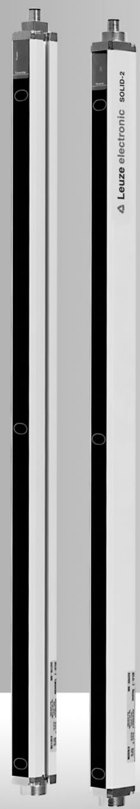
Leuze electronic

the sensor people

SOLID-2SF-K

Guarding the delivery of sheet fed offset printing machines



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CONNECTING AND OPERATING INSTRUCTIONS

Original Instructions

Notes on Connecting and Operating Instructions

This connecting and operating instructions manual contains information on the proper use of SOLID-2SF-K Multiple Light Beam Safety Devices in accordance with its intended purpose. It is included with delivery.

Warning!

All the information contained herein, in particular the safety notes, must be carefully observed.

This connecting and operating instructions manual must be stored carefully. It must be available for the entire operating time of the optical safety device.

Notes regarding safety and warnings are marked by this symbol ⚠ .

Notes regarding important pieces of information are marked by the symbol ℹ .

Leuze electronic GmbH + Co. KG is not liable for damage resulting from improper use of its equipment. Familiarity with these instructions is an element of the knowledge required for proper use.

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1 General

The SOLID-2SF Multiple Light Beam Safety Devices are optimized for use on sheet delivery on sheet-fed printing machines. This requires defined interruption of beams without a stop being activated. Temporary bridging in accordance with EN 1010 can, for example, be activated by a suitable control unit.

With a suitable control unit, SOLID-2SF are type 2 Active Optoelectronic Protective Devices (AOPDs) in acc. with EN/IEC 61496-1, EN/IEC 61496-2, PL d in acc. with ISO 13849-1, and comply with SIL 2 in acc. with IEC EN 61508.

All SOLID-2SF Multiple Light Beam Safety Devices are equipped with integrated cyclical testing and display elements (LEDs and 7-Segment). This is especially convenient when starting a unit up or performing diagnostics.

SOLID-2SF has the appropriate number of beams via 2-4 SSDs, enabling the definitive assignment of the interruption of individual beams. Each SOLID-2SF also has a dynamic SSD, which transfers the result of the integrated cyclical testing to the control unit.

The devices of the SOLID-2SF series are available with up to 4 beams and in various lengths (beam distances), so that they provide an optimum solution for specific applications.

1.1 Certifications

Company

Leuze electronic GmbH & Co. KG in D-73277 Owen - Teck, Germany, has a certified quality assurance system in compliance with ISO 9001.

Products

SOLID-2SF Safety Light Curtains are developed and manufactured in compliance with applicable European directives and international standards.

EC prototype test in accordance with
EN/IEC 61496 Part 1 and Part 2
TÜV PRODUCT SERVICE GmbH, IQSE
Ridlerstrasse 65
D-80339 Munich

1.2 Symbols and terms

Symbols used

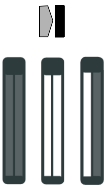
⚠	Warning sign – This symbol indicates possible dangers. Please pay especially close attention to these instructions!
ℹ	Sign indicating important information.
↳	A note, which also refers to a course of action, provides information about special attributes or describes set-up procedures
	Symbols for SOLID-2SF Transmitter, SD2T General transmitter symbol Transmitter not active Transmitter active
	Symbols for SOLID-2SF Receiver, SD2R General Receiver symbol The Receiver’s active protective field is not free; outputs in OFF state The Receiver's active protective field is free; outputs in ON state The Receiver's active protective field is free; outputs in OFF state
⇒ ⇐ ⇔	Signal output Signal input Signal input and/or output

Table 1.1: Symbols

Terms used in this manual

AOPD	Active Opto-electronic Protective Device
AOPD response time	Time between penetration into the active protective field of the AOPD and the actual switching off of the OSSDs.
AutoReset	When an error indication occurs, caused, for example, by faulty external wiring, the AOPD attempts to start again. If the error is no longer present, the AOPD returns to normal operation mode.
Contactor Monitoring (EDM)	Also called "External Device Monitoring", monitors the positive-guided normally closed contacts of downstream relays, contactors or valves
DoubleScan	Two scans are made: Beams must be interrupted in two consecutive scans, before the Receiver switches OFF.
FS	Factory setting
S/RS interlock	Start/restart interlock
Scan	All beams, beginning with the synchronization beam, are activated and deactivated one after the other, i.e. only one beam is active at a time.
SSD1,.. ,SSD4, Dyn SSD	Safety-relevant switching outputs (transistors)
Start/restart interlock	Prevents automatic start after the supply voltage has been turned on, or after the protective field has been penetrated

Table 1.2: Terms

2 Safety

Before using the safety sensor, a risk evaluation must be performed according to valid standards (e.g. EN ISO 14121, EN ISO 12100-1, ISO 13849-1, IEC 61508, EN 62061). The result of the risk assessment determines the required safety level of the safety sensor (see table 2.1). For mounting, operating and testing, document "SOLID-2SF-K, Optoelectronic delivery guard of sheet-fed printing machines" as well as all applicable national and international standards, regulations, rules and directives must be observed. Relevant and supplied documents must be observed, printed out and handed to the affected personnel.

Before working with the safety sensor, completely read and understand the documents applicable to your task.

In particular, the following national and international legal regulations apply for the start-up, technical inspections and work with safety sensors:

- Machinery directive 2006/42/EC
- Low voltage directive 2006/95/EC
- Electromagnetic compatibility directive 2004/108/EC
- Use of Work Equipment Directive 89/655/EEC supplemented by Directive 95/63 EC
- OSHA 1910 Subpart 0
- Safety regulations
- Accident-prevention regulations and safety rules
- Ordinance on Industrial Safety and Health and Labor Protection Act
- Device Safety Act

Notice!

For safety-related information you may also contact the local authorities (e.g., industrial inspectorate, employer's liability insurance association, labor inspectorate, occupational safety and health authority).

2.1 Approved purpose and foreseeable improper operation

Warning!

A running machine can cause severe injuries!
Make certain that, during all conversions, maintenance work and inspections, the system is securely shut down and protected against being restarted again.

2.2 Proper use

The safety sensor must only be used after it has been selected in accordance with the respectively applicable instructions and relevant standards, rules and regulations regarding labor protection and occupational safety, and after it has been installed on the machine, connected, commissioned, and checked by a competent person.

When selecting the safety sensor it must be ensured that its safety-related capability meets or exceeds the required performance level PL_r ascertained in the risk assessment.

Listed in the following table are the safety-related characteristic parameters of the SOLID-2SF-K optoelectronic delivery guard for sheet-fed printing machines.

Type in accordance with IEC/EN 61496	Type 2
SIL in accordance with IEC 61508	SIL 2
SILCL in accordance with IEC/EN 62061	SILCL 2
Performance Level (PL) in accordance with ISO 13849-1: 2008	PL d
Category in accordance with ISO 13849	Cat. 2
Average probability of a failure to danger per hour (PFH_d) For protective field heights up to 900 mm, all resolutions For protective field heights up to 1800 mm, all resolutions For protective field heights up to 2850 mm, all resolutions	 8.2×10^{-8} $^1/_h$ 8.9×10^{-8} $^1/_h$ On request
Service life (T_M)	20 years

Table 2.1: Safety-related characteristic parameters of the SOLID-2SF-K optoelectronic delivery guard of sheet-fed printing machines

- The safety sensor protects persons at access points or at points of operation of machines and plants.
- When mounted vertically at entry points to hazard locations, the safety sensor detects the human body.
- The safety sensor only detects persons upon entry to the danger zone; it does not detect persons who are located within the danger zone. For this reason, a start/restart interlock is mandatory.
- The construction of the safety sensor must not be altered. When manipulating the safety sensor, the protective function is no longer guaranteed. Manipulating the safety sensor also voids all warranty claims against the manufacturer of the safety sensor.
- The safety sensor must be tested regularly by competent personnel.
- The safety sensor must be exchanged after a maximum of 20 years. Repairs or the exchange of parts subject to wear and tear do not extend the service life.

2.2.1 Foreseeable misuse

In principle, the safety sensor is not suitable as a protective device in case of:

- danger of objects being expelled or hot or dangerous liquids spurting from the danger zone
- applications in explosive or easily flammable atmospheres

2.3 Competent personnel

Prerequisites for competent personnel:

- he has a suitable technical education
- he knows the rules and regulations for occupational safety, safety at work and safety technology and can assess the safety of the machine
- he knows the instructions for the safety sensor and the machine
- he has been instructed by the responsible person on the mounting and operation of the machine and of the safety sensor

2.4 Responsibility for safety

Manufacturer and operating company must ensure that the machine and implemented safety sensor function properly and that all affected persons are adequately informed and trained.

The type and content of all imparted information must not lead to unsafe actions by users.

The manufacturer of the machine is responsible for:

- safe machine construction
- safe implementation of the safety sensor
- imparting all relevant information to the operating company
- adhering to all regulations and directives for the safe starting-up of the machine

The company operating the machine is responsible for:

- instructing the operating personnel
- maintaining the safe operation of the machine
- adhering to all regulations and directives for occupational safety and safety at work
- regular testing by competent personnel

2.5 Exemption of liability

Leuze electronic GmbH + Co. KG is not liable in the following cases:

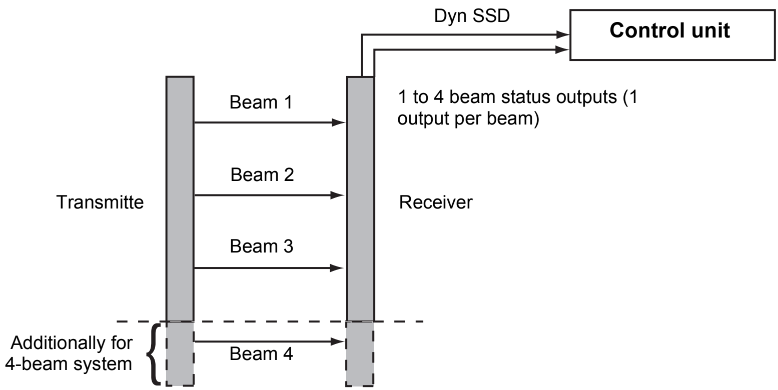
- safety sensor is not used as intended
- safety notices are not adhered to
- reasonably foreseeable misuse is not taken into account
- mounting and electrical connection are not properly performed
- Proper function is not tested (see Chapter 10)
- changes (e.g., constructional) are made to the safety sensor

3 System design and selectable functions

3.1 The opto-electronic protective device

Working principle

SOLID-2SF consists of a transmitter and a receiver. Beginning with the first beam (synchronization beam) directly after the display panel, the Transmitter pulses beam for beam in rapid sequence. The synchronization between Transmitter and Receiver is performed optically.



Picture 3.1:Working principle of the opto-electronic protective device

The Receiver recognizes the specially coded pulse packages of the Transmitter beams and opens the corresponding Receiver elements in sequence in the same rhythm. A protective field is consequently formed in the area between Transmitter and Receiver. Its height depends on the geometrical dimensions of the protective device and its width is determined by the distance selected between the Transmitter and Receiver within the permissible range.

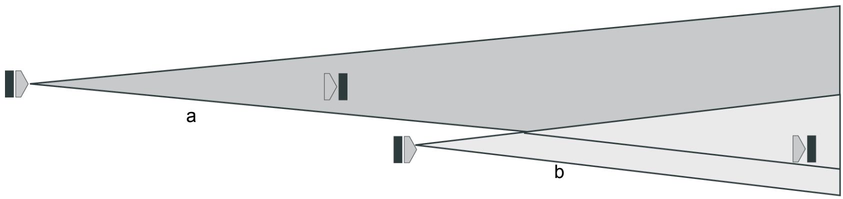
The safety output consists of the 1-channel SSDs, which provide the status of the corresponding beams (SSD 1 shows the status of beam 1, SSD 2 the status of beam 2, SSD 3 the status of beam 3 and SSD 4 the status of beam 4), and the Dyn SSD output shared for all beams. When no errors are present on the SOLID-2SF, this delivers a symmetrical square-wave signal with 300 ms pulse width. This dynamic signal must be monitored by the downstream control unit. If the Dyn SSD signal fails to appear, the power-driven machinery must be switched off. Correct connection must be checked with the machine's first startup!

3.2 Transmission channel

The infrared beams are modulated with specially coded pulse packages so that they are distinct from ambient light, thus ensuring undisturbed operation. Welding sparks or warning flash lights from passing forklifts do not having any effect on the protective field.

If two protective fields are located directly next to each other for two adjacent machines, however, measures must be taken to ensure the optical protective devices do not affect each other.

Another possible way to suppress mutual influence is to switch one of the two protective devices from transmission channel 1 to 2 and therefore to differently formed pulse packages. This solution should be considered when more than two optical protective devices must be arranged next to each other.



a AOPD "A" transmission channel 1
b AOPD "B" transmission channel 2, not affected by AOPD "A"

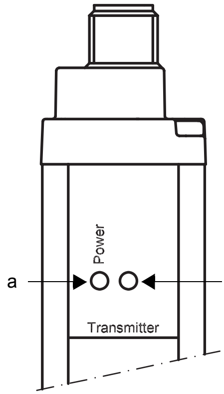
Picture 3.2: Transmission channel selection (AOPD = Active Opto-electronic Protective Device)

The change from transmission channel 1 to 2 must be made both on the Transmitter and the Receiver of the optical protective device in question. You will find more detailed information in Chapter 7.

4 Display elements

4.1 Transmitter status displays

When the Transmitter's green LED1 is lit, this indicates that the current supply is available.



a LED1 (green/red)
b LED2 (green/red)

Picture 4.1:Transmitter, LED status displays

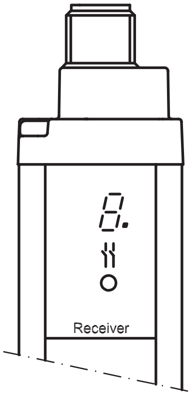
Display of the current state of the Transmitter:

Display		**Meaning**
LED1 green	LED2 off	Operating voltage present, transmission channel 1 selected
LED1 green	LED2 green	Operating voltage present, transmission channel 2 selected
LED1 green	LED2 red	Operating voltage present, transmission channel 1 or transmission channel 2 selected, external test signal activated
LED1 red	LED2 any	Device fault

Table 4.1: Transmitter, LED status displays

4.2 Receiver status displays

LED1 and the 7-Segment display signal the operating states of the Receiver.



a LED1 = (green/red)

Picture 4.2:Receiver, status displays

4.2.1 7-Segment display

After the supply voltage is switched on, the following data appears on the 7-Segment display of the Receiver:

7-Segment display	Meaning
	Permanent display after startup
1 or 2	Transmission channel TC1 or TC2 display

Table 4.2: Receiver, 7-Segment permanent displays

7-Segment display	Meaning
	Temporary event displays, 1 s per display
E xx	Display of locking status “Malfunction”, which can be released by the user; E xx = Error code (see Chapter 10). The display shows E, 3 (1st position) and 0 (2nd position) alternating, and then repeats this sequence.
F xx.	Locking status display "device fault" and an internal fault code. Receiver must be replaced.
1 or 2 flashing	Flashing transmission channel number -> weak signal display, device not adjusted optimally or dirty

Table 4.3: Receiver, 7-Segment temporary event display

4.2.2 LED displays

Receiver, LED status displays

LED	Color	Meaning	
LED1	Red/ green	Red	= At least one safety output SSD in OFF state
		Green	= All safety outputs SSDs in the ON state
		No display	= Device without supply voltage

Table 4.4: Receiver LED displays

5 Installation

5.1 Location of the AOPD

EN 1010-2 specifies the position of the beams on the sheet delivery for sheet-fed printing machines in the following table:

Access height h	Location of the AOPD for the access level(s)		
	Beam 1 [a]	Beam 2 [b]	Beam 3 [c]
h ≤ 1200 mm	300 mm	If [d] n/a	400 mm below h (h-400)
1200 mm < h ≤ 1500 mm	300 mm	Centered between beams 1 and 3	400 mm below h) (h-400)
h > 1500 mm	300 mm	700 mm	1100 mm

a Position measured from access level or from fixed or swiveling platform; because of structural tolerances where installed, the permissible tolerance for the position is ± 35 mm.

b Beam between beams 1 and 3, if distance between beams 1 and 3 > 500 mm

c maximum 1100 mm high

d Some blanking functions require 3 beams for guarding the access side. Where these blanking functions are to be used, with access heights over 1200 mm a third beam that is positioned centered between the top and the bottom beam must be provided.

Select the suitable SOLID-2SF type according to the access heights on the sheet delivery (e.g. 2, 3 or 4-beam, see order data) and mount the SOLID-2SF at the appropriate height.

5.2 Calculating the safety distance

With general applications, i.e. in cases where SOLID-2SF is not used for guarding the sheet delivery of a sheet-fed printing machine, the safety distance must be calculated in acc. with EN 999.

The safety distance is calculated here using the following formula:

$S = (K \times T) + C$

S: Safety distance between SOLID-2SF and the danger zone (mm)

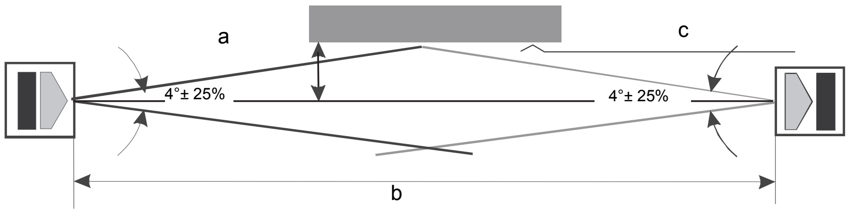
K: Approach speed – 1600 mm/s

T: Total time of the delay in seconds, i.e. the total of the response time of the protective device and the downstream control unit or safety interface and the machine's stopping time

C: Additional amount – 850 mm

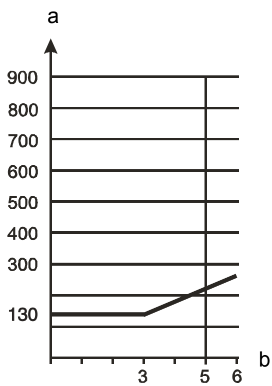
5.3 Minimum distance from reflective surfaces

Reflective surfaces near opto-electronic protective devices can indirectly deflect beams from the Transmitter into the Receiver. This can cause an object in the protective field not to be detected! All reflective surfaces and objects (material containers, cans, etc.) must therefore be kept at a minimum distance "a" from the protective field. The minimum distance "a" depends on the distance “b” between the Transmitter and the Receiver.



a = Minimum distance
b = Protective field width
c = Reflective surface

Picture 5.1:Minimum distances from reflective surfaces



a = Required distance from reflective surfaces [mm]
b = Protective field width [m]

Picture 5.2:Minimum distance to reflective surfaces depending on protective field width

5.4 Mechanical mounting

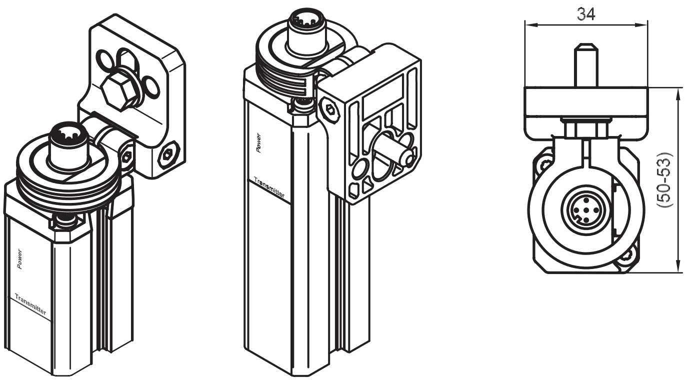
What should generally be taken into consideration during installation?

- Make certain that the Transmitter and Receiver are mounted on even surfaces.
- The Transmitter and Receiver must be positioned at the same height and their connection plugs must be pointing in the same direction.
- Use screws for mounting that can only be loosened with a tool.
- Fasten and secure the Transmitter and Receiver so that they cannot be swiveled or moved. Securing the Transmitter and Receiver so they cannot be moved or swiveled is especially important in the close area with a narrow protective field.
- The safety distance between the protective field and the danger zone must be observed.
- Make sure that access to the danger point/danger zone is only possible through the protective field. Additional access routes must be secured separately (for example by hard guards, additional Safety Light Curtains or doors with locking devices).

5.5 Mounting types

5.5.1 Standard mounting

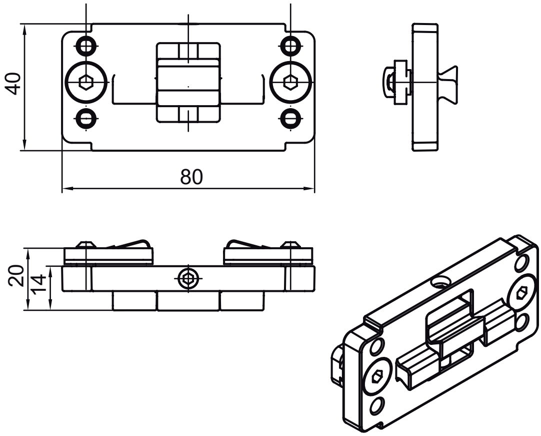
Four standard mounting brackets (two each for Transmitter and Receiver) are included with delivery.



Picture 5.3:Standard mounting bracket examples

5.5.2 Mounting with straddle bracket

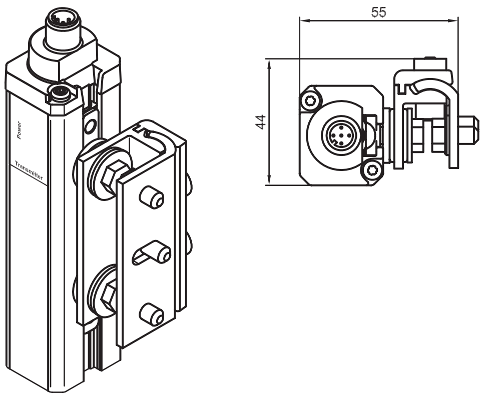
Four straddle brackets can be ordered as an option. They are not included with delivery.



Picture 5.4:Clamping bracket for C-slot mounting

5.5.3 Mounting with swiveling brackets

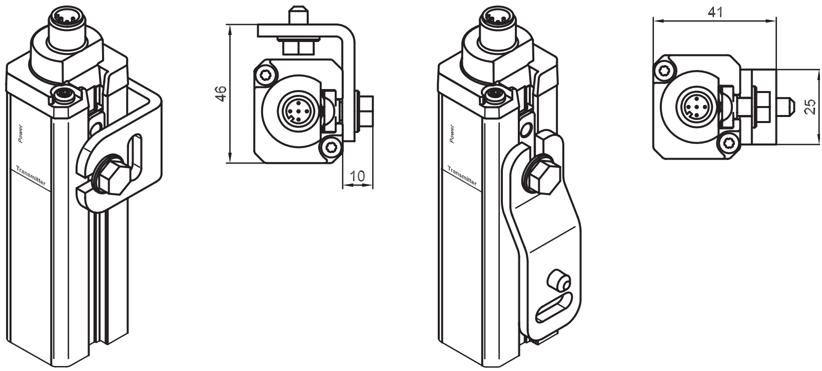
Four swivel mounting brackets with shock absorbers can be ordered optionally. They are not included with delivery. The swivel range is ± 8°.



Picture 5.5:Swiveling bracket with shock absorber

5.5.4 Side mounting

Optionally, mounting is possible with mounting brackets and sliding nuts on the side slot. They are not included with delivery.



L-mounting bracket Z-mounting

Picture 5.6:Mounting examples, L-mounting bracket and Z-mounting bracket

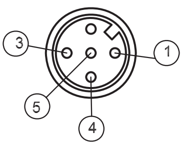
6 Electrical connection

- The electrical connection must be performed by experienced personnel. Knowledge of all safety instructions in these connecting and operating instructions is part of this competence.
- The external supply voltage of 24V DC ± 15 % must guarantee safe isolation from the mains voltage and be able to bridge a power outage period of at least 20 ms. Leuze electronic offers suitable power supplies.
- The power supply must provide at least 1 A current reserve. Transmitter and Receiver must be fused against overcurrent.
- It is vital during the electrical installation that the power of the machine or system to be protected is switched off and locked, so that the dangerous movements cannot be started unintentionally. The protective device may only be connected to the machine after all of its safety functions have been entirely tested.

6.1 M12 connection

Transmitter and Receiver are equipped with M12 plugs. The Transmitter is equipped with a 5-pin plug; the Receiver has an 8-pin plug.

6.1.1 Transmitter



1 brown
3 blue
4 black
5 grey

Picture 6.1:SD-2T 5-pin (view of the pins)

Pin	Color	Assignment		Inputs/outputs
1	Brown	⇐	Supply voltage	+24V DC for TC1 or 0V for TC2
2	White			nc
3	Blue	⇐	Supply voltage	0V for TC1 or +24V DC for TC2
4	Black	⇐	Test in	Test input connected to +24V DC → internal test activated to 0V or free → external test activated
5	Grey/Plug housing	⇐	Shield	Functional earth

Table 6.1: Transmitter, connection assignment

The polarity of the power supply from Pin1 and Pin3 determines the selected optical transmission channel. If +24V DC is present on Pin1 and 0V on Pin3, transmission channel 1 is selected. If 0V is present on Pin1 and +24V DC on Pin3, transmission channel 2 is selected.

Be sure to select the same transmission channel for both, for Transmitter and Receiver.

Caution!
For optimum shielding, cables where the shield is routed on the knurled nut of the connecting cable socket must be used (suitable cables are listed under accessories in Chapter 10.3).

6.1.2 Testing

Caution!
In fault-free operation the cyclical internal testing delivers an alternating signal on the Dyn SSD between low and high every 300 ms. Faults found are signaled by a static signal.

The downstream control unit must evaluate the safety-relevant aspects of this signal and activate a machine stop if the signal does not change.

There is also the option of an external testing, with which the SSDs of the Receiver switch off consecutively as a response to the creation of a test signal on the Transmitter. If external testing is required, the Transmitter's test input must be wired accordingly (see below).

In most cases, however, internal cyclical testing is sufficient. For this purpose, the Transmitter's test input must be permanently connected with +24V DC.

Internal cyclical testing

To activate external testing, connect Pin4 of the Transmitter permanently to +24V DC.

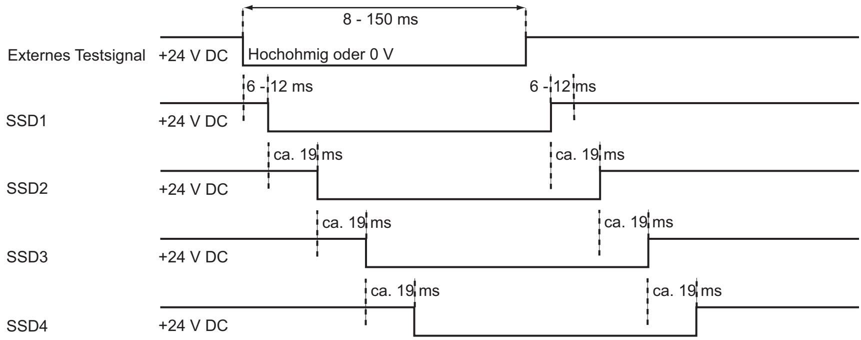
When using the internal cyclical testing, the corresponding SSDs and the shared Dyn SSD must always be evaluated for safety relevance by the downstream control unit.

External test signal

To use the external testing option, connect the test output of the corresponding test monitoring unit with Pin4 of the Transmitter. When using the external testing procedure in combination with a test monitoring unit, only the SSDs must to be connected to the test monitoring unit.

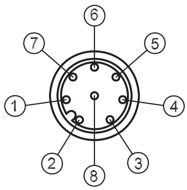
Note!
External testing takes precedence over internal testing. If the external test is used, a corresponding frequency of the dangerous movement (typically at least 10 times as frequent) is sufficient to guarantee test frequency.

Test input Pin4, Transmitter:	+24V DC	Test = not activated
	High impedance or 0V	Test = activated



Picture 6.2:SOLID-2SF external testing

6.1.3 Receiver



1 white
2 brown
3 green
4 yellow
5 grey
6 pink
7 blue
8 black

Picture 6.3:SD-2R 8-pin (view of the pins)

Pin	Color	Assignment		Inputs/outputs
1	White	⇒	Output	SSD4, transistor switching output
2	Brown	⇐	Supply voltage	+24V DC for transmission channel 1 or 0V for transmission channel 2
3	Green	⇒	Output	SSD3, transistor switching output
4	Yellow	⇒	Output	Dyn SSD, transistor switching output
5	Grey	⇒	Output	SSD1, transistor switching output
6	Pink	⇒	Output	SSD2, transistor switching output
7	Blue	⇐	Supply voltage	0V for TC1 or +24V for TC2
8	Black/Plug housing	⇔	Shield	Functional earth

Table 6.2: Receiver, connection assignment

With three-beam receivers SSD4 is switched off; with two-beam SSD3 is also switched off.

Selection of the transmission channel

The polarity of the power supply from Pin2 and Pin7 determines the selected optical transmission channel.

If +24V DC is present on Pin2 and 0V on Pin7, transmission channel 1 is selected. If 0V is present on Pin2 and +24V DC on Pin7, transmission channel 2 is selected.

Note!

Be sure to select the same transmission channel for both, for Transmitter and Receiver.

For optimum shielding, cables where the shield is routed on the knurled nut of the connecting cable socket must be used.

SSD and Dyn SSD switching outputs

Caution!

The safety output consists of the 1-channel SSDs, which provide the status of the corresponding beams, and the Dyn SSD output shared for all beams. When no errors are present, this delivers a symmetrical square-wave signal with 300 ms pulse width. This dynamic signal must be monitored by the downstream control unit. If the Dyn SSD signal remains static, the power-driven machinery must be switched off. Correct connection must be checked with the machine's first startup!

7 Troubleshooting

The following information is used for rapid troubleshooting in the event of a malfunction.

7.1 What should I do if an error occurs?

If the AOPD shows an error on the display, the machine must be stopped immediately and checked by an experienced technician. If it is determined that the error cannot be clearly defined and remedied, your local Leuze office and or the Leuze electronic hotline can assist.

7.2 Diagnostics

Operational malfunctions often have simple causes that you can remedy yourself. The following tables will help you do this.

7.2.1 Transmitter diagnostics

LED display	Measure to eliminate error
LED1 is not lit	Check + 24V supply voltage and connecting cable, replace Transmitter if necessary
LED1 is lit red continuously	Check the test input, hardware fault, replace Transmitter if necessary

Table 7.1: Transmitter diagnostics

7.2.2 Receiver diagnostics

The Receiver distinguishes between error codes (E xx) and fault codes (F xx). Only error messages (E) provide information about events or states that you can eliminate. If the Receiver shows a fault code (F), it must be replaced. Consequently, only error codes (E) are shown in the table below:

Code	Cause/meaning	Measure to eliminate error
	LEDs and 7-Segment displays are not lit	Check the + 24 V DC supply voltage and the connecting cable; replace Receiver if necessary
8	Is constantly lit/hardware fault	Replace Receiver
F xx	Internal hardware fault	Replace Receiver
E 00	Source of failure in the ambient area	Eliminate the source of the failure
E 01	Cross connection between two SSDs or between SSD and Dyn SSD	Eliminate cross connection

Code	Cause/meaning	Measure to eliminate error
E 06	Short circuit of an SSD against GND or cross connection between two SSDs or between SSD and Dyn SSD	Eliminate cross connection
E 07	Short circuit of an SSD against +24V DC or cross connection between two SSDs or between SSD and Dyn SSD	Eliminate cross connection
E 14	Power supply undervoltage	Check/replace power supply or load
E 18	Test time-limit exceeded	Test time > 150 ms; check external test
E 22	Power supply cable overvoltage	Check power supply/load

Table 7.2: Receiver diagnostics

7.3 AutoReset

After an error or a fault has been detected and displayed, an automatic restart occurs within

- about 2 seconds for the Transmitter
- about 20 seconds for the Receiver

for the device in question. If the error or fault is then no longer present, the machine or system can be started again.

8 Technical data

8.1 General data

8.1.1 Beam data

Range		Number of beams		Beam distances	
Min.	Max.	Min.	Max.	Min.	Max.
0.25 m	6 m	2	4	200	400

Table 8.1: Beam data

8.1.2 Safety relevant technical data

Type in accordance with IEC/EN 61496	Type 2
SIL in accordance with IEC 61508	SIL 2
SILCL in accordance with IEC/EN 62061	SILCL 2
Performance Level (PL) in accordance with ISO 13849-1: 2008	PL d
Category in accordance with ISO 13849	Cat. 2
Average probability of a failure to danger per hour (PFH_d) For protective field heights up to 900 mm, all resolutions For protective field heights up to 1800 mm, all resolutions For protective field heights up to 2850 mm, all resolutions	 $8.2 \times 10^{-8}\ ^1/_h$ $8.9 \times 10^{-8}\ ^1/_h$ On request
Service life (T_M)	20 years

8.1.3 General system data

Safety category	Type 2 in acc. with EN IEC 61496; SIL2 in acc. with IEC 61508
Supply voltage U_v Transmitter and Receiver	24V DC, ± 15 %, external power supply with secure mains supply isolation and equalization for a 20 ms power outage, minimum 1 A current reserve
Residual ripple of supply voltage	± 5 % within U_v limits
Transmitter power consumption	45 mA
Receiver power consumption	80 mA without external load
Shared value for external fuse in the supply line for Transmitter and Receiver	1A

Permissible wire cross-section: Transmitter Receiver	 0.14 mm² 0.14 mm²
Transmitter: Class: Wave length: Pulse duration: Pulse pause: Power:	Light-emitting diodes in acc. with EN 60825-1:1994+ A1:2002+A2001: 1 950 nm 7 µs 3.1 ms < 10µW
Synchronization	Optical between Transmitter and Receiver
Test repetition time for integrated cyclical test	300 ms
Safety class (VDE 106)	III*)
Type of protection	IP 65
Ambient temperature, operation	0 ... 50 °C
Ambient temperature, storage	-25 ... 70 °C
Relative humidity	15 ... 95 %

*) The circuits connected to the inputs and outputs must maintain the clearance distances for safe isolation in the relevant standards

Table 8.2: General system data

8.1.4 Transmitter, signal input

Test input	Input: Contact or transistor against +24V DC current load: 20 mA max.

Table 8.3: Transmitter, signal input

8.1.5 Receiver, transistor outputs

Dyn SSD/SSD, transistor outputs	**5 safety pnp transistor outputs, short , circuit-proof**		
	Minimum	**Typical**	**Maximum**
Low switching voltage (beam not interrupted) Switching current Load capacity			+ Vcc- 0.5 VDC 35 mA < 30nF
Permissible wire resistance for load	-	-	< 50 Ω*)
Permissible wire cross-section: Receiver			0.14 mm²
Permissible cable length between Receiver and load	-	-	100 m
Auxiliary pulse width	-	<40 µs	-
Auxiliary pulse spacing Channel 1 Channel 2	-	6.5 ms 6.2 ms	-
SSD restart time after beam interruption	-	100 ms	-
SSD response time Beams 1-3 Beam 4 (if available)		70 ms 30 ms	34 ms
Dyn SSD switching frequency	3.3 Hz (300 ms pulse width) ± 10%		
Dyn SSD signal delay after switching on/autoreset	3 sec		

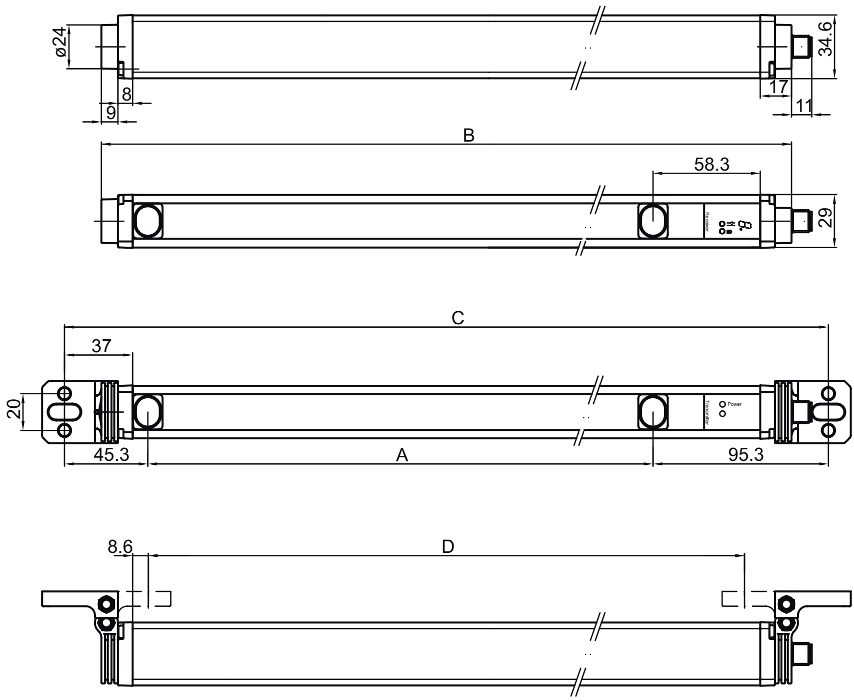
*) Note the additional restrictions caused by cable length and load current.

Table 8.4: Receiver, transistor outputs

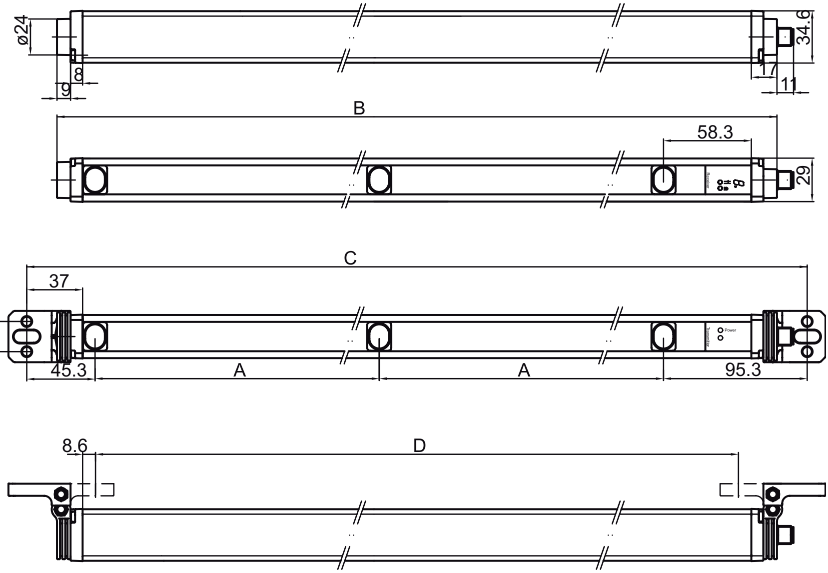
8.2 Dimensions, weights

8.2.1 Multiple Light Beam Safety Devices

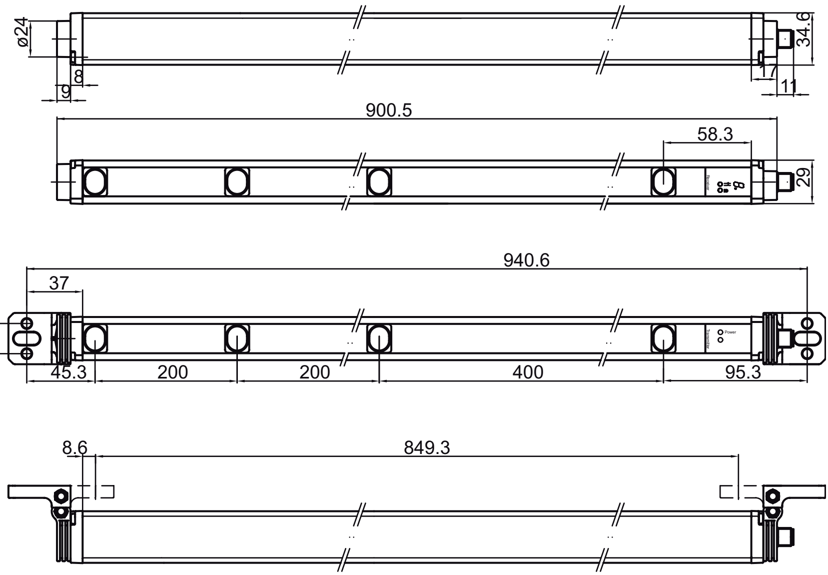
2-beam:



3-beam:

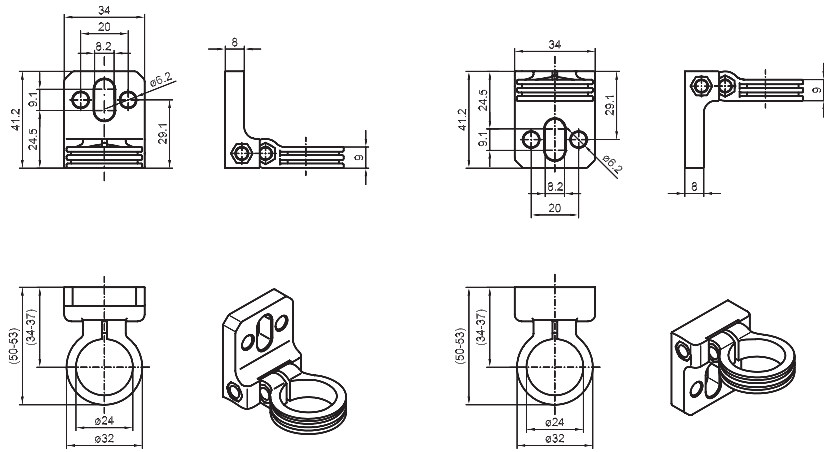

ø24
34.6
8
9
17
11
B
58.3
29
C
37
20
45.3
A
A
95.3
8.6
D

4-beam:

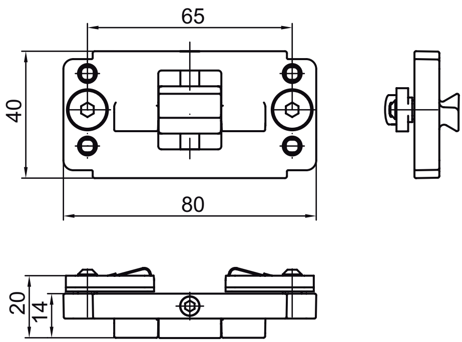

ø24
34.6
8
9
17
11
900.5
58.3
29
940.6
37
20
45.3
200
200
400
95.3
8.6
849.3

Name	Transmitter /Receiver	Number of beams	Beam distance	A	B	C	D	Weight [g]
SD2T270-3	Transmitter	3	270	270/270	640,5	680,6	589	580
SD2R270-3-5P	Receiver	3	270	270/270	640,5	680,6	589	600
SD2T375-3	Transmitter	3	375	375/375	850,5	890,6	799	760
SD2R375-3-5P	Receiver	3	375	375/375	850,5	890,6	799	780
SD2T400-3	Transmitter	3	400	400/400	900,5	940,6	849	803
SD2R400-3-5P	Receiver	3	400	400/400	900,5	940,6	849	823
SD2T330-3	Transmitter	3	330	330/330	760,5	800,6	709	683
SD2R330-3-5P	Receiver	3	330	330/330	760,5	800,6	709	703
SD2T330-2	Transmitter	2	330	330	430,5	470,6	379	400
SD2R330-2-5P	Receiver	2	330	330	430,5	470,6	379	420
SD2T200-4-400	Transmitter	4	200/400	200/ 200/400	900,5	940,6	849	803
SD2R200-4-400-5P	Receiver	4	200/400	200/ 200/400	900,5	940,6	849	823
SD2T400-2	Transmitter	2	400	400	500,5	540,6	449	460
SD2R400-2-5P	Receiver	2	400	400	500,5	540,6	449	480
SD2T200-2	Transmitter	2	200	200	300,5	340,6	249	289
SD2R200-2-5P	Receiver	2	200	200	300,5	340,6	249	309

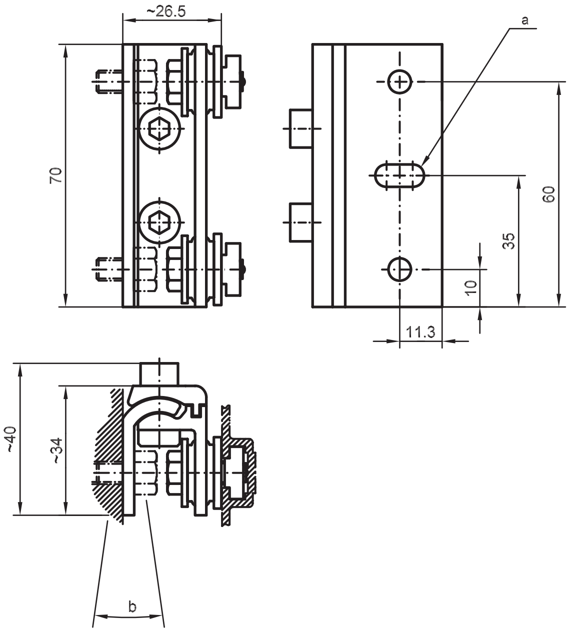
8.2.2 Mounting bracket dimensions



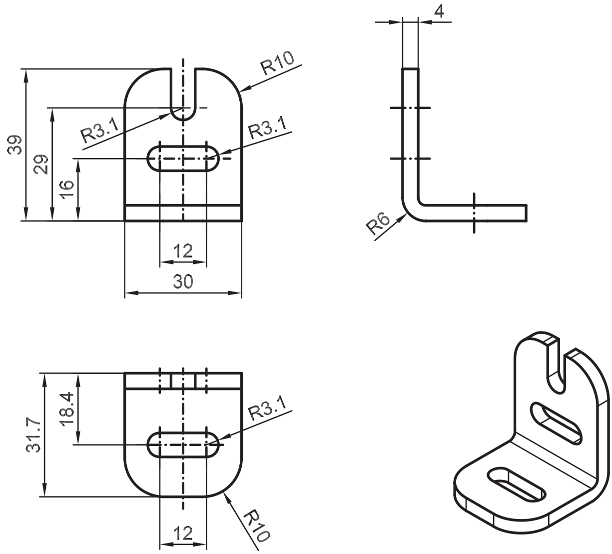
Picture 8.1:360° mounting bracket



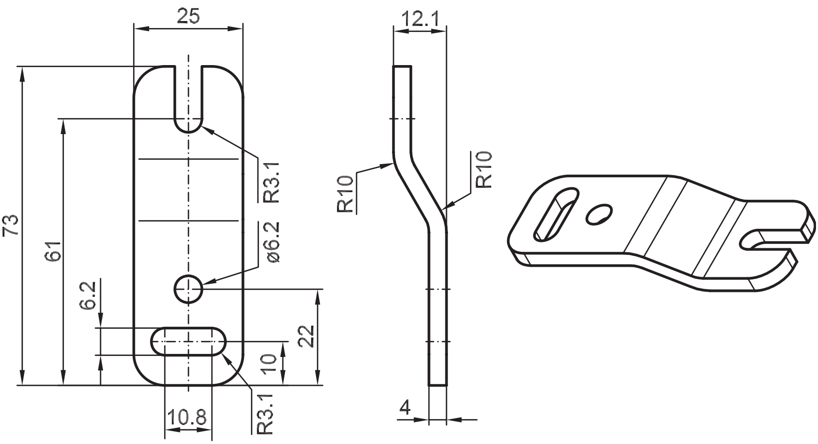
Picture 8.2:Clamping bracket for C-slot mounting



Picture 8.3:Option: Swiveling mounting bracket with shock absorber



Picture 8.4:Option: L-mounting bracket



Picture 8.5:Option: Z-mounting bracket

9 Order data

9.1 Scope of delivery

SOLID2-SF-K Multiple Light Beam Safety Devices are delivered with:

- 1SD2Txy Transmitter Unit
- 1 SD2Rxy Receiver Unit
- 4 BT 360 Mounting Brackets
- 1 connecting and operating instructions manual

9.2 Order numbers

Article no.	Name	Transmitter/ Receiver	Number of beams	Beam distance
67822253	SD2T270-3	Transmitter	3	270
67822254	SD2R270-3-5P	Receiver	3	270
67822255	SD2T375-3	Transmitter	3	375
67822256	SD2R375-3-5P	Receiver	3	375
67822257	SD2T400-3	Transmitter	3	400
67822258	SD2R400-3-5P	Receiver	3	400
67822259	SD2T330-3	Transmitter	3	330
67822260	SD2R330-3-5P	Receiver	3	330
67822261	SD2T330-2	Transmitter	2	330
67822262	SD2R330-2-5P	Receiver	2	330
67822263	SD2T200-3-400	Transmitter	3	200/400
67822264	SD2R200-3-400-5P	Receiver	3	200/400
67822265	SD2T400-2	Transmitter	2	400
67822266	SD2R400-2-5P	Receiver	2	400
67822267	SD2T200-3	Transmitter	3	200
67822268	SD2R200-3-5P	Receiver	3	200

9.3 Accessories

Article no.	Article	Name
424416	BT-P40	Clamping bracket for C-slot
429050	BT-360°	360° mounting bracket for SOLID-2
429055	BT-360°-SET	360° mounting set, consisting of 2 BT-360° mounting brackets
429051	BT-L	L-mounting bracket
429052	BT-Z	Z-mounting bracket
429056	BT-L bracket set	Mounting set
429057	BT-Z mounting set	Mounting set
560300	BT-SSD	Mounting bracket, swiveling with shock absorber
429058	BT-SSD/2er-SET	BT-SSD mounting set, consisting of 2 BT-SSD
429059	BT-SSD/4er-SET	BT-SSD mounting set, consisting of 4 BT-SSD
429049	BT-SSD-270/2er-SET	BT-SSD-270 mounting set, consisting of 2 BT-SSD-270 mounting brackets
Connecting cable, 5-pin for Transmitter		
429070	CB-M12-500S-5WF	Connecting cable shield. with M12 connection, angled, length 0.5 m
429071	CB-M12-5000S-5GF	Connecting cable shielded with M12 connection, straight, length 5 m
429072	CB-M12-5000S-5WF	Connecting cable shielded with M12 connection, angled, length 5 m
429073	CB-M12-10000S-5GF	Connecting cable shield. with M12 connection, straight, length 10 m
429074	CB-M12-10000S-5WF	Connecting cable shielded with M12 connection, angled, length 10 m
429075	CB-M12-15000S-5GF	Connecting cable shield. with M12 connection, straight, length 15 m
429076	CB-M12-15000S-5WF	Connecting cable shielded with M12 connection, angled, length 15 m
Connecting cable, 8-pin for Receiver		
429080	CB-M12-500S-8WF	Connecting cable shield. with M12 connection, angled, length 0.5 m
429081	CB-M12-5000S-8GF	Connecting cable shielded with M12 connection, straight, length 5 m
429082	CB-M12-5000S-8WF	Connecting cable shielded with M12 connection, angled, length 5 m
429083	CB-M12-10000S-8GF	Connecting cable shield. with M12 connection, straight, length 10 m
429084	CB-M12-10000S-8WF	Connecting cable shielded with M12 connection, angled, length 10 m
429085	CB-M12-15000S-8GF	Connecting cable shield. with M12 connection, straight, length 15 m
429086	CB-M12-15000S-8WF	Connecting cable shielded with M12 connection, angled, length 15 m

Table 9.1: SOLID-2SF accessories

10 Tests

10.1 Testing before startup

Testing by an experienced technician before startup must ensure that the optical protective device and any other safety components that might be present have been selected in accordance with the required specifications, especially the European Machine and Machine Utilization Directives, and that they provide the necessary protection when properly operated.

- ↳ *Use the applicable local regulations, with the help of the checklists provided in the Appendix where required, to check that the protective devices are properly installed, that they are properly wired into the control unit and that they work in all machine operating modes.*
- ↳ *The same testing requirements apply if the machine in question has not been operated for some time and after major modifications or repairs if this could affect the safety of the machine.*
- ↳ *Observe the specifications regarding the instructing of operating personnel by experienced technicians before work is started. The machine owner is responsible for instructing personnel.*

Leuze electronic offers a specialist service which performs the required testing and instruction tasks (www.leuze.de). This service must be ordered separately. The results of these tests are documented for the machine owner in accordance with ISO 9000 ff.

10.2 Regular tests

Regular tests must also be carried out in accordance with local regulations. These are designed to discover changes (e.g. in machine stopping times) or manipulations to the machine controls or protective device.

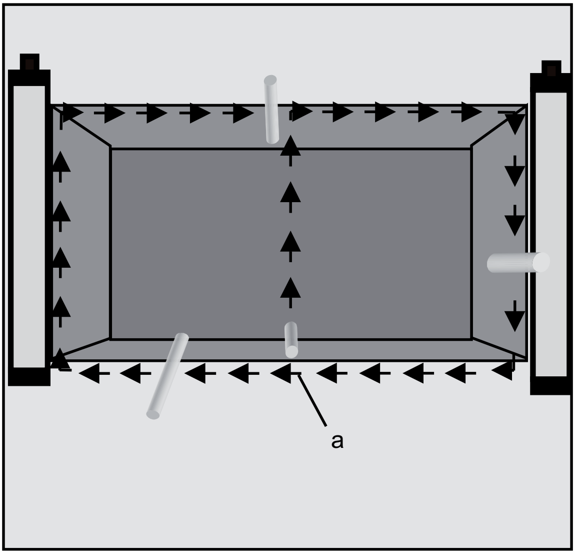
- ↳ *You must have the effectiveness of the protective device checked by an experienced technician at suitable intervals, but at least once a year.*
- ↳ *The applicable checklist in the Appendix may also be used during regular testing.*

Leuze electronic also provides a specialist service for regular tests.

10.3 Daily testing with the test rod

SOLID-2SF Multiple Light Beam Safety Devices are subjected to cyclical testing. Nevertheless it is very important to check the protective field for its effectiveness every day, so as to ensure that the protection stays effective at every point of the protective field after a parameter or tool change.

Only use an appropriate test rod with ∅ 30 mm (accessory), and NEVER use your fingers, hand or arm for checking the system!



a = Test start

Picture 10.1:Testing the protective field with the test rod

↳ *The LED1 of the Receiver must be observed during the testing procedure. If a beam is interrupted by the test rod, this LED1 must change from "green" to "red".*

10.4 Checklists

The test before startup ensures the safety-related fault-free integration of the active opto-electronic protective device (AOPD) into the machine and its control unit. The results of the test must be written down and kept with the machine documents. They can then be used as a reference during the subsequent regular tests.

10.4.1 Checklist for access guarding

Note!
This checklist is intended as a help tool. It supports but does not replace for the test before startup or the regular tests by an expert.

Only with general applications, i.e. in cases in which SOLID-2SF is not used for guarding the sheet delivery of a sheet-fed printing machine: Has the safety distance been calculated according to the applicable formula and specifications and is this minimum distance observed between the protective field and the point of operation?	Yes No
Are the required beam heights of the lowest and the highest beam complied with?	Yes No
If access to the point of operation is possible through routes other than the protective field of the AOPD, are the other access options suitably secured by other means?	Yes No
Is the external condition of the protective device and the control devices fault-free?	Yes No
Are Transmitter and Receiver fixed against displacement/turning after the alignment?	Yes No
Are all connectors and connecting cables in fault-free conditions?	Yes No
Is the start/restart button for resetting the AOPD positioned outside the danger zone in line with specifications so that it cannot be reached from the danger zone? Is there a complete overview of the danger area from the start/restart button position?	Yes No
Are the safety-related switching outputs (OSSDs) linked into the downstream machine control unit in accordance with the required safetycategory?	Yes No
Does the actual integration of the AOPD into the machine control unit comply with the circuit diagrams?	Yes No
Does the AOPD respond correctly when any beam* is interrupted and does the system lock (inevitable with activated start/restart interlock as only the access not the presence of a person in the danger zone is detected)?	Yes No
Does the dangerous movement stop immediately if the supply voltage of the AOPD is interrupted and is the start/restart button needed to start the machine again after the supply voltage returns?	Yes No

11 EC Declaration of Conformity

Leuze electronic

the sensor people

EG-KONFORMITÄTS-ERKLÄRUNG	EC DECLARATION OF CONFORMITY	DECLARATION CE DE CONFORMITE
Der Hersteller	The Manufacturer	Le constructeur
	Leuze electronic GmbH + Co. KG In der Braike 1, PO Box 1111 73277 Owen, Germany	
erklärt, dass die nachfolgend aufgeführten Produkte den einschlägigen Anforderungen der genannten EG-Richtlinien und Normen entsprechen.	declares that the following listed products fulfil the relevant provisions of the mentioned EC Directives and standards.	déclare que les produits identifiés suivants sont conformes aux directives CE et normes mentionnées.
Produktbeschreibung:	Description of product:	Description de produit:
Sicherheits- Lichtvorhang Mehrstrahl-Sicherheits-Lichtschranke, Berührungslos wirkende Schutzeinrichtung, Sicherheitsbauteil nach 2006/42/EG SOLID-2SF Seriennummer siehe Typschild	**Safety Light Curtain Multiple Light Beam Safety Device, Active opto-electronic protective device, safety component in acc. with 2006/42/EC annex IV SOLID-2SF Part No. see name plates**	**Barrière immatérielle de sécurité Barrage immatériel multifaisceau de sécurité, Èquipement de protection électro-sensible, Èlément de sécurité selon 2006/42/CE annexe IV SOLID-2SF Art. n° voir plaques signalétiques**
Angewandte EG-Richtlinie(n):	Applied EC Directive(s):	Directive(s) CE appliquées:
2006/42/EG 2004/108/EG	**2006/42/EC 2004/108/EC**	**2006/42/CE 2004/108/CE**
Angewandte Normen:	Applied standards:	Normes appliquées:

**EN 61496-1:2009; IEC 61496-2:2006 ; IEC 61508:1998 Part 1,3,4 (SIL 2); IEC 61508-2:2000 (SIL2)
EN 50178:1997; EN ISO 13849-1:2008 (Kat.2, PLd)**

Benannte Stelle / Baumusterprüfbescheinigung:	Notified Body / Certificate of Type Examination:	Organisme notifié / Attestation d'examen CE de type:
TÜV-SÜD PRODUCT SERVICE GmbH Zertifizierungsstelle Ridlerstraße 65 D-80339 München	/	**Z10 09 12 22795 085**
Bevollmächtigter für die Zusammenstellung der technischen Unterlagen:	Authorized person to compile the technical file:	Personne autorisée à constituer le dossier technique:

**Robert Sammer; Leuze electronic GmbH + Co. KG, business unit safety systems
Liebigstr. 4; 82256 Fuerstenfeldbruck; Germany**

Owen, 22.4.10

Datum / Date / Date

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Persönlich haftende Gesellschafterin Leuze electronic Geschäftsführungs-GmbH, Sitz Owen, Registergericht Stuttgart, HRB 230550
Geschäftsführer: Dr. Harald Grübel (Vorsitzender), Karsten Just
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Only our current Terms and Conditions of Sale and Delivery shall apply

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http://www.leuze.com/solid