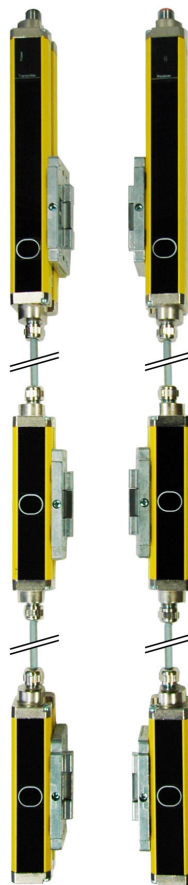


Translation of original operating instructions

## SOLID-2SF-M

Optoelectronic delivery guarding for sheet fed offset printing machines

CONNECTING AND OPERATING INSTRUCTIONS



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# 1 General information

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 c in acc. with EN 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 during commissioning or diagnosis.

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

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

## 1.1 Symbols and terms

### Symbols used





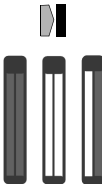

	Warning sign – This symbol indicates possible dangers. Please pay especially close attention to these instructions!
	Sign indicating important information.
	A note, which also refers to a course of action, provides information about special attributes or describes set-up procedures.
	Symbols for SOLID-2SF 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

*Terminology*

Start/restart interlock	Start/restart interlock
Start/restart interlock	Prevents automatic start after switching on the supply voltage or after interrupting the protective field
Response time of the AOPD	Time between interruption of the active protective field of the AOPD and the actual switching off of the OSSDs.
AOPD	Active Optoelectronic Protective Device
AutoReset	When a fault message 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.
DoubleScan	Two scans are made: Beams must be interrupted in two consecutive scans, before the receiver switches off.
SSD1,... ,SSD4, Dyn. SSD	Safety-related switching outputs (transistor)
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.
Contactormonitoring (EDM)	The contactormonitoring (External Device Monitoring) monitors the normally closed contacts of downstream positive-guided relays and contactors or valves
FS	Factory setting

Table 1.2: Terms


## 2 Safety

Before using the safety sensor, a risk assessment must be performed according to valid standards (e.g. EN ISO 14121, EN ISO 12100-1, EN ISO 13849-1, IEC 61508, EN 62061). The result of the risk assessment determines the required safety level of the safety sensor (see see table 2.1). For mounting, operating and testing, document "SOLID-2SF-M, Optoelectronic delivery guarding 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 and handed to the affected personnel.


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

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

- Machinery directive 2006/42/EC
- Low voltage directive 2014/35/EU
- EMC directive 2014/30/EU
- OSHA 1910 sub-part 0
- Safety regulations
- Accident-prevention regulations and safety rules
- Ordinance on Industrial Safety and Health and employment protection act
- Device Safety Act

NOTE	
	Local agencies can also provide safety-relevant information (e.g. occupational safety and health inspectorate, employer's liability insurance association, labor inspectorate, OSHA).

### 2.1 Intended use and foreseeable misuse

⚠ WARNING!	
	<p><b>A running machine can cause severe injuries!</b></p> <p>☞ Make certain that, during all conversions, maintenance work and inspections, the system is securely shut down and protected against being restarted.</p>

**2.2 Intended use**

The safety sensor may 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 safety at work, 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-M optoelectronic delivery guarding for sheet-fed printing machines.

Type in accordance with IEC/EN 61496	Type 2
SIL in accordance with IEC 61508	SIL 2
Performance Level (PL) acc. to EN ISO 13849-1: 2015	PL c
Category in accordance with EN 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	$8.2 \times 10^{-8} \text{ 1/h}$ $8.9 \times 10^{-8} \text{ 1/h}$ On request
Mission time ( $T_M$ )	20 years

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

- The safety sensor protects persons at access points or at points of operation of machines and systems.
- When mounted vertically at entry points to hazard locations, the safety sensor detects the human body.
- The safety sensor detects persons only when they enter the danger zone but cannot tell whether there are any persons inside 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 wear parts do not extend the mission time.

**2.2.1 Foreseeable misuse**

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

- Danger posed by ejected objects or the spraying of hot or hazardous liquids from within the danger zone
- Applications in explosive or easily flammable atmospheres

**2.3 Competent personnel**

Prerequisites for competent personnel:

- They have a suitable technical education.
- They know the rules and regulations for labor protection, 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 operator must ensure that the machine and the 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 commissioning of the machine

The operator of the machine is responsible for:

- Instructing the operating personnel
- Maintaining the safe operation of the machine
- Adhering to all regulations and directives for labor protection 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 optoelectronic protective device

##### Mode of operation

SOLID-2SF consists of a transmitter and a receiver. Beginning with the first beam (= synchronization beam) after the display field, the transmitter pulses beam for beam in rapid sequence. Synchronization between transmitter and receiver occurs optically.

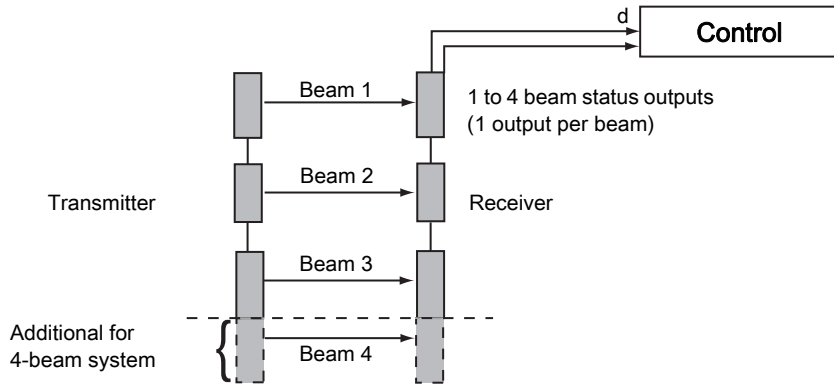


Figure 3.1: Functional principle of the optoelectronic protective device

The receiver detects the specially coded pulse packages of the transmitted beams and evaluates the corresponding receiving elements in sequence in the same rhythm. In this way, a protective field is created in the area between the transmitter and receiver. The height of the area is determined by the geometric dimensions of the protective device; its width is determined by the distance selected between transmitter and receiver within the permissible operating 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 dynamic 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. 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 initial commissioning!

#### 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 lights from passing high-lift trucks, thereby do not influence 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 interference 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.



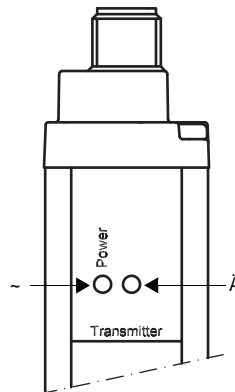
Figure 3.2: Transmission channel selection (AOPD = Active Optoelectronic Protective Device)

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. Further details can be found in see chapter 6.

## 4 Display elements

### 4.1 Operation indicators on the transmitter

When the transmitter's green LED1 is lit, this indicates that the power supply is available.



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

Figure 4.1: LED operation indicators, transmitter

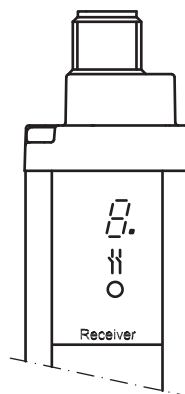
Display of the current state of the transmitter:

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

Table 4.1: LED operation indicators, transmitter

### 4.2 Operation indicators on the receiver

LED1 and the 7-segment display signal the operating states of the receiver.



- a LED1 = red/green

Figure 4.2: Operation indicators, receiver

### 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	Display of the transmission channel 1 or 2

Table 4.2: 7-segment display, receiver, permanently

7-segment display	Meaning
	Temporary event displays, 1 s per display
E xx	Display of locking status "Error", which can be rectified by the user; E xx = Error code (see see chapter 9). The display shows E, 3 (1st position) and 0 (2nd position) alternating, and then repeats this sequence
F xx.	Display of locking status "device error" and internal error code. Receiver must be replaced
1 or 2 flashing	Flashing transmission channel number -> weak signal display, device not optimally aligned or soiled

Table 4.3: 7-segment display, receiver, temporary

### 4.2.2 LED indicators

#### LED indicators for the receiver

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: LED indicators at the receiver

## 5 Mounting

### 5.1 Arrangement 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	Arrangement of the AOPD for the access level(s)		
	Light beam 1 <sup>a</sup>	Light beam 2 <sup>a</sup>	Light beam 3 <sup>a</sup>
$h \leq 1200$ mm	300 mm	N/A <sup>d</sup>	400 mm below h (h-400)
$1200$ mm < $h \leq 1500$ mm	300 mm	Centered between light beams 1 and 3	400 mm below h (h-400)
$h > 1500$ mm	300 mm	700 mm	1100 mm

<sup>a</sup> Position measured from access level or from fixed or swiveling platform; because of structural tolerances where installed, the permissible tolerance for the position is  $\pm 35$  mm.  
<sup>b</sup> Light beam between light beams 1 and 3, if distance between light beam 1 and 3 > 500 mm  
<sup>c</sup> Maximum 1100 mm high  
<sup>d</sup> Some blanking functions require 3 light beams for guarding the access side. Where these blanking functions are to be used, with access heights over 1200 mm, a third light beam must be provided that is positioned centered between the top and the bottom light beam.

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)

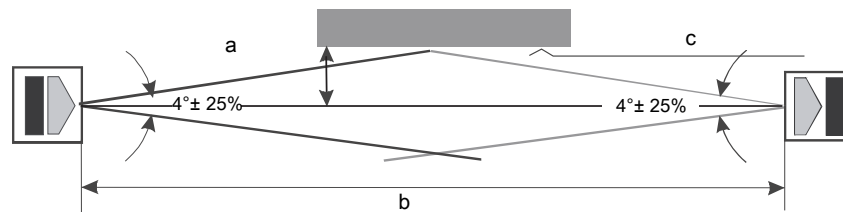
K: Approach speed 1600 mm/s

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

C: Additional distance 850 mm

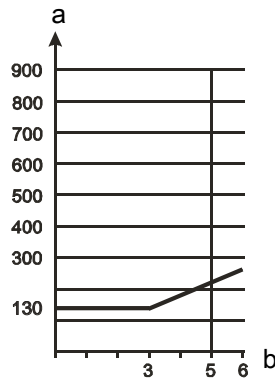
### 5.3 Minimum distance to reflective surfaces

Reflective surfaces near optoelectronic 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" to the protective field. The minimum distance "a" depends on the distance "b" between transmitter and receiver.



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

Figure 5.1: Minimum distances to reflective surfaces



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

Figure 5.2: Minimum distances to reflective surfaces as a function of the protective field width

## 5.4 Mechanical fastening

What should generally be taken into consideration when mounting?

- 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 connections 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. At close range, securing against swiveling is particularly important for safety reasons.
- The safety distance between the protective field and the danger zone must be observed.
- Make sure that it is only possible to reach or go into the danger zone through the protective field. Additional access points must be secured separately (e.g., by hard guards, additional safety light curtains or doors with interlock devices).

## 5.5 Types of fastening

### 5.5.1 Standard fastening

Straddle brackets (for transmitter and receiver each) are included in delivery.

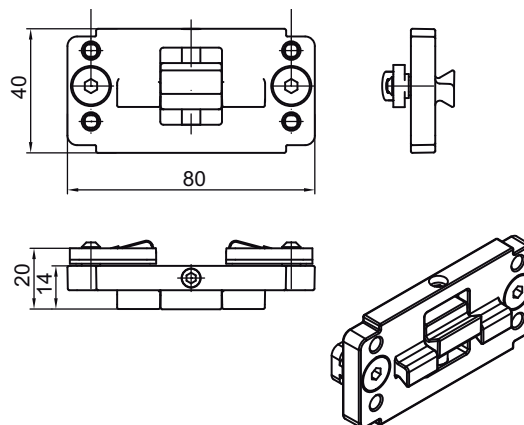


Figure 5.3: Clamp bracket for C-groove mounting

### 5.5.2 Fastening via swiveling mounting brackets

Swiveling mounting brackets with shock absorbers can be ordered as an option. They are not included in the scope of delivery. The swivel range is  $\pm 8^\circ$ .

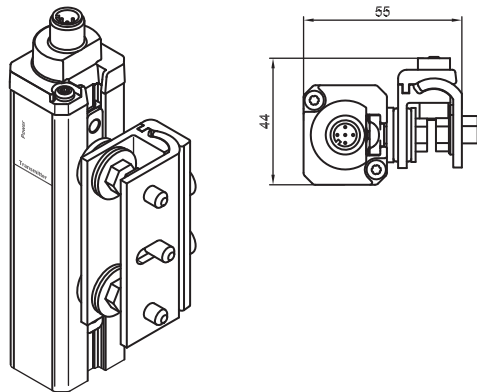


Figure 5.4: Swiveling bracket with shock absorber

### 5.5.3 Lateral fastening

Optionally, mounting is possible with mounting brackets and sliding blocks on the lateral groove. They are not included in the scope of delivery.

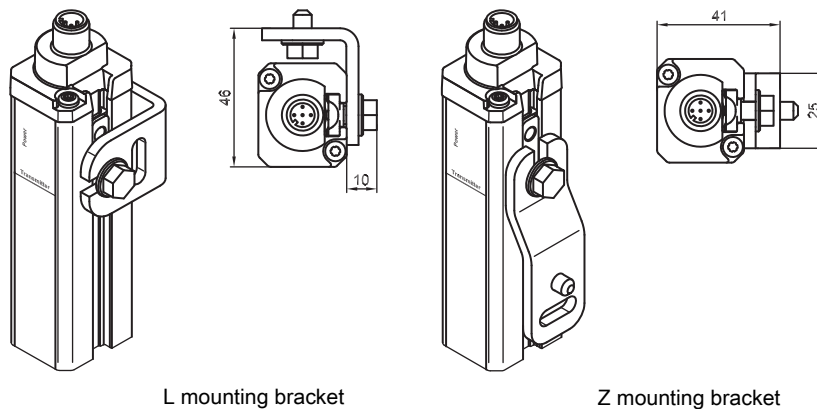


Figure 5.5: Mounting examples, L mounting bracket and Z mounting bracket



## 6 Electrical connection

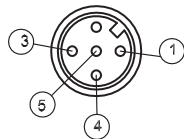


- The electrical connection must be performed by competent personnel only. Knowledge of all safety instructions in these connecting and operating instructions is part of this competence.
- The 24 V DC ±15% external supply voltage must guarantee safe insulation from the mains voltage and, for devices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

### 6.1 M12 connection

Transmitter and receiver are equipped with M12 connector plugs. The transmitter is equipped with a 5-pin connector and the receiver with an 8-pin connector.

#### 6.1.1 Transmitter



- 1 Brown
- 3 Blue
- 4 Black
- 5 Gray

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

Pin	Color	Assignment	Inputs/outputs	
1	Brown	⇐	Supply voltage	+24V DC for UK1 or 0V for UK2
2	White			nc
3	Blue	⇐	Supply voltage	0V for ÜK1 or +24V DC for ÜK2
4	Black	⇐	Test in	Test input Connected to +24 V DC → internal test activated Connected to 0 V or free → external test activated
5	Gray/connector housing	⇐	Shield	Functional earth


Table 6.1: Pin assignment transmitter

The optical transmission channel can be selected by reversing the polarity of Pin1 and Pin3. If +24 V DC is applied at Pin1 and 0 V at Pin3, transmission channel 1 is selected. If 0 V is applied at Pin1 and +24 V DC at Pin3, transmission channel 2 is selected.

Be sure to select the same transmission channel for both, transmitter and receiver.

<b>⚠ ATTENTION!</b>	
	For optimum shielding, connection cables where the shield is routed on the knurled nut of the housing connector must be used (suitable cables are listed under accessories in see chapter 9.3).

6.1.2 Testing

⚠ ATTENTION!	
	In fault-free operation, the cyclical internal testing delivers a signal on the Dyn. SSD alternating between low and high every 300 ms. Detected errors are signaled by a static signal.

The downstream control 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 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 used. For this purpose, the transmitter's test input must be permanently connected to +24 V DC.


**Internal cyclical testing**

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

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

**External test signal**

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

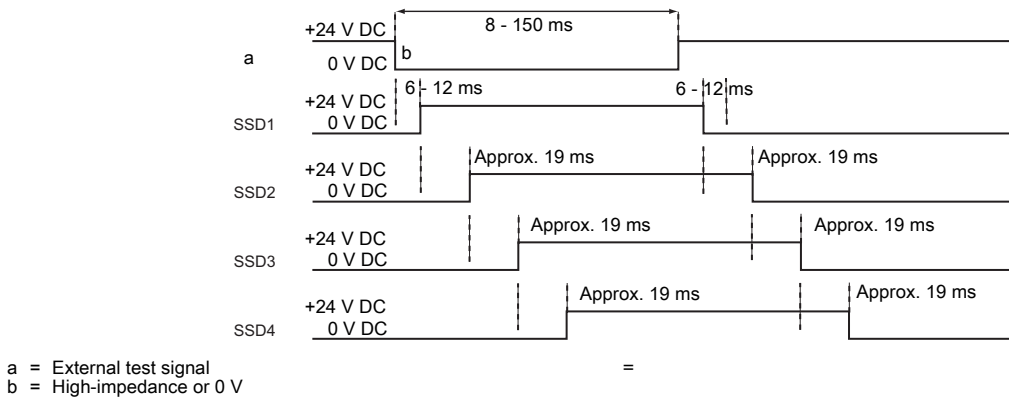


Figure 6.2: SOLID-2SF external testing

6.1.3 Receiver

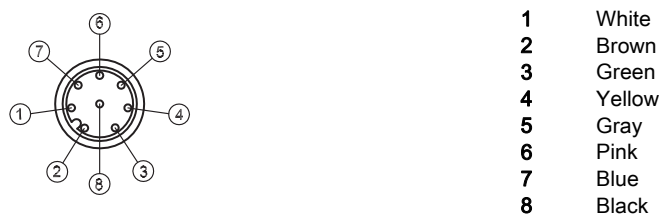


Figure 6.3: 8-pin SD-2R (view of the pins)

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	Gray	⇒	Output	SSD1, transistor switching output
6	Pink	⇒	Output	SSD2, transistor switching output
7	Blue	⇐	Supply voltage	0 V for UK 1 or +24 V DC for UK 2
8	Black/connector housing	↔	Shield	Functional earth


Table 6.2: Pin assignment receiver

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

**Selection of the transmission channel**


The optical transmission channel can be selected by reversing the polarity of Pin2 and Pin7.

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

NOTE	
	Be sure to select the same transmission channel for both, transmitter and receiver.

For optimum shielding, connection cables where the shield is routed on the housing connector must be used.

**SSD and Dyn SSD safety outputs**

⚠ ATTENTION!	
	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. If the Dyn SSD signal remains static, the power-driven machinery must be switched off. Correct connection must be checked with the machine's initial commissioning!

## 7 Error diagnostics

The following information is used for rapid troubleshooting in case of failure.

### 7.1 What to do in case of failure?

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

### 7.2 Diagnosis

Operating faults often have simple causes that you can remedy yourself. The following tables provide detailed assistance.

#### 7.2.1 Transmitter diagnosis

LED indicator	Measure for troubleshooting
LED1 does not illuminate	Check supply voltage and connection cable, replace transmitter if necessary
LED1 illuminates red continuously	Check the test input, hardware error, replace transmitter

Table 7.1: Transmitter diagnosis

#### 7.2.2 Receiver diagnosis

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

Code	Cause/meaning	Measure for troubleshooting
	LEDs and 7-segment display do not illuminate	Check the 24V DC supply voltage and the connection cable; replace receiver if necessary
8	Illuminates continuously/hardware error	Replace receiver
F xx	Internal hardware error	Replace receiver
E 00	Source of interference in the ambient area	Eliminate the source of interference
E 01	Cross-circuit between two SSDs or between SSD and Dyn SSD	Rectify short-/cross-circuit
E 06	Short-circuit of an SSD against GND or cross-circuit between two SSDs or between SSD and Dyn SSD	Rectify short-/cross-circuit
E 07	Short-circuit of an SSD against +24V DC or cross-circuit between two SSDs or between SSD and Dyn SSD	Rectify short-/cross-circuit
E 14	Undervoltage at the supply line	Check/replace power supply unit or load
E 18	Test time limit exceeded	Test time > 150 ms; check external testing
E 22	Overvoltage at the supply line	Check power supply unit/load

Table 7.2: Receiver diagnosis

### 7.3 AutoReset

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

- approx. 2 seconds for the transmitter
- approx. 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 specifications

#### 8.1.1 Beam data

Operating range		Number of beams		Beam spacings	
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
Performance Level (PL) acc. to EN ISO 13849-1: 2015	PL c
Category in accordance with EN ISO 13849	Cat. 2
Average probability of a failure to danger per hour (PFH <sub>d</sub> ) 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 x 10 <sup>-8</sup> 1/h 8.9 x 10 <sup>-8</sup> 1/h On request
Mission time (T <sub>M</sub> )	20 years

#### 8.1.3 General system data

Supply voltage U <sub>v</sub> , transmitter and receiver	24V DC, ± 15 %, external power supply with safe mains separation and compensation at 20 ms voltage dip required, at least 1 A current reserve
Residual ripple of the supply voltage	± 5 % within the limits of U <sub>v</sub>
Current consumption - transmitter	45 mA
Current consumption - receiver	80 mA without external load
Common value for ext. fuse in the supply line for transmitter and receiver	1A
Permissible conductor cross section: transmitter receiver	0.14 mm <sup>2</sup> 0.14 mm <sup>2</sup>
Transmitter: Wavelength: Pulse duration: Pulse pause: Power:	LED; exempt group in acc. with IEC/EN 62471 950 nm 7 μs 3.1 ms < 10μW
Synchronization	Optical between transmitter and receiver
Test repeat time for integrated cyclical test	300 ms
Protection class (VDE 106)	III <sup>*)</sup>
Degree of protection	IP 65

Ambient temperature, operation	0 ... 50 °C
Ambient temperature, storage	-25 ... 70 °C
Relative humidity, non-condensing	15 ... 95%
Shock resistance	10g, 16ms (IEC 60068-2-27)
Vibration resistance	5g, 10-55Hz, amplitude 0.35 mm (IEC 60068-2-6)

\*) The circuits connected to inputs and outputs must comply with the air and creepage gaps stipulated for safe isolation in the relevant standards.

Table 8.2: General system data

### 8.1.4 Signal input transmitter

Test input	Input: Contact or transistor against +24 V DC current load : 20 mA max.
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Table 8.3: Signal input transmitter

### 8.1.5 Transistor outputs, receiver

Dyn SSD/SSD transistor outputs	5 npn safety-related transistor outputs, short-circuit proof		
	Minimum	Typical	Maximum
Switching voltage low (beam not interrupted) Switching current Load capacity			GND+ 15 VDC 35 mA < 30nF
Permissible wire resistance for load	-	-	< 50 Ω*)
Permissible conductor cross section: receiver			0.14 mm <sup>2</sup>
Permissible cable length between receiver and load	-	-	100 m
Help impulse width	-	<40 µs	-
Help pulse distance Channel 1 Channel 2	-	6.5ms 6.2ms	-
SSD restart delay time after beam interruption	-	100 ms	-
SSD response time Beams 1-3 Beam 4 (if available)		130 ms 30 ms	34 ms
Dyn SSD switching frequency	3.3 Hz (300 ms pulse width) +/-10%		
Dyn SSD signal delay after switch-on/ autoreset	3 sec		

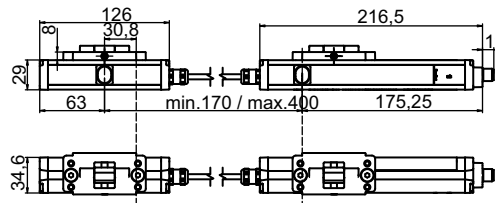
\*) Note the additional restrictions due to cable length and load current

Table 8.4: Transistor outputs, receiver

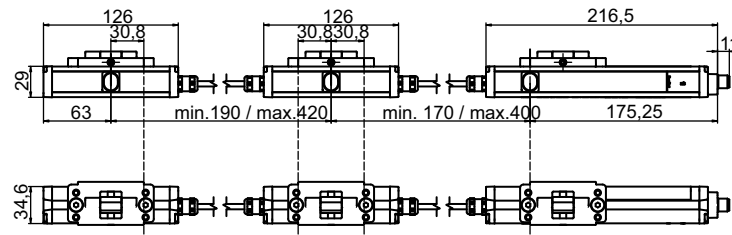
## 8.2 Dimensions, weights

### 8.2.1 Multiple light beam safety devices

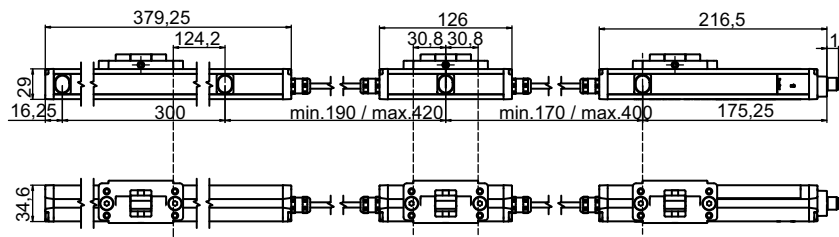
2-beam:



3-beam:



4-beam:





8.2.2 Dimensions mounting bracket

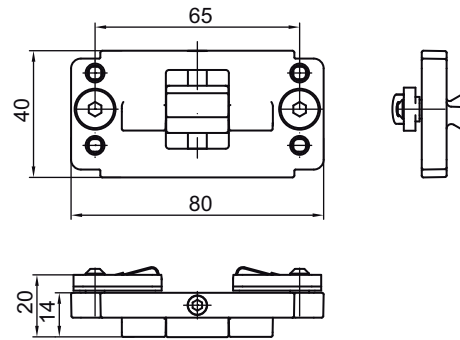


Figure 8.1: Clamp bracket for C-groove mounting

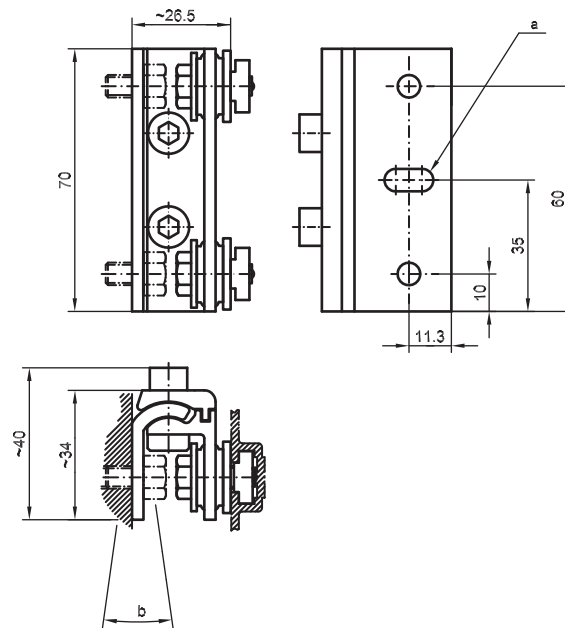


Figure 8.2: Option: swiveling mounting bracket with shock absorber

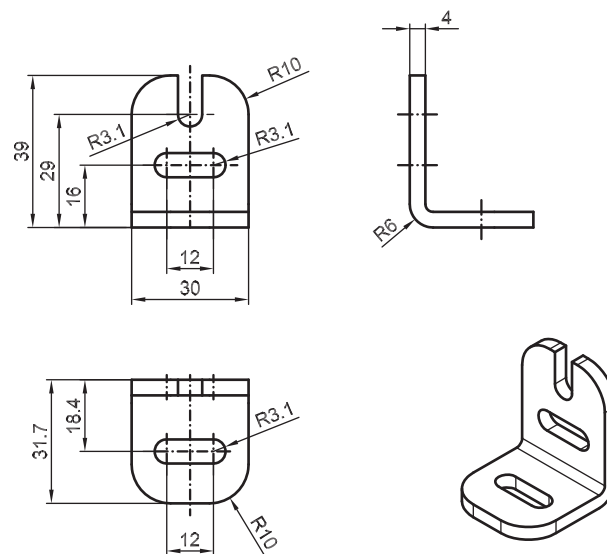


Figure 8.3: Option: L mounting bracket

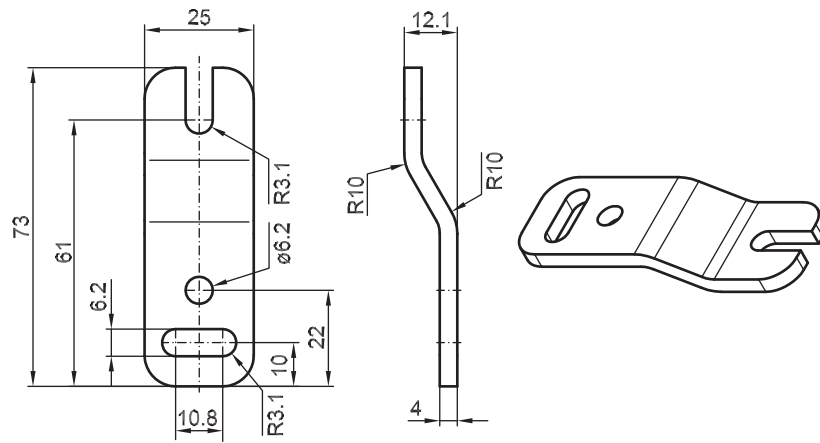


Figure 8.4: Option: Z mounting bracket

## 9 Ordering data

### 9.1 Scope of delivery

SOLID2-SF-M multiple light beam safety devices are delivered with:

- 1x SD2Txy transmitter unit
- 1x SD2Rxy receiver unit
- 4-6 BT-P40 clamping brackets (depending on number of beams)
- 1x connecting and operating instructions

### 9.2 Order nos.

Part no.	Designation	Transmitter/receiver	Number of beams
67822280	SD2T-2	Transmitter	2
67822281	SD2R-2-5N	Receiver	2
67822282	SD2T-3	Transmitter	3
67822283	SD2R-3-5N	Receiver	3
67822284	SD2T-4	Transmitter	4
67822285	SD2R-4-5N	Receiver	4

### 9.3 Accessories

Part no.	Article	Designation
424416	BT-P40	Clamp bracket for C-groove
429050	BT-360°	360° mounting bracket for SOLID-2
429055	BT-360°-SET	360° mounting set, consisting of 2x BT-360° mounting brackets
429051	BT-L	L mounting bracket
429052	BT-Z	Z mounting bracket
429056	BT-L mounting set	Mounting set
429057	BT-Z mounting set	Mounting set
560300	BT-SSD	Swiveling mounting bracket with shock absorber
429058	BT-SSD/SET of 2	BT-SSD mounting bracket set, consisting of 2x BT-SSD
429059	BT-SSD/SET of 4	BT-SSD mounting bracket set, consisting of 4x BT-SSD
429049	BT-SSD-270/SET of 2	BT-SSD-270 mounting set, consisting of 2x BT-SSD-270 mounting brackets

Part no.	Article	Designation
<b>Connection cable, 5-pin for transmitters</b>		
429070	CB-M12-500S-5WF	Connection cable, shielded, with M12 connection, angled, length 0.5 m
429071	CB-M12-5000S-5GF	Connection cable, shielded, with M12 connection, straight, length 5 m
429072	CB-M12-5000S-5WF	Connection cable, shielded, with M12 connection, angled, length 5 m
429073	CB-M12-10000S-5GF	Connection cable, shielded, with M12 connection, straight, length 10 m
429074	CB-M12-10000S-5WF	Connection cable, shielded, with M12 connection, angled, length 10 m
429075	CB-M12-15000S-5GF	Connection cable, shielded, with M12 connection, straight, length 15 m
429076	CB-M12-15000S-5WF	Connection cable, shielded, with M12 connection, angled, length 15 m
<b>Connection cable, 8-pin for receivers</b>		
429080	CB-M12-500S-8WF	Connection cable, shielded, with M12 connection, angled, length 0.5 m
429081	CB-M12-5000S-8GF	Connection cable, shielded, with M12 connection, straight, length 5 m
429082	CB-M12-5000S-8WF	Connection cable, shielded, with M12 connection, angled, length 5 m
429083	CB-M12-10000S-8GF	Connection cable, shielded, with M12 connection, straight, length 10 m
429084	CB-M12-10000S-8WF	Connection cable, shielded, with M12 connection, angled, length 10 m
429085	CB-M12-15000S-8GF	Connection cable, shielded, with M12 connection, straight, length 15 m
429086	CB-M12-15000S-8WF	Connection cable, shielded, with M12 connection, angled, length 15 m

Table 9.1: Accessories SOLID-2SF

## 10 Tests

### 10.1 Tests to be performed prior to the initial commissioning

Testing by qualified persons prior to initial commissioning should ensure that the optoelectronic protective device and any other safety components that might be present have been selected in accordance with the required local specifications, particularly the machine and work-equipment directive (moreover, in Germany the Ordinance on Industrial Safety and Health), 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 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 qualified persons before work is started. Trainings are the responsibility of the operating company.

Leuze offers a specialist service which performs the required testing and instruction tasks ([www.leuze.com](http://www.leuze.com)). This service must be ordered separately. The results of these tests are documented for the operating company 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 or protective device.

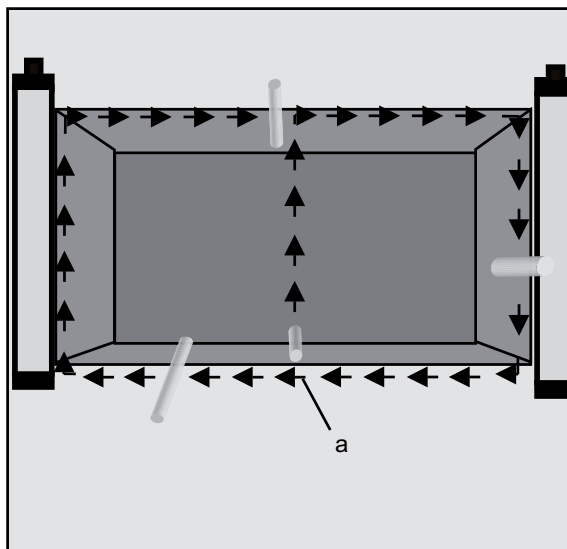
- ↪ You must have the effectiveness of the protective device checked by an qualified personnel at suitable intervals, but at least once a year.
- ↪ The applicable checklist in the Appendix may also be used during regular testing.

Leuze 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 all points of the protective field, e.g. even after a parameter or tool change.

Only use an appropriate test rod with  $\varnothing$  30 mm (accessory), and NEVER use your fingers, hand or arm for testing!



a = Start of test


Figure 10.1: Testing with the test rod

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

## 10.4 Checklists

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

### 10.4.1 Checklist for access guarding


NOTE	
	This checklist is intended as a help tool. It supports but does not replace the test before initial commissioning or regular testing by qualified persons.

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:	Yes	No
Was the safety distance calculated according to the applicable formula and specifications and is this minimum distance observed between the protective field and the point of operation?		
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 safety components?	Yes	No
Is the external condition of the protective device and command devices fault-free?	Yes	No
Are transmitter and receiver fixed against displacement/turning after alignment?	Yes	No
Are all connectors and connection cables in fault-free condition?	Yes	No
Is the start/restart button for resetting the AOPD mounted outside of the danger zone in accordance with specifications in such a way that it cannot be reached from within the danger zone? Can the entire danger zone be seen from the place at which the start/restart button is installed?	Yes	No
Are the safety-related switching outputs (OSSDs) integrated in the downstream machine control acc. to the required safety category?	Yes	No
Does the actual integration of the AOPD into the machine control 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
When the AOPD is separated from its supply voltage, does the dangerous movement stop, and, after the supply voltage has been restored, is it necessary to actuate the start/restart button to reset the machine?	Yes	No

## 11 EU Declaration of Conformity

The device meets the basic requirements and the other relevant provisions of the machinery directive 2006/42/EC.

The manufacturer of the product, Leuze electronic GmbH & Co KG in D-73277 Owen, possesses a certified quality assurance system in accordance with ISO 9001.

NOTE	
	<p>You can download the translation of original operating instructions and the EC declaration of conformity from our website.</p> <ul style="list-style-type: none"><li>↳ Call up the Leuze website: <i>www.leuze.com</i></li><li>↳ Enter the type designation or part number of the device as the search term. The part number can be found on the name plate of the device under the "Part No." entry.</li><li>↳ The documents can be found on the product page for the device under the <i>Downloads</i> tab.</li></ul>