

IN4000 Direct

Safety switches



Described product

IN4000 Direct

Manufacturer

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Contents

| | | |
|----------|---------------------------------------------------|-----------|
| 1 | About this document..... | 5 |
| 1.1 | Purpose of this document..... | 5 |
| 1.2 | Target group..... | 5 |
| 1.3 | Information depth..... | 5 |
| 1.4 | Scope..... | 5 |
| 1.5 | Symbols and document conventions..... | 6 |
| 2 | On safety..... | 7 |
| 2.1 | Qualified safety personnel..... | 7 |
| 2.2 | Applications of the safety switches..... | 7 |
| 2.3 | Intended use..... | 8 |
| 2.4 | Reasonably foreseeable misuse..... | 8 |
| 2.5 | General safety notes and protective measures..... | 8 |
| 3 | Product description..... | 9 |
| 3.1 | IN4000 Direct Series safety switches..... | 9 |
| 3.2 | Features and principle of operation..... | 9 |
| 3.3 | Enable zone and assured switch-off distance..... | 9 |
| 3.4 | LED indicators..... | 10 |
| 3.4.1 | Displays in operating mode..... | 10 |
| 3.4.2 | Displays in adjustment mode..... | 11 |
| 3.5 | Signal behavior..... | 11 |
| 3.6 | Manipulation prevention..... | 12 |
| 4 | Mounting..... | 13 |
| 4.1 | Mounting the safety switch..... | 13 |
| 5 | Connection and adjustment..... | 16 |
| 5.1 | Electrical connection..... | 16 |
| 5.2 | Adjustment..... | 16 |
| 5.3 | Connecting cables..... | 17 |
| 5.3.1 | Requirements for the connecting cables..... | 17 |
| 5.3.2 | Maximum length of cable..... | 17 |
| 5.3.3 | Determining the cable length - case study..... | 18 |
| 6 | Commissioning and operation..... | 19 |
| 6.1 | Checks before initial commissioning..... | 19 |
| 6.1.1 | Checking the start function..... | 19 |
| 6.2 | Periodic technical inspections..... | 19 |
| 6.2.1 | Daily check..... | 19 |
| 6.2.2 | Inspections by qualified safety personnel..... | 19 |
| 7 | Troubleshooting..... | 20 |
| 7.1 | Safety..... | 20 |
| 7.2 | Troubleshooting..... | 20 |

| | | |
|-----------|---------------------------------------|-----------|
| 7.3 | Safe status when an error occurs..... | 20 |
| 8 | Maintenance..... | 21 |
| 8.1 | Maintenance..... | 21 |
| 9 | Decommissioning..... | 22 |
| 9.1 | Disposal..... | 22 |
| 10 | Technical data..... | 23 |
| 10.1 | Data sheet..... | 23 |
| 10.2 | Pin assignment..... | 25 |
| 10.3 | Dimensional drawings..... | 25 |
| 11 | Ordering information..... | 26 |
| 11.1 | Devices..... | 26 |
| 11.2 | Accessories..... | 26 |
| 12 | Annex..... | 27 |
| 12.1 | Conformities and certificates..... | 27 |
| 12.1.1 | EU declaration of conformity..... | 27 |
| 12.1.2 | UK declaration of conformity..... | 27 |
| 13 | List of figures..... | 28 |
| 14 | List of tables..... | 29 |

1 About this document

1.1 Purpose of this document

These operating instructions provide technical personnel of the machine manufacturer or machine operator with instructions regarding the safe mounting, parameterization, electrical installation, commissioning, operation and thorough check of the inductive safety switch.

These operating instructions do not provide information on operating the machine in which a safety switch is integrated. For information about this, refer to the operating instructions of the specific machine.

1.2 Target group

These operating instructions are intended for planning engineers, developers, and operating entities of plants and systems that are to be protected by one or more inductive safety switches. They are also intended for people who integrate the safety switch into a machine, or perform the initial commissioning or inspection.

1.3 Information depth

These operating instructions contain information about the inductive safety switch on the following topics:

- Mounting,
- Electrical installation,
- Hardware commissioning,
- Fault diagnosis and troubleshooting,
- Part numbers,
- Conformity and approval.

Please note that technical skills not covered by this document are also required when planning and using SICK protective devices.

The official and legal regulations for operating the inductive safety switch must always be complied with.

General information on the topic of safety technology can be found in the “Guide for Safe Machinery”.



NOTE

Please also refer to the website at: www.sick.com

There you will find:

- example applications
- a list of frequently asked questions

1.4 Scope

Product

This document applies to the following products:

- Product code: IN4000 Direct

Document identification

Document part number:

- This document: 8027271
- Available language versions of this document: 8012183

You can find the current version of all documents at www.sick.com.

1.5 Symbols and document conventions

The following symbols and conventions are used in this document:

Warnings and other notes



DANGER

Indicates a situation presenting imminent danger, which will lead to death or serious injuries if not prevented.



WARNING

Indicates a situation presenting possible danger, which may lead to death or serious injuries if not prevented.



CAUTION

Indicates a situation presenting possible danger, which may lead to moderate or minor injuries if not prevented.



NOTICE

Indicates a situation presenting possible danger, which may lead to property damage if not prevented.



NOTE

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

Instructions to action

- ▶ The arrow denotes instructions to action.
- 1. The sequence of instructions for action is numbered.
- 2. Follow the order in which the numbered instructions are given.
- ✓ The check mark denotes the result of an instruction.

LED symbols

These symbols indicate the status of an LED:

- The LED is off.
- ◐ The LED is flashing.
- The LED is illuminated continuously.

2 On safety

This section concerns your own safety and the safety of the system operator.

- ▶ Please read this section carefully before you begin working with the IN4000 Direct series of inductive safety switches, or the machine protected by these safety switches in conjunction with the corresponding protective devices.

National and international legal regulations apply to the use/installation of the IN4000 Direct series of safety switches as well as to their commissioning and recurring technical inspections, in particular

- the Machinery Directive,
- the EMC Directive,
- the Work Equipment Directive,
- the safety regulations, and
- the accident prevention regulations and work safety regulations.

2.1 Qualified safety personnel

The safety switches must only be installed and commissioned by qualified safety personnel. A person is considered qualified safety personnel if he/she

- has taken part in adequate technical training

and

- has been instructed by the machine operator in machine operation and the applicable safety guidelines

and

- can access these operating instructions.

2.2 Applications of the safety switches

The IN4000 Direct series of safety switches are inductive safety proximity switches that are actuated by metal in a non-contact manner. The safe state is the de-energized state (logical "0" of an OSSD).

The IN4000 Direct series of safety switches and the corresponding machine or system controller can be used, for example, to protect movable physical guards in such a way that:

- the dangerous state of the machine or system can only be switched on when the protective devices are closed.
- a stop command is triggered if a protective device is opened while the machine is running.

For the controller, this means that:

- switch-on commands that result in dangerous states may only be activated when the protective devices are in the protective position,

and

- dangerous states must be ended before the protective devices are moved out of the protective position.

Before using the safety switches, a risk assessment must be carried out on the machine.

Intended use also includes compliance with the relevant requirements for installation and operation.

The safety switches must be subjected to periodic technical inspections (see "Periodic technical inspections", page 19).

2.3 Intended use

The IN4000 Standard series of safety switches may only be used as described in section "Applications of the safety switches". The safety switches may only be installed by qualified safety personnel and may only be used on the machine on which they were installed and commissioned for the first time by qualified safety personnel in accordance with these operating instructions.

The product may be used in safety functions.

The safety switch must only be used within the limits of the prescribed and specified technical data and operating conditions at all times.

If used in any other way or if alterations are made to the devices – including in the context of mounting and installation – any warranty claims directed to SICK AG will be rendered void.

2.4 Reasonably foreseeable misuse

The safety switch is not suitable for the following applications, among others:

- In the vicinity of chemical and biological media (solid, liquid, gaseous)
- In environments with increased levels of ionizing radiation

2.5 General safety notes and protective measures

The safety switch performs a personal protection function. Improper installation or manipulation can lead to serious personal injuries.

The safety switch complies with the following safety requirements:

- SIL3 according to IEC 61 508,
- SILCL3 according to EN 62 061,
- Performance Level e according to EN ISO 13 849-1 (depending on application).

Change information

- **For devices up to CW24 2018, the following applies:**
PFH_D 1.33×10^{-9} /Category 4 (EN ISO 13 849-1)
- **For devices on or after CW25 2018, the following applies :**
PFH_D 1.0×10^{-8} /Category 3 (EN ISO 13 849-1)
- ▶ Please check whether the device meets the safety requirements of your application.

Note regarding the classification of the device according to EN 60 947–5-2:



WARNING

Safety switches must not be circumvented, rotated away, removed, or rendered ineffective in any other way. Their contacts must not be bridged.

The inductive safety switches respond to metallic objects. Other metallic objects that are not intended to trigger the safety function must not be placed on the sensing face of the safety switches under any circumstances. Appropriate measures must therefore be taken to prevent this.

Please observe the installation measures according to EN ISO 14 119.

Damaged devices must be replaced.

3 Product description

3.1 IN4000 Direct Series safety switches

The safety switch has a cuboid housing with an alignable active sensor face. Its classification according to EN 60 947–5-2 depends on the mounting method (see table 4, page 13).

3.2 Features and principle of operation

The IN4000 Direct series of safety switches are typically used for safe position detection, as is the case, for example, when monitoring a movable protective device. The sensor detects the presence of metal. In order to meet the requirements against easy manipulation, the switching range of the sensor is monitored in time and space.

Its status can be read directly on the sensor or the protective device by means of LEDs. Errors, such as a coil break, short-circuit or wire break are detected by the self-monitoring function of the sensor.

The safety switch can be connected directly to a safe PLC or to a SICK safety controller, e.g., Flexi Classic or Flexi Soft.

3.3 Enable zone and assured switch-off distance

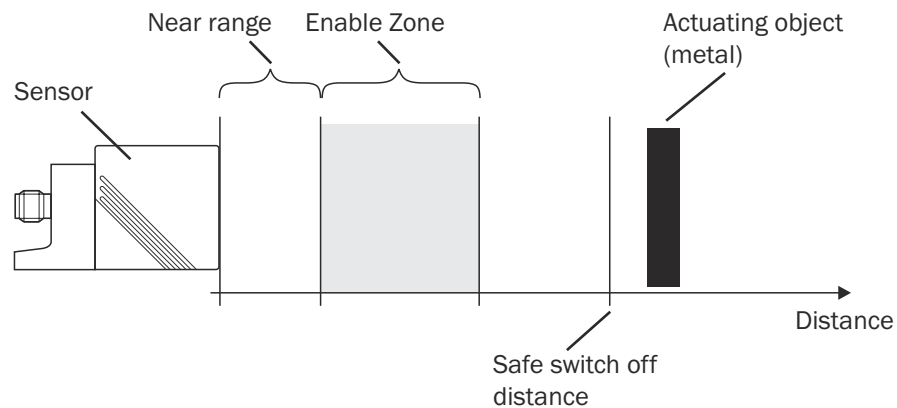


Figure 1: Schematic illustration of the zones

The output of the safety switch is only enabled in the event of actuation within the enable zone. Outside the enable zone, i.e., also in the close range, the output remains switched off.

After actuation in the close range, either the supply voltage must be interrupted or the actuator must be brought into the assured switch-off distance for more than 2 s before it can be enabled again.

The enable zone depends on the type of safety switch and the material and shape of the actuator. Using other actuators (material, shape) results in a different enable zone.

Typically, the following enable zones are achieved at an ambient temperature of 20 °C with non-flush installation of the safety switch using a standard plate according to EN 60 947-5-2 (IN40-E0101K: 45 × 45 × 1 mm³, IN40-E0109K: 60 × 60 × 1 mm³) and with different materials:

Table 1: Enable zone and assured switch-off distance IN40-E0101K

| Material | Enable zone | | Assured switch-off distance |
|------------------------------|----------------|----------------|-----------------------------|
| | Lower boundary | Upper boundary | |
| FE360 steel | 10 mm | 15.0 mm | 30 mm |
| 1.4302 stainless steel (V2A) | 7.5 mm | 13.2 mm | |
| AlMg 3G22 | 2.0 mm | 5.8 mm | |
| Al 99 % | 1.4 mm | 5.0 mm | |
| CuZn 37 | 2.3 mm | 6.2 mm | |
| Cu | 0.8 mm | 4.3 mm | |

Table 2: Enable zone and assured switch-off distance IN40-E0109K

| Material | Enable zone | | Assured switch-off distance |
|------------------------------|----------------|----------------|-----------------------------|
| | Lower boundary | Upper boundary | |
| FE360 steel | 4.0 mm | 20.0 mm | 45 mm |
| 1.4302 stainless steel (V2A) | 2.0 mm | 17.6 mm | |
| AlMg 3G22 | 0.0 mm | 9.6 mm | |
| Al 99 % | 0.0 mm | 8.6 mm | |
| CuZn 37 | 0.0 mm | 10.0 mm | |
| Cu | 0.0 mm | 7.0 mm | |

3.4 LED indicators

The safety switches have two LEDs that indicate the status of the supply voltage and the operational status.

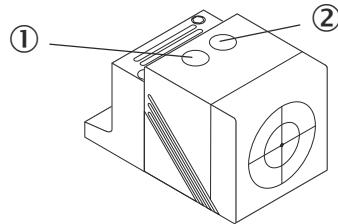


Figure 2: LED displays for voltage supply and operational status

- ① Power LED, green
- ② Signal LED, yellow

3.4.1 Displays in operating mode

The yellow signal LED lights up immediately or after a time delay, depending on the duration of the preceding de-actuation, when an actuator enters the enable zone.



NOTE

Regardless of the behavior of the yellow LED, the output always switches within the normal response times without any additional delay.

- If the actuator is in the enable range when the supply voltage is switched on, the yellow signal LED switches after a time delay of 5 s.
- If the actuator was ≥ 2 s away from the sensor at the assured switch-off distance and is then brought back into the enable zone, the yellow signal LED switches after a delay of 3 s.

- If the actuator was < 2 s away from the sensor at the assured switch-off distance and is then brought back into the enable zone, the yellow signal LED switches without a time delay.
- If the actuator is brought to the assured switch-off distance from the sensor, the yellow signal LED switches off without delay.
- If the actuator is brought into the close range, the yellow signal LED switches off after a delay of 2 s.

Further topics

- ["Enable zone and assured switch-off distance", page 9](#)
- ["Data sheet", page 23](#)

3.4.2 Displays in adjustment mode

- In adjustment mode, the yellow signal LED flashes when the actuator is outside the enable zone.
- In adjustment mode, the yellow signal LED goes out when the actuator is within the enable zone or in the assured switch-off range.



NOTE

In adjustment mode, the output remains in the safe state.

| Display | Meaning | Output states of the outputs | |
|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|--------------|
| | | OUT1 (OSSD1) | OUT2 (OSSD2) |
| ○ Yellow ○ Green | No supply voltage | 0 | 0 |
| ○ Yellow ● Green, flashing slowly | Undervoltage | 0 | 0 |
| ○ Yellow ● Green, flashing quickly | Overvoltage | 0 | 0 |
| ○ Yellow ● Green | Output switched off (safe state); actuator outside the enable zone (operating mode) or actuator within the enable zone (adjustment mode) | 0 | 0 |
| ● Yellow ● Green | Output activated; actuator within the enable zone (operating mode) | 1 | 1 |
| ● Yellow ● Green | Output switched off (safe state); actuator outside the enable zone (adjustment mode) | 0 | 0 |
| ● Yellow ○ Green | Internal or external error: | 0 | 0 |
| | • e.g., cross-circuit between the outputs | 0 | 1 |
| | • e.g., short-circuit of an output to supply or ground | 1 | 0 |

- ["Adjustment", page 16](#)

3.5 Signal behavior

The safe state is the switched off state (de-energized state: logical "0" of an OSSD).

If the actuator is in the enable zone and no sensor error is present, both output stages (OSSD) are activated (logical "1").

The output characteristics are compatible with the input characteristics according to EN 61 131-2 type 1 or 2:

Table 3: Output characteristics

| | | |
|-------------|--------------------------------------------|------------------------------------------------------------|
| Logical "1" | $\geq 15 \text{ V}$ $\geq 11 \text{ V}$ | 2 ... 15 mA 15 ... 30 mA |
| Logical "0" | $\leq 5 \text{ V}$ | Off-state current: 0.2 mA Pull-down current, typ: 30 mA |

If the actuator is outside the enable zone, the output is switched off (logical "0"; safe state).



WARNING

Cross-circuits between the two outputs are detected by the safety switch and lead to the outputs being switched off (OSSD).

Cross-circuits between the supply voltage and one output are detected and cause the other output to be switched off.

3.6 Manipulation prevention



WARNING

The inductive safety switches respond to metallic objects, e.g. the frame of a safety door. Other metallic objects that are not intended to trigger the safety function must not be placed near the sensing face of the safety switches under any circumstances. Appropriate measures must therefore be taken to prevent this.

The safety switch is protected against simple circumvention by the following switching behavior:

- When slowly bringing a metallic object into the enable zone, the output is triggered immediately, but is only indicated by the signal LED after a time delay of approx. 3 s. As a result, the object is usually in the close range zone before the signal LED lights up. The technical regulations relating to restarting the system must be observed.
- If this object remains in the close range zone for longer than approx. 2 s, the output is completely blocked and is no longer enable if actuation occurs in the enable zone. If the object remains in the close range zone for longer than approx. 5 s, adjustment mode is activated [see "Adjustment", page 16](#).

The enable zone can be unlocked either

- by de-actuation (IN40-E0101K: > 30 mm, IN40-E0109K: > 45 mm) for a period of more than 2 s

or

- by interrupting the voltage [see "Adjustment", page 16](#).

4 Mounting



WARNING

The safety system must only be mounted by authorized qualified personnel.

Select the mounting location and the mounting position of the safety switch in such a way that

- the safety switch is difficult to access for operating personnel when the protective device is open,
- thorough checking and replacement of the safety switch is possible.



WARNING

Circumvention of the inductive safety switch in a simple way or unintentional actuation must be prevented by suitable installation measures in accordance with EN ISO 14 119.



DANGER

Damage to the safety switch due to mechanical stress
Loss of the safety function

- ▶ Protect the safety switch from mechanical stress such as impacts or permanent contact pressure, for example by means of an additional stop.

4.1 Mounting the safety switch



WARNING

Observe the prescribed mounting method and the resulting classification according to EN 60947-5-2!

Table 4: Permissible mounting methods and resulting classification according to EN 60947-5-2

| Surrounding material | Permissible mounting methods | |
|-------------------------|----------------------------------------------|-------------------------|
| | IN40-E0101K | IN40-E0109K |
| Copper, aluminum, brass | Flush → I1C40SP2 | Non-flush → I2C40SP2 |
| Steel | Flush on one side or non-flush → I2C40SP2 | |

- Note the assured switch-off distance and enable zone (see figure 1, page 9).
- The specified minimum distances for adjacent and opposite sensors and the minimum distances to fixed system components and walls must be maintained (see figure 3 and figure 4).

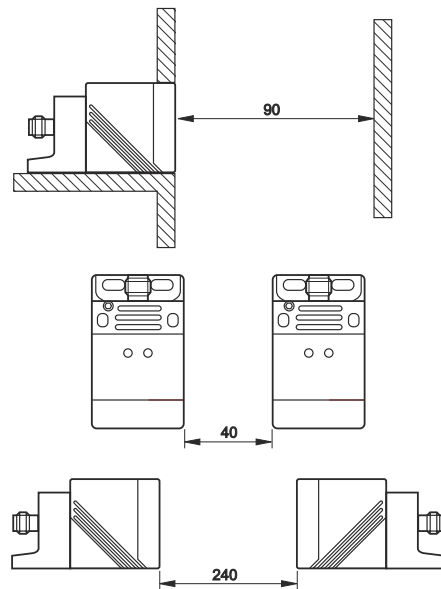


Figure 3: Minimum distances when mounting the IN40-E0101K safety switch

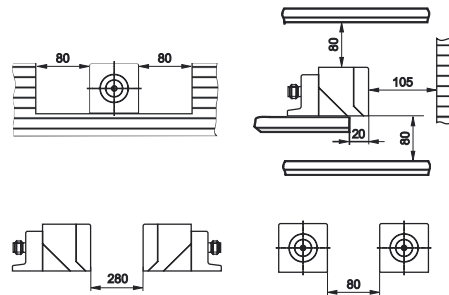


Figure 4: Minimum distances when mounting the IN40-E0109K safety switch

- The safety switch must be mounted so that the sensing face of the sensor is oriented towards the moving part of the protective device (door or the like). The sensing face can be aligned if necessary.
- The safety switch is supplied pre-mounted on a mounting bracket. The mounting bracket does not need to be removed to align the sensing face of the sensor.

Align the sensing face of the safety switch so that it is oriented towards the moving part of the protective device after mounting.

To align the safety switch:

1. Unscrew the hexagon socket screw on the sensor bracket and pull the sensor off the bracket (see figure 5 a-b).
2. Loosen the two screws at the lower corner of the sensor housing and rotate the active sensor face into the correct position (see figure 5 c-d).
3. Screw the sensor housing back on and remount the sensor on the sensor bracket (see figure 5 e-f).

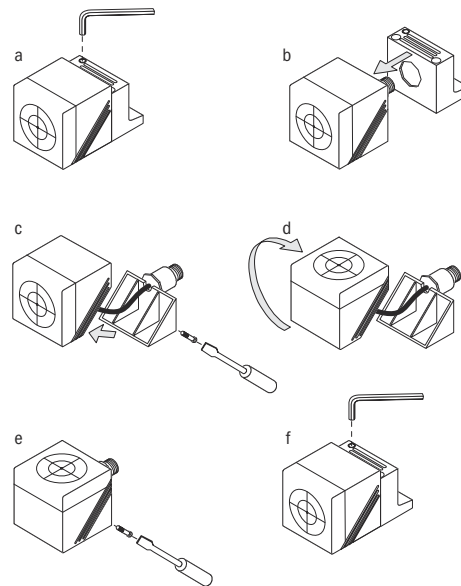


Figure 5: Alignment of the active sensor face of the safety switch

4. Fasten the safety switch as securely as possible at the selected mounting location and position using the mounting bracket. Tighten the non-loosening screws to 1.0 Nm.

5 Connection and adjustment

5.1 Electrical connection

The supply voltage (L+...L-) must be connected between pin 1 and pin 3 of the male connector. The nominal voltage is 24 V DC. This voltage is allowed to fluctuate between 19.2 V and 30 V with a residual ripple of 5 % in accordance with EN 61 131-2.



WARNING

The supply voltage must comply with SELV according to EN 60 950-1.

To deploy and use the device in accordance with cULus requirements, the supply voltage must be provided by a secondary fuse-protected transformer. A safe industrial power supply unit with overvoltage protection must be used. In the event of an error, 60 V DC must not be exceeded.

One of the following requirements must be met:

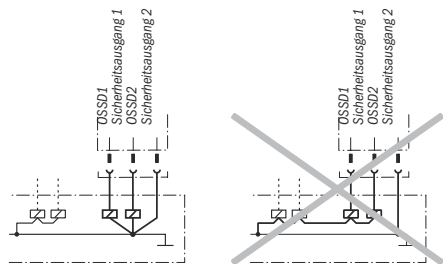
- max. 5 A for voltages from 0 ... 20 Vrms (0 ... 28.3 Vp)
- 100/Vp for voltages from 20 ... 30 Vrms (28.3 ... 42.4 Vp)



WARNING

Prevent the formation of a potential difference between the load and the protective device!

- If you connect loads to the OSSDs or safety outputs that are not protected against polarity reversal, you must connect the 0 V connections of these loads and the connections of the corresponding protective device individually and directly to the same 0 V terminal strip. In the event of an error, this is the only way to ensure that there can be no potential difference between the 0 V connections of the loads and those of the corresponding protective device.



5.2 Adjustment

To determine a suitable mounting position, the sensor can be put into an adjustment mode.

1. Hold a metallic object for about 5 s in the close range (see "Enable zone and assured switch-off distance", page 9) of the sensor; when the yellow signal LED flashes, the sensor is in adjustment mode.



NOTE

In adjustment mode, the output remains in the safe state.

2. To determine the enable zone, move the actuator in front of the sensor; the yellow signal LED goes out when the actuator is in the enable zone.
3. Securely mount the sensor and actuator in the position found.
4. Switch off the adjustment mode again by interrupting the voltage or de-actuating the sensor for more than 2 s.

5.3 Connecting cables

5.3.1 Requirements for the connecting cables

Incorrect sizing of the connecting cables can lead to failure of the safety function. If possible, use connection components and connecting cables from SICK AG. The connecting cables must meet the following conditions:

Table 5: Suitable connecting cables

| | Value |
|-------------------------|--------------------------------------|
| Min. wire cross-section | 0.34 mm ² |
| R max. | 60 Ω/km |
| C max. | 120 nF/km |
| L max. | 0.65 mH/km |
| Recommended cable type | LIYY 8 × or 5 × 0.34 mm ² |

5.3.2 Maximum length of cable

Taking into account the rated cable resistance, the following cable lengths are permissible per channel depending on the output current I_{out} .

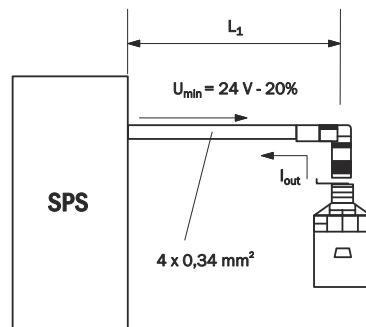


Figure 6: Maximum length of cable

Table 6: Maximum length of cable

| I_{out} [mA] Possible output current per channel OUT1/OUT2 | L_1 [m] Maximum cable length | R_{max} [Ω] Maximum permissible cable resistance |
|--------------------------------------------------------------|--------------------------------|----------------------------------------------------|
| 20 | 65 | 6.4 |
| 30 | 45 | 4.4 |
| 40 | 30 | 3.2 |
| 50 | 25 | 2.6 |
| 70 | 18 | 1.8 |
| 90 | 15 | 1.4 |
| 100 | 12 | 1.3 |



WARNING

Limit the cable length and cable resistance to the downstream safety monitoring module to the determined maximum cable length L_1 and maximum cable resistance R_{max} so that a cross-circuit between the outputs is reliably detected.

5.3.3 Determining the cable length - case study

The downstream safety monitoring module to which the IN4000 Direct is connected draws 75 mA current on each of the two safety inputs. All relevant values can be determined with the help of the corresponding table (see [table 6](#)).

- In the I_{out} column, search for a current ≥ 75 mA (example: 90 mA).
- The maximum cable length can be found in the L_1 column (example: 15 m).
- The maximum permissible cable resistance can be found in the R_{max} column (example: 1.4 Ω).

6 Commissioning and operation



WARNING

Prior to initial commissioning, qualified safety personnel must thoroughly check and document the safety functions of the machine or system.

After each modification and after maintenance and repair work, the entire protective device must be tested for effectiveness by qualified safety personnel.

6.1 Checks before initial commissioning

1. Check adherence to the mounting requirements (see "Mounting", page 13).
2. Perform an electrical function check of the sensor in conjunction with a safety controller or a safe PLC.

6.1.1 Checking the start function

The check must be performed separately for each protective device.

1. Switch off the machine or system.
2. Move the actuator (metal) to outside the response range of the sensor.
3. Start the machine or system; if the safety function of the protective device is working, the machine or system must not start.



WARNING

If the machine or system starts nevertheless, check again that the mounting requirements have been adhered to and all electrical connections are of the correct type, and establish the functional readiness of the safety system.

6.2 Periodic technical inspections

No maintenance is required. Regular thorough checks are required to ensure proper and lasting function.

6.2.1 Daily check

Every day or before the start of a shift, the operating personnel must check the safety switch for the following:

- fault-free operation
- no recognizable manipulation

6.2.2 Inspections by qualified safety personnel

The inspection by qualified safety personnel must be carried out regularly in accordance with the nationally applicable regulations and at the intervals specified therein. If any changes are made to the machine or someone tampers with the protective device after initial commissioning, this will ensure that any such issues are detected.

7 Troubleshooting

7.1 Safety



WARNING

Risk of ineffectiveness of the protective device

Persons and parts of the body to be protected are not recognized in case of non-observance.

- ▶ Immediately put the machine out of operation if the behavior of the machine cannot be clearly identified.
- ▶ Immediately put the machine out of operation if you cannot clearly identify or allocate the error and if you cannot safely remedy the error.
- ▶ Secure the machine such that it cannot be switched on unintentionally.



NOTE

If you cannot remedy the error with the help of the information provided in this section, please contact your SICK subsidiary.

In the event of an error, the type of error is indicated by the LED display on the sender or receiver.

7.2 Troubleshooting

Table 7: LED indicators

| Problem | Possible cause | Fix the error |
|--------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No LED display | No supply voltage | ▶ Switch on the voltage supply. |
| <ul style="list-style-type: none"> • "Power" LED does not flash. • Sensor does not switch. | <ul style="list-style-type: none"> • Undervoltage • Overvoltage | ▶ Check the supply voltage (see "Data sheet", page 23). |
| <ul style="list-style-type: none"> • "Power" LED is off. • "Signal" LED flashes. | Internal or external error | <ul style="list-style-type: none"> ▶ Perform a de-actuation and actuation ▶ Switch the voltage supply off and on again ▶ Check the connections and their wiring ▶ Eliminate any cross-circuits. ▶ Check the connected components, e.g., the PLC. ▶ Replace the device. |

Further topics

- [see "LED indicators", page 10](#)

7.3 Safe status when an error occurs

When an error occurs that leads to the loss of the safety function, the safety switch assumes a defined, safe state. The safety switch remains in this state until the error or the cause of the error has been rectified.

Possible errors that can lead to loss of the safety function are:

- Safety-related internal errors
- Invalid input signal conditions
- Loss of the supply voltage
- Loss of the guaranteed detection capability

8 Maintenance

8.1 Maintenance

When operating properly, no maintenance or servicing measures are required.

9 Decommissioning

9.1 Disposal

Procedure

- ▶ Always dispose of unusable devices in accordance with national waste disposal regulations.



Complementary information

SICK will be glad to help you dispose of these devices on request.

10 Technical data

10.1 Data sheet

Table 8: IN4000 Direct

| Parameter | Value | | |
|----------------------------------------------------------------------|------------------------------------------------------------------------------------|---------|------------------|
| | Minimum | Typical | Maximum |
| Safety integrity level | SIL3 (IEC 61 508) | | |
| SIL claim limit | SILCL3 (EN 62 061) | | |
| Category | Category 3 (EN ISO 13 849–1) | | |
| Performance level | PL e (EN ISO 13 849-1) | | |
| PFH _D (mean probability of a dangerous failure per hour) | 1.0 × 10 ⁻⁸ | | |
| Type | Type 3 (EN ISO 14 119) | | |
| Actuator coding level | Uncoded (EN ISO 14 119) | | |
| Safe status when an error occurs | At least one OSSD is in LOW state (logical "0") | | |
| Housing material | PPE, zinc die cast | | |
| Enclosure rating | IP65/IP67 (EN 60 529) | | |
| Protection class | III | | |
| Display | LED yellow (signal) LED green (power) | | |
| Connection | M12 plug connection, gold-plated contacts | | |
| Ambient conditions | | | |
| Operation site | Class C according to EN 60 654--1 Weather-protected location of use | | |
| Temperature change rate | 0.5 K/min | | |
| Height above sea level | ≤ 2000 m | | |
| Ionizing radiation | Not allowed | | |
| Salt spray | No | | |
| T _M (mission time) | EN ISO 13 849–1; depending on the ambient conditions: see the following lines | | |
| Operating temperature T _M = 10 years | | | |
| IN40-E0101K IN40-E0109K | -25 °C -25 °C | | +70 °C +60 °C |
| Operating temperature T _M = 20 years | +10 °C | | +40 °C |
| Relative humidity | | | |
| T _M = 10 years T _M = 20 years | 5 % 5 % | | 95 % 70 % |
| Air pressure | 80 kPa | | 106 kPa |
| Electrical data | | | |
| Supply voltage | 24 V DC (19.2 ... 30 V DC) see "Electrical connection", page 16 | | |
| Current consumption | | | |
| IN40-E0101K IN40-E0109K | < 15 mA < 35 mA | | |
| Voltage drop at output OUT1 and OUT2 | < 2.5 V; 100 mA see "Signal behavior", page 11 | | |

| Parameter | Value | | |
|----------------------------------------------------------------------------------------------------|--------------------|---------|----------------|
| | Minimum | Typical | Maximum |
| Max. switching current per output | 100 mA | | |
| EMC/vibration resistance/shock resistance | EN 60 947-5-2 | | |
| Operating data | | | |
| Response range/enable zone | | | |
| IN40-E0101K ¹ N40-E0109K ² | 10 mm 4 mm | | 15 mm 20 mm |
| Assured switch-off distance | | | |
| IN40-E0101K ¹ N40-E0109K ² | > 30 mm > 45 mm | | |
| Response times | | | |
| Response time for safety request Within this time the output will be switched off (Logical "0") | | | 50 ms |
| Response time when approaching the close-range zone (non-safety-relevant zone) | | | 100 ms |
| Response time when approaching the enable zone (enable time) | | 100 ms | 200 ms |
| Error response time for safety-relevant errors | | | 100 ms |
| Permissible dwell time at close range | | 2 s | |
| Delay time for activation of the adjustment mode (see "Adjustment", page 16) | | 5 s | |
| Dwell time in de-actuated state for return to operating mode (see "Adjustment", page 16) | | 2 s | |
| Simultaneity of the on and off switching of the outputs for a safety request | | | 50 ms |
| Duration of the shutdown test pulses | | | 1 ms |

- ¹ Applies over the entire temperature range, based on a 45 × 45 × 1 mm³ reference plate according to IEC 60 947-5-2 (FE360 = ST37K).
- ² Applies over the entire temperature range, based on a 60 × 60 × 1 mm³ reference plate according to IEC 60 947-5-2 (FE360 = ST37K).

10.2 Pin assignment

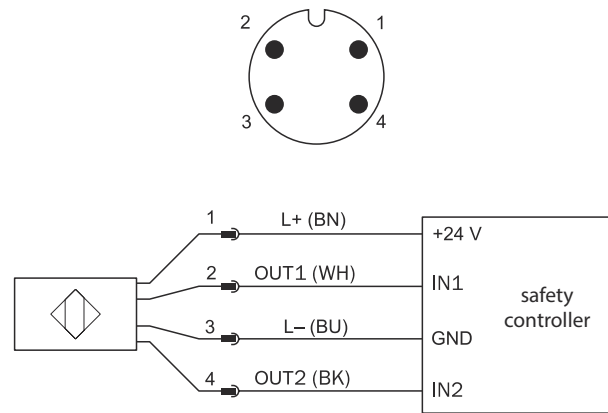


Figure 7: Pin assignment and connection diagram

Table 9: Pin assignment of the safety switches

| PIN | Wire color | Function |
|-----|------------|--------------|
| 1 | BN (brown) | L+ (24 V) |
| 2 | WH (white) | OUT1 (OSSD1) |
| 3 | BU (blue) | L- (GND) |
| 4 | BK (black) | OUT2 (OSSD2) |

10.3 Dimensional drawings

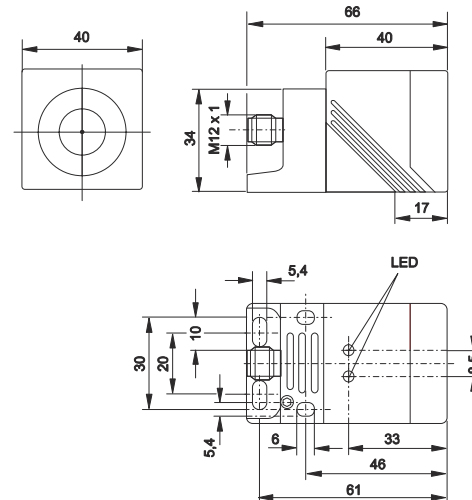


Figure 8: Dimensional drawing

11 Ordering information

11.1 Devices

| Description | Type | Part number |
|-------------------------------|-------------|-------------|
| Safety switch in cubic design | IN40-E0101K | 6027388 |
| | IN40-E0109K | 6050281 |

11.2 Accessories

| Description | Type | Part number |
|------------------------------------------------|--------------------|-------------|
| Connecting cable 5 m, straight male connector | YF2A14-050VB3XLEAX | 2096235 |
| Connecting cable 10 m, straight male connector | YF2A14-100VB3XLEAX | 2096236 |
| Connecting cable 15 m, straight male connector | YF2A14-150VB3XLEAX | 2096237 |
| Connecting cable 20 m, straight male connector | YF2A14-200VB3XLEAX | 2096238 |

12 Annex

12.1 Conformities and certificates

You can obtain declarations of conformity, certificates and the current documentation for the product at www.sick.com. To do so, enter the product part number in the search field (part number: see the entry in the “P/N” or “Ident. no.” field on the type label).

12.1.1 EU declaration of conformity

Excerpt

The undersigned, representing the manufacturer, herewith declares that the product is in conformity with the provisions of the following EU directive(s) (including all applicable amendments), and that the standards and/or technical specifications stated in the EU declaration of conformity have been used as a basis for this.

- ROHS DIRECTIVE 2011/65/EU
- EMC DIRECTIVE 2014/30/EU
- MACHINERY DIRECTIVE 2006/42/EC

12.1.2 UK declaration of conformity

Excerpt

The undersigned, representing the following manufacturer herewith declares that this declaration of conformity is issued under the sole responsibility of the manufacturer. The product of this declaration is in conformity with the provisions of the following relevant UK Statutory Instruments (including all applicable amendments), and the respective standards and/or technical specifications have been used as a basis.

- Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012
- Electromagnetic Compatibility Regulations 2016
- Supply of Machinery (Safety) Regulations 2008

13 List of figures

| | | |
|----|--------------------------------------------------------------------|----|
| 1. | Schematic illustration of the zones..... | 9 |
| 2. | LED displays for voltage supply and operational status..... | 10 |
| 3. | Minimum distances when mounting the IN40-E0101K safety switch..... | 14 |
| 4. | Minimum distances when mounting the IN40-E0109K safety switch..... | 14 |
| 5. | Alignment of the active sensor face of the safety switch..... | 15 |
| 6. | Maximum length of cable..... | 17 |
| 7. | Pin assignment and connection diagram..... | 25 |
| 8. | Dimensional drawing..... | 25 |

14 List of tables

| | | |
|----|---------------------------------------------------------------------------------------------|----|
| 1. | Enable zone and assured switch-off distance IN40-E0101K..... | 10 |
| 2. | Enable zone and assured switch-off distance IN40-E0109K..... | 10 |
| 3. | Output characteristics..... | 12 |
| 4. | Permissible mounting methods and resulting classification according to EN 60947-5-2..... | 13 |
| 5. | Suitable connecting cables..... | 17 |
| 6. | Maximum length of cable..... | 17 |
| 7. | LED indicators..... | 20 |
| 8. | IN4000 Direct..... | 23 |
| 9. | Pin assignment of the safety switches..... | 25 |

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