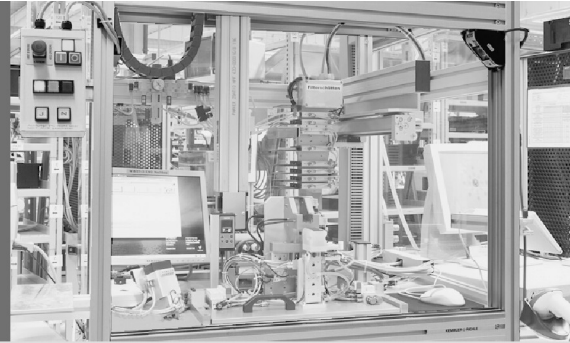


OPERATING INSTRUCTIONS

V200 Work Station Extended, V300 Work Station Extended

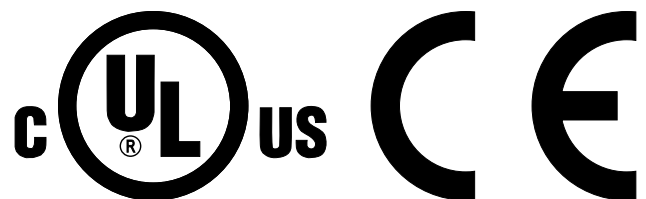


Safety camera system



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1 About this document

Please read this chapter carefully before working with the documentation and the V200 Work Station Extended or V300 Work Station Extended safety camera system, referred to in the following as V200/V300 for short.

1.1 Function of this document

These operating instructions are designed to address the *technical personnel of the machine manufacturer* or the *machine operator* in regards to safe mounting, installation, configuration, electrical installation, commissioning, operation and maintenance of the V200/V300 safety camera system.

These operating instructions do not provide instructions for operating machines on which the safety camera system is, or will be, integrated. Information on this is to be found in the operating instructions for the machine.

1.2 Target group

These operating instructions are addressed to *planning engineers, machine designers and operators* of plants and systems which are to be protected by one or several V200/V300 safety camera systems. It also addresses people who integrate the V200/V300 into a machine, initialise its use, or who are in charge of servicing and maintaining the device.

1.3 Information depth

These operating instructions contain the following information on the V200/V300 safety camera system:

- mounting
- electrical installation
- commissioning
- care and maintenance
- fault diagnosis and troubleshooting
- part numbers
- conformity and approval

Planning and using protective devices such as the V200/V300 also require specific technical skills which are not detailed in this documentation.

When operating the V200/V300, the national, local and statutory rules and regulations must be observed.

General information on accident prevention using opto-electronic protective devices can be found in the competence brochure "Guidelines Safe Machinery".

Note Please refer also to the SICK homepage on the Internet at www.sick.com.

Here you will find information on:

- application examples and application reports that supplement the application examples in chapter 6
- a list of frequently asked questions regarding the V200/V300
- these operating instructions in different languages for viewing and printing
- certificates on the prototype test, the EU declaration of conformity and other documents

1.4 Scope

This document is an original document.

Notes These operating instructions are only applicable to the V200/V300 safety camera system with one of the following entries on the type label in the field *Operating Instructions*:

- 8012225 XF85
- 8012225 YY28
- 8012225 YT87

This document is part of SICK part number 8012225 (operating instructions “V200/V300 – Safety camera system” in all available languages).

1.5 Abbreviations used

ANSI	American National Standards Institute
EDM	External device monitoring
ESPE	Electro-sensitive protective equipment (e.g. V200/V300)
LED	Light Emitting Diode
OSSD	Output signal switching device = signal output from the protective device to the controller that is used to stop the dangerous movement
V200/V300	Short code for the V200 Work Station Extended/V300 Work Station Extended safety camera system

1.6 Symbols used

Recommendation Recommendations are designed to give you some assistance in your decision-making process with respect to a certain function or a technical measure.

Note Refer to notes for special features of the device.



LED symbols describe the status of an LED. Examples:

- The LED is off.
- The LED is illuminated constantly.
- ◐ The LED flashes evenly (0.5 seconds on, 0.5 seconds off).
- ◑ The LED goes off briefly (0.9 seconds on, 0.1 seconds off, ...).
- ◒ The LED flashes with a short duty cycle (0.9 seconds off, 0.1 seconds on, ...).



In combination with the LED symbols, these symbols identify which LED is described:

- ⊘● The LED “Stop” (OSSDs switched off) is illuminated constantly.
- ⚠◐ The LED “Warning” flashes.
- ✓○ The LED “OK” (OSSDs switched on) is off.

➤ Take action ... Instructions for taking action are shown by an arrow. Read carefully and follow the instructions for action.



WARNING

Warning!

A warning notice indicates an actual or potential risk or health hazard. They are designed to help you to prevent accidents.

Read carefully and follow the warning notices!

The term “dangerous state”

The dangerous state (standard term) of the machine is always shown in the drawings and diagrams of this document as a movement of a machine part. In practical operation, there may be a number of different dangerous states:

- machine movements
- electrical conductors
- visible or invisible radiation
- a combination of several risks and hazards

2 On safety

This chapter deals with your own safety and the safety of the equipment operators.

- Please read this chapter carefully before working with the V200/V300 or with the machine protected by the V200/V300.

2.1 Qualified safety personnel

The V200/V300 safety camera system must only be installed, commissioned and serviced by qualified safety personnel. Qualified safety personnel are defined as persons who

- due to their specialist training and experience have adequate knowledge of the power-driven equipment to be checked

and

- have been instructed by the responsible machine owner in the operation of the machine and the current valid safety guidelines

and

- are sufficiently familiar with the applicable official health and work safety regulations, directives and generally recognized engineering practice (e.g. DIN standards, VDE stipulations, engineering regulations from other EU member states) that they can assess the work safety aspects of the power-driven equipment

and

- have access to these operating instructions and have read them.

As a rule these are qualified safety personnel from the ESPE manufacturer or also persons who have been appropriately trained at the ESPE manufacturer, are primarily involved in checking ESPE and are allocated the task by the organisation operating the ESPE.

2.2 Applications of the device

The V200/V300 safety camera system is an item of electro-sensitive protective equipment (ESPE).

The V200/V300 safety camera system can be operated with 3 resolutions. Depending on the resolution used, the maximum protective field dimensions change:

Tab. 1: Maximum protective field dimensions as a function of the resolution

Resolution [mm]	Protective field dimensions [m]		
	Minimum	Maximum	Note
20	0.40 × 0.40	1.00 × 1.00	On sizing the protective field the ratio for the lengths of the sides must be considered (see section 4.1 “Checking the dimensions of the protective field” on page 18 ff.)
24	0.40 × 0.40	1.20 × 1.20	
30	0.60 × 0.60	1.50 × 1.50	

The device is a *Type 3 ESPE* (V300 Work Station Extended) or a *Type 2* (V200 Work Station Extended) according to IEC 61496-1 and IEC/TR 61496-4 and is therefore allowed for use with controls in category 3 according to EN ISO 13849-1. The device is suitable for hazardous point protection (hand protection).

Access to the hazardous point must be allowed only through the protective field. As long as the hazardous point is occupied, the system must not start. Refer to section 3.3 “Application examples” on page 13 for an illustration of the protection modes.



WARNING

Only use the safety camera system as an indirect protective measure!

An opto-electronic protective device provides indirect protection, e.g. by switching off the power at the source of the hazard. It cannot provide protection from parts thrown out, nor from emitted radiation. Transparent objects are not detected.

Depending on the application, mechanical guards may be required in addition to the safety camera system.

The safety camera system is only intended for use in industrial environments. When used in residential areas it can cause radio interferences.

2.3 Correct use

The V200/V300 safety camera system must be used only as defined in section 2.2 “Applications of the device”. It must be used only by qualified personnel and only on the machine where it has been installed and initialised by qualified safety personnel in accordance with these operating instructions.

If the device is used for any other purposes or modified in any way – also during mounting and installation – any warranty claim against SICK AG shall become void.

2.4 General safety notes and protective measures



WARNING

Pay attention to the safety notes!

Please observe the following procedures in order to ensure the correct and safe use of the V200/V300 safety camera system.

- The national/international rules and regulations apply to the installation, use and periodic technical inspections of the safety camera system, in particular:
 - Machinery Directive
 - Work Equipment Directive
 - the work safety regulations/safety rules
 - other relevant safety regulations

Manufacturers and operators of the machine on which the safety camera system is used are responsible for obtaining and observing all applicable safety regulations and rules.

- The notices, in particular the test regulations (see section 7.1 “Test notes” on page 42) of these operating instructions (e.g. on use, mounting, installation or integration into the existing machine controller) must be observed.
- The tests must be carried out by qualified safety personnel or specially qualified and authorised personnel and must be recorded and documented to ensure that the tests can be reconstructed and retraced at any time.
- Changes to the configuration of the devices can degrade the protective function. After every change to the configuration you must therefore check the effectiveness of the protective device. The person who makes the change is also responsible for the correct protective function of the device.
- The light beams from the camera may be deflected by reflective surfaces. This can result in failure to identify an object. For this reason reflective surfaces on the reflective tape or in the protective field are not allowed.
- The operating instructions must be made available to the operator of the machine where the V200/V300 safety camera system is fitted. The machine operator is to be instructed in the use of the device by qualified safety personnel and must be instructed to read the operating instructions.
- To meet the requirements of the relevant product standards (e.g. IEC 61496-1), the external voltage supply for the devices (SELV) must be able to bridge a brief mains failure of 20 ms. Power supplies according to EN 60204-1 satisfy this requirement. Suitable power supplies are available as accessories from SICK (see section 12.2 “Accessories” on page 59).

2.5 Environmental protection

The V200/V300 safety camera system has been designed to minimise environmental impact. It uses only a minimum of power and natural resources.

- At work, always act in an environmentally responsible manner.

2.5.1 Disposal

- Always dispose of unserviceable or irreparable devices in compliance with local/national rules and regulations with respect to waste disposal (e.g. European waste code 16 02 14).

Note We would be pleased to be of assistance to you on the disposal of these devices. Contact us.

2.5.2 Separation of materials



WARNING

Only qualified safety personnel are allowed to separate materials!

Caution is required when dismantling devices. There is a risk of injuries.

Before you send the devices for appropriate recycling, it is necessary to separate the different materials in the V200/V300.

- Separate the housing from the rest of the parts (in particular the circuit board).
- Send the separated parts for recycling as appropriate:

Tab. 2: Overview on disposal by components

Components	Disposal
Product	
Housing	Metal recycling (aluminium)
Circuit boards, cable, connector and electrical connecting pieces	Electronic recycling
Packaging	
Cardboard, paper	Paper/cardboard recycling
Polyethylene packaging	Plastic recycling

3 Product description

This chapter provides information on the special features and properties of the V200/V300 safety camera system. It describes the construction and the operating principle of the device, in particular the different operating modes.

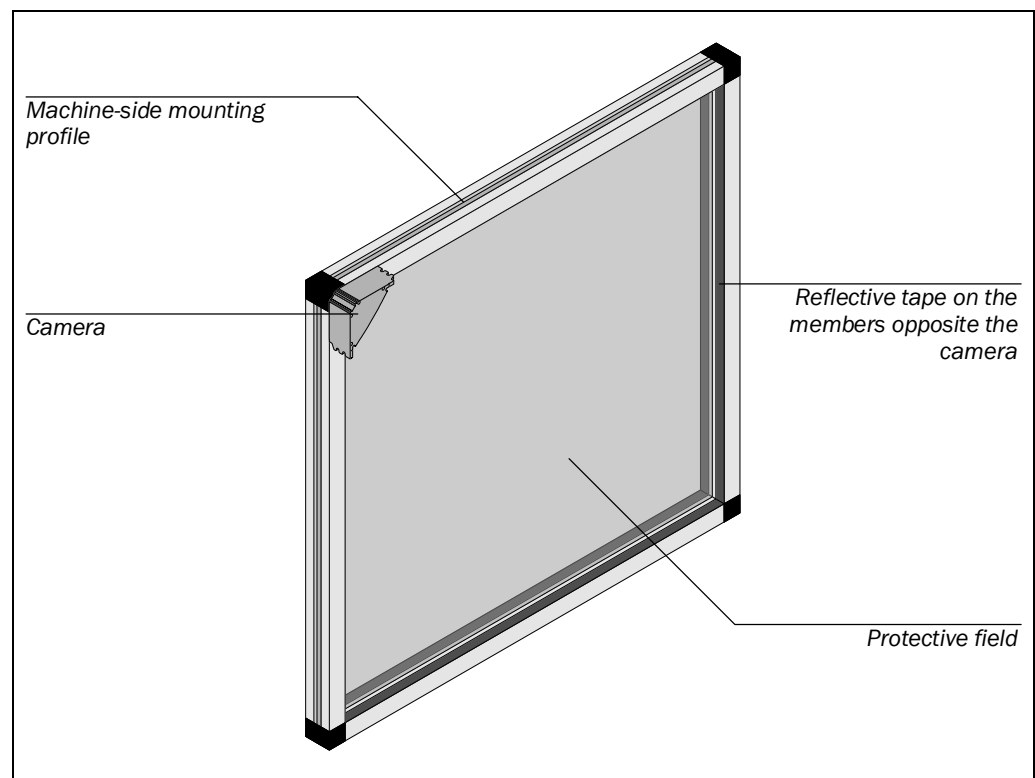
➤ Please read this chapter before mounting, installing and commissioning the device.

3.1 Special features

- V200 Work Station Extended: Type 2 ESPE according to IEC 61496-1
- V300 Work Station Extended: Type 3 ESPE according to IEC 61496-1 complies with the requirements for the “Control reliable” safety level.
- protective operation with either internal or external (realised on the machine) restart interlock
- facility for connecting a reset button
- facility for connecting an external device monitoring (EDM)
- status indication by LED

3.2 Operating principle of the device

Fig. 1: Operating principle of the V200/V300



The V200/V300 safety camera system comprises a camera as well as a reflective tape with which the contour to be monitored is defined.

The camera monitors the area bounded by its field of view and the reflective tape – the protective field – for interruptions. If the V200/V300 detects an interruption in the shape of the protective field, the camera shuts down its safe outputs.

Please refer to chapter 11 “Technical specifications” on page 52 for the data sheet.

Please refer to page 56 for the dimensional drawings.

V200/V300

3.3 Application examples

Note The mounting of the device is only shown schematically in the following figures for reasons of simplicity.

For correct mounting, pay attention to the notes in chapter 4 “Mounting” on page 18.

Fig. 2: Hazardous point protection with one V200/V300, mounting in the frame (left figure)

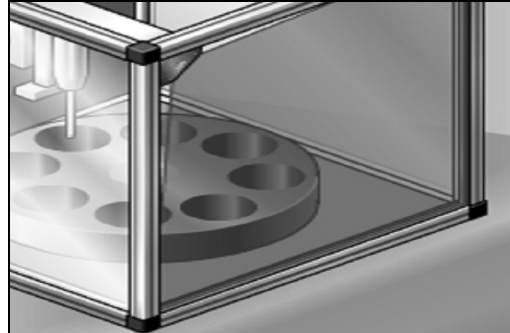


Fig. 3: Hazardous point protection with one V200/V300, mounting on the frame (right figure)

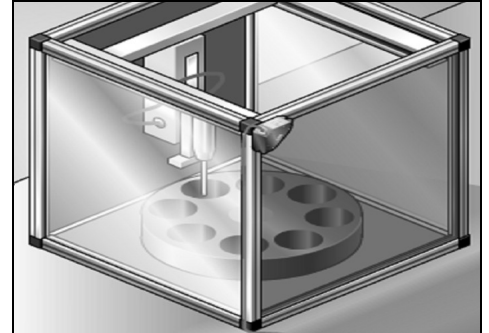


Fig. 4: Hazardous point protection with two V200/V300, placement in opposite directions (left figure)

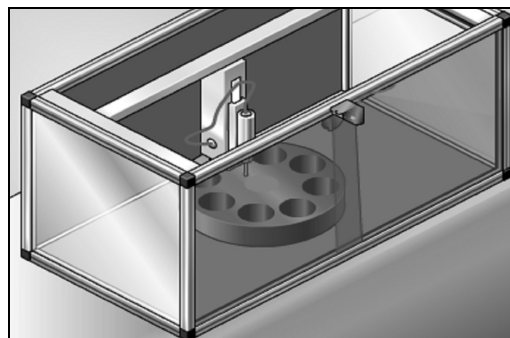
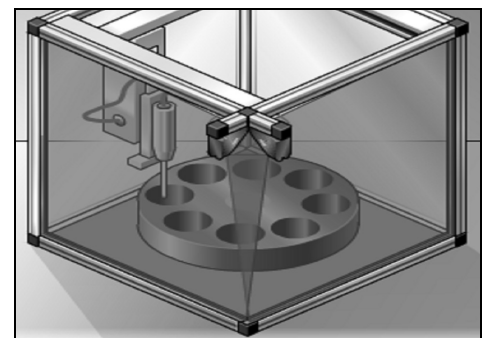


Fig. 5: Hazardous point protection with two V200/V300, placement at corner (right figure)



The V200/V300 safety camera system operates correctly as a protective device only if the following conditions are met:

- The control of the machine must be electrical.
- It must be possible to achieve a safe state on the machine at any time.
- Camera and reflective tape must be so mounted that objects penetrating into the hazardous area are safely identified by the V200/V300.
- The reset button must be fitted outside the hazardous area such that it cannot be operated by a person working inside the hazardous area. When operating the reset button, the operator must have full visual command of the hazardous area.
- The statutory and local rules and regulations must be observed when installing and using the device.
- The necessary protective field dimensions must not exceed the permitted ratio for the lengths of the sides (see section 4.1 “Checking the dimensions of the protective field” on page 18).

3.4 Configurable functions

This section describes the functions of the V200/V300 safety camera system that can be configured.



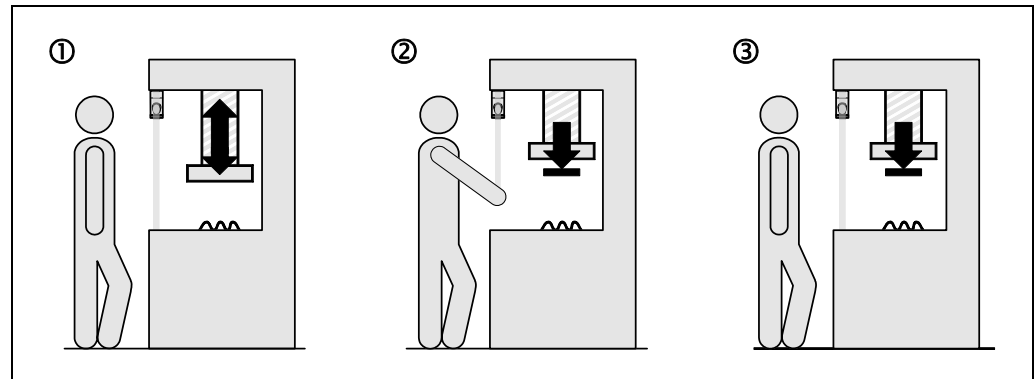
WARNING

Test the protective device after any changes!

After each modification to the protective device or its connection, you must check the whole protective device for effectiveness (see section 7.1 “Test notes” on page 42).

3.4.1 Restart interlock

Fig. 6: Outline drawing of the protective operation



The V200/V300 has an internal restart interlock. The dangerous state of the machine (①) is interrupted on a protective field interruption (②), and is not re-enabled (③) until the operator presses the reset button.

- Notes**
- If you use the V200/V300 without internal restart interlock, then you must implement the restart interlock externally, i.e. machine-side.
 - Do not confuse the restart interlock with the starting interlock on the machine. The starting interlock prevents the machine starting after switching on. The restart interlock prevents the machine starting again after an error or an interruption of the light path.

When using the V200/V300, you can implement the restart interlock in two different ways:

- with the internal restart interlock of the V200/V300:
The V200/V300 controls the restart.
- with the restart interlock of the machine (external):
The V200/V300 has no control over the restart.

V200/V300

Tab. 3: Permissible restart interlock configurations on the V200/V300

The possible combinations are shown in the following table:

Restart interlock of the V200/V300	Restart interlock of the machine	Permissible application
Deactivated	Deactivated	Only if ... <ul style="list-style-type: none"> the safety camera system cannot be stood behind. Observe EN 60 204-1! it is ensured no work clothing with reflectors is used.
Deactivated	Activated	All
Activated	Deactivated	Only if the safety camera system cannot be stood behind. Observe EN 60 204-1!
Activated	Activated	All. Restart interlock of the V200/V300 handles the reset function (see “Reset” below).



WARNING

Always configure the application with restart interlock!

Ensure that there is always a restart interlock. The V200/V300 is unable to verify if the restart interlock of the machine is connected. If you deactivate both the internal and the external restart interlock, the users and operators of the machine will be at acute risk of injury.

Reset

If you activate the restart interlock on the V200/V300 (internal) and also realise a restart interlock on the machine (external), then each restart interlock gets its own button.

When actuating the reset button (for the internal restart interlock) ...

- the V200/V300 activates the output signal switching devices.
- switches the V200/V300 to green.

Only the external restart interlock prevents the machine from restarting. After pressing the reset button for the V200/V300, the operator must also press the restart button for the machine. If the reset button and the restart button are not pressed in the specified sequence, the dangerous state must remain disrupted.

Recommendation

The reset button prevents the accidental and inadvertent operation of the external restart button. The operator must first acknowledge the safe state with the reset button.

The electrical connection of the reset button is described in section 5.3 on page 33. The configuration of the internal restart interlock is described in section 8.2 “Internal restart interlock” on page 46.

3.4.2 External device monitoring (EDM)

The V200/V300 has external device monitoring. If you activate the external device monitoring, then the V200/V300 checks whether the contactors are actually de-energized when the protective device triggers. If, after an attempted Reset/restart, the EDM does not detect a response from the switched device within 300 ms, the EDM will deactivate the output signal switching devices again. In this case the safety camera system signals as follows:

- The system remains at red. The status LED illuminates.
- The status LED flashes with a short duty cycle
- The diagnostics LED 2 flashes with a short duty cycle.

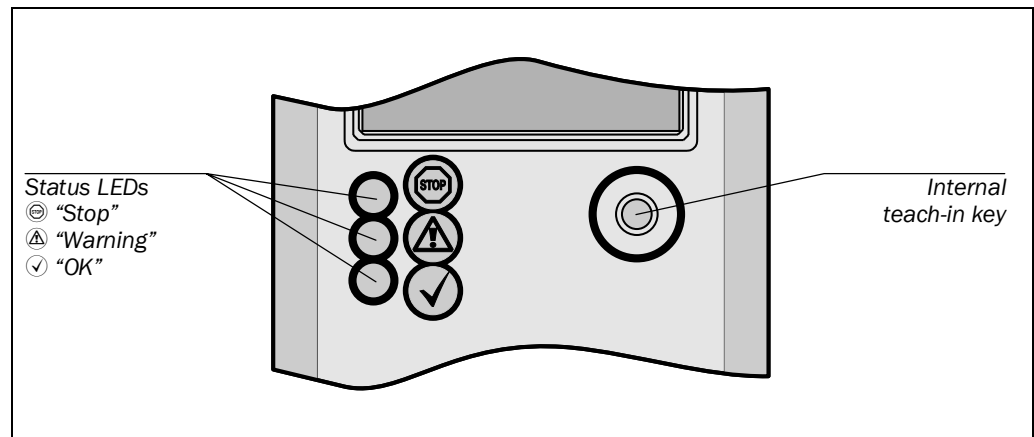
Note If the system is unable to change to a safe operational state (e.g. after contactor failure), the system locks and shuts down completely (“lock-out”, see page 50). The electrical connection for the external device monitoring is described in section 5.3 on page 33. The configuration of the external device monitoring is described in chapter 8 “Configuration” on page 44.

3.5 Status indicators

The light emitting diodes (LEDs) on the V200/V300 signal its operating status.

3.5.1 Status LEDs of the V200/V300

Fig. 7: Status LEDs of the V200/V300



Tab. 4: Meaning of the status LEDs of the V200/V300

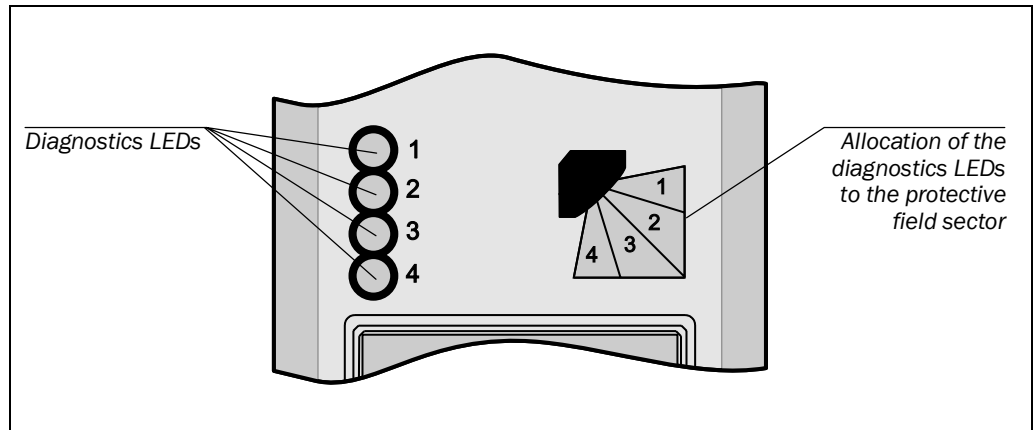
Display	Colour	Meaning
⊘ ●	Red	OSSDs shut down (e.g. if object in protective field or “lock-out”)
✓ ●	Green	OSSDs activated. Protective field unoccupied
⚠ ●	Yellow	No valid configuration taught-in (default delivery status) ➤ Perform the teach-in procedure (see section 8.1 “Teach-in” on page 44).
⚠ ●		Even flashing: reset required ➤ Press the reset button.
⚠ ●		Warning ➤ Carry out a fault diagnosis (see chapter 10 “Fault diagnosis” on page 50).
⚠ ●		Error ➤ Carry out a fault diagnosis (see chapter 10 “Fault diagnosis” on page 50).

V200/V300

3.5.2 Diagnostics LEDs of the V200/V300

The camera indicates diagnostic information with the aid of four LEDs.

Fig. 8: Diagnostics LEDs of the V200/V300



Tab. 5: Meaning of the diagnostics LEDs

Display	Meaning
● 1 ... ● 2 ... ● 3 ... ● 4	Power-up sequence: After switching on the V200/V300 and after each teach-in, the power up sequence runs. Starting with the diagnostics LED 1, the next diagnostics LED illuminates after one second and so on until all 4 diagnostics LEDs are illuminated.
○	Protective field sector free
●	Interruption of the protective field in the allocated protective field sector (see Fig. 8). A protective field sector represents one quarter of the field of view of the V200/V300.
☉	Teach-in mode (see section 8.1 "Teach-in" on page 44)
☉	Warning (see chapter 10 "Fault diagnosis" on page 50)
☉	Error (see chapter 10 "Fault diagnosis" on page 50)

4 Mounting

This chapter describes the preparation and completion of the mounting of the V200/V300 safety camera system. Mounting requires the following steps:

- checking the dimensions of the protective field (see below)
- determining the minimum distance (see page 20)
- mounting of the camera (see page 24)
- mounting the reflective tape (see page 29)

The following steps are necessary after mounting:

- completing the electrical connections (see chapter 5 on page 31)
- testing the installation (see section 7.1 on page 42)

4.1 Checking the dimensions of the protective field



WARNING

Only use the V200/V300 safety camera system if the ratio allowed for the lengths of the sides of the protective field can be met!

If the maximum ratio of the lengths of the sides is exceeded, the safety camera system may not operate correctly. This would mean that the operator is at risk.

Note Applicable to all resolutions:

- The ratio of the lengths of the sides of a protective field monitored must not exceed 2:1.
- If you require a larger protective field than is possible with a single V200/V300, you can mount two V200/V300 in parallel in opposite directions. In this way you can generate two overlapping protective fields (see 6.2 “Application with two V200/V300” on page 39).

4.1.1 Protective field dimensions allowed at a resolution of 20 mm

The lengths of the sides of a protective field monitored must not be shorter than 0.40 m and not longer than 1.00 m.

Tab. 6: Protective field dimensions allowed for a rectangular protective field at a resolution of 20 mm (intermediate values are allowed)

Shorter side of the protective field	Longer side of the protective field	
	Minimum	Maximum
$\geq 0.40 \text{ m} \dots < 0.50 \text{ m}$	= shorter side	$2 \times \text{shorter side}$
$\geq 0.50 \text{ m} \dots \leq 1.00 \text{ m}$	= shorter side	1.00 m

Example 1: The shorter side is 0.43 m long. Then the longer side must be at least 0.43 m and is allowed to be a maximum of $2 \times 0.43 \text{ m} = 0.86 \text{ m}$ long.

Example 2: The shorter side is 0.78 m long. Then the longer side must be at least 0.78 m and is allowed to be a maximum of 1.00 m long.

4.1.2 Protective field dimensions allowed at a resolution of 24 mm

The lengths of the sides of a protective field monitored must not be shorter than 0.40 m and not longer than 1.20 m.

Tab. 7: Protective field dimensions allowed for a rectangular protective field at a resolution of 24 mm (intermediate values are allowed)

Shorter side of the protective field	Longer side of the protective field	
	Minimum	Maximum
$\geq 0.40 \text{ m} \dots < 0.60 \text{ m}$	= shorter side	$2 \times \text{shorter side}$
$\geq 0.60 \text{ m} \dots \leq 1.20 \text{ m}$	= shorter side	1.20 m

Example 1: The shorter side is 0.43 m long. Then the longer side must be at least 0.43 m and is allowed to be a maximum of $2 \times 0.43 \text{ m} = 0.86 \text{ m}$ long.

Example 2: The shorter side is 0.78 m long. Then the longer side must be at least 0.78 m and is allowed to be a maximum of 1.20 m long.

4.1.3 Protective field dimensions allowed at a resolution of 30 mm

The lengths of the sides of a protective field monitored must not be shorter than 0.60 m and not longer than 1.50 m.

Tab. 8: Protective field dimensions allowed for a rectangular protective field at a resolution of 30 mm (intermediate values are allowed)

Shorter side of the protective field	Longer side of the protective field	
	Minimum	Maximum
$\geq 0.60 \text{ m} \dots < 0.75 \text{ m}$	= shorter side	$2 \times \text{shorter side}$
$\geq 0.75 \text{ m} \dots \leq 1.50 \text{ m}$	= shorter side	1.50 m

Example 1: The shorter side is 0.63 m long. Then the longer side must be at least 0.63 m and is allowed to be a maximum of $2 \times 0.63 \text{ m} = 1.26 \text{ m}$ long.

Example 2: The shorter side is 0.78 m long. Then the longer side must be at least 0.78 m and is allowed to be a maximum of 1.50 m long.

4.2 Determining the minimum distance

The safety camera system must be mounted with an adequate minimum distance between the protective field and the hazardous point. This minimum distance ensures that the hazardous point can only be reached after the dangerous state of the machine has been completely stopped.



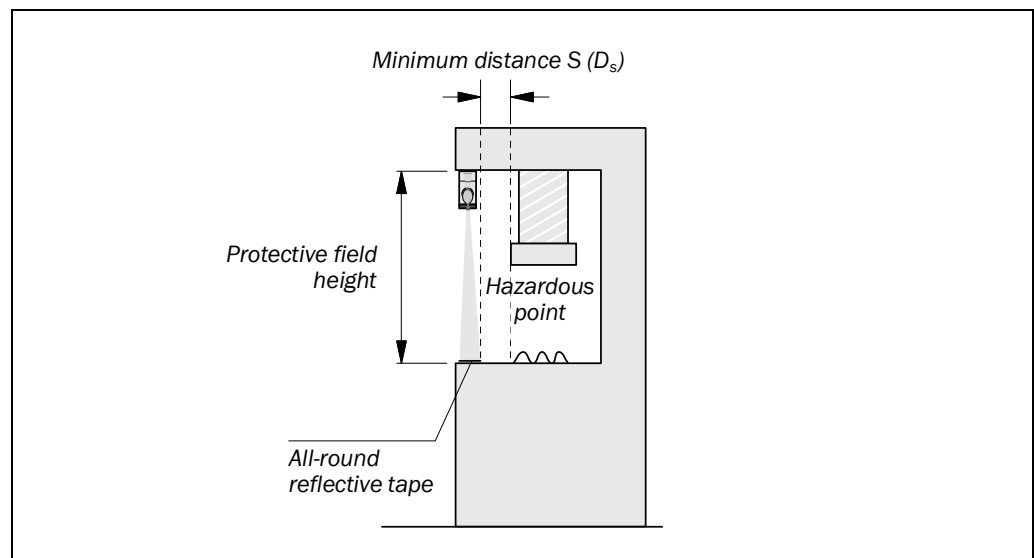
WARNING

No protective function without sufficient minimum distance!

The reliable protective effect of the safety camera system depends on the safety camera system being mounted with the correct minimum distance from the hazardous point.

Note If mounted vertically, the protective field is from the centre of the camera lens to the edge of the reflective tape that is closest to the hazardous point. (The reference point for the minimum distance S is therefore **not** the middle of the reflective tape. Cf. Fig. 9.)

Fig. 9: Minimum distance from the hazardous point

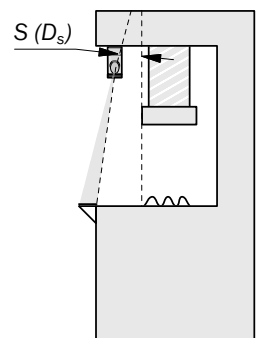


WARNING

If the protective field is at an angle, pay special attention to the minimum distance!

Ensure the necessary minimum distance between the access point and the hazardous point is met at all parts of the protective field at an angle.

- Note that different rules may apply to the calculation of the minimum distance for protective fields at an angle.
- Your SICK-subsiary will be pleased to assist you with the implementation of special applications.



4.2.1 Minimum distance according to EN ISO 13 855 and EN ISO 13 857

The minimum distance as defined in EN ISO 13 855 and EN ISO 13 857 depends on the following factors:

- stopping/run-down time of the machine or system
(The stopping/run-down time is shown in the machine documentation or must be determined by taking a measurement.)
- response time of the entire protective device (V200/V300: 20 ms)
- reach or approach speed
- other parameters that are stipulated by the standard depending on the application

How to calculate the minimum distance S according to EN ISO 13 855 and EN ISO 13 857:

Note The following calculation shows an example calculation of the minimum distance. The calculation is based on the assumption that the approach is perpendicular to the protective field.

Depending on the application and the ambient conditions, a different calculation may be necessary.

➤ Initial formula: $S = K \times T + 8 \times (d - 14)$

Where ...

S = Minimum distance in [mm]

K = 2000 mm/s

Definition and value as per EN ISO 13 855, derived from data on the approach speed of the body or parts of the body

T = Stopping/run-down time of the entire system in [s]

Stopping/run-down time of the entire system = Stopping/run-down time of the machine + response time of the protective device after light path interruption

d = Detection capability (resolution) of the protective device in [mm]

The reach/approach speed is already included in the calculation formula.

With K = 2000 mm/s the 1st formula is:

1. calculation formula: $S = 2000 \times T + 8 \times (d - 14)$

➤ If the result S is ≥ 100 mm and $S \leq 500$ mm, then use the determined value as the minimum distance.

Note As per EN ISO 13 855 a minimum distance $S < 100$ mm is not allowed. If you obtain a value $S < 100$ mm with your calculation, please contact SICK service.

➤ If the result is $S > 500$ mm, use K = 1600 mm/s in the formula and calculate S again:
2. calculation formula: $S = 1600 \times T + 8 \times (d - 14)$

➤ If the new value S is > 500 mm, then use the newly determined value as the minimum distance.

If the new value S is ≤ 500 mm, then use 500 mm as the minimum distance.

Example:

The following values apply:

Stopping/run-down time of the machine = 290 ms

Response time of the V200/V300 after light path interruption = 20 ms

Detection capability (resolution) d of the V200/V300 = 20 mm

Note You will find the values for the response time and the resolution of the V200/V300 in chapter 11 "Technical specifications" on page 52.

Minimum distance calculation:

- Step 1: Calculation of the stopping/run-down time of the entire system:
 $T = 290 \text{ ms} + 20 \text{ ms} = 310 \text{ ms} = 0.31 \text{ s}$
- Step 2: Insert the values in the 1st formula ($S = 2000 \times T + 8 \times (d - 14)$):
 $S = 2000 \times 0.31 + 8 \times (20 - 14) = 668 \text{ mm}$
- Step 3: Check the value for S.
 $S > 500 \text{ mm}$. For this reason the 2nd formula must be used.
- Step 4: Insert the values in the 2nd formula ($S = 1600 \times T + 8 \times (d - 14)$):
 $S = 1600 \times 0.31 + 8 \times (20 - 14) = 544 \text{ mm}$
- Step 5: Check the value of S.
 $S > 500 \text{ mm}$. For this reason 544 mm must be used as the minimum distance.

4.2.2 Minimum distance if OSHA and ANSI are applicable¹⁾

If OSHA and ANSI are applicable, the minimum distance depends on the following factors:

- stopping/run-down time of the machine or system
(The stopping/run-down time is shown in the machine documentation or must be determined by taking a measurement.)
- response time of the entire protective device (V200/V300: 20 ms)
- reach or approach speed
- other parameters that are stipulated by the standard depending on the application

How to calculate the minimum distance D_s if OSHA and ANSI are applicable¹⁾:

Note The following calculation shows an example calculation of the minimum distance. Depending on the application and the ambient conditions, a different calculation may be necessary.

➤ Calculate D_s using the following formula:

$$D_s = H_s \times (T_s + T_c + T_r + T_{bm}) + D_{pf}$$

Where ...

D_s = The minimum distance in inches (or millimetres) from the hazardous point to the protective device

H_s = A parameter in inches/second or millimetres/second, derived from data on approach speeds of the body or parts of the body. Often 63 inches/second (1600 mm/second) is used for H_s .

T_s = Stopping/run down time of the machine tool measured at the final control element

T_c = Stopping/run-down time of the control system

T_r = Response time of the entire protective device after light path interruption (V200/V300: 20 ms)

T_{bm} = Additional response time allowed for brake monitor to compensate for wear

Note Any additional response times must be accounted for in this calculation.

D_{pf} = An additional distance added to the overall minimum distance required. This value is based on intrusion toward the hazardous point prior to actuation of the electro-sensitive protective equipment (ESPE). Values range from 0.25 inches to 48 inches (6 to 1220 millimetres) or more depending on application.

Example:

For vertical protection with an opto-electronic protective device with an effective resolution finer than 2.5 inches (64 millimetres), D_{pf} can be determined approximately using the following formula:

$$D_{pf} \text{ (inches)} = 3.4 \times (\text{effective resolution} - 0.276), \text{ but not less than } 0.$$

¹⁾ Minimum distance according to ANSI B11.19:2003-0-4, Annex D and Code of Federal Regulations, Volume 29, Part 1910.217 ... (h) (9) (v).

4.3 Avoiding unmonitored areas



WARNING

Provide separate protection for unmonitored areas!

During the installation of the V200/V300 safety camera system, incorrect mounting or mutual interference between several systems may result in areas that are not monitored and through which an operator could reach the hazardous point.

- Protect unmonitored areas using mechanical guards.
- Note the following warning and precautions to prevent unmonitored areas!



WARNING

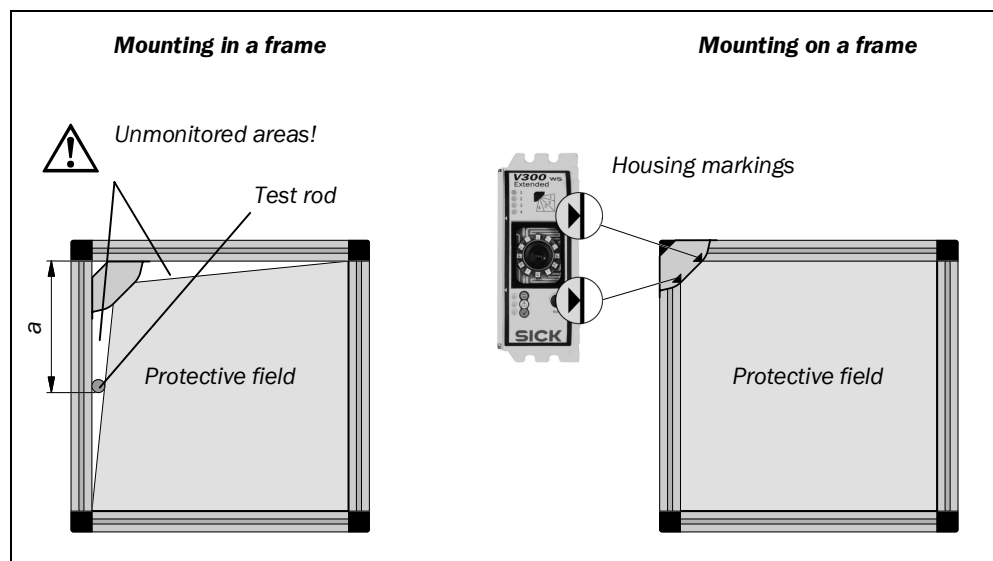
Avoid mounting in a frame!

In the case of mounting in a frame, due to the principle of operation unmonitored areas will be produced through which an operator could reach the hazardous point.

- Mount the camera on the frame instead of in the frame to avoid unmonitored areas from the start (see section 4.4.1 “Mounting on a frame” on page 27).
- If mounting in a frame is nevertheless necessary, you must identify the unmonitored areas with the aid of the test rod and provide protection using mechanical panels.

In the case of mounting in a frame, the unmonitored area reaches from the inside of the mounting corner to the position at which the test rod is safely detected (see Fig. 10).

Fig. 10: Avoiding unmonitored areas due to mounting on a frame



Tab. 9: Length of the unmonitored area in the case of mounting in a frame

Resolution	20 mm	24 mm	30 mm
Length a of the unmonitored area	> 0.40 m	> 0.40 m	> 0.60 m

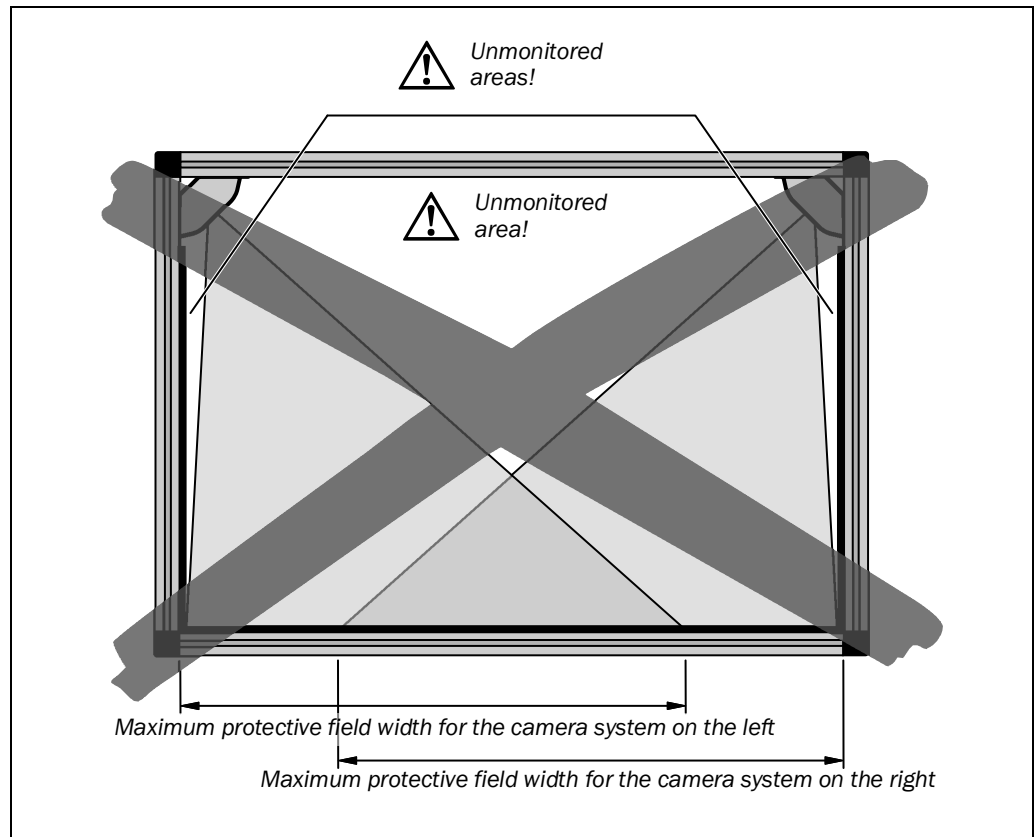


WARNING

Fig. 11: Dangerous mounting mistake: maximum protective field width exceeded
The mounting shown here is expressly **not recommended** by SICK.

During mounting, please observe the maximum protective field width!

If, during mounting, the maximum protective field width for one or two camera systems is exceeded, the camera will not see the reflective tape opposite. As a result an unmonitored area will be produced. The operator is at risk!



WARNING

Prevent the mutual interference of systems mounted in close proximity!

If two V200/V300 are so arranged that they entirely or partially look at the same reflective tape, the two cameras may interfere with each other. This can disrupt the protective function of the system. This would mean that the operator is at risk.

➤ Take suitable measures to prevent mutual interference:

- If the two cameras are used in different applications:
 - reverse the direction in which one of the systems looks.
 - choose a different mounting method (see section 4.4 “Steps for mounting the safety camera system” on page 26).
 - mount non-reflective field of view guards.
- If the two cameras are used in the same application, then synchronise the two systems (see section 5.4 “Two V200/V300 with synchronisation” on page 35).

4.4 Steps for mounting the safety camera system

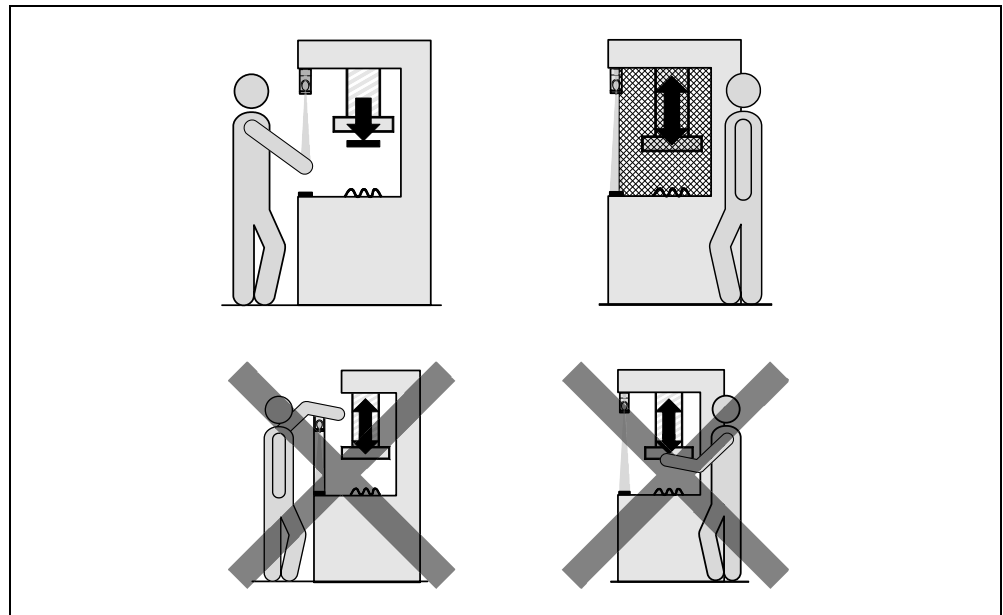


WARNING

Special features to note during mounting:

- Avoid unmonitored areas as described in the previous section.
- Always mount the camera on a flat surface.
- Always mount the camera on a metal surface and ensure good mechanical contact. In this way you will ensure adequate heat dissipation from the device.
- During mounting, ensure that camera and reflective tape are aligned correctly. The V200/V300 accepts a defined lateral tolerance (see section 4.4.3 “Mounting the reflective tape” on page 29).
- Take suitable measures to attenuate vibration if the shock requirements are above the values given in section 11.1 “Data sheet” on page 52.
- Observe the minimum distance of the system during mounting. On this subject read section 4.2 “Determining the minimum distance” on page 20.
- Mount the safety camera system such that it is not possible reaching under, reaching over or standing behind the camera and that the camera cannot be repositioned.

Fig. 12: The correct installation (above) must eliminate the errors (below) reaching over, reaching under and standing behind.



- Secure the two fixing screws against unintentional loosening.
- Once the system is mounted, one or several of the enclosed self-adhesive safety information labels must be affixed:
 - Use only information labels in the language which the operators of the machine understand.
 - Affix the information labels such that they are easily visible by the operators during operation. After attaching additional objects and equipment, the information labels must not be concealed from view.
 - Affix the information label “Important Information” to the system in close proximity to the safety camera system.

The most common mounting options are:

- mounting on a frame
- mounting in a frame

Note You will find other mounting options on the example application at www.sick.com.

4.4.1 Mounting on a frame

- Notes**
- Always mount the camera with at least two screws and use the fastening openings on two opposite sides of the housing.
 - Secure the two fixing screws against unintentional loosening.
 - Always use washers under the screws (cf. figure).
 - To mount the camera use sliding nuts suitable for the profile system used or the clamping lugs available as accessories (see section 12.2 “Accessories” on page 59).
 - Pay attention to the thickness of the flange on the camera when selecting a suitable screw length (see section 11.2 “Dimensional drawings” on page 56).

Fig. 13: Example: mounting with sliding nuts on different thickness profiles

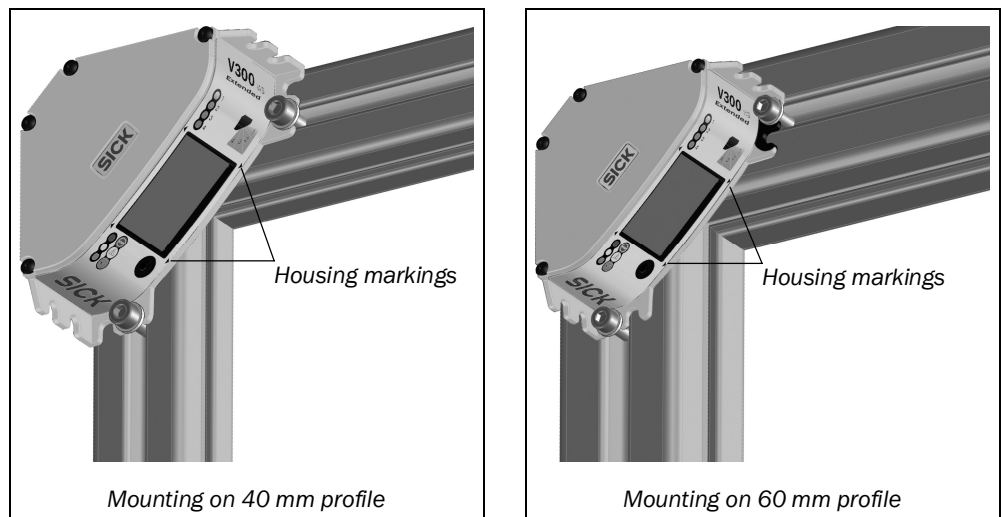
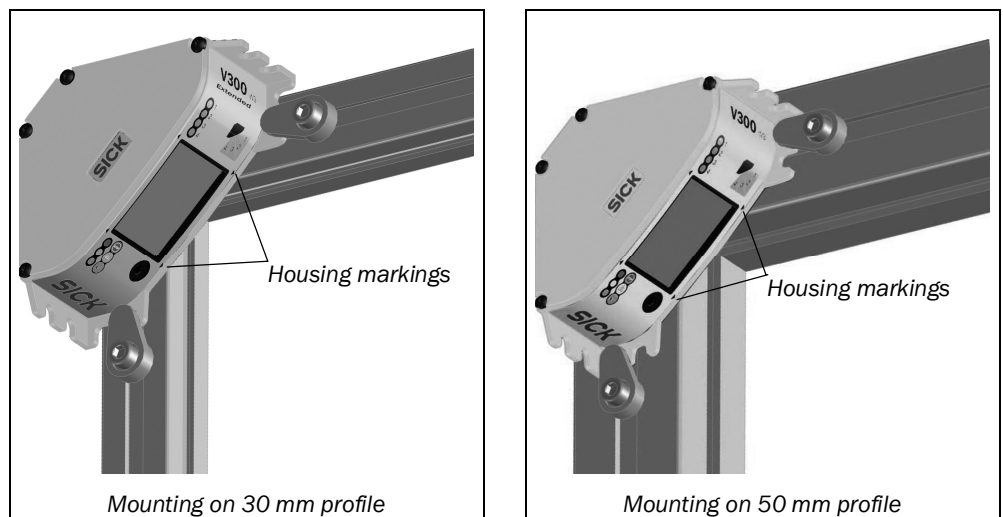


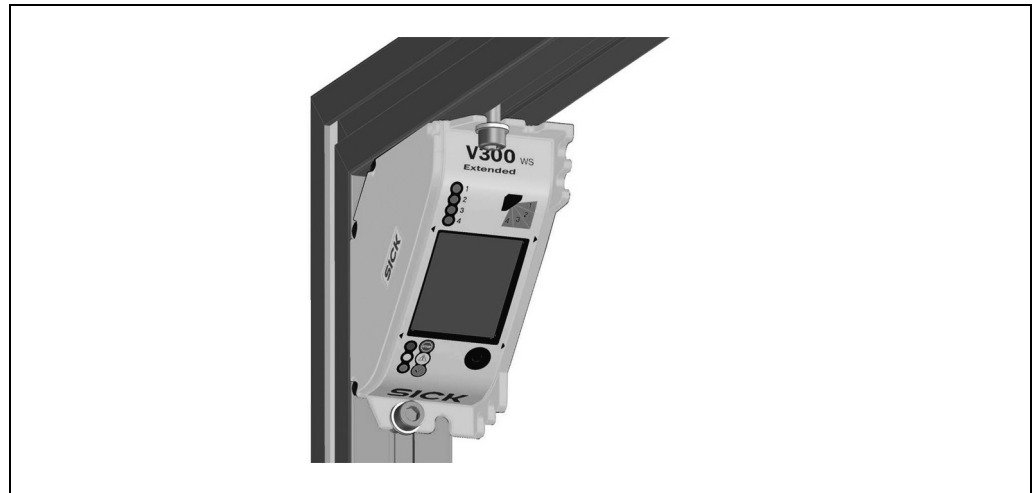
Fig. 14: Example: mounting with clamping lugs on different thickness profiles



- Align the camera such that the housing markings are aligned with the inside of the frame profile. (The protective field stretches between the housing markings and the ends of the reflective tape.)

4.4.2 Mounting in a frame

Fig. 15: Mounting in a frame



- Notes**
- Always mount the camera with at least two screws and use the fastening openings on two opposite sides of the housing.
 - Secure the two fixing screws against unintentional loosening.
 - Always use washers under the screws (cf. figure).
 - Use sliding nuts suitable for the profile system employed for mounting the camera.
 - Pay attention to the thickness of the flange on the camera when selecting a suitable screw length (see section 11.2 “Dimensional drawings” on page 56).



WARNING

Protect unmonitored areas using mechanical guards!

- Take organisational measures to protect the un-monitored areas (see section 4.3 “Avoiding unmonitored areas” on page 24).
-

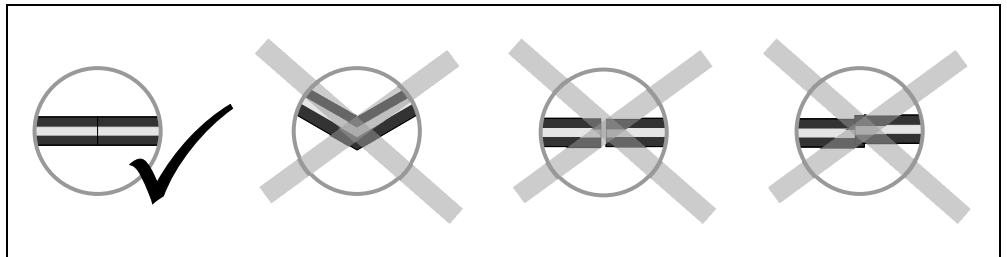
4.4.3 Mounting the reflective tape

Prior to mounting the reflective tape, pay attention to the following notes:

- Notes**
- Plan the attachment of the reflective tape exactly prior to bonding it in place. The adhesive on the reflective tape is very resilient. It is not possible to remove the tape again without destroying it. You will need a suitable solvent to remove the reflective tape (see 12.2 “Accessories” on page 59).
 - If you must bond the reflective tape in several sections, then ensure there are no gaps, folds or offset at the joints. The reflective tape must run seamlessly along the contour to be monitored.

Only the longest contiguous section of the reflective tape is taught-in by the V200/V300. If there are gaps in the reflection, the safety camera system will ignore the shorter section of the reflective tape.

Fig. 16: Correct arrangement of the reflective tapes at joints



- If damage to the reflective tape is to be expected due to the application, e.g. because heavy or sharp-edged objects are to be pushed over the working area, you should use one of the following possible mounting methods:
 - Mount the camera in the bottom of the frame.
 - Mount the camera lower than the contact surface in front of the frame.

How to mount the reflective tape:

The reflective tape is attached by simply bonding it in place.

- Clean the surface where the tape is to be attached so that it is clean of residue.
- Remove the protective film on the rear of the reflective tape and apply the tape perpendicular to the camera’s optical axis. The camera will tolerate a small divergence from the optical axis (cf. Fig. 17ff.).

Fig. 17: Permissible divergence of the reflective tape from the optical axis of the camera as a function of the distance at 20 mm resolution (illustration of divergence not to scale)

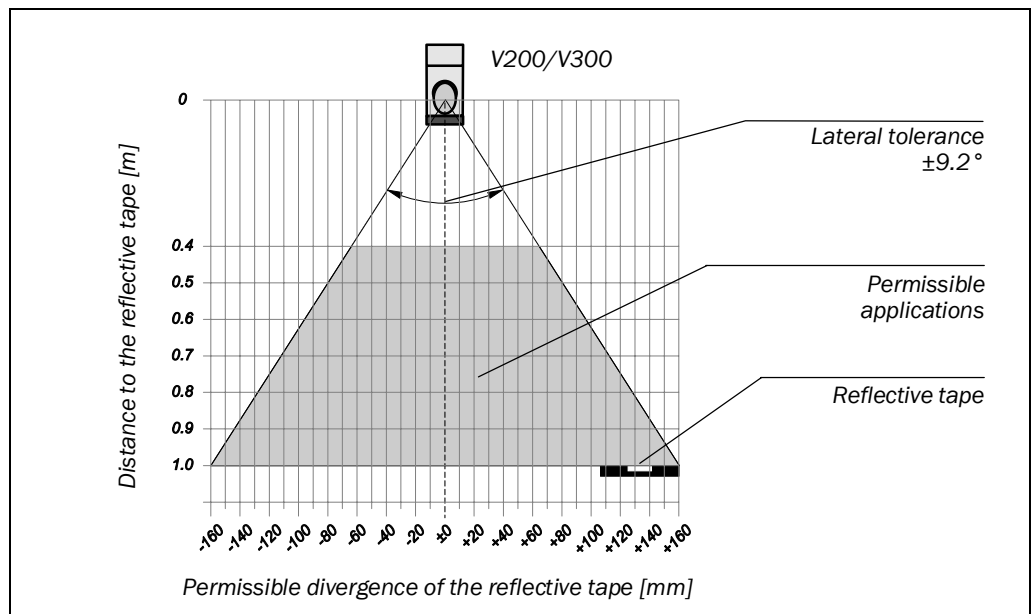


Fig. 18: Permissible divergence of the reflective tape from the optical axis of the camera as a function of the distance at 24 mm resolution (illustration of divergence not to scale)

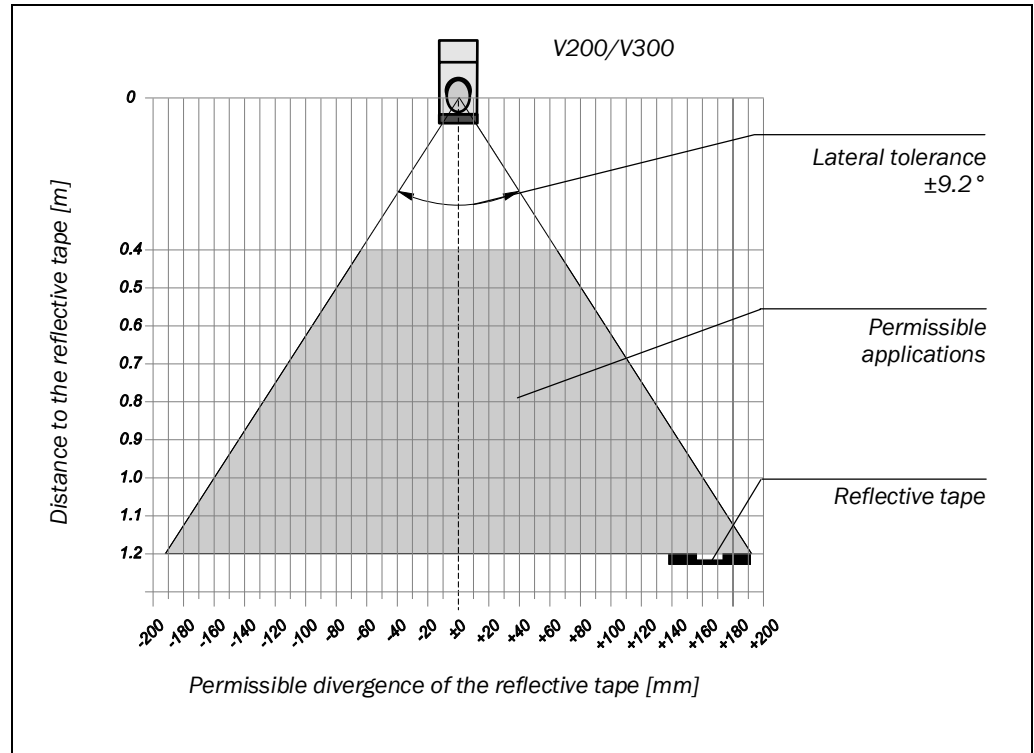
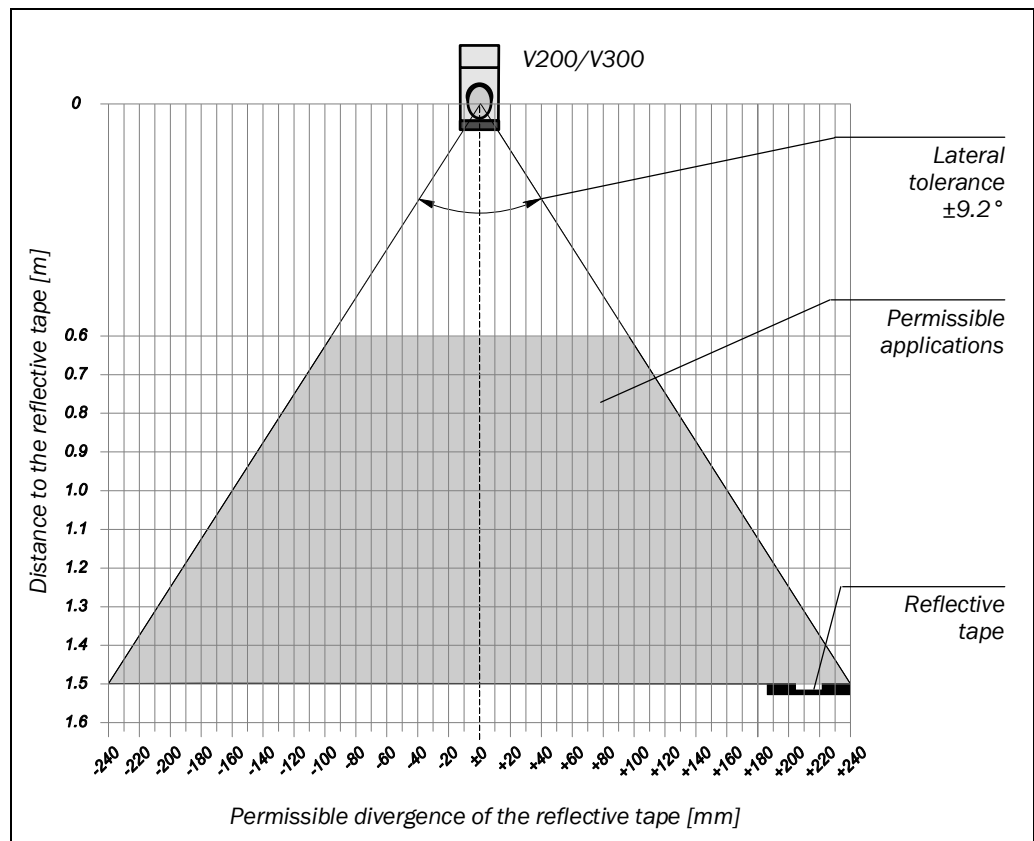


Fig. 19: Permissible divergence of the reflective tape from the optical axis of the camera as a function of the distance at 30 mm resolution (illustration of divergence not to scale)



- Press the reflective tape firmly and ensure the edges are firmly sealed. In this way you will prevent dirt and liquids getting under the reflective tape.

5 Electrical installation



WARNING

Switch the entire machine/system off line!

The machine/system could unintentionally start up while you are connecting the devices.

- Ensure that the entire machine/system is disconnected during the electrical installation.

Connect OSSD1 and OSSD2 separately!

You are not allowed to connect OSSD1 and OSSD2 together, otherwise signal safety will not be ensured.

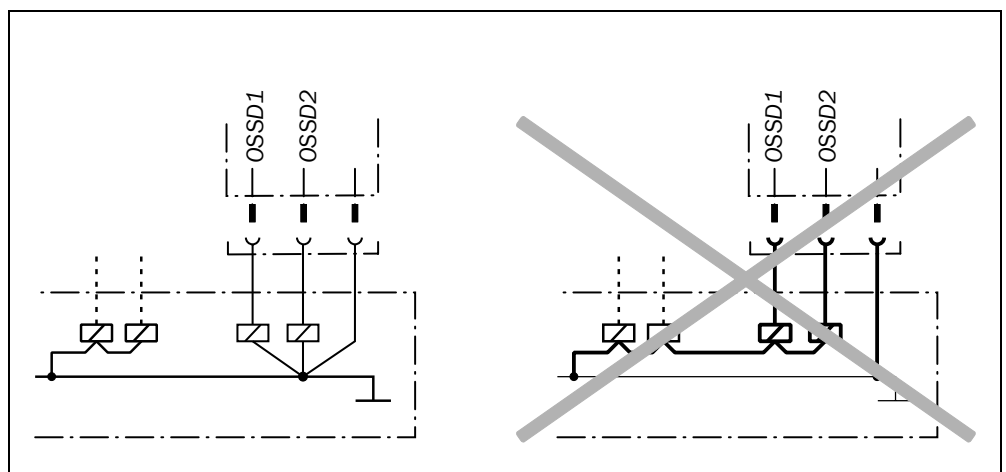
- Ensure that the machine controller processes the two signals separately.
- Contactors connected in series must be positively guided and monitored (see section 5.3 in “External device monitoring (EDM)” on page 34).

Only connect the OSSDs to a single subsequent switching element!

- Each output signal switching device (OSSD) is only allowed to be connected to one switching element (e.g. relay or contactor). If several switching elements are required, then you must choose a suitable form of contact duplication.

Prevent the occurrence of a potential difference between the loads and the protective device!

- If you connect loads to the OSSDs that are not reverse polarity protected, then you must connect the 0 V connections for these loads and the related protective device separately, one after the other, to the same 0 V terminal strip. Only then is it ensured that in the case of a fault, it is not possible for a potential difference to form between the 0 V connections for the loads and the related protective device.



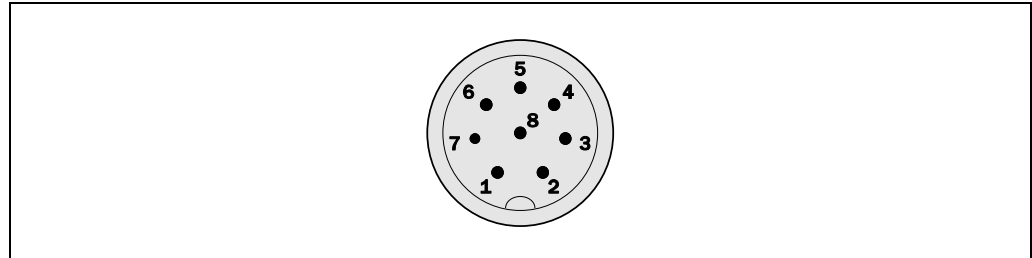
Notes

- The two outputs are protected against short-circuits to 24 V DC and 0 V. When the light path is clear, the signal level on the outputs is HIGH DC (at potential), when the light path is interrupted or there is a device fault the outputs are LOW DC.
- The V200/V300 safety camera system meets the interference suppression requirements (EMC) for industrial use (interference suppression class A). When used in residential areas it can cause radio interferences.
- To ensure full electromagnetic compatibility (EMC), functional earth (FE) must be connected.

- To meet the requirements of the relevant product standards (e.g. IEC 61496-1), the external voltage supply for the devices (SELV) must be able to bridge a brief mains failure of 20 ms. Power supplies according to EN 60204-1 satisfy this requirement. Suitable power supplies are available as accessories from SICK (see section 12.2 “Accessories” on page 59).

5.1 System connection M12 × 8

Fig. 20: System connection V200/V300



The V200/V300 has a hard-wired cable (length: approx. 30 cm) with a cable plug M12 × 8.

Tab. 10: Pin assignment system connection V200/V300

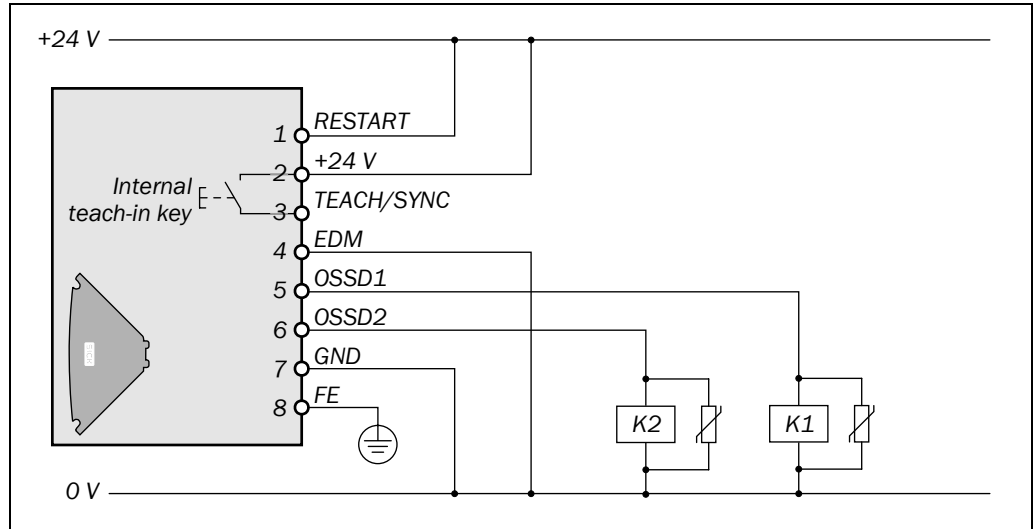
Pin	Colour	Signal	Function
1	White	RESTART	Reset/restart (optional)
2	Brown	+24 V DC	24 V DC (voltage supply)
3	Green	TEACH/SYNC	Teach-in/synchronisation
4	Yellow	EDM	External device monitoring (EDM) (optional)
5	Grey	OSSD1	OSSD1 (safe output signal switching device 1)
6	Pink	OSSD2	OSSD2 (safe output signal switching device 2)
7	Blue	GND	0 V DC (voltage supply)
8	–	FE	Functional earth

Note Connecting cables of different length are available as accessories from SICK (see section 12.2 “Accessories” on page 59). If you use connecting cables you have assembled yourself, ensure the functional earth (pin 8) is connected.

5.2 Connecting the V200/V300 without external device monitoring (EDM), without internal restart interlock and without external key-operated pushbutton for teach-in

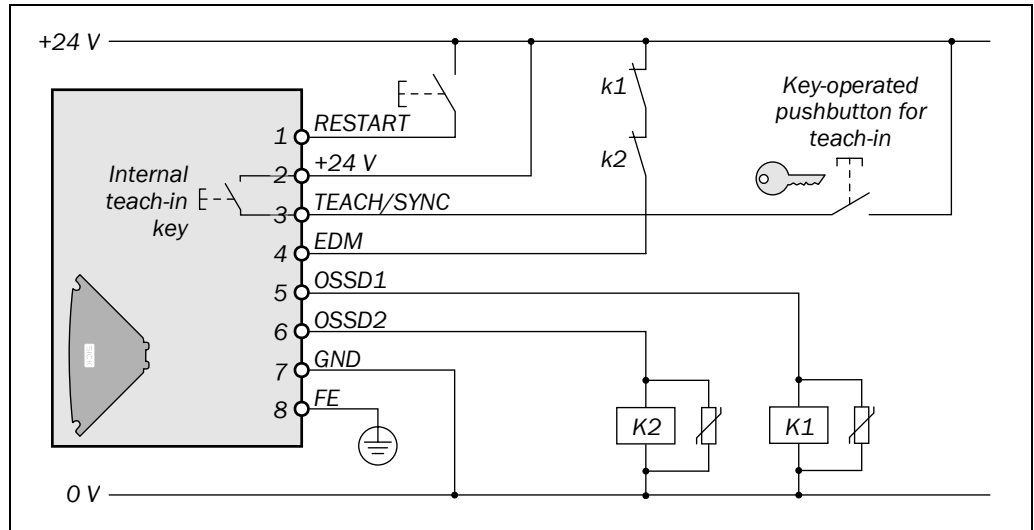
Note If you use the V200/V300 without the internal restart interlock, then you must implement the restart interlock externally, i.e. machine-side.

Fig. 21: Connecting the V200/V300 without external device monitoring (EDM), without internal restart interlock and without external key-operated pushbutton for teach-in



5.3 Connecting the V200/V300 with external device monitoring (EDM), with internal restart interlock and with external key-operated pushbutton for teach-in

Fig. 22: Connecting the V200/V300 with external device monitoring (EDM), with internal restart interlock and with external key-operated pushbutton for teach-in



Reset button/restart

When using the V200/V300 with internal restart interlock (see section 3.4.1 “Restart interlock” on page 14), the operator must press the reset button prior to restart.



WARNING

Select the correct installation site for the reset button!

Install the reset button outside the hazardous area such that it cannot be operated from inside the hazardous area. When operating the reset button, the operator must have full visual command of the hazardous area.

Perform a teach-in procedure after any change to the connection!

The V200/V300 activates the internal restart interlock only after the next teach-in procedure. Otherwise the system will not switch to green.

The configuration of the internal restart interlock is described in section 8.2 “Internal restart interlock” on page 46.

External device monitoring (EDM)

You must implement the external device monitoring electrically as follows: When the contact elements (K1, K2) reach their de-energised position after the protective device has responded, the two positively guided N/C contacts (k1, k2) must close. 24 V is then applied at the input of the EDM. If 24 V is not present after the response of the protective device, then one of the contact elements is faulty and the external device monitoring prevents the machine starting up again.



WARNING

Perform a teach-in procedure after any change to the connection!

The V200/V300 activates the external device monitoring only after the next teach-in procedure. If you place the system in operation after connecting the contacts to the *external device monitoring (EDM)* input without teach-in, then the external device monitoring will remain deactivated. The system can therefore switch to green despite faulty contactors.

The configuration of the external device monitoring is described in section 8.3 “External device monitoring” on page 47.

External key-operated pushbutton for teach-in

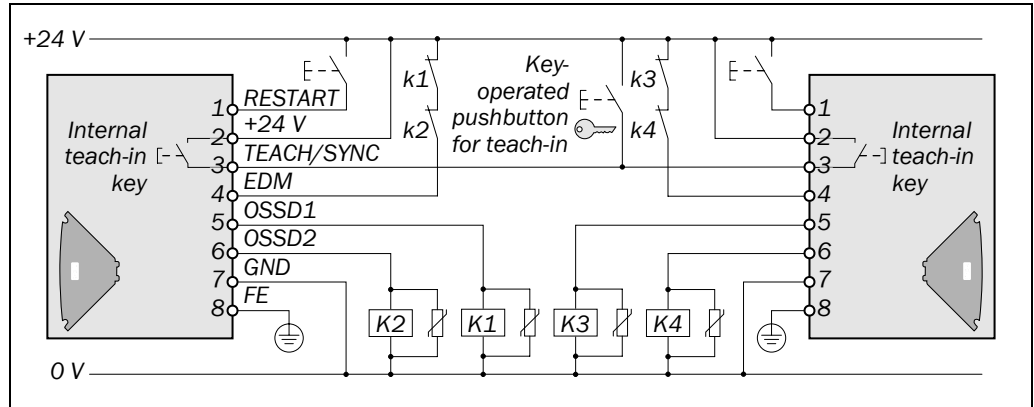
To permit remote teach-in and/or to protect the configuration, you can connect an external key-operated pushbutton for teach-in and lock the internal teach-in key.

Notes

- Once the key-operated pushbutton for teach-in has been operated, the V200/V300 locks the internal teach-in key and saves this configuration in the device. Teach-in can only be performed using the external key-operated pushbutton for teach-in (see section 8.4 “Locking the internal teach-in key” on page 48).
- If you use two V200/V300 in an application, then both systems use the same external key-operated pushbutton for teach-in (see Fig. 23 on page 35).

5.4 Two V200/V300 with synchronisation

Fig. 23: Connection of two V200/V300 with synchronisation



If two V200/V300 are so arranged that they entirely or partially look at the same reflective tape, the two cameras may interfere with each other. To prevent this situation occurring, you must synchronise the two cameras.

How to synchronise two V200/V300:

- Connect pin 3 on the two cameras together. The cameras will synchronise automatically each time after switch on and after every teach-in procedure.

Notes

- If you actuate the external key-operated pushbutton for teach-in or one of the two internal teach-in keys, both devices will learn their protective fields at the same time.
- If you use the internal restart interlock, then you can connect separate reset buttons or a common reset button for both cameras.
- If you use the external device monitoring, then must connect separate normally closed contacts (k1, k2) for both cameras.

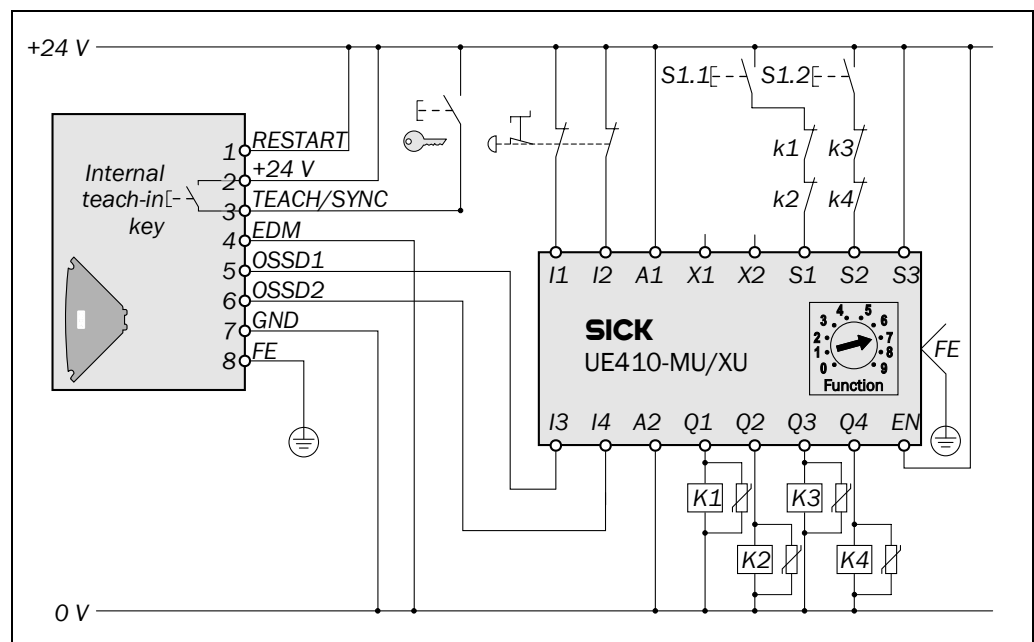
5.5 Connection diagrams

- Notes**
- Take note of the related operating instructions of the integrated devices!
 - You can find more connection diagrams at www.sick.com.

5.5.1 V200/V300 on UE410 Flexi with external device monitoring (EDM) and with restart interlock both for V200/V300 as well as for emergency switching off

The V200/V300 safety camera system can be integrated into a relay controller/contactor controller with the aid of the modular UE410 Flexi (UE410-MU with expansion UE410-XU) safety controller. Operation is with external device monitoring and internal restart interlock on the V200/V300 as well as restart interlock for emergency switching off.

Fig. 24: Connection diagram V200/V300 at UE410 Flexi



Principle of operation

When the light path on the V200/V300 is clear and the input conditions on the UE410 are valid, the system is ready for switch on and waits for an input signal/switch on signal. The system's corresponding logic path is enabled by pressing and releasing the related button S1. The related output on the UE410 carries power. If the input conditions are no longer met, then the related outputs on the UE410 shut down.

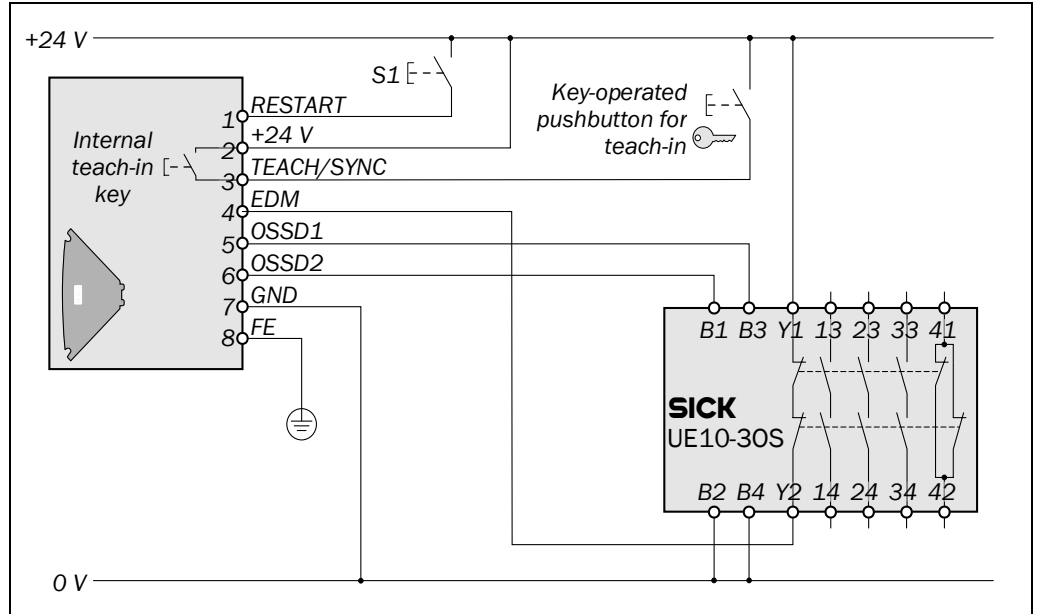
Possible errors

Cross-circuits and short-circuits on the connecting cables for the V200/V300 are detected and result in "lock-out" (see page 50). Malfunctions on the contactors K1 to K4 are detected. The shutdown function is retained. (If the button S1.x is tampered with (e.g. by jamming) the system will not re-enable the output circuits.


5.5.2 V200/V300 on UE10-30S with external device monitoring (EDM) and internal restart interlock

The V200/V300 safety camera system can be integrated into a relay controller/contactor controller with the aid of the UE10-30S safety relay. Operation is with external device monitoring (EDM) and internal restart interlock.

Fig. 25: Connection diagram V200/V300 at UE10-30S



Principle of operation

If the light path is clear and there are no errors in the quiescent state of the UE10-30S, the status LED  on the V200/V300 flashes (Reset required). The system is ready for switch on and waits for an input signal/switch on signal. The system is enabled by pressing and releasing the button S1. The outputs OSSD1 and OSSD2 carry power. The UE10-30S is switched on. On interruption of the light path, the UE10-30S is de-energized by the OSSD1 and OSSD2 outputs.

Possible errors

Cross-circuits and short-circuits on the outputs OSSD1 and OSSD2 are detected and will result in “lock-out” (see page 50). Malfunctions on the UE10-30S are detected. The shutdown function is retained. If the button S1 is tampered with (e.g. by jamming) the system will not re-enable the output circuits.

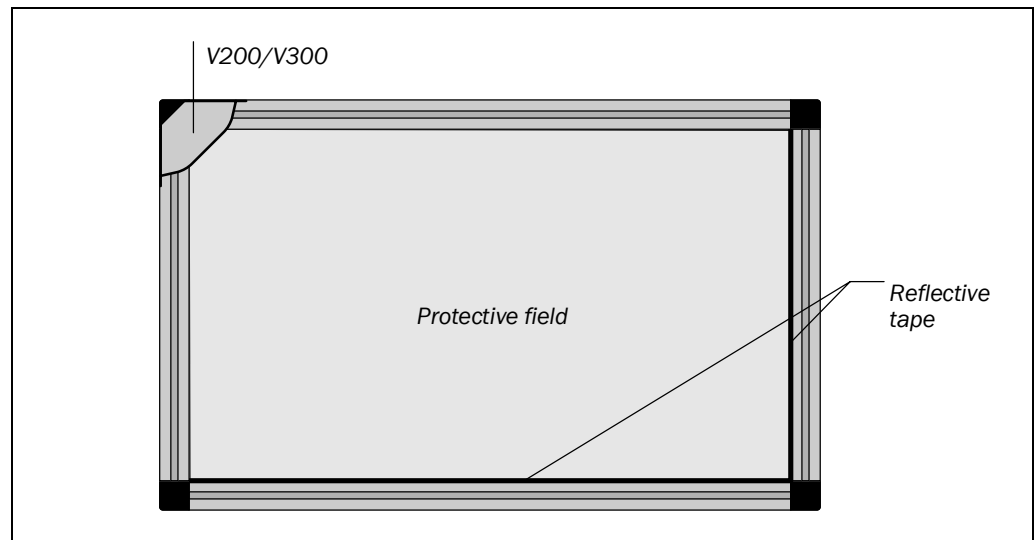
6 Application examples

Note The examples shown are only provided as an aid for your planning. You may need to consider additional protection measures for your application.

6.1 Application with one V200/V300

If the necessary protective field dimensions can be realised using a single V200/V300, then mount the camera on a corner of the frame or in a corner of the frame. Apply the reflective tape to the opposite sides.

Fig. 26: Application with small protective field (1 × V200/V300)

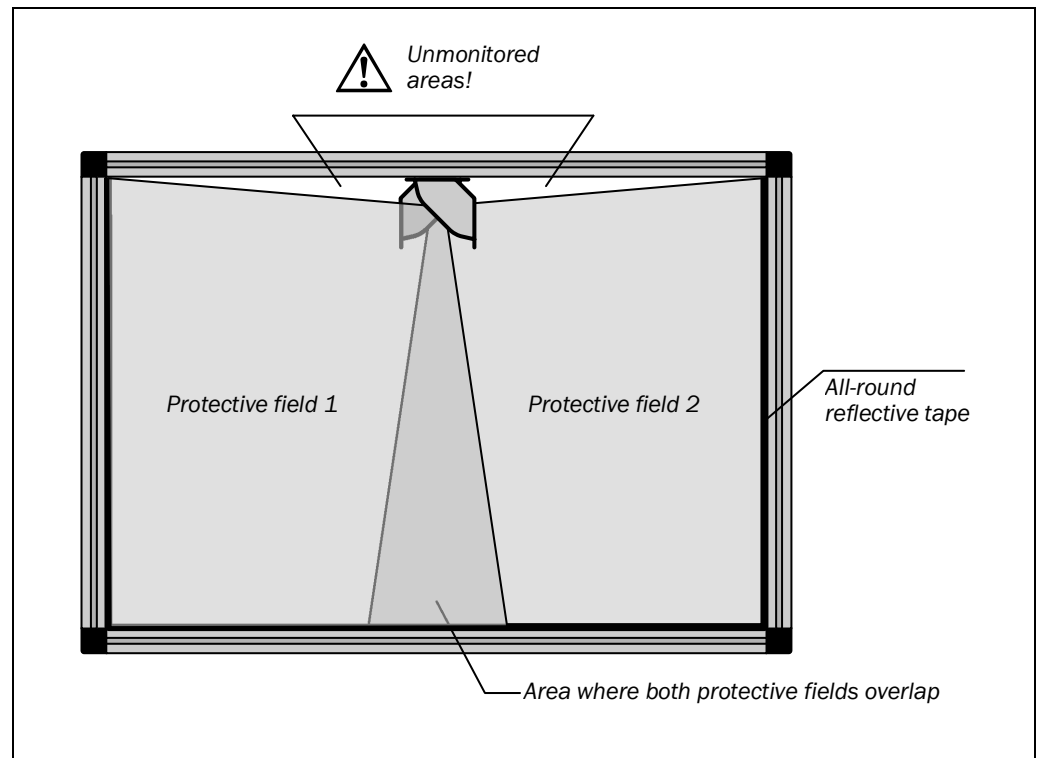


6.2 Application with two V200/V300

If the application requires a larger protective field width that can be covered with one V200/V300, or the hazardous point is to be protected in an ergonomic manner, you can mount two V200/V300 in parallel in opposite directions (see Fig. 27) or at the corners (see Fig. 28). In this way you can realise two overlapping protective fields.

- Notes**
- Mount the devices overlapping as shown in the figure (i.e. **not** back to back). Otherwise un-monitored areas may be produced.
 - Ensure the housing markings on the two cameras are aligned.
 - You must synchronise the two V200/V300 with each other so that they do not interfere with each other (see section 5.4 on page 35).

Fig. 27: Application with large protective field (2 × V200/V300)

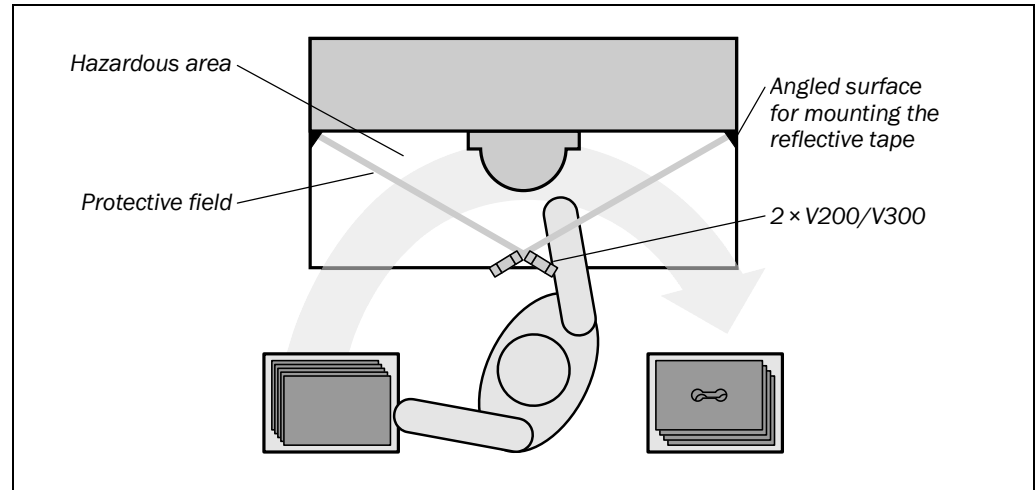


6.3 Application with safe access on three sides (ergonomic workplace design)

To realise an equally ergonomic and effective workplace, you can mount two safety camera systems diagonally. In this way the hazardous point can be safely accessed from three sides.

Note Due to the diagonal arrangement of the protective fields and the necessary minimum distance, the working distance for the operator may be larger in this application.

Fig. 28: Ergonomic workplace design due to the use of two V200/V300 (view from above)



- Notes**
- In this application pay special attention to the correct mounting of the reflective tapes as shown in the diagram. The reflective tapes must always be perpendicular to the protective field area.
 - In this application the monitored area is mostly smaller than the working area available. For this reason mark the contour of the monitored area on the working area if this marking is not already provided by the reflective tape.

6.4 Application with automatic material transport to the workstation

If the application requires automatic material transport into the workstation, you can mount the safety camera system such that only the area above the material transport is monitored.



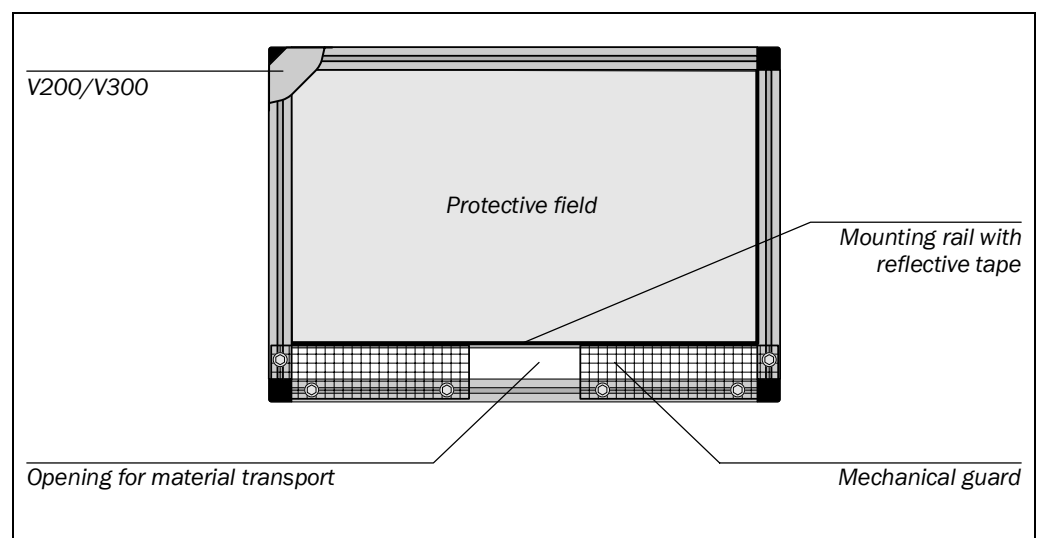
WARNING

Protect the material transport using other measures!

The V200/V300 does not monitor the material transportation with this mounting method.

- Protect the unmonitored areas on both sides of the material transport using mechanical guards.
- Prevent people from being able to reach through the material transport to the hazardous point using organisational measures (e.g. by increasing the minimum distance).

Fig. 29: Mounting with automatic material transport into the workstation



7 Commissioning



WARNING

Commissioning requires a thorough check by qualified safety personnel!

Before you operate a system protected by the V200/V300 safety camera system for the first time, make sure that the system is first checked and released by qualified safety personnel. Please read the notes in chapter 2 “On safety” on page 8.

7.1 Test notes

Check the protective device as described below and in accordance with the applicable standards and regulations.

These tests are also used to identify if the protection is affected by external light sources or other unusual ambient effects.

These tests must therefore always be performed.

7.2 Tests before the initial commissioning

- Check the effectiveness of the protective device mounted to the machine, using all selectable operating modes as specified in the checklist in the annex (see 13.2 “Checklist for the manufacturer” on page 61).
- Ensure that the operating personnel of the machine protected by the safety camera system are correctly instructed by qualified safety personnel before being allowed to operate the machine. Instructing the operating personnel is the responsibility of the machine owner.

7.3 Regular inspection of the protective device by qualified safety personnel

- Check the system, following the inspection intervals specified in the national rules and regulations. This procedure ensures that any changes on the machine or manipulations of the protective device after the initial commissioning are detected.
- If any modifications have been made to the machine or the protective device, or if the safety camera system has been changed or repaired, the system must be checked again as specified in the checklist in the annex.

7.4 Tests of the protective device by a specialist or authorised personnel



WARNING

Do not operate the machine if the green or yellow LED is lit during the test. During the check only the ☹ Red LED is allowed to illuminate!

If the ☑ or the ⚠ LED lights up *during the test* even for a short period, work must stop at the machine. In this case the installation of the safety camera system must be checked by qualified safety personnel.

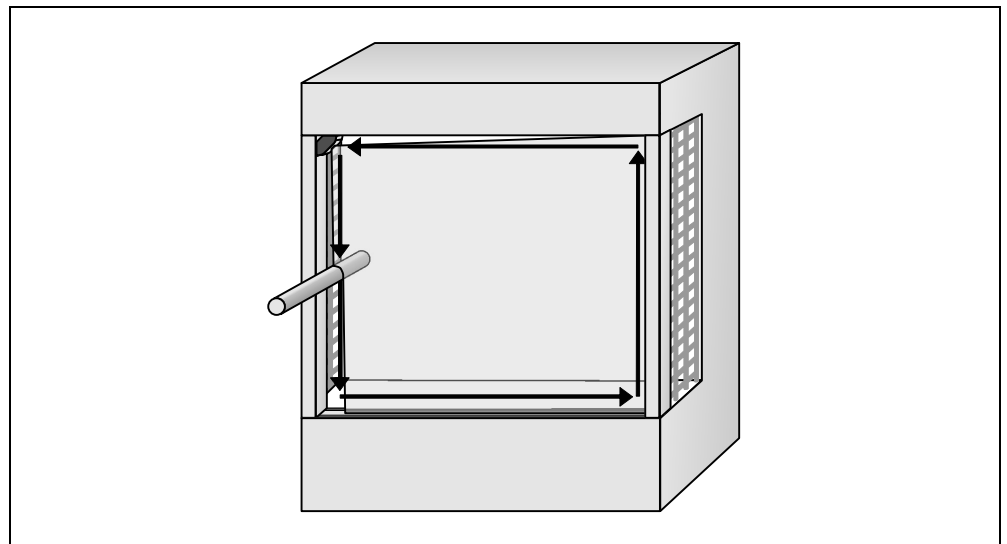
When must the effectiveness of the protective device be checked?

- The effectiveness of the protective device must be checked **daily** by a specialist or by authorised personnel.
- The effectiveness of the protective device must be checked **each time the operator changes**.

How to check the effectiveness of the protective device:

- Check the protective device for correct seating and for damage, in particular the mounting, the electrical connection, the front screen and the reflective tape.
- Check that personnel or body parts can only intrude into the hazardous area through the protective field of the V200/V300 (e.g. if a mechanical guard has been removed).
- Check whether the protective device is effective for the set operating mode.
- Choose the test rod that matches the resolution used. The diameter of the test rod must correspond to the actual resolution of the system achieved by the resolution set that has been used.
- Move the test rod slowly through the area to be protected, as shown in Fig. 30.

Fig. 30: Daily test of the protective device with the test rod



8 Configuration



WARNING

Ensure the machine is in a safe condition!

While you configure the safety camera system, the machine could start unintentionally.


- Ensure that the whole system is in a safe condition during the configuration process.

8.1 Teach-in

Prior to initial commissioning, you must perform a new teach-in procedure. The following occurs during teach-in:

- The V200/V300 detects the current connection configuration and configures the internal restart interlock, the external device monitoring and the locking of the internal teach-in key to suit. In the default delivery status, these functions are deactivated.
- The V200/V300 detects the protective field based on the reflective tape. In the default delivery status, the V200/V300 has no protective field configured.

How to teach-in the current configuration and shape of the protective field:

- Ensure camera and reflective tape are correctly mounted and the electrical connections have been made.
- Switch on the V200/V300. The  LED is constantly illuminated.








WARNING

Ensure there are no objects in the protective field during teach-in!

Only the longest contiguous section of the reflective tape is taught-in by the V200/V300. If there are gaps in the reflection, e.g. because the reflective tape has been damaged or because there is an object in the protective field, the safety camera system will ignore the shorter section of the reflective tape.

- Start the teach-in process as follows:





Tab. 11: Starting the teach-in process

Using the internal teach-in key	Using the key-operated pushbutton for teach-in
<p>Actuate the internal teach-in key using the teach-in pin as follows:</p> <ul style="list-style-type: none"> ➤ Actuate for approx. 5 s (the diagnostics LED  flashes 5 times). If the V200/V300 does not react, the internal teach-in key is probably locked. Start the teach-in process using the key-operated pushbutton for teach-in or unlock the teach-in key (see section 8.4 “Locking the internal teach-in key” on page 48). ➤ Release for approx. 2 seconds (the diagnostics LED  flashes 2 times). ➤ Actuate for approx. 5 s (the diagnostics LED  flashes 5 times). ➤ Important: Now remove your hand from the protective field so that the V200/V300 can completely detect the protective field. 	<ul style="list-style-type: none"> ➤ Press the external key-operated pushbutton for teach-in for at least 0.5 seconds. The diagnostics LED  illuminates. ➤ Release the key-operated pushbutton for teach-in. The diagnostics LED  goes off.

V200/V300

























The V200/V300 now teaches-in the current configuration and shape of the protective field. The process takes approx. 30 seconds. During the teach-in the flashing diagnostics LEDs indicate the configuration detected:

Tab. 12: Meaning of the diagnostics LEDs during teach-in

Display	Meaning
1 	OSSDs detected and OK
2 	External device monitoring (EDM) detected and activated
3 	Reset button detected and restart interlock activated
4 	Internal teach-in key unlocked

➤ Using the LEDs, check whether the teach-in was successful:

Tab. 13: LED displays after teach-in

Status LEDs			Diagnostics LEDs				Meaning
			1	2	3	4	
							Teach-in was successful. If the protective field is clear and the restart interlock is deactivated, the V200/V300 switches to green.
							Teach-in was successful. If the protective field is clear and restart interlock is activated, the V200/V300 waits until the reset button is operated.
							Teach-in has failed (for measures see below).

➤ After teach-in it is imperative you check the protective field (see section 7.4 “Tests of the protective device by a specialist or authorised personnel” on page 43).

If the teach-in fails:

- Check and rectify as necessary the following causes:
 - Is the reflector fitted and clean?
 - Is the reflector perpendicular to the area of the protective field?
 - Is the reflective tape or are sub-segments of the tape very short?
 - Are there other reflective objects in the immediate vicinity that could interfere with the system (e.g. reflective strips on safety clothing, packaging film, etc.)?
- Remove the cause.
- Perform teach-in again.

8.2 Internal restart interlock

The configuration of the restart interlock is defined by the wiring that is in place during the first or last teach-in process performed.

How to activate the internal restart interlock:

- Make the electrical connections for the reset button (see section 5.3 on page 33).
- Switch on the V200/V300.
- Perform a teach-in procedure.

If there is no signal on the *Reset/restart* input, then the safety camera system will activate the internal restart interlock and save this configuration in the device. The device is now waiting for the reset button to be pressed.

- Check the effectiveness of the protective device as described in section 7.1 “Test notes” on page 42.

How to deactivate the internal restart interlock:

- Permanently connect the *Reset/restart* input to 24 V (see section 5.2 on page 33).
- Switch on the V200/V300.
- Perform a teach-in procedure.

If 24 V are present on the *Reset/restart* input, the safety camera system will deactivate the internal restart interlock and save this configuration in the device.

- Check the effectiveness of the protective device as described in section 7.1 “Test notes” on page 42.

8.3 External device monitoring

In the default delivery status, the external device monitoring is deactivated.

How to activate the external device monitoring:

- Make the electrical connections (see section 5.3 on page 33).
- Switch on the V200/V300.
- Perform a teach-in procedure.

If the contacts to be monitored are connected to the *external device monitoring (EDM)* input, then the safety camera system will activate the external device monitoring and save this configuration in the device.



WARNING

The external device monitoring will remain deactivated without teach-in!

If you place the system in operation after connecting the contacts to the *external device monitoring (EDM)* input without teach-in, then the external device monitoring will remain deactivated. The system can therefore switch to green despite faulty contactors.

- Check the effectiveness of the protective device as described in section 7.1 “Test notes” on page 42.

How to deactivate the external device monitoring:

- Permanently connect the *External device monitoring (EDM)* input to 0 V (see section 5.2 on page 33).
- Switch on the V200/V300.
- Perform a teach-in procedure.

If there is no signal or 0 V on the *external device monitoring (EDM)* input, the safety camera system will deactivate the external device monitoring and save this configuration in the device.

- Check the effectiveness of the protective device as described in section 7.1 “Test notes” on page 42.

8.4 Locking the internal teach-in key

In the default delivery status the internal teach-in key is unlocked, i.e. it can be used. To permit remote teach-in and/or to protect the configuration, you can connect an external key-operated pushbutton for teach-in and lock the internal teach-in key.

How to lock the internal teach-in key:

- Connect an external key-operated pushbutton for teach-In (see section 5.3 on page 33).
- Switch on the V200/V300.
- Perform a teach-in procedure **using the key-operated pushbutton for teach-in.**

The V200/V300 locks the internal teach-in key and saves this configuration in the device. Teach-in can now only be performed using the key-operated pushbutton for teach-in.

- Check the effectiveness of the protective device as described in section 7.1 “Test notes” on page 42.

How to unlock the internal teach-in key:

- Switch on the V200/V300.
- Press the key-operated pushbutton for teach-in for at least 60 seconds.
The V200/V300 unlocks the internal teach-in key and saves this configuration in the device.
- If you no longer need the key-operated pushbutton for teach-in, remove it from the electrical installation. Otherwise the V200/V300 will again lock the internal teach-in key the next time the key-operated pushbutton for teach-in is actuated.
- Check the effectiveness of the protective device as described in section 7.1 “Test notes” on page 42.

9 Care and maintenance

The V200/V300 safety camera system is maintenance-free in operation. The front screen on the V200/V300 as well as the reflective tape should be cleaned regularly and also cleaned immediately in case of soiling.

- Do not use aggressive cleaning agents.
- Do not use abrasive cleaning agents.

Note Static charges cause dust particles to be attracted to the front screen and the reflective tape. You can reduce this effect by using the antistatic plastic cleaner (SICK part number 5600006) and the SICK lens cloth (part number 4003353).

How to clean the front screen and the reflective tape:

- Use a clean and soft brush to remove dust from the front screen and the reflective tape.
- Then wipe the front screen and the reflective tape with a clean and damp cloth.

Note

- After cleaning, check the position of the camera and check the reflective tape for good condition to ensure it is not possible to reach over, reach under or stand behind the protective device.
- Check the effectiveness of the protective device as described in section 7.1 “Test notes” on page 42.

10 Fault diagnosis

This chapter describes how to identify and rectify errors and malfunctions during the operation of the safety camera system.

10.1 In the event of faults or errors





WARNING

Cease operation if the cause of the malfunction has not been clearly identified!

- Stop the machine if you cannot clearly identify or allocate the error and if you cannot safely rectify the malfunction.
-

The system state “lock-out”

In case of certain faults or an erroneous configuration, the system can go into the “lock-out” state. The status LED  flashes with a short duty cycle  (short on/long off). To place the device back in operation:



- Rectify the cause of the fault following the information given in this chapter.
- Switch the power supply for the V200/V300 off and on again (e.g. by unplugging the system plug and reinserting it).



































































10.2 SICK support

- If you cannot rectify an error with the help of the information provided in this chapter, please contact your local SICK representative.

10.3 Warnings and error messages of the LEDs

This section explains the meaning of the indications on the LEDs in case of warnings and errors and how you can react to them.

The procedure for troubleshooting varies for warnings  and errors  only in the last step: If there is an error, you must re-start the V200/V300 after rectification.

Status LEDs			Diagnostics LEDs				Meaning	Rectification of the error
			1	2	3	4		
							Warning	<ul style="list-style-type: none"> ➤ Check the contactor. Replace, if necessary. ➤ Check the wiring for short-circuits or cross-circuits.
							Error	
							Warning	<ul style="list-style-type: none"> ➤ Check the contactors and their wiring, eliminate any wiring errors, if necessary. ➤ Switch the device off and back on again. Check the configuration of the external device monitoring (see page 15).
							Error	
							Warning	<ul style="list-style-type: none"> ➤ Check the reset button for correct function. The button may be defective or stuck. ➤ Check the wiring of the reset button for any short-circuit to 24 V.
							Error	
							Warning	<ul style="list-style-type: none"> ➤ Check the connection of the external key-operated pushbutton for teach-in.
							Error	
							Error	<ul style="list-style-type: none"> ➤ Disconnect the supply voltage to the V200/V300 for at least 3 seconds. ➤ If the problem persists, replace the unit.

Tab. 14: Indications on completion of the teach-in

11 Technical specifications

11.1 Data sheet

Tab. 15: Data sheet
V200/V300

	Minimum	Typical	Maximum
General system data			
Protective field dimensions	See section 4.1 "Checking the dimensions of the protective field" on page 18ff.		
Type			
V200 Work Station Extended	2 (IEC 61496-1, IEC/TR 61496-4)		
V300 Work Station Extended	3 (IEC 61496-1, IEC/TR 61496-4)		
Safety integrity level ²⁾			
V200 Work Station Extended	SIL1 (IEC 61508)		
V300 Work Station Extended	SIL2 (IEC 61508)		
SIL claim limit ²⁾			
V200 Work Station Extended	SILCL1 (EN 62061)		
V300 Work Station Extended	SILCL2 (EN 62061)		
Category			
V200 Work Station Extended	2 (EN ISO 13849-1)		
V300 Work Station Extended	3 (EN ISO 13849-1)		
Performance Level ²⁾			
V200 Work Station Extended	PL c (EN ISO 13849-1)		
V300 Work Station Extended	PL d (EN ISO 13849-1)		
Test rate	50 1/s (EN ISO 13849-1)		
Demand rate ³⁾	30 1/min (EN ISO 13849-1)		
PFHd (mean probability of a dangerous failure per hour)	5.6 × 10 ⁻⁹		
T _M (mission time)	20 years (EN ISO 13849)		
Protection class	III (EN 50178)		
Enclosure rating	IP 54 (EN 60529)		
Resolution	20 mm, 24 mm or 30 mm		
Field of view	103° ± 3°		
Ambient operating temperature	-5 °C		+50 °C
Storage temperature	-25 °C		+70 °C (≤ 24 h)
Humidity, taking into account the operating temperature range	IEC 61496-1, section 5.1.2 and section 5.4.2 as well as IEC/TR 61496-4, section 5.4.2		
Air humidity (non-dewing)	15 %		95 %
Sinusoidal vibration	5 g, 10–55 Hz (EN 60068-2-6)		
Shock resistance	10 g, 16 ms (EN 60068-2-27)		

²⁾ For detailed information on the safety design of your machine/system, please contact your local SICK representative.

³⁾ For V200 Work Station Extended the following applies: Between two demands for a safety-related reaction from the device, at least 100 internal or external tests must be performed.

	Minimum	Typical	Maximum
Lighting			
Wavelength	850 nm		
Ocular safety	Photobiologically harmless (IEC 62 471-7)		
Housing			
Material	Aluminium die cast		
Dimensions	See section 11.2 "Dimensional drawings" on page 56.		
Total weight	0.355 kg		
Reflective tape (length × width) for resolution:			
20 mm	1.00 m × 37 mm		
24 mm	1.20 m × 37 mm		
30 mm	1.50 m × 48 mm		
Power-up delay after connecting the supply voltage			6 s

Electrical data

Supply voltage V_S at the device (SELV) ⁴⁾⁵⁾	19.2 V	24 V	28.8 V
Permissible cable resistance on the supply cable			1 Ω
Residual ripple ⁶⁾			$\pm 5\%$
Operating current at 24 V without output load with maximum output load			165 mA 690 mA
Power consumption at 24 V without output load with maximum output load			4 W 19 W
Electrical connection	M12 × 8 (see section 5.1 on page 32)		
Cable length for wire cross-section 0.25 mm ²			7.5 m
Synchronisation	Electrical (see section 5.1 on page 32)		

⁴⁾ To meet the requirements of the relevant product standards (e.g. IEC 61 496-1), the external voltage supply for the devices (SELV) must be able to bridge a brief mains failure of 20 ms. Power supplies according to EN 60 204-1 satisfy this requirement. Suitable power supplies are available as accessories from SICK (see section 12.2 "Accessories" on page 59).

⁵⁾ A fuse rated maximum 2 A shall be installed in the isolated 24 V DC power supply circuit to the device in order to limit the available current.

⁶⁾ Within the limits of V_S .

	Minimum	Typical	Maximum
<i>External device monitoring (EDM) input</i>			
Resistance HIGH		2 kΩ	
Capacitance		15 nF	
Voltage (IEC 61 131-2)			
HIGH	11 V	24 V	30 V
LOW	-3 V	0 V	5 V
Static current	6 mA		15 mA
<i>Reset/restart input (RESTART)</i>			
Resistance HIGH		2 kΩ	
Capacitance		15 nF	
Voltage (IEC 61 131-2)			
HIGH	11 V	24 V	30 V
LOW	-3 V	0 V	5 V
Static current	6 mA		15 mA
Actuating time control switch input	120 ms		
<i>Teach-in/synchronisation (TEACH/SYNCH) input</i>	The input must be operated by a key-operated switch (contact).		
Resistance HIGH		2 kΩ	
Capacitance		15 nF	
Voltage HIGH	11 V	24 V	30 V
Static current	6 mA		15 mA

	Minimum	Typical	Maximum
Output signal switching devices (OSSDs)	2 PNP semiconductors, short-circuit protected ⁷⁾ , cross-circuit monitored		
Switching voltage HIGH (active, U_{rms}) at 250 mA	$V_S - 2.7 V$		V_S
Switching voltage LOW (inactive)	0 V	0 V	3.5 V
Source switching current	6 mA		250 mA ⁸⁾
Leakage current ⁹⁾			250 μA
Load inductance			2.2 H
Load capacity at 50 Ω			2.2 μF
Permissible line resistance between device and load ¹⁰⁾			2.5 Ω
Test pulse data ¹¹⁾			
Test pulse width		230 μs	300 μs
Test frequency		120 ms	
Response time			20 ms
Switch off time	100 ms		
Power-up delay of the OSSDs from red to green			30 ms
Contactors			
Permissible dropout time			300 ms
Permissible pick-up time			300 ms

⁷⁾ Applies to the voltage range between U_V and 0 V.

⁸⁾ Switching currents ≤ 500 mA are allowed briefly (≤ 100 ms).

⁹⁾ In the case of a fault (0 V cable open circuit) the maximum leakage current flowing in the OSSD cable. The downstream controller must detect this status as LOW. A safe PLC (Programmable Logic Controller) must be able to identify this status.

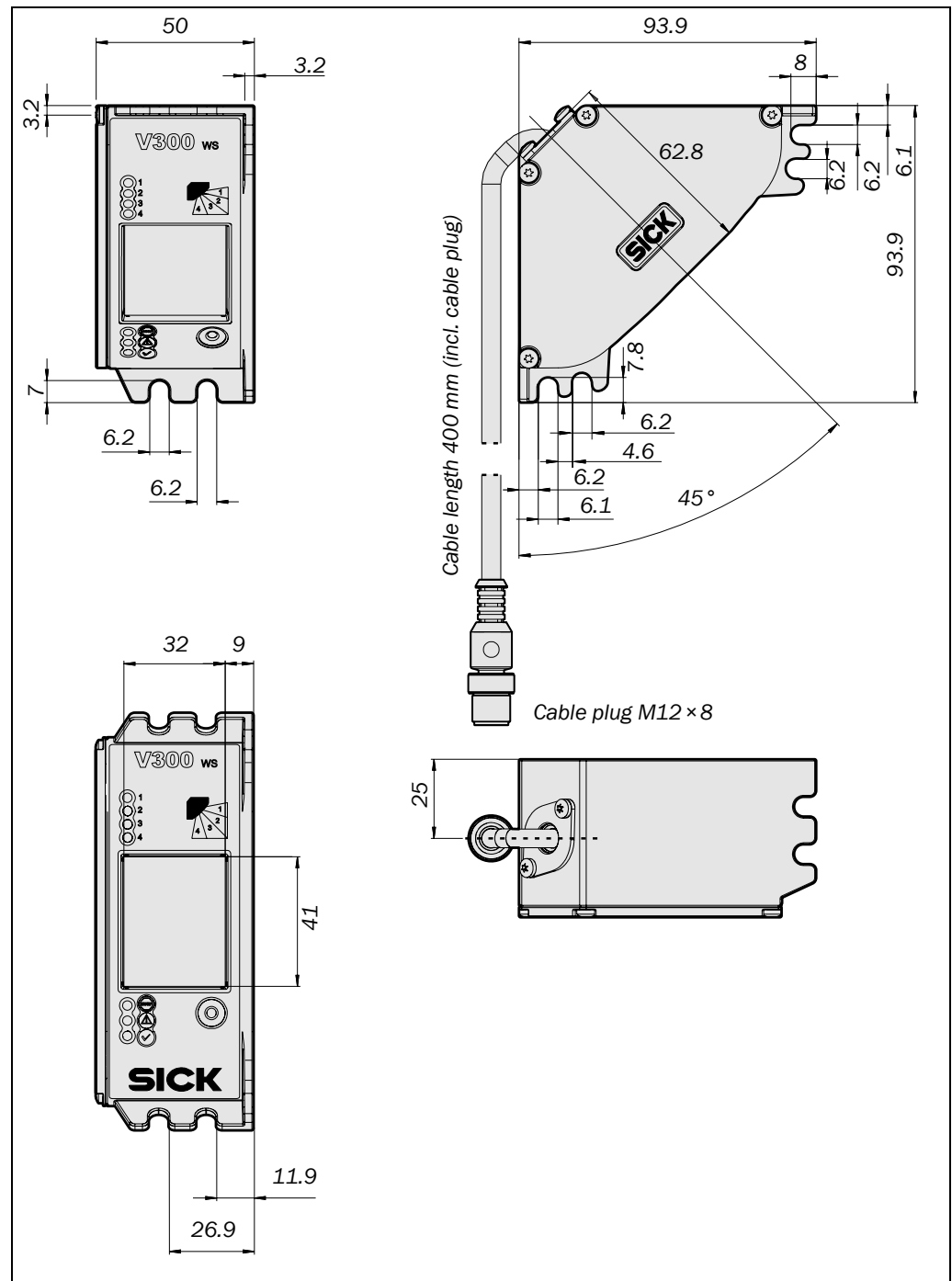
¹⁰⁾ Make sure to limit the individual cable resistance to the downstream controller to this value to ensure that a cross-circuit between the outputs is safely detected. (Also note EN 60 204 Electrical Machine Equipment, Part 1: General Requirements.)

¹¹⁾ When active, the outputs are tested cyclically (brief LOW). When selecting the downstream controllers, make sure that the test pulses do not result in deactivation when using the above parameters.

11.2 Dimensional drawings

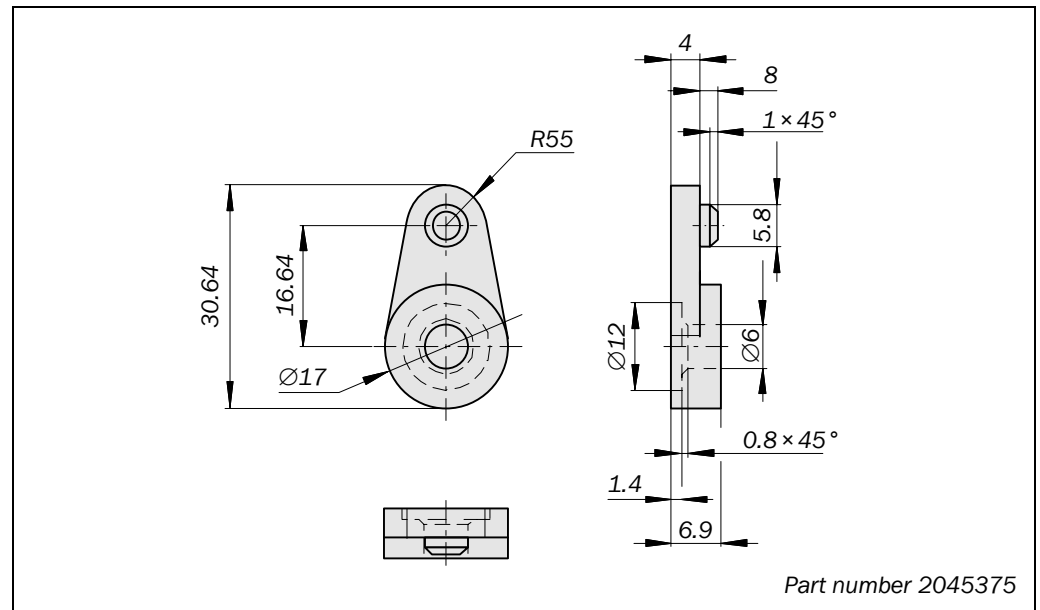
11.2.1 Dimensional drawing V200/V300

Fig. 31: Dimensional drawing V200/V300 (mm)



11.2.2 Dimensional drawing, mounting kit

Fig. 32: Dimensional drawing, mounting kit (mm)



12 Ordering information

12.1 Safety camera systems

Note In addition to the safety camera system, you will require one of the resolution sets.

Tab. 16: Part numbers safety camera systems

Description	Part number
Safety camera systems	
consisting of camera, teach-in pin, label "Important Information", operating instructions on CD-ROM and Quick-Start (instructions for quick commissioning), multi-lingual	
V200 Work Station Extended (Cat. 2 according to EN ISO 13849-1)	1042027
V300 Work Station Extended (Cat. 3, PL d according to EN ISO 13849-1)	1041542
Resolution sets	
consisting of test rod (to suit the resolution) and 2 reflector strips	
Resolution set for 20 mm resolution	2051336
Resolution set for 24 mm resolution	2051338
Resolution set for 30 mm resolution	2051339

Ordering example

A V300 is to be used in your application with a resolution of 20 mm.

Then you must order the following:

- V300 Work Station Extended (Cat. 3, PL d according to EN ISO 13849-1) 1041542
- Resolution set for 20 mm resolution 2051336

V200/V300

Tab. 17: Part numbers accessories

12.2 Accessories

Description	Part number
<p>Reflective tapes</p> <p>Robust version. Suitable for applications in which the reflective tape is subject to friction or weight.</p> <p>For 20 mm resolution, 2 pieces of 1.0 m</p> <p>For 24 mm resolution, 2 pieces of 1.2 m</p> <p>For 30 mm resolution, 2 pieces of 1.5 m</p>	<p>2046005</p> <p>2051581</p> <p>2051582</p>
<p>Test rods</p> <p>For 20 mm resolution, 1 piece with Ø 20 mm</p> <p>For 24 mm resolution, 1 piece with Ø 24 mm</p> <p>For 30 mm resolution, 1 piece with Ø 30 mm</p>	<p>2022600</p> <p>2045592</p> <p>2022602</p>
<p>Mounting kit</p> <p>To mount the V200/V300 on profile frames, 2 clamping lugs incl. screws</p>	2045375
<p>Test rod holder</p> <p>For storing the test rod on the machine</p>	2052249
<p>Power supply</p> <p>Power supply 24 V, 100/240 V AC, 50 W</p> <p>Power supply 24 V, 100/240 V AC, 95 W</p>	<p>7028789</p> <p>7028790</p>
<p>Connecting cable</p> <p>With cable socket M12 × 8, straight socket/stripped</p> <p>2.5 m</p> <p>5 m</p> <p>7.5 m</p>	<p>6020537</p> <p>6020354</p> <p>6020353</p>
<p>Other accessories</p> <p>Teach-in pin</p> <p>Anti-static plastic cleaner</p> <p>Lens cloth</p> <p>Solvent for adhesive, spray bottle, 200 ml</p> <p>Suitable for removing the reflective tape</p>	<p>4052939</p> <p>5600006</p> <p>4003353</p> <p>5602135</p>
<p>Operating instructions</p> <p>Multi-language operating instructions on CD-ROM</p> <p>Printed operating instructions, format DIN A4, in the language ...</p> <p>German</p> <p>English</p> <p>French</p> <p>Italian</p> <p>Spanish</p> <p>Japanese</p>	<p>2044268</p> <p>8012226</p> <p>8012227</p> <p>8012228</p> <p>8012229</p> <p>8012230</p> <p>8012453</p>

13 Annex

13.1 Compliance with EU directives

EU declaration of conformity (excerpt)

The undersigned, representing the following 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 respective standards and/or technical specifications are taken as the basis.

Complete EU declaration of conformity for download: www.sick.com

13.2 Checklist for the manufacturer

SICK

Checklist for the manufacturer/installer for the installation of electro-sensitive protective equipment (ESPE)

Details about the points listed below must be present at least during initial commissioning – they are, however, dependent on the respective application, the specifications of which are to be controlled by the manufacturer/installer.

This checklist should be retained and kept with the machine documentation to serve as reference during recurring tests.

1. Have the safety rules and regulations been observed in compliance with the directives/standards applicable to the machine? Yes No
2. Are the applied directives and standards listed in the declaration of conformity? Yes No
3. Does the protective device comply with the required PL/SILCL and PFHd as per EN ISO 13849-1/EN 62061 and the type as per IEC 61496-1? Yes No
4. Is the access to the hazardous point only possible through the protective field of the ESPE? Yes No
5. Have appropriate measures been taken to protect (mechanical protection) or monitor (protective devices) any persons or objects in the hazardous area when protecting a hazardous area or hazardous point, and have these devices been secured or locked to prevent their removal? Yes No
6. Are additional mechanical protective measures fitted and secured against manipulation which prevent reaching under, over or around the ESPE? Yes No
7. Has the maximum stopping and/or stopping/run-down time of the machine been measured, specified and documented (at the machine and/or in the machine documentation)? Yes No
8. Has the ESPE been mounted such that the required minimum distance from the nearest hazardous point has been achieved? Yes No
9. Are the ESPE devices correctly mounted and secured against manipulation after adjustment? Yes No
10. Are the required protective measures against electric shock in effect (protection class)? Yes No
11. Is the control switch for resetting the protective device (ESPE) or restarting the machine present and correctly installed? Yes No
12. Are the outputs of the ESPE (OSSD) integrated according to required PL/SILCL compliant with EN ISO 13849-1/EN 62061 and does the integration correspond to the comply with the circuit diagrams? Yes No
13. Has the protective function been checked in compliance with the test notes of this documentation? Yes No
14. Are the specified protective functions effective at every operating mode that can be set? Yes No
15. Are the switching elements activated by the ESPE, e.g. contactors, valves, monitored? Yes No
16. Is the ESPE effective over the entire period of the dangerous state? Yes No
17. Once initiated, will a dangerous state be stopped when switching the ESPE on or off and when changing the operating mode, or when switching to another protective device? Yes No
18. Has the information label for the daily check been attached so that it is easily visible for the operator? Yes No

This checklist does not replace the initial commissioning, nor the regular inspection by qualified safety personnel.

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