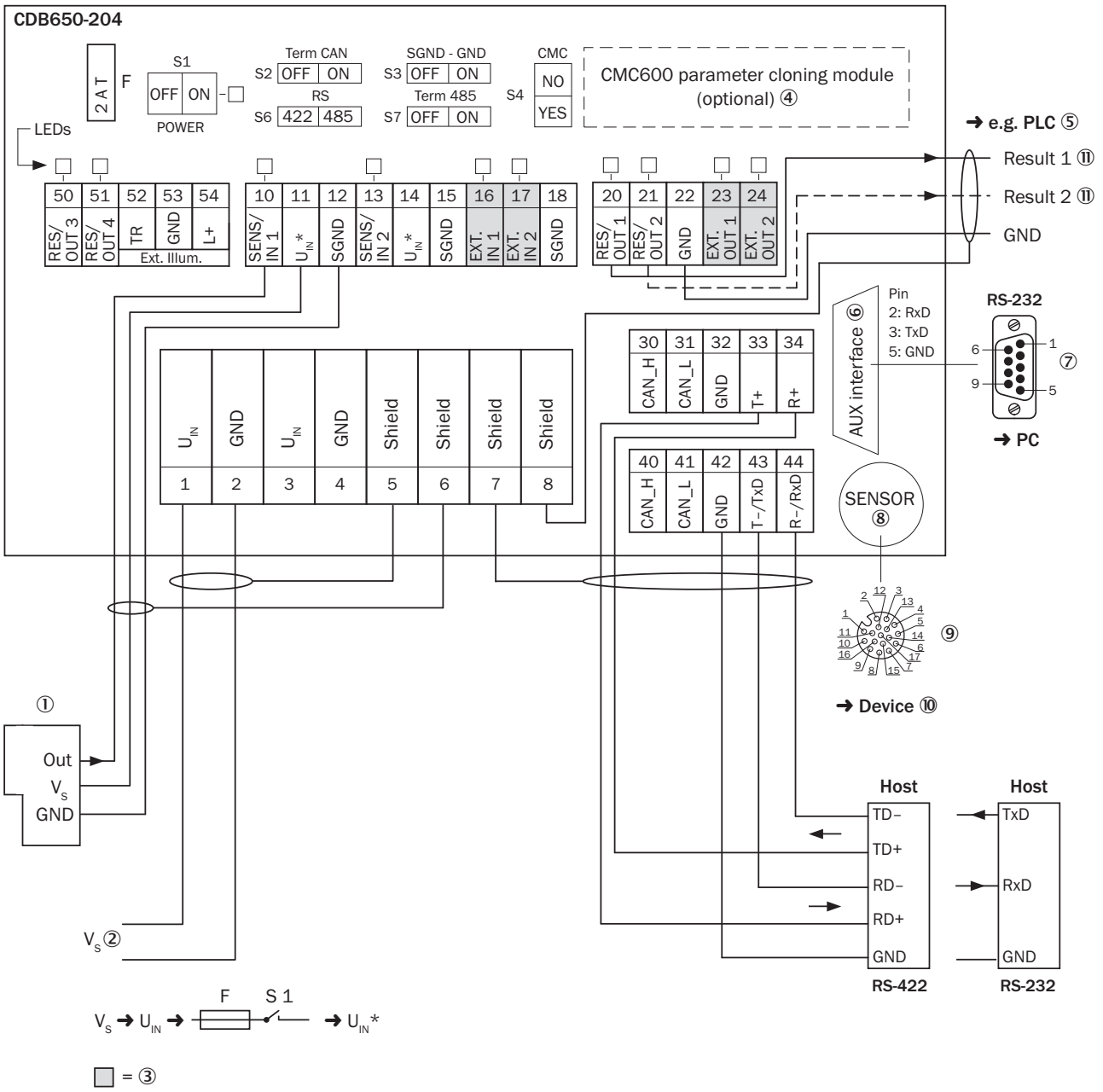



*Figure 15: Connecting the device to the CDB650-204 connection module (overview)*

① External trigger (e.g., photoelectric sensor)

② Supply voltage $V_S = U_V$

③ CMC600 parameter cloning module required in order to be able to use the additional labeled switching inputs and outputs on the device (type-dependent)

④ CMC600 parameter cloning module

⑤ E.g., PLC (programmable logic controller)
⑥ Auxiliary interface “AUX”
⑦ Male connector, D-Sub, 9-pin
⑧ Sensor = Device
⑨ Female connector, M12, 17-pin, A-coded
⑩ Device to be connected
⑪ Name of the switching output

### 6.5.2 Connecting supply voltage for the in the CDB650-204

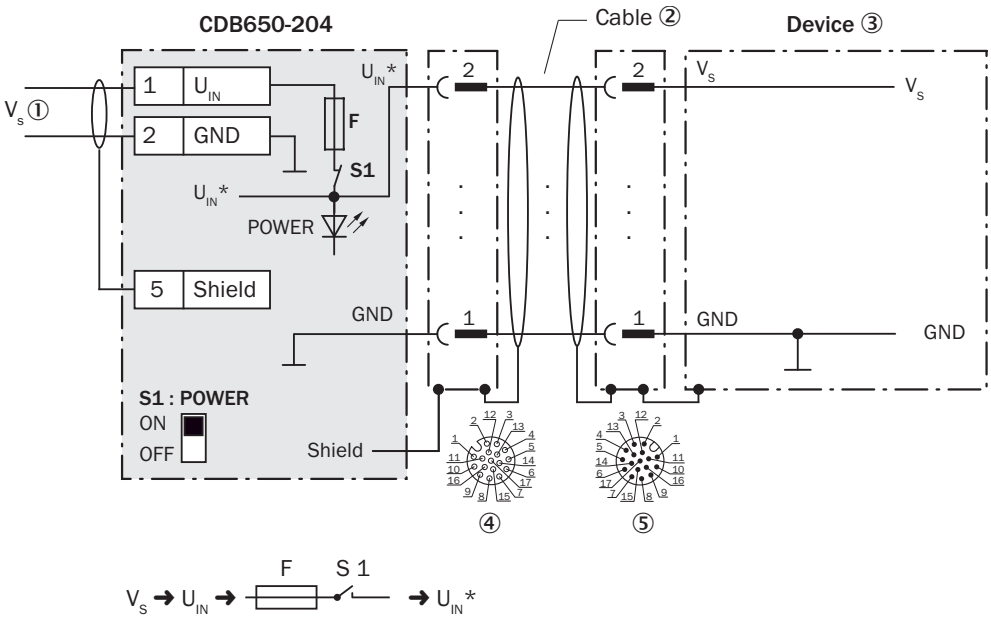



*Figure 16: Connecting the device supply voltage in the CDB650-204 connection module*

① Supply voltage $V_S = U_V$
② 1:1 connecting cable, e.g., part no. 6052286 (2 m)
③ Device
④ Female connector, M12, 17-pin, A-coded
⑤ Male connector, M12, 17-pin, A-coded

#### Function switch S1

| Switch setting | Function |
|---|---|
| ON | Supply voltage $U_{IN}$ supplied to CDB650-204 and device via fuse as $U_{IN}$*.<br>Voltage $U_{IN}$* also available at terminals 11 and 14. |
| OFF | CDB650-204 and device isolated from supply voltage.<br>Recommended position for all connection work. |

*Table 2: Switch S1: power*

### 6.5.3 Wiring the serial host interface RS-232 in the CDB650-204

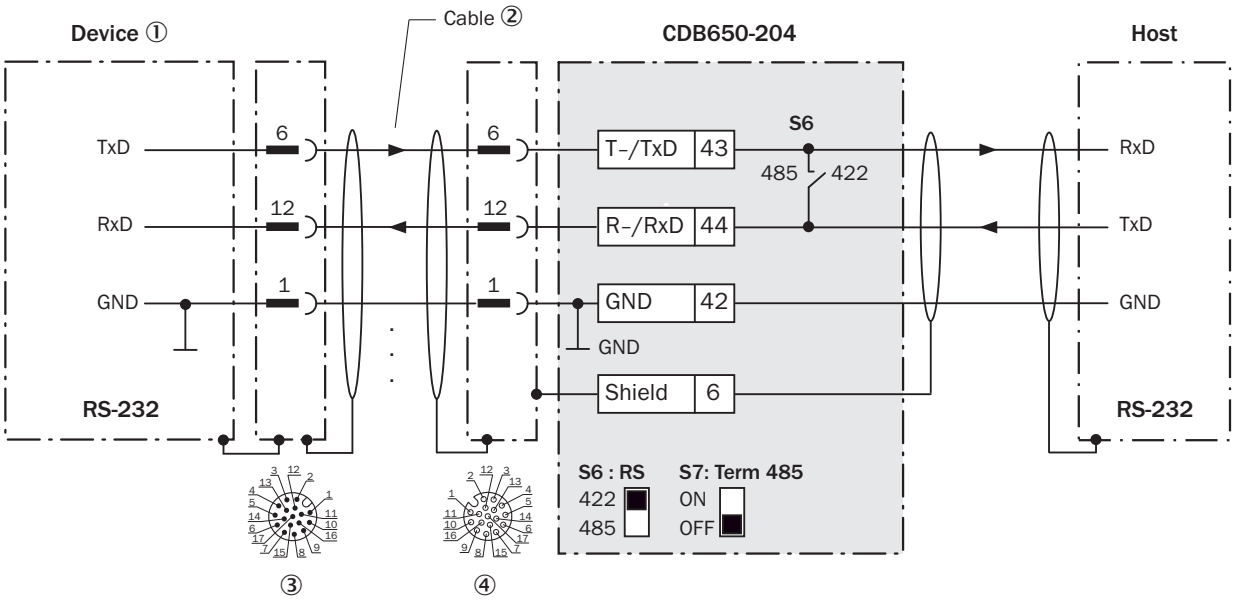



*Figure 17: Wiring the RS-232 data interface*

① Device
② 1:1 connecting cable, e.g., part no. 6052286 (2 m)
③ Male connector, M12, 17-pin, A-coded
④ Female connector, M12, 17-pin, A-coded

### 6.5.4 Wiring the serial host interface RS-422 in the CDB650-204

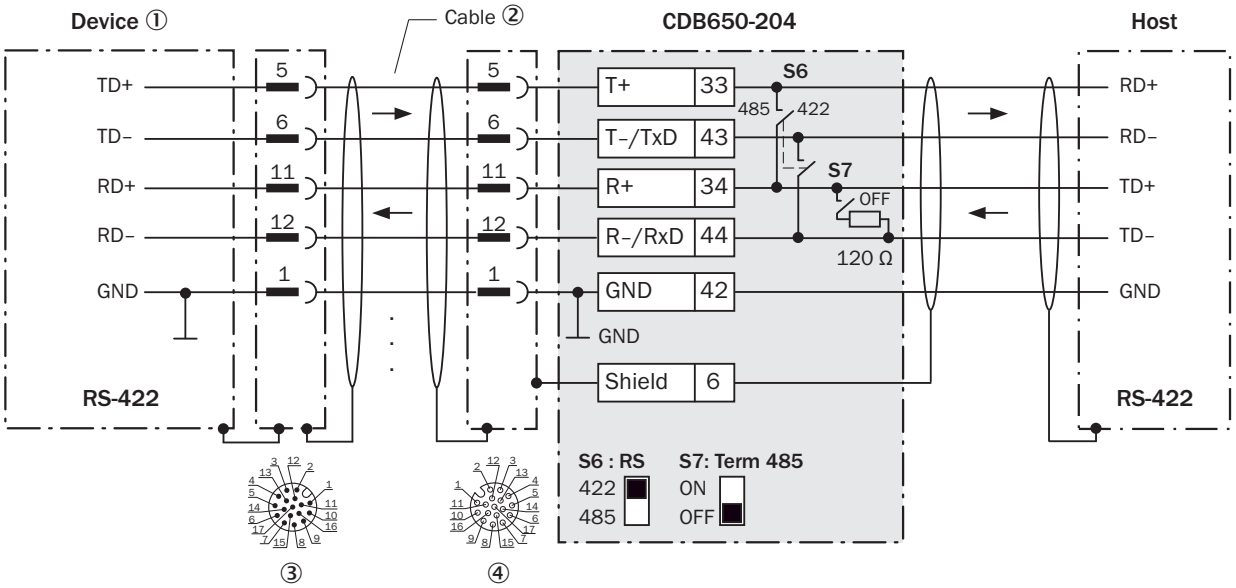



*Figure 18: Wiring the RS-422 data interface*

① Device
② 1:1 connecting cable, e.g., part no. 6052286 (2 m)
③ Male connector, M12, 17-pin, A-coded
④ Female connector, M12, 17-pin, A-coded

### Function switch S7

| Switch setting | Function |
|---|---|
| ON | Terminates the RS-422 receiver in the device in order to improve the interference distance to the cable. |
| OFF | No termination |

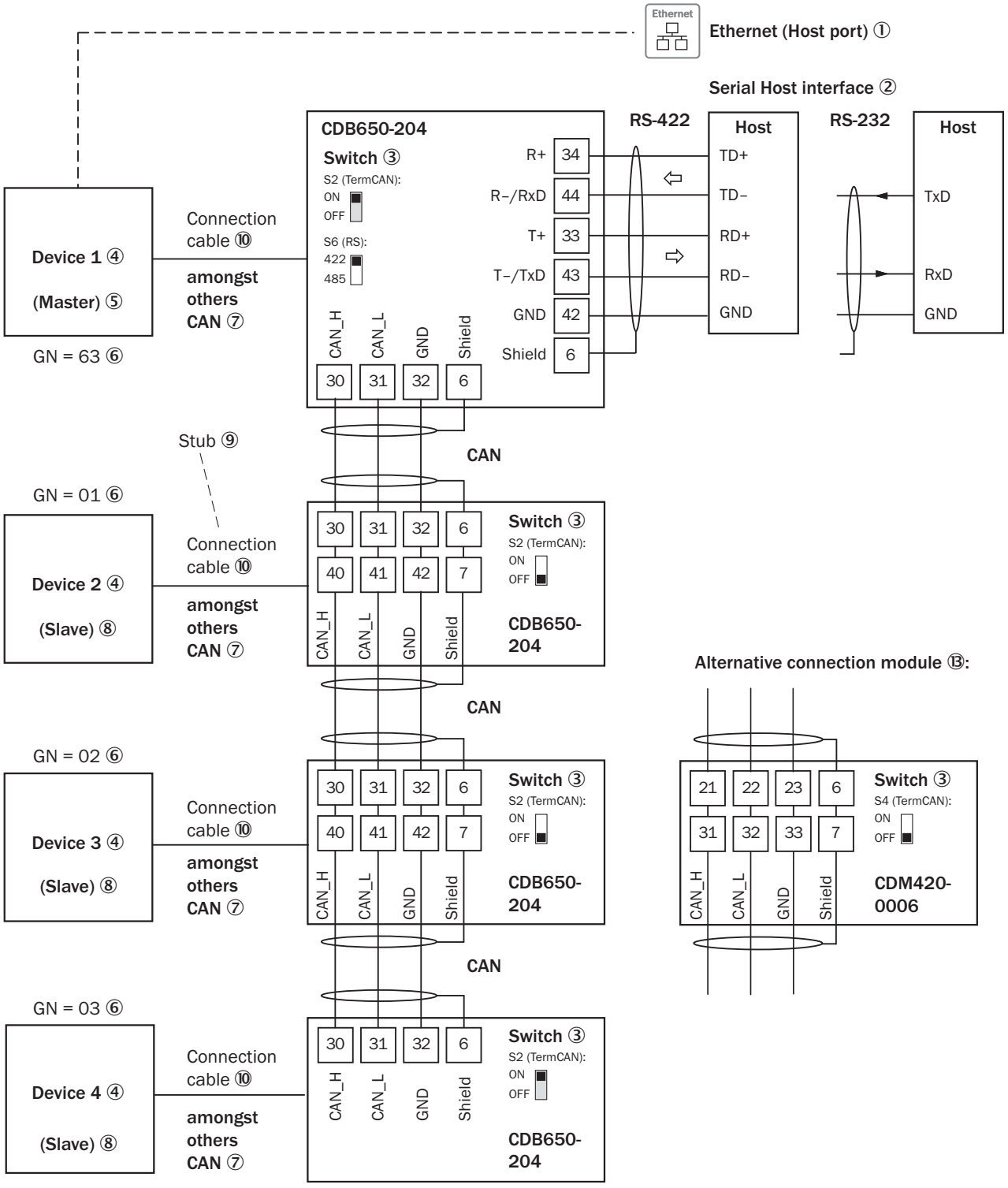
*Table 3: Switch S7: Term 485*

**NOTE**

Use of the RS-422 data interface:

- The relevant interface drivers of the device comply with the standard for RS-422.
- The interface in the device is activated using SICK AppStudio (point-to-point).
- The connection shown above is configured for operation of the host with permanently activated drivers (often described as “RS-422 operation”).

### 6.5.5 Wiring the CAN interface in the CDB650-204




GN = Device number ⑪
(max. 32 participants) ⑫

*Figure 19: Wiring the CAN interface of the device in the CDB650-204 connection module Connection and looping of the supply voltage and connection of the trigger sensor, e.g., to the master not discussed here!*

① Ethernet (host port)
② Serial host interface

③ Switch
④ Device
⑤ Master
⑥ Device number
⑦ CAN, for example
⑧ Slave
⑨ Stub cable
⑩ 1:1 connecting cable, e.g., part no. 6052286 (2 m)
⑪ Device number
⑫ Max. 32 nodes
⑬ Alternative connection module; an adapter cable (e.g., part no. 2055419, 2 m) is required to connect the device

### 6.5.6 Wiring switching inputs “Sensor 1” and “Sensor 2” in the CDB650-204

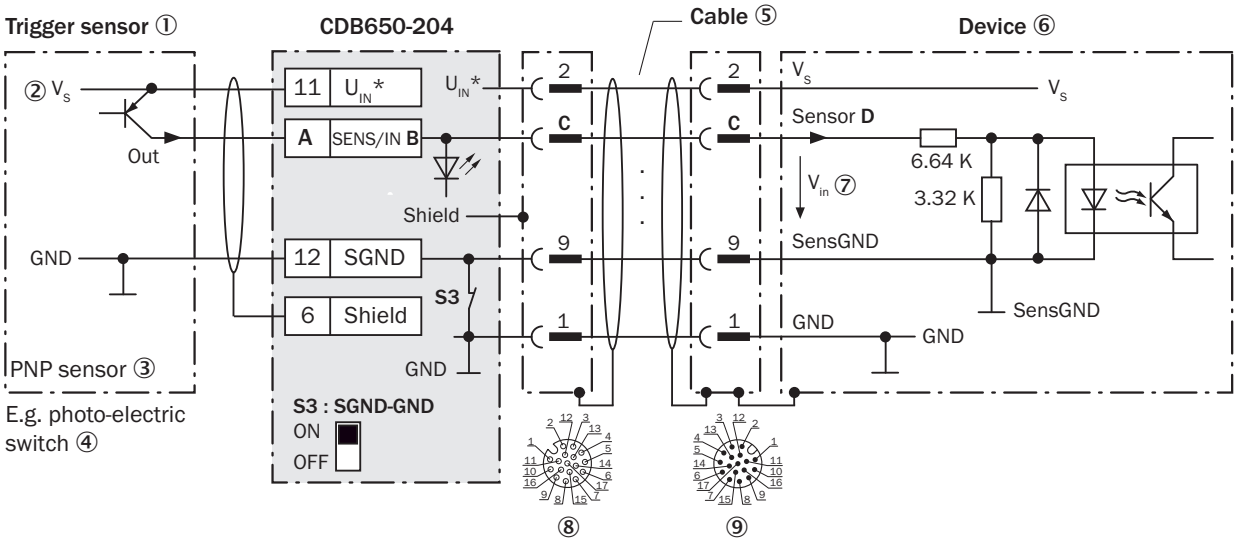



*Figure 20: Trigger sensor powered by the CDB650-204*

① Trigger sensor
② Supply voltage $V_S = U_V$
③ PNP sensor
④ E.g., photoelectric sensor
⑤ 1:1 connecting cable, e.g., part no. 6052286 (2 m)
⑥ Device
⑦ Input voltage $V_{IN} = U_e$. Maximum DC 30 V.
⑧ Female connector, M12, 17-pin, A-coded
⑨ Male connector, M12, 17-pin, A-coded

| CDB650-204 | | | Device |
|---|---|---|---|
| **Terminal A** | **Signal B** | **Pin C** | **Sensor D** |
| 10 | SENS/IN 1 | 10 | 1 |
| 13 | SENS/IN 2 | 15 | 2 |

*Table 4: Assignment of placeholders to the switching inputs*

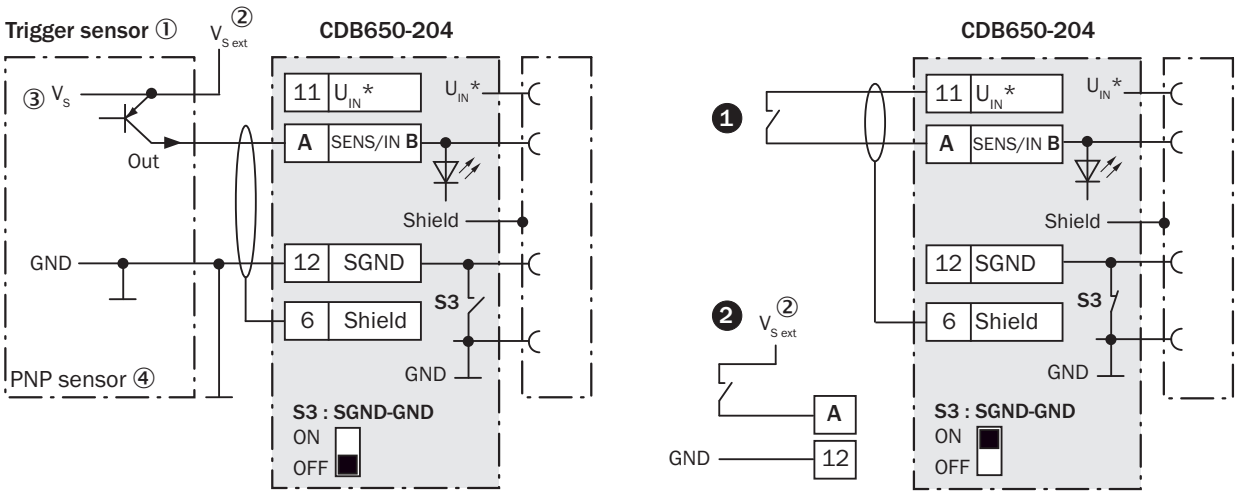



*Figure 21: Left: trigger sensor connected volt-free and powered externally. Right: alternative switch, ❶ powered by CDB650-204 or ❷ connected volt-free and powered externally. Switch setting S3 as in the left-hand figure.*

① Trigger sensor

② External supply voltage $V_{S\ ext}$ = $U_{V\ ext}$

③ Supply voltage $V_S$ = $U_V$

④ PNP sensor

### Function switch S3

| Switch setting | Function |
|---|---|
| ON | GND of the trigger sensor connected to GND of the CDB650-204 and GND of the device |
| OFF | Trigger sensor connected to the CDB650-204 and the device volt-free. The shared, insulated reference potential for all switching inputs = SGND. |

*Table 5: Switch S3: SGND - GND*

### Characteristic data for digital switching inputs

| | |
|---|---|
| **Logic** | Current to input starts the assigned function, e.g., start analysis . Default setting for device: logic not inverted (active high), debouncing 10 ms |
| **Properties** | • Opto-decoupled, reverse-polarity protected<br>• Can be wired with PNP output of a trigger sensor |
| **Electrical values** | Low: $U_e \leq 2$ V; $I_e \leq 0.3$ mA<br>High: 6 V ≤ $U_e \leq 30$ V; 0.7 mA ≤ $I_e \leq 5$ mA |

*Table 6: Characteristic data for the switching inputs “Sensor 1” and “Sensor 2”*

**NOTE**

SICK AppStudio is used to assign functions to the switching inputs.

### 6.5.7 Wiring the switching inputs “External input 1” and “External input 2” in the CDB650-204

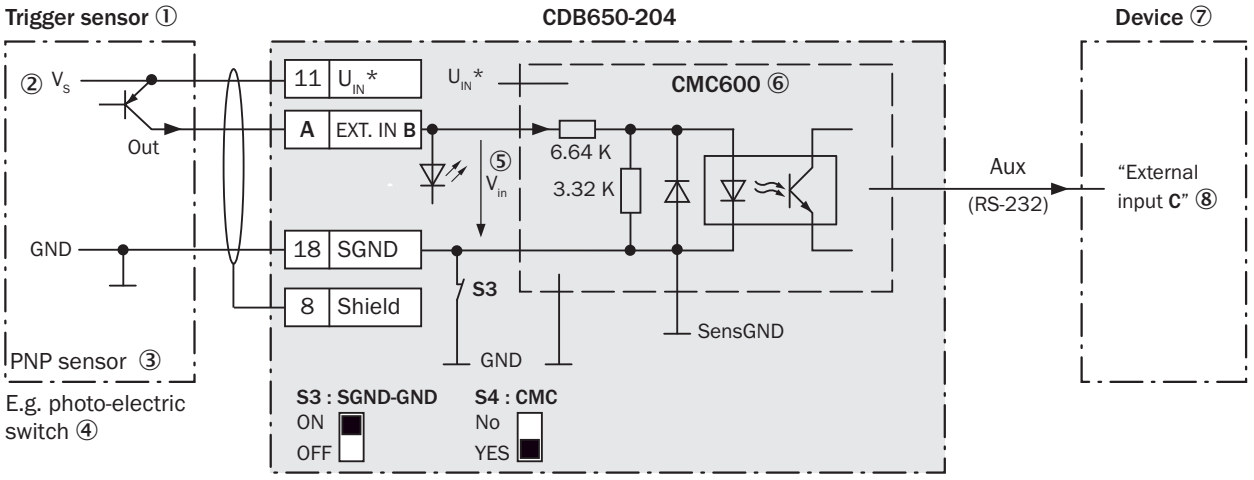



*Figure 22: Trigger sensor powered by the CDB650-204*

① Trigger sensor

② Supply voltage $V_S = U_V$

③ PNP sensor

④ E.g., photoelectric sensor

⑤ Input voltage $V_{IN} = U_e$. Maximum DC 30 V.

⑥ CMC600 parameter cloning module required in order to be able to use the additional external switching inputs of the device

⑦ Device

⑧ Logical “External input” in device

| CDB650-204 | | Device |
|---|---|---|
| **Terminal A** | **Signal B** | **External input C** |
| 16 | EXT. IN 1 | 1 |
| 17 | EXT. IN 2 | 2 |

*Table 7: Assignment of placeholders to the switching inputs*

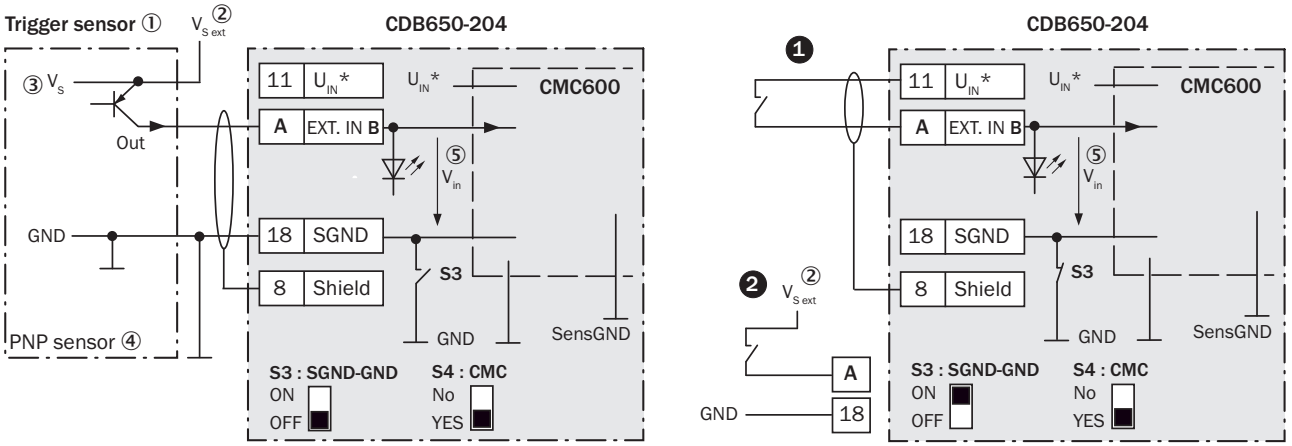



*Figure 23: Left: trigger sensor connected volt-free and powered externally. Right: alternative switch, ❶ powered by CDB650-204 or ❷ connected volt-free and powered externally. Switch setting S3 as in the left-hand figure.*

① Trigger sensor

② External supply voltage $V_{S\,ext} = U_{V\,ext}$

③ Supply voltage $V_S = U_V$

④ PNP sensor

⑤ Input voltage $V_{IN}$ = $U_e$. Maximum DC 30 V.

**Function switch S3**

| Switch setting | Function |
|---|---|
| ON | GND of the trigger sensor connected to the GND of the CDB650-204 and CMC600. |
| OFF | Trigger sensor connected volt-free to the CDB650-204 and CMC600. The shared, insulated reference potential for all switching inputs = SGND. |

*Table 8: Switch S3: SGND - GND*

The software causes the CMC600 to automatically transfer the output state of its physical inputs “EXT. IN 1” and “EXT. IN 2” to the serial AUX-interface of the device via the connecting cable. The device internally applies these statuses to its logical inputs “External input 1” and “External input 2”.

**NOTE**
Neither of the external switching inputs are suitable for time-critical applications.

**Characteristic data for digital switching inputs**

| | |
|---|---|
| **Logic** | Current to input starts the assigned function, e.g., start trigger.<br>Default setting for device: logic not inverted (active high), debouncing 10 ms |
| **Properties** | • Opto-decoupled, reverse-polarity protected<br>• Can be wired with PNP output of a trigger sensor |
| **Electrical values** | Low: $U_e \leq 2$ V; $I_e \leq 0.3$ mA<br>High: 6 V ≤ $U_e \leq 30$ V; 0.7 mA ≤ $I_e \leq 5$ mA |

*Table 9: Characteristic data for the switching inputs “External input 1” and “External input 2”*

**NOTE**
SICK AppStudio is used to assign functions to the switching inputs.

### 6.5.8 Wiring IN/OUT 3 ... 6 of the device in the CDB650-204

These outputs can be configured independently as IN and OUT. Default: IN

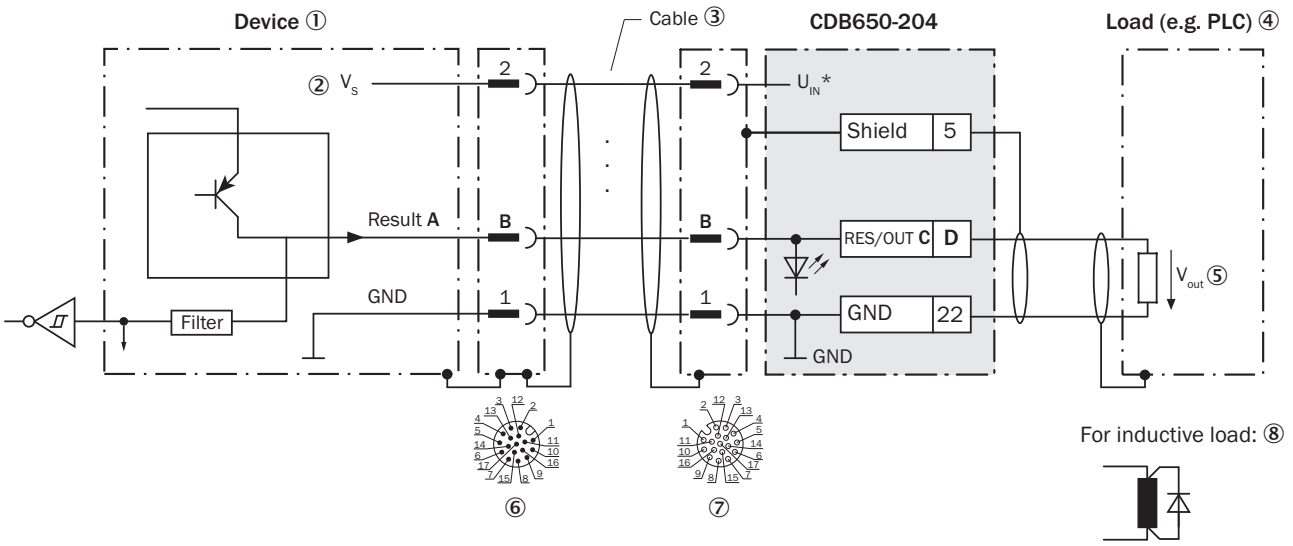



*Figure 24: Wire the switching outputs*

① Device
② Supply voltage $V_S = U_V$
③ Connecting cable 1:1, e.g. part number 6052286 (2 m)
④ Load (e.g. PLC)
⑤ Output voltage $V_{OUT} = U_a$
⑥ Male connector, M12, 17-pin, A-coded
⑦ Female connector, M12, 17-pin, A-coded
⑧ With inductive load: see note

### Inductive load

**NOTE**

Provide a arc-suppression switch at the switching output if inductive load is present. Attach a freewheeling diode directly to the load.

| Device | | CDB650-204 | |
|---|---|---|---|
| **Output A** | **Pin B** | **Signal C** | **Terminal D** |
| IN/OUT 3 | 13 | Res/Out 1 | 20 |
| IN/OUT 4 | 14 | Res/Out 2 | 21 |
| IN/OUT 5 | 16 | Res/Out 3 | 50 |
| IN/OUT 6 | 17 | Res/Out 4 | 51 |

*Table 10: Assignment of placeholders to switching outputs*

### Characteristic data, digital IN/OUT used as switching output (OUT)

| | |
|---|---|
| **Switching behavior** | PNP switching to supply voltage $U_V$.<br>Default settings in the device: no function, logic: not inverted (active high) |
| **Properties** | • Short-circuit protected + temperature protected<br>• Not electrically isolated from $U_V$ |
| **Electrical values** | $0\ V \leq U_a \leq U_V$<br>$(U_V - 1.5\ V) \leq U_a \leq U_V$ at $I_a \leq 100\ mA$ |

*Table 11: Characteristic data of "IN/OUT 3" to "IN/OUT 6" switching outputs*

**NOTE**
Functional assignment for the switching outputs is done with AppStudio.

### 6.5.9 Wiring a digital switching input in configurable switching inputs

**Characteristic data for digital IN/OUT used as a switching input (IN)**

V2D65x

- Low: $U_e \leq 5$ V; $I_e \leq 0.3$ mA
- High: 12 V $\leq U_e \leq U_V$ ; $I_e \leq 1$ mA

For the purpose of electromagnetic compatibility, inputs must be set to a defined low-impedance level!

### 6.5.10 Wiring the switching outputs “External output 1” and “External output 2” in the CDB650-204

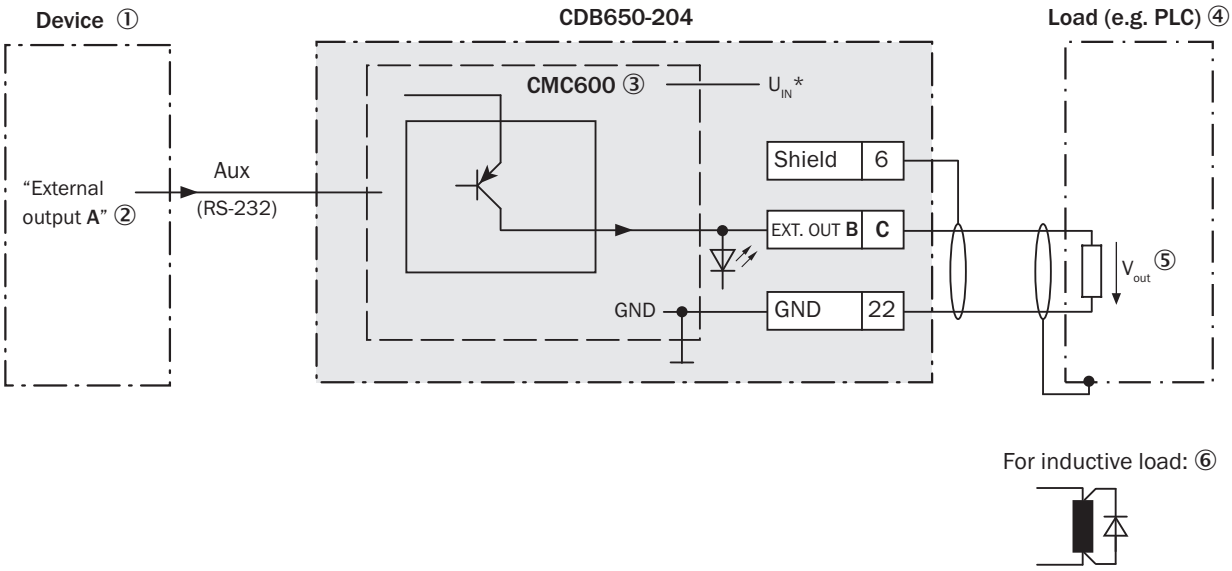



*Figure 25: Wiring external switching outputs*

① Device
② Logical “external output” in device
③ CMC600 parameter cloning module required in order to be able to use the additional external switching outputs of the device
④ Load (e.g., PLC)
⑤ Output voltage $V_{OUT} = U_a$
⑥ In the case of inductive loads: see note

**Inductive load**

**NOTE**
In the case of inductive loads, the switching output is equipped with arc-suppression.
To use, directly apply a freewheeling diode to the load.

| Device | CDB650-204 | |
|---|---|---|
| **External output A** | **Signal B** | **Terminal C** |
| 1 | EXT. OUT 1 | 23 |
| 2 | EXT. OUT 2 | 24 |

*Table 12: Assignment of placeholders to the switching outputs*

The device indicates the output state of its logical outputs “External output 1” and “External output 2” via its serial AUX interface. The software causes the CMC600 to automatically identify the statuses via the connecting cable and to apply them to its physical outputs “EXT. OUT 1” and “EXT.OUT 2” in the CDB650-204.

**NOTE**
Neither of the external switching outputs are suitable for time-critical applications.

**Characteristic data of digital switching outputs**

| | |
|---|---|
| **Logic** | PNP switching to supply voltage $U_V$<br>Default device setting: no function, logic: not inverted (active high) |
| **Properties** | • Short-circuit protected + temperature protected<br>• Not electrically isolated from $U_V$ |
| **Electrical values** | $0\ V \leq U_a \leq U_V$<br>$(U_V - 1.5\ V) \leq U_a \leq U_V$ at $I_a \leq 100\ mA$ |

*Table 13: Characteristic data of the switching outputs “External output 1” and “External output 2”*

**NOTE**
SICK AppStudio is used to assign functions to the switching outputs.

## 6.6 CDM420-0006 wiring connection module

### 6.6.1 Wiring overview for InspectorP63x ... 65X (one switching input in use)

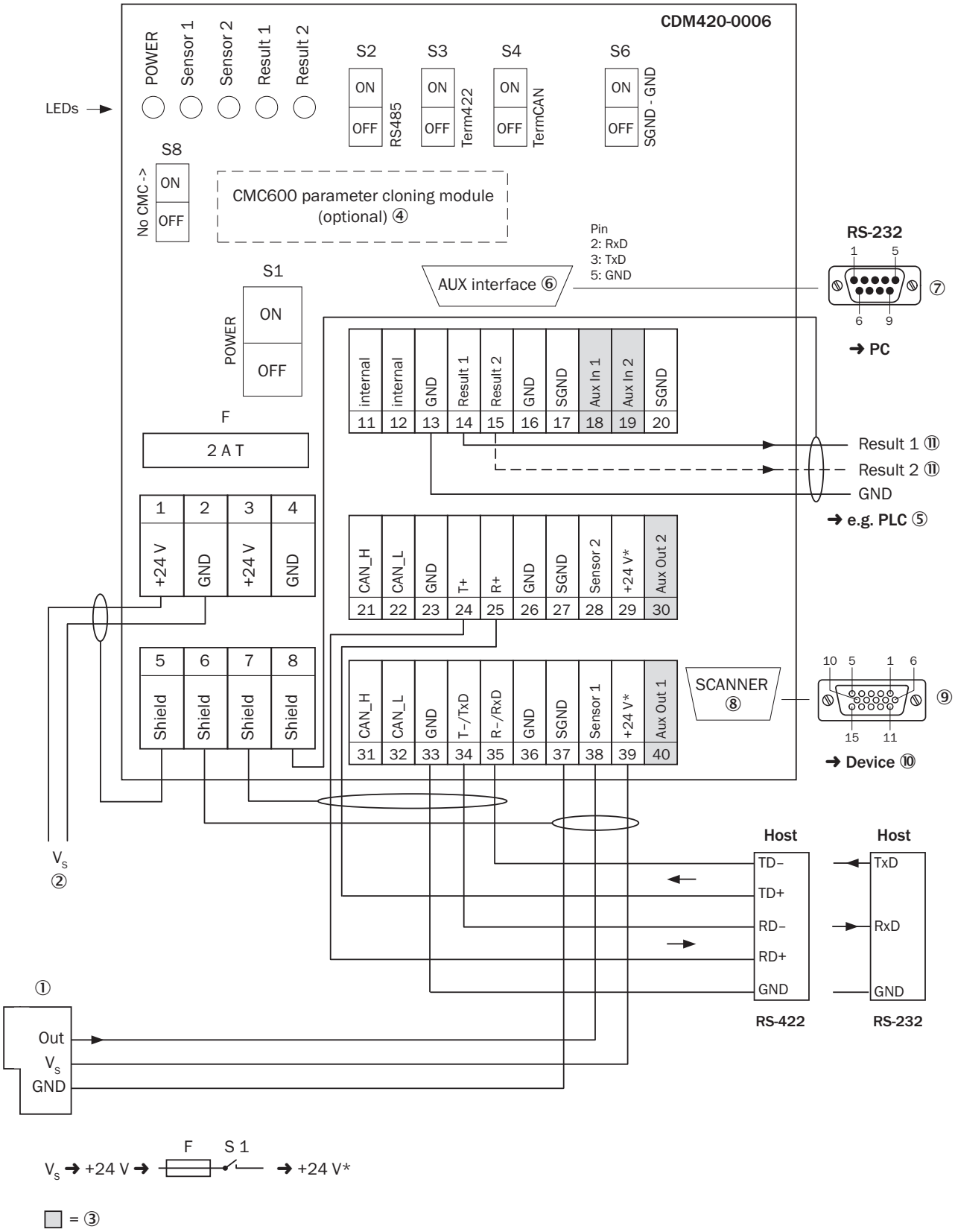



*Figure 26: Connecting the device to the CDM420-0006 connection module (overview)*

① External trigger (e.g., photoelectric sensor)

② Supply voltage $V_S = U^V$

③ CMC600 parameter cloning module required in order to be able to use the additional labeled switching inputs and outputs on the device (type-dependent)
④ CMC600 parameter cloning module
⑤ E.g., PLC (programmable logic controller)
⑥ Auxiliary interface “AUX”
⑦ Male connector, D-Sub, 9-pin
⑧ Sensor = Device
⑨ Female connector, D-Sub-HD, 15-pin
⑩ Device to be connected
⑪ Name of the switching output

### 6.6.2 Connecting the supply voltage in the CDM420-0006

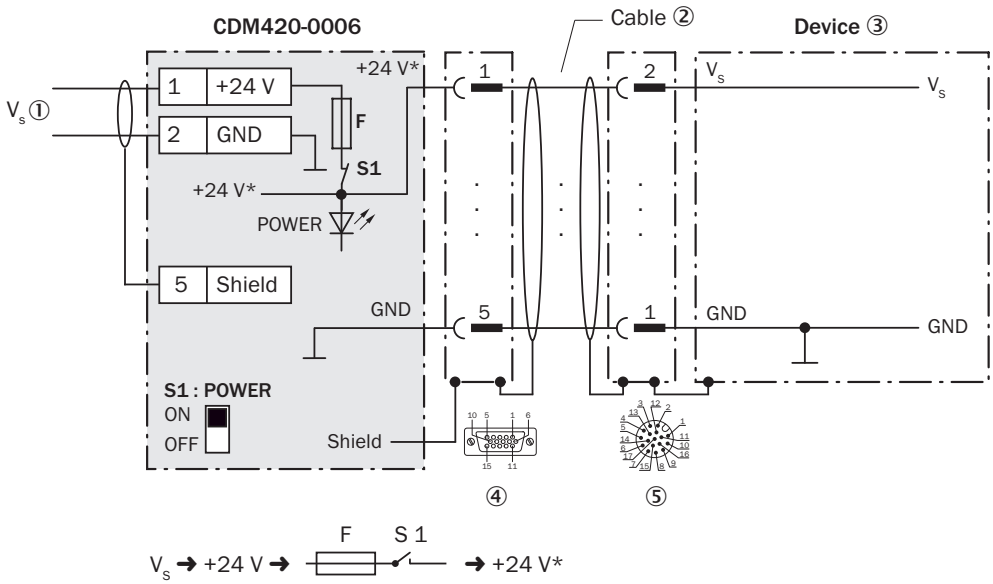



*Figure 27: Connecting the device supply voltage in the CDM420-0006 connection module*

① Supply voltage $V_S = U_V$
② Adapter cable, e.g., part no. 2055419 (2 m)
③ Device
④ Female connector, D-Sub-HD, 15-pin
⑤ Male connector, M12, 17-pin, A-coded

#### Function switch S1

| Switch setting | Function |
|---|---|
| ON | +24 V supply voltage supplied to CDM420-0006 and device via fuse as +24 V*.<br>+24 V* voltage also available at terminals 29 and 39. |
| OFF | CDM420-0006 and device isolated from supply voltage.<br>Recommended position for all connection work. |

*Table 14: Switch S1: power*

### 6.6.3 Wiring the serial host interface RS-232 in the CDM420-0006

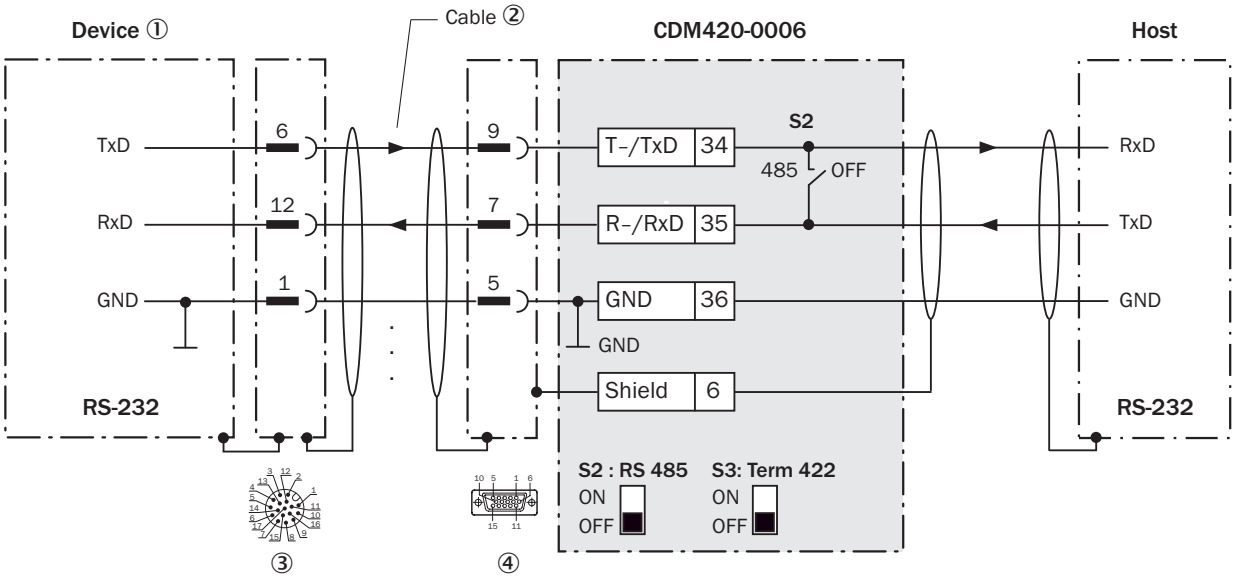



*Figure 28: Wiring the RS-232 data interface*

① Device
② Adapter cable, e.g., part no. 2055419 (2 m)
③ Male connector, M12, 17-pin, A-coded
④ Female connector, D-Sub-HD, 15-pin

### 6.6.4 Wiring the serial host interface RS-422 in the CDM420-0006

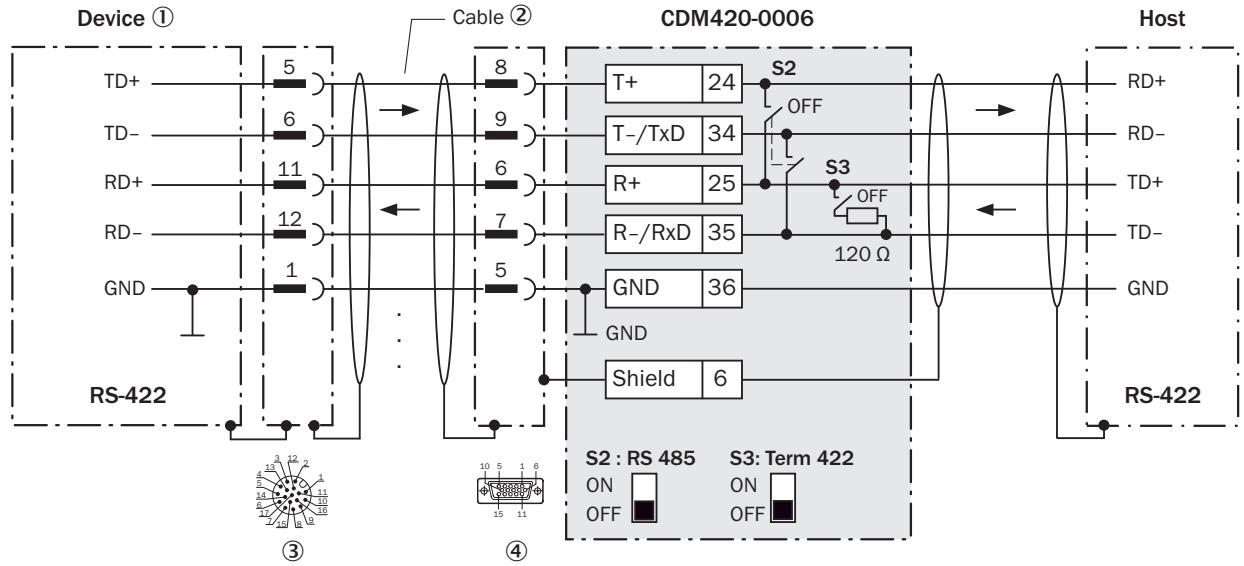



*Figure 29: Wiring the RS-422 data interface*

① Device
② Adapter cable, e.g., part no. 2055419 (2 m)
③ Male connector, M12, 17-pin, A-coded
④ Female connector, D-Sub-HD, 15-pin

### Function switch S3

| Switch setting | Function |
|---|---|
| ON | Terminates the RS-422 receiver in the device in order to improve the interference distance to the cable. |
| OFF | No termination |

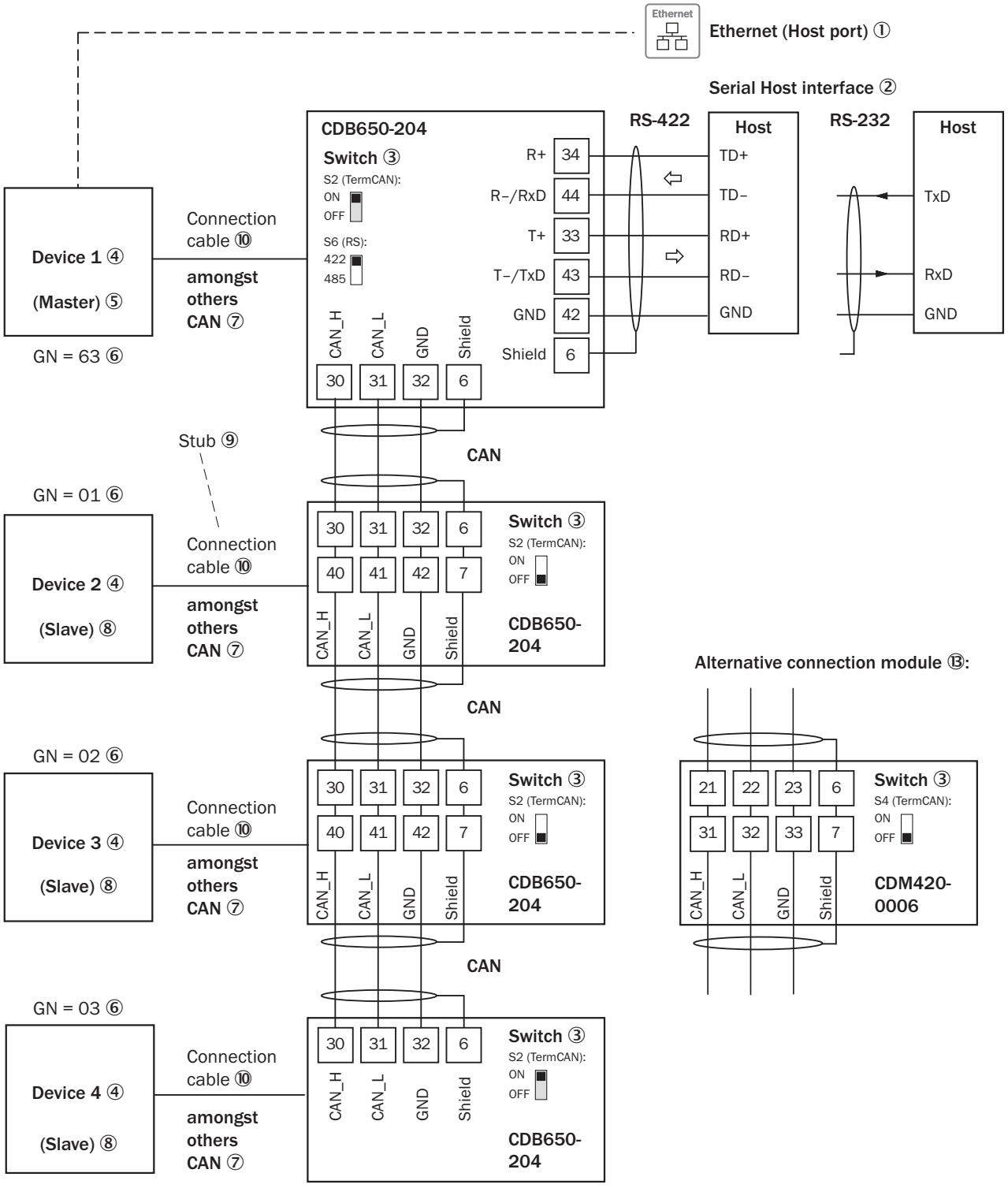
*Table 15: Switch S3: Term 485*

**NOTE**

Use of the RS-422 data interface:

- The relevant interface drivers of the device comply with the standard for RS-422.
- The interface in the device is activated using SICK AppStudio (point-to-point).
- The connection shown above is configured for operation of the host with permanently activated drivers (often described as “RS-422 operation”).

### 6.6.5 Wiring the CAN interface in the CDM420-0006




GN = Device number ⑪
(max. 32 participants) ⑫

*Figure 30: Wiring the CAN interface of the device in the CDM420-0006 connection module Connection and looping of the supply voltage and connection of the trigger sensor, e.g., to the master not discussed here!*

① Ethernet (host port)
② Serial host interface

③ Switch
④ Device
⑤ Master
⑥ Device number
⑦ CAN, for example
⑧ Slave
⑨ Stub cable
⑩ Adapter cable, e.g., part no. 2055419 (2 m)
⑪ Device number
⑫ Max. 32 nodes
⑬ Alternative connection module: in order to connect the device, a 1:1 connecting cable is required, e.g. part no. 6052286 (2 m)

### 6.6.6 Wiring the switching inputs “Sensor 1” and “Sensor 2” in the CDM420-0006

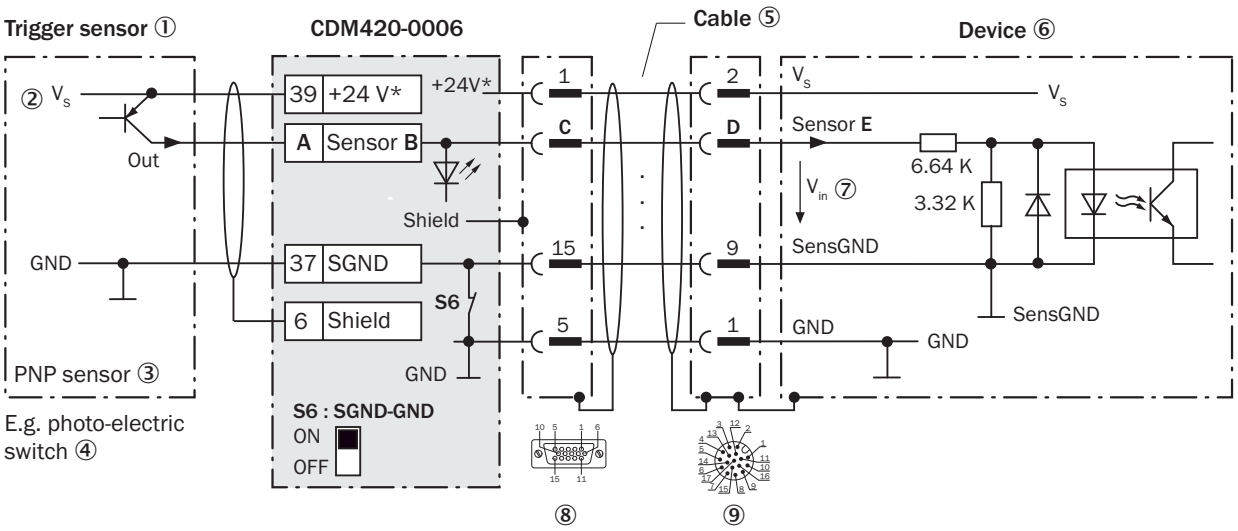



*Figure 31: Trigger sensor powered by the CDM420-0006*

① Trigger sensor
② Supply voltage $V_S = U_V$
③ PNP sensor
④ E.g., photoelectric sensor
⑤ Adapter cable, e.g., part no. 2055419 (2 m)
⑥ Device
⑦ Input voltage $V_{IN} = U_e$. Maximum DC 30 V.
⑧ Female connector, D-Sub-HD, 15-pin
⑨ Male connector, M12, 17-pin, A-coded

| CDM420-0006 | | | Device | |
|---|---|---|---|---|
| **Terminal A** | **Signal B** | **Pin C** | **Pin D** | **Sensor E** |
| 38 | Sensor 1 | 14 | 10 | 1 |
| 28 | Sensor 2 | 4 | 15 | 2 |

*Table 16: Assignment of placeholders to the switching inputs*

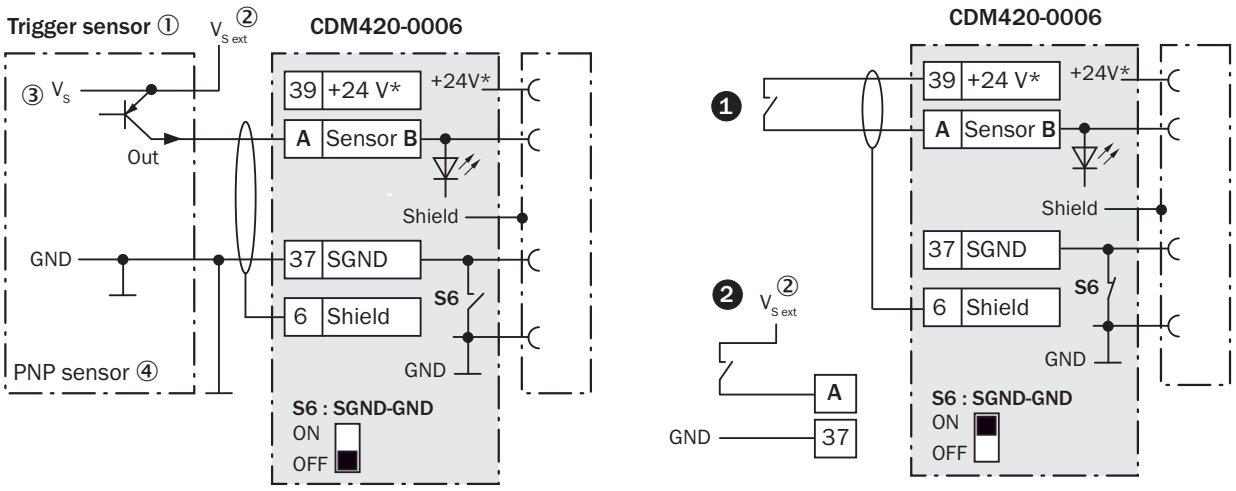



*Figure 32: Left: trigger sensor connected volt-free and powered externally. Right: alternative switch, ❶ powered by CDM420-0006 or ❷ connected volt-free and powered externally. Switch setting S6 as in the left-hand figure.*

① Trigger sensor

② External supply voltage $V_{S\ ext}$ = $U_{V\ ext}$

③ Supply voltage $V_S$ = $U_V$

④ PNP sensor

### Function switch S6

| Switch setting | Function |
|---|---|
| ON | GND of the trigger sensor connected to GND of the CDM420-0006 and GND of the device |
| OFF | Trigger sensor connected to the CDM420-0006 and the device volt-free.<br>The shared, insulated reference potential for all switching inputs = SGND. |

*Table 17: Switch S6: SGND - GND*

### Characteristic data for digital switching inputs

| | |
|---|---|
| **Logic** | Current to input starts the assigned function, e.g., start trigger.<br>Default setting for device: logic not inverted (active high), debouncing 10 ms |
| **Properties** | • Opto-decoupled, reverse-polarity protected<br>• Can be wired with PNP output of a trigger sensor |
| **Electrical values** | Low: $U_e \leq 2$ V; $I_e \leq 0.3$ mA<br>High: 6 V ≤ $U_e \leq 30$ V; 0.7 mA ≤ $I_e \leq 5$ mA |

*Table 18: Characteristic data for the switching inputs “Sensor 1” and “Sensor 2”*

**NOTE**

SICK AppStudio is used to assign functions to the switching inputs.

### 6.6.7 Wiring the switching inputs “External input 1” and “External input 2” in the CDM420-0006

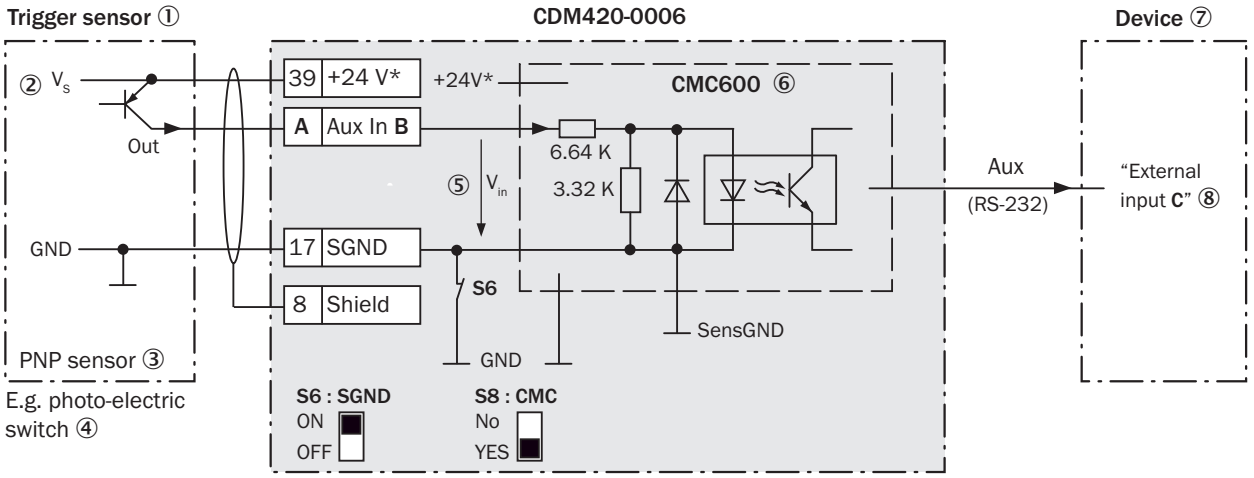



*Figure 33: Trigger sensor powered by the CDM420-0006*

① Trigger sensor

② Supply voltage $V_S = U_V$

③ PNP sensor

④ E.g., photoelectric sensor

⑤ Input voltage $V_{IN} = U_e$. Maximum DC 30 V.

⑥ CMC600 parameter cloning module required in order to be able to use the additional external switching inputs of the device

⑦ Device

⑧ Logical “External input” in device

| CDM420-0006 | | Device |
|---|---|---|
| **Terminal A** | **Signal B** | **External input C** |
| 18 | AUX In 1 | 1 |
| 19 | AUX In 2 | 2 |

*Table 19: Assignment of placeholders to the switching inputs*

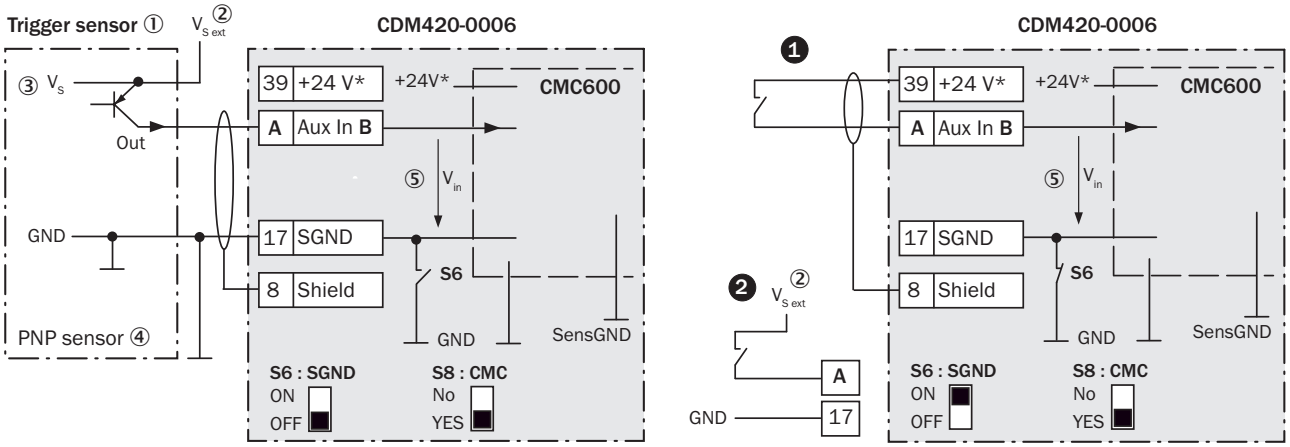



*Figure 34: Left: trigger sensor connected volt-free and powered externally. Right: alternative switch, ❶ powered by CDM420-0006 or ❷ connected volt-free and powered externally. Switch setting S6 as in the left-hand figure.*

① Trigger sensor

② External supply voltage $V_{S\,ext} = U_{V\,ext}$

③ Supply voltage $V_S = U_V$

④ PNP sensor

⑤ Input voltage $V_{IN}$ = $U_e$. Maximum DC 30 V.

### Function switch S6

| Switch setting | Function |
|---|---|
| ON | GND of the trigger sensor connected to the GND of the CDM420-0006 and CMC600. |
| OFF | Trigger sensor connected volt-free to the CDM420-0006 and CMC600. The shared, insulated reference potential for all switching inputs = SGND. |

*Table 20: Switch S6: SGND - GND*

The software causes the CMC600 to automatically transfer the output state of its physical inputs “AUX. In 1” and “AUX. In 2” to the serial AUX interface of the device via the connecting cable. The device internally applies these statuses to its logical inputs “External input 1” and “External input 2”.

**NOTE**

Neither of the external switching inputs are suitable for time-critical applications.

### Characteristic data for digital switching inputs

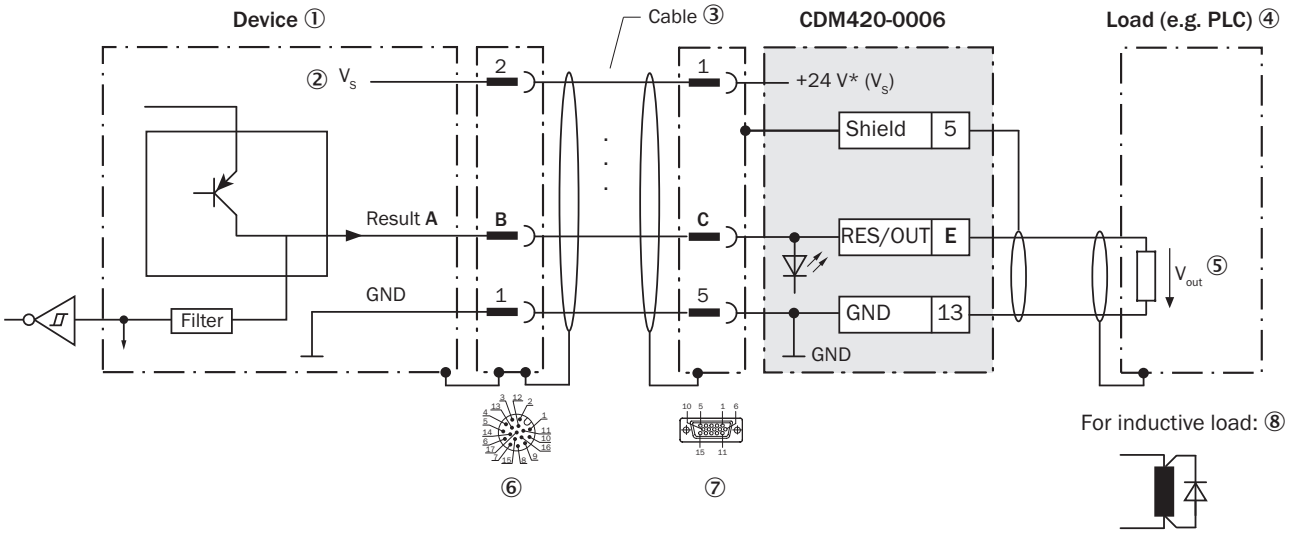
| | |
|---|---|
| **Logic** | Current to input starts the assigned function, e.g., start trigger.<br>Default setting for device: logic not inverted (active high), debouncing 10 ms |
| **Properties** | • Opto-decoupled, reverse-polarity protected<br>• Can be wired with PNP output of a trigger sensor |
| **Electrical values** | Low: $U_e \leq 2$ V; $I_e \leq 0.3$ mA<br>High: 6 V ≤ $U_e \leq 30$ V; 0.7 mA ≤ $I_e \leq 5$ mA |

*Table 21: Characteristic data for the switching inputs “External input 1” and “External input 2”*

**NOTE**

SICK AppStudio is used to assign functions to the switching inputs.

### 6.6.8 Wiring “IN/OUT 3” and “IN/OUT 4” switching outputs in the CDM420-0006




① Device
② Supply voltage $V_S = U_V$
③ Adapter cable 1:1, e.g. part number 2055419 (2 m)
④ Load (e.g. PLC)
⑤ Output voltage $V_{OUT} = U_a$
⑥ Male connector, M12, 17-pin, A-coded
⑦ Female connector, D-Sub-HD, 15-pin
⑧ With inductive load: see note

#### Inductive load

**NOTE**
Provide a arc-suppression switch on the switching output if inductive load present.
Attach a freewheeling diode directly on the load.

| Device | | CDM420-0006 | | |
|---|---|---|---|---|
| **Output A** | **Pin B** | **Pin C** | **Signal D** | **Terminal E** |
| IN/OUT 3 | 13 | 12 | Result 1 | 14 |
| IN/OUT 4 | 14 | 13 | Result 2 | 15 |

*Table 22: Assignment of placeholders to switching outputs*

#### Characteristic data, IN/OUT used as switching output (OUT)

| | |
|---|---|
| **Logic** | PNP switching to supply voltage +24 V*<br>Settings in the device: no function, logic: not inverted (active high) |
| **Properties** | • Short-circuit protected + temperature protected<br>• Not electrically isolated from supply voltage +24 V* |
| **Electrical values** | 0 V ≤ $U_a$ ≤ +24 V*<br>(+24 V* −1.5 V) ≤ $U_a$ ≤ +24 V* at $I_a$≤ 100 mA |

*Table 23: Characteristic data of “IN/OUT 3” and “IN/OUT 4” switching outputs*

**NOTE**
Functional assignment for the switching outputs is done with AppStudio.

### 6.6.9 Wiring a digital switching input in configurable switching inputs

**Characteristic data for digital IN/OUT used as a switching input (IN)**

V2D65x

- Low: $U_e \leq 5$ V; $I_e \leq 0.3$ mA
- High: 12 V $\leq U_e \leq U_V$ ; $I_e \leq 1$ mA

For the purpose of electromagnetic compatibility, inputs must be set to a defined low-impedance level!

### 6.6.10 Wiring the switching outputs “External output 1” and “External output 2” in the CDM420-0006

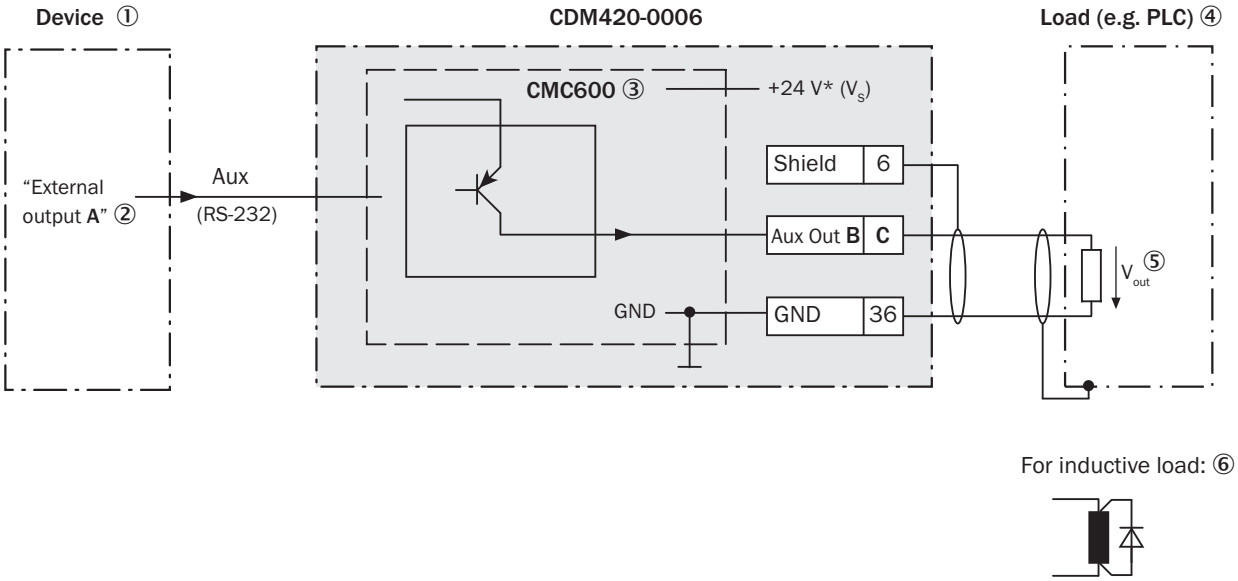



*Figure 35: Wiring external switching outputs*

① Device

② Logical “external output” in device

③ CMC600 parameter cloning module required in order to be able to use the additional external switching outputs of the device

④ Load (e.g., PLC)

⑤ Output voltage $V_{OUT} = U_a$

⑥ In the case of inductive loads: see note

**In the case of inductive loads**

**NOTE**

In the case of inductive loads, the switching output is equipped with arc-suppression.

To use, directly apply a freewheeling diode to the load.

| Device | CDM420-0006 | |
|---|---|---|
| **External output A** | **Signal B** | **Terminal C** |
| 1 | AUX Out 1 | 40 |
| 2 | AUX Out 2 | 30 |

*Table 24: Assignment of placeholders to the switching outputs*

The device indicates the output state of its logical outputs “External output 1” and “External output 2” via its serial AUX interface. The software causes the CMC600 to automatically identify the statuses via the connecting cable and to apply them to its physical outputs “AUX. Out 1” and “AUX.Out 2” in the CDM420-0006.

**NOTE**
Neither of the external switching outputs are suitable for time-critical applications.

### Characteristic data of digital switching outputs

| | |
|---|---|
| **Logic** | PNP switching to +24 V* supply voltage<br>Default device setting: no function, logic: not inverted (active high) |
| **Properties** | • Short-circuit protected + temperature protected<br>• Not electrically isolated from +24 V* supply voltage |
| **Electrical values** | 0 V ≤ $U_a$ ≤ +24 V*<br>(+24 V* − 1.5 V) ≤ $U_a$ ≤ +24 V* at $I_a$ ≤ 100 mA |

*Table 25: Characteristic data of the switching outputs “External output 1” and “External output 2”*

**NOTE**
SICK AppStudio is used to assign functions to the switching outputs.

# 7 Commissioning

## 7.1 Programming the device with SICK AppStudio

The SICK AppStudio development environment is used by default to program the device in accordance with the application and to perform diagnostics in case of faults.

### Installing and starting the development environment

1. Download and install the latest version of SICK AppStudio from the online product page for the software by following the instructions provided there. supportportal.sick.com
   Administrator rights may be required on the PC to install the software.
2. Enter your personal license key to complete installation.
3. Start the program. Path: **Start** > **All programs** > **SICK** > **SICK AppStudio**
4. Establish a connection between the software and the device via Ethernet or USB (depending on type).
   The connection wizard starts automatically.
5. The following IP addresses are configured by default on the device:
   - IP address P1: 192.168.0.1

### First steps with the device

The device is supplied with the pre-installed sensor app ImageSetup.

1. Double-click the paths in the AppExplorer to display all content.
2. Double-click the primary script file to open it in the script editor and display the source code.

### Receiving images

1. Click on the corresponding button to start all apps.
2. The device page (in online mode) will now display an image on the right-hand side, enabling basic configuration to adjust parameters such as illumination, gain, contrast, and trigger methods.

**NOTE**

If the device page displays Error 404, port 80 is already occupied by another piece of software. To find out which process you need to quit, go to Task Manager > Performance tab > Resource monitor > Network tab.

Search for port 80 among the listed ports.

### C-mount lens: adjusting the brightness and sharpness

1. protective optics cover.
2. Loosen the lock nut fitting on the aperture ring and sharpness ring.
3. Adjust the mask using the aperture ring (top ring) on the lens to a low value such as “2”.
4. Reduce the **shutter time** and **brightness** until the object is clearly visible on the image.
5. Increase the image sharpness using the sharpness ring (bottom ring) on the lens. The object must be clearly displayed in sharp focus so that all edges are easy to identify.
6. Use the lock nut fitting to fix the sharpness ring setting in place.
7. Apply the correct mask setting for the depth of field. In order to do this, check the settings with the test object. Adjust the mask to a higher value. If a greater depth of field is required, select a higher value. Bear in mind that using a greater mask

value reduces image brightness, meaning that brightness must be increased using the software. This reduces image quality.

8. Fix the aperture ring using the lock nut fitting.
9. Mount the protective optics cover.

### Continuing programming

- Adjust the settings for additional functions during planned operation such as triggers, result formats, data interface, etc.

### Quitting programming

1. Save the program in the non-volatile memory of the device.
2. Save the parameter set on the PC.

# 8 Maintenance

## 8.1 Maintenance

The product requires the following maintenance work at regular intervals:

| Interval | Maintenance work | To be carried out by |
|---|---|---|
| Cleaning interval depends on ambient conditions and climate | Clean housing and front screen | Specialist |
| Every 6 months | Check the screw connections and plug connections | Specialist |

*Table 26: Maintenance schedule*

## 8.2 Cleaning the device

At regular intervals, check the inspection window and the housing of the device for contamination (see "Maintenance", page 66). This is especially relevant in harsh operating environments (dust, abrasion, damp, fingerprints, etc.).

The inspection window lens must be kept clean and dry during operation.

**NOTICE**
**Device damage due to improper cleaning!**

Improper cleaning may result in damage to the device.

- Only use suitable cleaning agents.
- Never use sharp objects for cleaning.

### Cleaning the inspection window

**NOTICE**
**Damage to the inspection window!**

Reduced analysis performance due to scratches or streaks on the inspection window!

- ▶ Only clean the inspection window when wet.
- ▶ Use a mild cleaning agent that does not contain powder additives. Do not use aggressive cleaning agents, such as acetone, etc.
- ▶ Avoid any movements that could cause scratches or abrasions on the inspection window.
- ▶ Only use cleaning agents suitable for the screen material.

The type of screen material used in the inspection window can be found on the type label (see "Type code", page 11).

**NOTE**
Static charge may cause dust particles to stick to the inspection window. This effect can be avoided by using an anti-static cleaning agent in combination with the SICK lens cloth (can be obtained from www.sick.com).

**Cleaning procedure:**

**CAUTION**

**Optical radiation: Laser class 1**

The accessible radiation does not pose a danger when viewed directly for up to 100 seconds. It may pose a danger to the eyes and skin in the event of incorrect use.

- Do not open the housing. Opening the housing will not switch off the laser. Opening the housing may increase the level of risk.
- Current national regulations regarding laser protection must be observed.

- Switch off the device for the duration of the cleaning operation. If this is not possible, use suitable laser protection goggles. These must absorb radiation of the device's wavelength effectively.
- Glass lens: Remove dust from the inspection window using a soft, clean brush. If necessary, also clean the inspection window with a clean, damp, lint-free cloth, and a mild anti-static lens cleaning fluid.
- Plastic lens: Clean the inspection window only with a clean, damp, lint-free cloth, and a mild anti-static lens cleaning fluid.

**CAUTION**

**LED risk group 1**

The accessible beam from the illumination unit (RG 1) does not represent a risk due to the normal restrictions imposed by human behavior.

**LED risk group 2**

The accessible beam from the illumination unit (RG 2) does not represent a risk due to aversion responses to very bright light sources and the perception of heat.

**For both types of beams**

It is not possible to entirely rule out temporary, disorienting optical effects on the human eye (e.g., dazzle, flash blindness, afterimages, impairment of color vision, photosensitive epilepsy), particularly in conditions of dim lighting. No safety precautions are required.

Comply with the latest version of the applicable regulations on photobiological safety of lamps and lamp systems as well as on laser protection.

If the product is operated in conjunction with external illumination systems, the risks described here may be exceeded. This must be taken into consideration by users on a case-by-case basis.

**CAUTION**

If any operating or adjusting devices other than those specified here are used or other methods are employed, this can lead to dangerous exposure to radiation. Damage to the eyes is possible.

- If the product is operated in conjunction with external illumination systems, the risks described here may be exceeded. This must be taken into consideration by users on a case-by-case basis.
- Do not look into the light source when it is switched on.
- Comply with the latest version of the applicable regulations on photobiological safety of lamps and lamp systems as well as on laser protection.

For internal illumination, only units provided by SICK for that purpose may be used.

**NOTE**
If the inspection window is scratched or damaged (cracked or broken), the lens must be replaced. Contact SICK Service to arrange this.

### Cleaning the housing

In order to ensure that heat is adequately dissipated from the device, the housing surface must be kept clean.

- ▶ Clear the build up of dust on the housing with a soft brush.

## 8.3 Repairs

Repairs on the product may only be carried out by the manufacturer. Any interruption or modification of the product will invalidate the manufacturer warranty.

# 9 Troubleshooting

## 9.1 Overview of possible errors and faults

| Situation | Error/fault |
|---|---|
| Mounting | ▪ Device poorly aligned to the object (e.g. dazzle). |
| Electrical installation | ▪ Data interfaces of the device incorrectly wired. |
| Programming | ▪ See SICK AppSpace interface documentation (troubleshooting of individual objects and functions). |
| Operation | ▪ Trigger control incorrect and/or not suitable for the object.<br>▪ Device faults (hardware/software). |

*Table 27: Errors and faults*

## 9.2 Detailed fault analysis

### 9.2.1 LEDs on the device

The statuses that can be read from the LEDs on the device housing (see "Status indicators and functions", page 13) include:

- Operational readiness (Ready)
- Analysis result status (Pass or Fail)
- Hardware fault
- Firmware download status
- Connection status of the device

The LED display can indicate any errors or faults with this. Further information for this can be found in the system information.

## 9.3 SICK Support

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

The device must not be repaired by the user. Interrupting or modifying 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 representative, see the final page of this document.

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

## 9.4 Returning devices

▶ Do not dispatch devices to the SICK Service department without consultation.

**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 Decommissioning

## 10.1 Environmental protection

**ATTENTION**

**Danger to the environment due to improper disposal of the product!**

Disposing of the product improperly may cause damage to the environment.

Therefore, take note of the following information:

- Always observe the valid regulations on environmental protection.
- Following correct disassembly, pass on any disassembled components for reuse.
- Separate the recyclable materials by type and place them in recycling containers.

## 10.2 Disposal

**CAUTION**

**Risk of injury due to hot device surface!**

In analysis mode, the surface of the device (particularly at the rear) can reach temperatures of up to 70 °C.

- Before commencing disassembly, switch off the device and allow it to cool down as necessary.

Any device which can no longer be used at the end of the product life cycle must be disposed of in an environmentally friendly manner in accordance with the respective applicable country-specific waste disposal regulations. As they are categorized as electronic waste, the device must never be disposed of with household waste.

# 11 Technical data

## 11.1 Optics and Illumination

| Type | InspectorP64x Flex (V2D64xP-MCxxxx)<br>InspectorP65x Flex (V2D65xP-MCxxxx) | InspectorP65x DynamicFocus (V2D65xP-MExxxx) |
|---|---|---|
| Focus | Manual adjustment of the sharpness and aperture on the optional lens unit | Dynamic and externally triggered electrical focus adjustment for working distance |
| Illumination for field of view | Optional e.g., variants of the VI83I integrable illumination unit:<br>11 x LED, visible light.<br>White (λ = 6,000 ± 500 K)<br>Blue (λ = 455 ± 20 nm)<br>Red (λ = 620 ± 30 nm) | 11 x LED, visible light.<br>White (λ = 6,000 ± 500 K)<br>Blue (λ = 455 ± 20 nm) |
| Feedback LED (spot in field of view) | Optional e.g., variants of the VI83I integrable illumination unit:<br>1 x LED, visible light.<br>Green (λ = 525 ± 15 nm) | 1 x LED, visible light.<br>Green (λ = 525 ± 15 nm) |
| LED risk group of illumination unit | "White + Feedback LED" option<br>"Blue – Medium + Feedback LED" option<br>"Blue – Wide + Feedback LED" option<br>• Risk group 1 (low risk) according to IEC 62471-1: 2006-07/EN 62471-1: 2008-09.<br>"Red + Feedback LED" option<br>**Radiance:**<br>$L_B$: < 10 x $10^3$ W/($m^2$sr) within 100 s; at a distance of ≥ 200 mm<br>$L_R$: < 7 x $10^5$ W/($m^2$sr) within 10 s; at a distance of ≥ 200 mm | "White + Feedback LED" option<br>• Risk group 1 (low risk) according to IEC 62471-1: 2006-07/EN 62471-1: 2008-09.<br>**Radiance:**<br>$L_B$: < 10 x $10^3$ W/($m^2$sr) within 100 s; at a distance of ≥ 200 mm<br>$L_R$: < 7 x $10^5$ W/($m^2$sr) within 10 s; at a distance of ≥ 200 mm |
| | "Blue – Narrow + Feedback LED" option<br>• Risk group 2 (moderate risk) according to IEC 62471-1: 2006-07/EN 62471-1: 2008-09 due to exposure to blue light.<br>**Radiance:**<br>$L_B$: < 10 x $10^3$ W/($m^2$sr) within 50 s (RG 2); at a distance of ≥ 200 mm<br>$L_R$: < 7 x $10^5$ W/($m^2$sr) within 10 s (RG 1); at a distance of ≥ 200 mm<br>Risk RG 1 (low risk) corresponding to $L_B$ < 10 x $10^3$ W/($m^2$sr) within 100 s for distances > 1 m. | "Blue + Feedback LED" option<br>• Risk group 2 (moderate risk) according to IEC 62471-1: 2006-07/EN 62471-1: 2008-09 due to exposure to blue light.<br>**Radiance:**<br>$L_B$: < 10 x $10^3$ W/($m^2$sr) within 50 s (RG 2); at a distance of ≥ 200 mm<br>$L_R$: < 7 x $10^5$ W/($m^2$sr) within 10 s (RG 1); at a distance of ≥ 200 mm<br>Risk RG 1 (low risk) corresponding to $L_B$ < 10 x $10^3$ W/($m^2$sr) within 100 s for distances > 1 m. |
| Aiming laser (field of view) | Visible light. Red (λ = 630 nm ... 680 nm), can be disengaged | |

| Type | InspectorP64x Flex (V2D64xP-MCxxxx)<br>InspectorP65x Flex (V2D65xP-MCxxxx) | InspectorP65x DynamicFocus (V2D65xP-MExxxx) |
|---|---|---|
| Laser class | Class 1 according to IEC 60825-1: 2014. Complies with 21 CFR 1040.10 except for deviations according to Laser Notice no. 50 of June 24, 2007. P < 1.40 mW<br>Different laser class for issue EN/IEC 60825-1:2007: laser class 1M | |

## 11.2 Performance

| Type | InspectorP64x Flex (V2D64xP-MCxxxx)<br>InspectorP65x Flex (V2D65xP-MCxxxx) | InspectorP65x DynamicFocus (V2D65xP-MExxxx) |
|---|---|---|
| Working distance | see "InspectorP64x Flex", page 21<br>see "InspectorP652 Dynamic Focus", page 22 | see "InspectorP652 Flex", page 23 |
| Lens unit | Application-specific<br>www.sick.com/inspectorp64x<br>www.sick.com/inspectorp65x | see "Type code", page 11 |
| Image sensor resolution | see "Type code", page 11 | |
| Image sensor type | see "Type code", page 11 | |
| Image recording rate | **InspectorP64x Flex**<br>At 1.7 Mpx: 40 Hz<br>**InspectorP65x Flex**<br>At 2 Mpx: 70 Hz<br>At 4 Mpx: 40 Hz | At 2 Mpx: 70 Hz<br>At 4 Mpx: 40 Hz |
| Ambient light tolerance | 2000 lx on surface | |
| Image memory | Internally 512 MB, externally on optional microSD memory card (max. 16 GB) | |

## 11.3 Interfaces

| Type | InspectorP64x Flex (V2D64xP-MCxxxx)<br>InspectorP65x Flex (V2D65xP-MCxxxx) | InspectorP65x DynamicFocus (V2D65xP-MExxxx) |
|---|---|---|
| Serial[1)]<br>RS-232/ 422 | Host (300 Bd ... 115.2 kBd), for data output | |
| Serial RS-232[1)] | Aux (57.6 kBd) | |
| USB[1)] | Aux (USB 2.0) | |
| Ethernet | Image transmission (FTP). 10/100/1,000 Mbit/s, TCP/IP, Ethernet/IP. MAC address(es), see type label. | |
| CAN | 20 kbit/s ... 1 Mbit/s<br>Protocol: SICK CAN sensor network | |
| PROFIBUS[1)] | Optional via external fieldbus module CDF600-21xx | |
| PROFINET IO[1)] | Optional via external fieldbus module CDF600-2200 | |

| Type | InspectorP64x Flex (V2D64xP-MCxxxx)<br>InspectorP65x Flex (V2D65xP-MCxxxx) | InspectorP65x DynamicFocus (V2D65xP-MExxxx) |
|---|---|---|
| Digital switching inputs and outputs | 2 x Sensor 1 and 2<br>4 x physical (freely configurable inputs and outputs)<br>2 x additional external via optional CMC600 module in connection module CDB650-204 or CDM420-0006 (external input/output 1 and 2) | |
| Digital switching inputs[1)] | 2 x Sensor 1 and 2<br>4 x physical (configurable IN 3 ... 6)<br>$U_e$= max. 32 V, $I_e$= max. 5 mA, opto-decoupled, reverse polarity protected, adjustable debounce time | |
| Digital switching outputs[1)] | 4 x physical (configurable OUT 3 ... 6)<br>$U_a = U_V$ – 1.5 V, $I_a \leq 100$ mA. Short-circuit protected, temperature protected. Not galvanically isolated from the supply voltage. | |

1) Does not apply to system variants of type V2D64xP-MCxxFx, type V2D65xP-MCxxFx and V2D65xP-MExxFx for systems, connection variant 2

## 11.4 Mechanics and electronics

| Type | InspectorP64x Flex (V2D64xP-MCxxxx)<br>InspectorP65x Flex (V2D65xP-MCxxxx) | InspectorP65x DynamicFocus (V2D65xP-MExxxx) |
|---|---|---|
| Optical indicators | 10 x RGB LEDs: status indicators<br>1 x LED: feedback LED, green<br>10 x RGB LEDs: bar graph, blue | |
| Acoustic indicators | 1 x beeper for signaling events, can be deactivated | |
| External backup of configuration data | Optional on plug-in micro SD memory card or via optional CMC600 module in connection module CDB650-204 or CDM420-0006. | |
| Supply voltage | DC 24 V ± 20%<br>SELV (EN 60950-1: 2014-08) and<br>LPS (EN 60950-1: 2014-08) or Class 2 (UL 1310) required | |
| Current consumption | Max. 2.0 A (with switching outputs) | |
| Power consumption | Typically 20 W (with switching outputs without load) | |
| Weight | Max. 635 g, without optic kit | Max. 950 g, model-dependent |
| Material Housing | Aluminum die cast | |
| Material Viewing window | Glass or plastic (PMMA), 2 mm thick, with scratch-proof coating: see "Type code", page 11 | |
| Electrical protection class | III, in accordance with DIN EN 60950-1: 2014-08 | |
| Enclosure rating | According to EN 60529: 2000-09: see "Type code", page 11<br>Maintaining the enclosure rating, see "Notes on electrical installation", page 27. | |

## 11.5 Ambient data

| Type | InspectorP64x Flex (V2D64xP-MCxxxx)<br>InspectorP65x Flex (V2D65xP-MCxxxx) | InspectorP65x DynamicFocus (V2D65xP-MExxxx) |
|---|---|---|
| Vibration resistance<br>Shock resistance | According to EN 60068-2-6: 2008-02<br>In accordance with EN 60068-2-27: 2009-05 | |
| Ambient temperature | Operation[1]: 0 °C ... +50 °C<br>Storage –20 °C ... +70 °C | |
| Permissible relative humidity | 0% ... 90%, non-condensing | |

1) Notes regarding adequate dissipation of lost heat: see "Mounting requirements", page 17

# 12 Accessories

## 12.1 Additional accessories

Accessories such as brackets and cables can be found at: www.sick.com.

# 13 Annex

## 13.1 Declaration of conformity

The EU declaration of conformity for the InspectorP6xx programmable vision sensor can be found online at:

## 13.2 Licenses

SICK uses open-source software. 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. View the complete license texts here: www.sick.com/licensetexts. Printed copies of the license texts are also available on request.

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