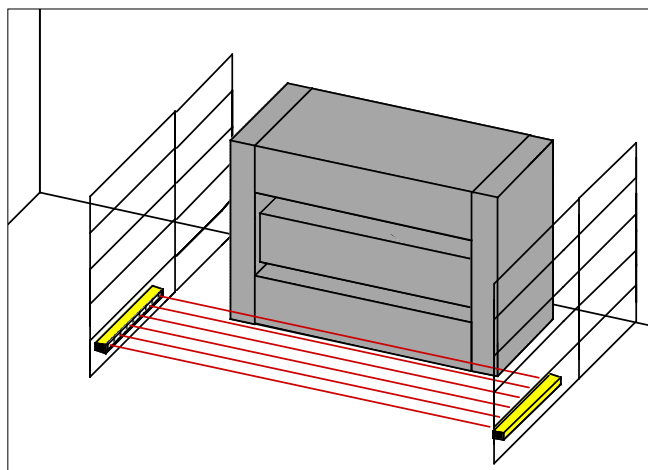
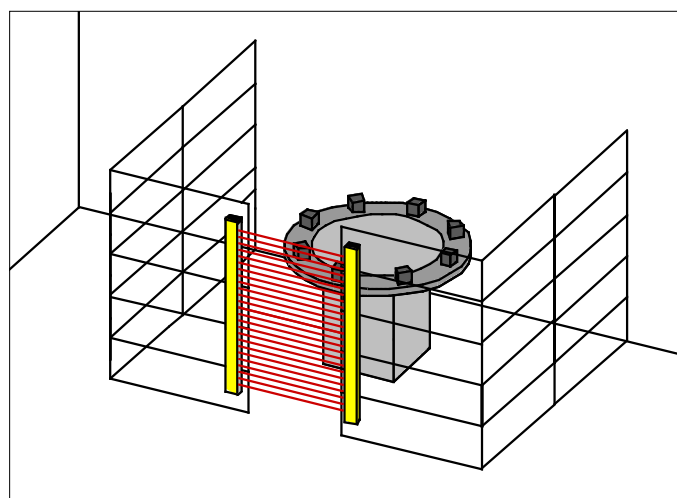


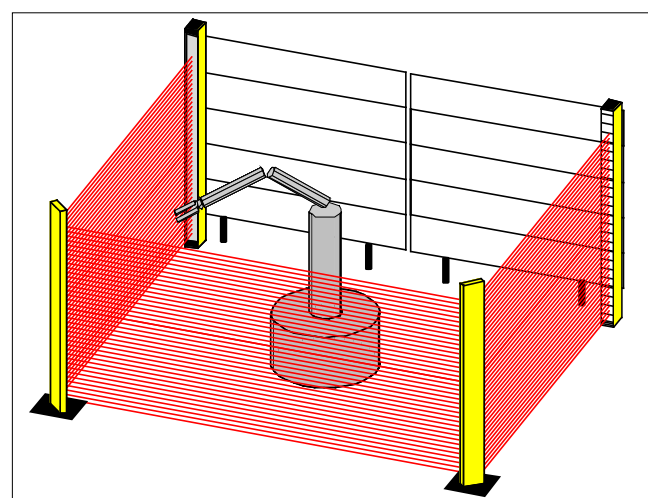
Barring from hazardous areas



Cordoning off areas



Restricting access to areas



Restricting access to areas via tilted mirrors



DIN EN ISO 9001
Reg.Nr. 96007



Optional

CONTENTS:

Safety Instructions

Application Notes

Installation

Electric Connection

Commissioning

Specifications




For over 40 years,

we have proved to be specialists in the
area of optoelectronics.

Our experience is your gain.

Tell us your problems, and we will be
pleased to advise you

Section	Contents	Page
1	Safety Instructions 	5
2	Prerequisites for the use of safety light barriers Standards and application guidelines	6
3	System description and application areas	7
3.1	Features	7
3.2	Application areas	7
3.3	Structure	8
3.4	Function	8
3.5	LED displays	8
3.6	Operating modes (with/without restart interlock, with/without contactor check, equivalent/antivalent outputs)	9
4	Installation	10
4.1	Safe distances from hazardous areas	10
4.1.1	- Vertical protection for hazardous areas	10
4.1.2	- Horizontal protection for hazardous areas	11
4.2	Construction requirements	12
4.2.1	- Installation without additional screening	12
4.2.2	- Protection against reaching over or under barriers	12
4.2.3	- Protection against avoiding barriers through cascading or additional screening	12
4.2.4	- Distance from reflective surfaces	13
4.2.5	- Arrangement of two safety light barriers	13
4.3	Attachment of transmitters and receivers - Mounting and adjustment	14
4.4	Option: Multi-sided screening through tilted mirrors	15
4.5	Option: Assembly columns	15
5	Electric connection	17
5.1	Integrated connector plug	17
5.2	Electric connection ratings	17
5.3	Connectors	17
5.4	Connection examples	18
6	Commissioning	19
6.1	Commissioning	19
6.2	Adjustment instructions	19
6.3	Troubleshooting	20
7	Additional functions with safety switchgears	21
7.1	LSUW N1 Muting K switchgear - Muting (temporary bridging)	21
7.1.1	- Muting function with four muting sensors and time-out	22
7.1.2	- Muting function with four muting sensors without time-out	23
7.2	LSUW NSR 3-1 K switchgear (operating modes "B" and "C" only with system changeover from LSUW to ULVT)	24
7.2.1	- Cycle mode	24
7.2.2	- Safety mode with restart interlock "B" (only with system changeover from LSUW to ULVT)	25
7.2.3	Selection mode (between cycle and safety mode with restart interlock, switchover mode)	26
7.2.4	- Safety mode with restart interlock during dangerous movement "B1" only	27
7.2.5	- Safety mode without restart interlock with valve or contactor check "C" (only when changing system)	28
7.3	ULSG switchgear (potential-free switching contacts and universal power supply)	29
8	Terminology	30
9	Specifications	32
10	Dimensions drawing	34
11	Accessories	37



All safety instructions are marked with this symbol and must be observed under all circumstances.

These operating instructions provide the user with important information concerning the proper use of the ULVT safety light barriers. The instructions are supplied with each light barrier and must be retained at the installation site of the light barrier.

All specifications of these operating instructions must be observed at all times.

Currently effective conditions and the regulations of the trade associations must also be adhered to. The operating instructions must be read before using the ULVT ... safety light barriers.

Qualified personnel

Installation, commissioning and maintenance must only be carried out by qualified personnel.

Danger sign



When operating a machine with ULVT ... safety light barriers, it must be ensured that nobody is located within a hazardous area. A danger sign to this effect must be attached to the machine.

Protect light barriers against flying objects resulting from the operation of the machine.

Caution, daily inspection (after 24 hours at the latest):

Before the start of a shift, the light barrier must be checked as follows:

Using the test rod*, the light barrier is to be interrupted on the transmitting side from start to finish in such a way that the light field is only covered by this part.

The green LED (or the yellow LED in the operating mode with restart interlock) must not light up from start to finish.

* The diameter of the test rod must correspond to the obstacle size specified on the nameplate of the receiving side.



The safe operation of the entire system can only be ensured through adherence to these operating instructions and the corresponding accident prevention regulations. These operating instructions comprise part of the light barrier and must be retained at the installation site.

When using safety light barriers, the effective standards and guidelines must be observed! (The local authorities or trade associations will provide you with the relevant information.)



- It must be possible for the hazardous condition of a machine to be eliminated by the sensor function.
- The **safety distance** between the protective field and the hazardous area must be large enough to ensure that when penetrating the protective field, the hazardous areas cannot be reached before the hazardous movement is interrupted or ended.
- **Access to the hazardous area** must only be possible through the protective field (reaching under, over or around the field must not be possible).
- **Passing through the light barrier** must only be possible if the restart interlock is activated subsequent to the light barrier being interrupted.
A new command to activate the next hazardous movement must only be implemented via a dead-man switch. It must not be possible for this start button to be actuated from within the hazardous area: The switch must be located at a point from which the accessible area can be viewed without obstruction.
- The unintentional repetition of a hazardous movement must be prevented by the appropriate safety facilities.
- **The safety category** (Type 4) of the accident-prevention light barrier should be at least the same as safety category of the machine.
- **Approval:**
Approval of the construction and the tests should be carried out by competent personnel who are in possession of all information provided by the supplier of the machine and the BWS.
- **Annual inspection:**
The operator must ensure that a competent person is assigned the task of inspecting the light barrier on a yearly basis. This person may, for example, comprise an employee of the light barrier manufacturer or of the operator.

On request by the customer, the Fiessler Elektronik company will carry out the initial approval and annual inspection. In addition, customer-training seminars concerning the implementation of the annual inspection are held at regular intervals.

3.1 Features

The ULVT safety light barriers are photo-electric guards and are characterized by the following:

- Safety category 4 pursuant to EN 954-1 and IEC 61496 Part 1 + 2, and/or EN 61496
- Integrated switchgear, contactor check and restart interlock activated via DIP switch
- Direct connection of contactors / valves, switching capacity of 0.5 A / 24 V
- Smallest safety distance through short response times: 6 ms to 25 ms, depending on construction length
- Detection of smallest obstacles from range of 14 mm / 30mm to 7 m /24 m
- 13 to 247 beams at protective field heights of 100 mm to 1900 mm
- Microprocessor monitoring of the safety functions
- Reverse-read semi-conductor outputs with line interruption, short-circuit and cross-circuit monitoring
- Integrated self-diagnostics with fault indication
- Muting and cycle mode with optional safety switchgear
- Protection category IP 65

3.2 Application areas

The ULVT safety light barriers are designed to protect hazardous areas, cordon off areas, and prevent access.

Protection of fingers, hands and body, for example in

- Presses for the processing of metal, wood, plastic, rubber, leather and glass
- Filter presses
- Folding and bending machines
- Injection moulding machines
- Processing centres and welding presses
- Automatic placement machines
- Robots
- Palletizing machines

Using tilted mirrors, the protective field can be "wrapped around" a hazardous area, thus ensuring protection from several sides (Fig. 7/4).

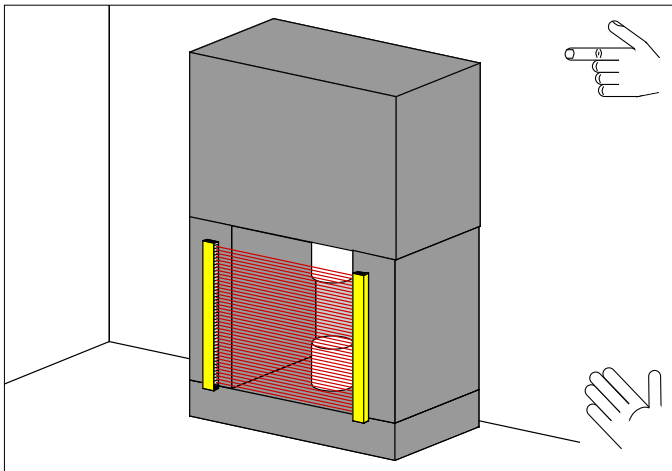


Fig. 7/1 Protecting in hazardous areas

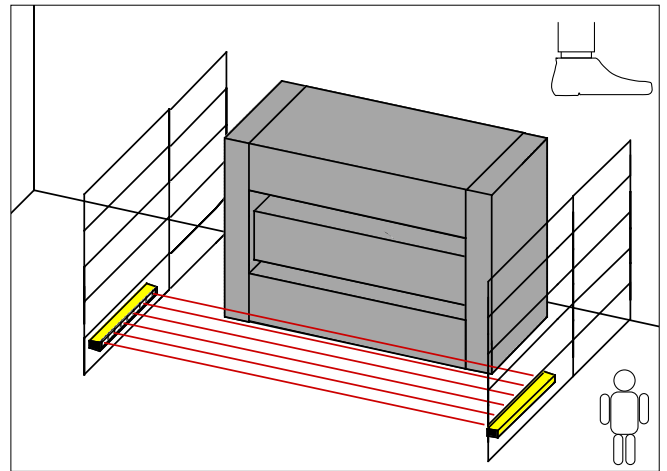


Fig. 7/2 Cordoning off areas

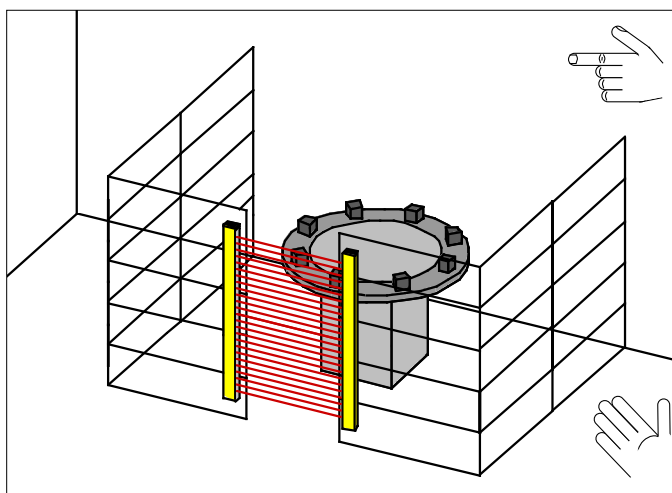


Fig. 7/3 Restricting access to areas

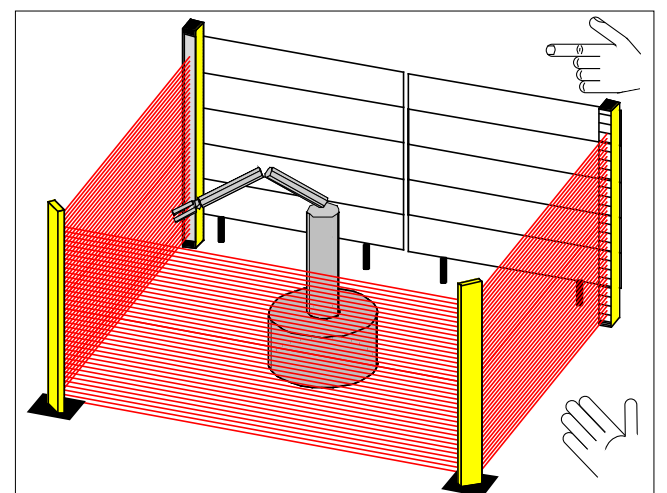


Fig 7/4 Restricting access to areas via tilted mirrors

3.3 Structure

The ULVT safety light barriers consist of two components: The light transmitter and receiver. The distance between the two components and the installation height are calculated from the width and height of the protective field (Fig. 8/1).

Due to its modular structure, protective field heights between 100 mm and 1900 mm can be attained (Table 8/1). Special sizes can be implemented for installation-dependent dimensions.

The transmitter and receiver are synchronous, i.e., at any one time, only one light beam and one receiving element are active. Synchronization is implemented by the first light beam and first receiving element. An electric connection between the transmitter and receiver is therefore not required.

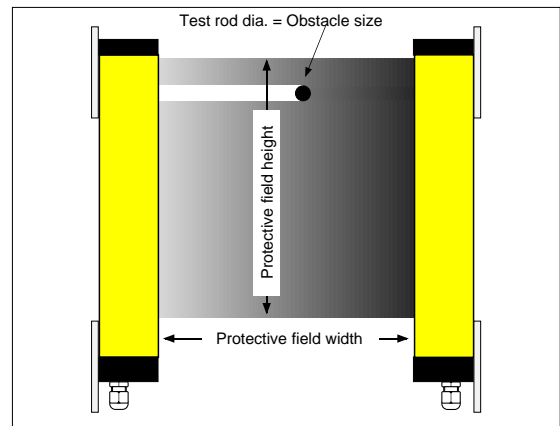


Fig. 8/1 The transmitter and receiver form the protective field

Protective field height (mm) SH	Construction length (mm) BL	Order data smallest obstacle 14mm	reaction time (ms) 14mm	Order data smallest obstacle 30mm	reaction time (ms) 30mm
100	196	ULVT100 / 13	6	ULVT100 / 7	5
200	296	ULVT200 / 26	7	ULVT200 / 14	6
300	396	ULVT300 / 39	8	ULVT300 / 21	6
400	496	ULVT400 / 52	9	ULVT400 / 28	7
500	596	ULVT500 / 65	10	ULVT500 / 35	7
600	696	ULVT600 / 78	11	ULVT600 / 42	8
700	796	ULVT700 / 91	12	ULVT700 / 47	9
800	896	ULVT800 / 104	13	ULVT800 / 56	9
900	996	ULVT900 / 117	14	ULVT900 / 63	10
1000	1096	ULVT1000 / 130	15	ULVT1000 / 70	10
1100	1196	ULVT1100 / 143	17	ULVT1100 / 77	11
1200	1296	ULVT1200 / 156	18	ULVT1200 / 84	12
1300	1396	ULVT1300 / 169	19	ULVT1300 / 91	12
1400	1496	ULVT1400 / 182	20	ULVT1400 / 98	13
1500	1596	ULVT1500 / 195	21	ULVT1500 / 105	13
1600	1696	ULVT1600 / 208	22	ULVT1600 / 112	14
1700	1796	ULVT1700 / 221	23	ULVT1700 / 119	15
1800	1896	ULVT1800 / 234	24	ULVT1800 / 126	15
1900	1996	ULVT1900 / 247	25	ULVT1900 / 133	16

Table 8/1 Standard construction sizes

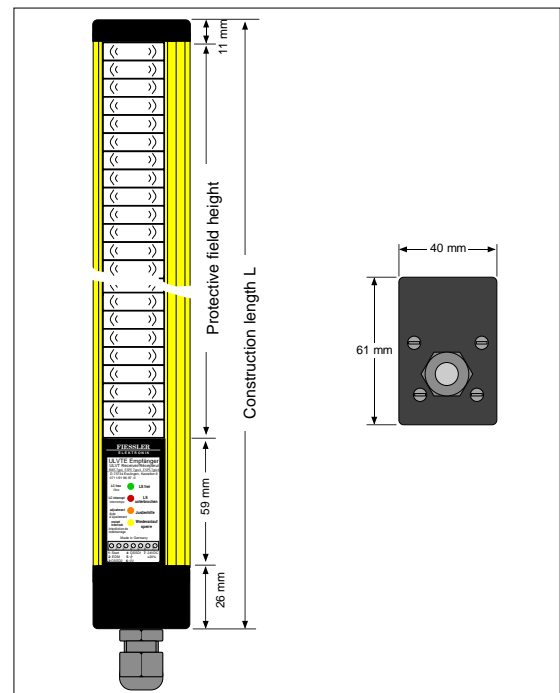


Fig 8/2 Dimensions

3.4 Function

The transmitter generates infrared light beams which are switched on an off in quick succession. The parallel light beams at a distance of 7.5 mm are assessed by two single-chip microcontrollers. The beam distance produces a definition of 14 mm.

If an object is located within the protective field, i.e., at least one of the light beams is blocked out, the two outputs of the receiver will stop the hazardous movement of the machine and/or prevent a start. In the operating mode with restart interlock, the machine can only be restarted by actuating the start button when the protective field is free again.

3.5 LED displays

Several LEDs on the receiver indicate the current operating status (Fig. 8/3). If the system test detects an internal or external fault, the machine will be switched off immediately and the LEDs on the transmitter and/or receiver indicate the fault status to the user.

Self-diagnostics system: A fault diagnostics program is available for trained service personnel. This program provides precise and on-site localization of the fault. When a fault is present, the flashing LEDs together with a fault code provide visual output of the detected fault and display in the diagnostics device.

Transmitter	
Yellow ON	Transmitter active
Yellow OFF	Transmitter off
Yellow flashing	Fault

Receiver	
Green ON	Light barrier free
Red ON	Light bar interrupted
Orange ON	Contamination (no reserve)
Yellow ON	Start prompt
Orange flashing	Fault
Yellow flashing	Fault

Fig. 8/3 LEDs indicate the operating and/or fault status

3.6 Operating modes

The DIP switches in the connector cover enable the following operating modes to be selected:

- Safety mode with / without restart interlock
- With / without contactor check
- equivalent / antivalent outputs (Fig. 9/1)

In the condition when delivered, the preset operating mode comprises safety mode with restart interlock, contactor check and equivalent outputs.

The following operating modes can be set:

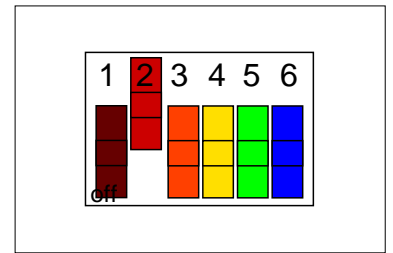


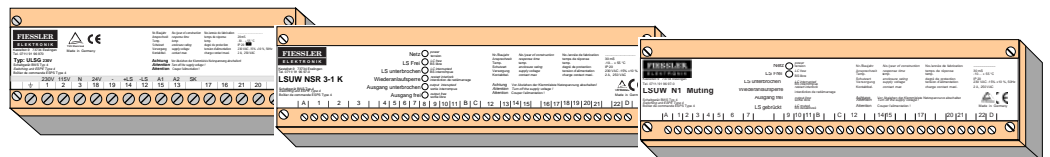
Fig. 9/1 The operating modes can be set using the DIP switches. The condition when delivered is shown here.

<p>Without contactor check</p>	<p>With contactor check</p>	<p>The operating mode with contactor check serves to monitor the driven succeeding contactors.</p> <p>After each interruption of the light path and before each release of the switching outputs, it is checked whether the succeeding contactors have fallen. Only then will a new release be possible. If the contactors do not respond within 300 ms, the light barrier switches off the outputs and goes into locking status.</p>
<p>Without restart interlock</p>	<p>With restart interlock</p>	<p>With the operating mode with restart interlock selected, a button must be connected to the start button input for a start release of the operating movement.</p> <p>When the protective field is free, the yellow LED lights up on the receiver as a start prompt. Only once the start button has been pressed will the outputs of the ULVT be switched to active.</p>
<p>Equivalent outputs</p>	<p>Antivalent outputs</p>	<p>In the equivalent outputs operating mode, both PNP outputs are failsafe and monitored internally for short-circuits and cross-circuits. With a free light path, both outputs are high (+24 V). In the antivalent outputs operating mode, output 1 is high (+24 V) and output 2 low (0 V) when the light path is free. Output 2 is not failsafe in this operating mode. This operating mode is only permissible in conjunction with the safety switchgears LSUW NSR 3-1-K, LSUW N1-Muting K, or another safe sequential phase control device which monitors output 2!</p>

Caution!

The operating mode may only be selected when no voltage is present. If the DIP switches are actuated during operation, the light barrier will switch off the outputs and go to locking status. This is indicated by flashing of the yellow and orange LEDs. Locking status will only be ended once the power supply has been switched off.

The switchgears ULSG, LSUW NSR 3-1-K and LSUW N1-Muting K are available for additional functions such as potential-free output contacts or muting (Refer to Section 7 for further information and electric connection).



Safety switchgear	ULSG	LSUW NSR 3-1-K	LSUW N1 Muting K
Additional function			
Muting (bridging)			X
Cycle mode - safety and control mode for cyclic penetration of the protective field (with either 1-cycle or 2-cycle mode)		X	
Potential-free output contacts	X	X	X
Selection mode (connection for mode selection switch)		X	
Start interlock		X	X
Safety mode with restart interlock only during the operating movement		X	

4.1 Safe distance from hazardous area

The safe distance (S) between the accident-preventing light barrier and hazardous area must be big enough to ensure that when the protective field is penetrated, the hazardous area cannot be accessed before the hazardous movement has been ended. In addition, it must be ensured that reaching over, under or around, or walking behind the protective field is prevented by additional mechanical screening or further light barriers. To this end, please also refer to EN 999 and other effective national and international safety regulations.



4.1.1 Vertical light barrier protection of hazardous areas

The safe distance S is calculated as follows:

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

- K = Grabbing speed or approach speed

For the grabbing speed K, a speed of 2000 mm/s is preset. If the calculation for S produces a value greater than 500 mm, the calculation can be repeated with 1600mm/s if this does not lead to a value lower than 500 mm ($s_{min} > 100$ mm)

- T = t1 + t2
 t1 = Response time of the safety device
 t2 = Run-on time of the machine

With ULVT light barriers, the response time of the safety device t1 depends on the number of beams (refer to Table 10/1).

When using the ULVT with the optional safety switchgears, the response time of the switchgears is added to t1:

- For LSUW N1 Muting switchgear: 20 ms
- For LSUW NSR 3-1K switchgear: 25 ms
- For ULSG switchgear: 6 ms

Table 10/1 Response time t1 of the ULVT light barriers (standard form factors)

Protective field height / no of smallest obstacle 14mm	reaction time (ms) 14mm	Protective field height / no of smallest obstacle 30mm	reaction time (ms) 30mm
ULVT100 / 13	6	ULVT100 / 7	5
ULVT200 / 26	7	ULVT200 / 14	6
ULVT300 / 39	8	ULVT300 / 21	6
ULVT400 / 52	9	ULVT400 / 28	7
ULVT500 / 65	10	ULVT500 / 35	7
ULVT600 / 78	11	ULVT600 / 42	8
ULVT700 / 91	12	ULVT700 / 47	9
ULVT800 / 104	13	ULVT800 / 56	9
ULVT900 / 117	14	ULVT900 / 63	10
ULVT1000 / 130	15	ULVT1000 / 70	10
ULVT1100 / 143	17	ULVT1100 / 77	11
ULVT1200 / 156	18	ULVT1200 / 84	12
ULVT1300 / 169	19	ULVT1300 / 91	12
ULVT1400 / 182	20	ULVT1400 / 98	13
ULVT1500 / 195	21	ULVT1500 / 105	13
ULVT1600 / 208	22	ULVT1600 / 112	14
ULVT1700 / 221	23	ULVT1700 / 119	15
ULVT1800 / 234	24	ULVT1800 / 126	15
ULVT1900 / 247	25	ULVT1900 / 133	16

The run-on time of the machine t2 must be specified by the machine manufacturer.

- C = 8 (d - 14 mm) d = Definition of the safety device (minimum detectable obstacle size)

The definition capacity d (= 14 mm or 30mm) is specified on the nameplate of the ULVT light barrier, for d=14mm => C=0, for d= 30 0> C= 128mm

Calculation examples for the safe distance with vertical area protection using ULVT light barriers

- ≥
- For S = 100 mm to 500 mm: $S = (2000 \text{ mm} / \text{s} \cdot T)$
- For S > 500 mm: $S = (1600 \text{ mm} / \text{s} \cdot T)$

Example 1:

ULVT100/13 safety light barrier
 Run-on time t2 of the machine from 75 ms
 $S = 2000 \text{ mm/s} \times (0.075\text{s} + 0.006\text{s})$
 $S = 162 \text{ mm}$

Example 2:

ULVT500/35 safety light barrier
 ULSG safety switchgear
 Run-on time t2 of the machine from 75 ms
 $S = 2000 \text{ mm/s} \times (0.075\text{s} + 0.007\text{s} + 0.006\text{s}) + 8(30\text{mm}-14\text{mm})$
 $S = 304 \text{ mm}$

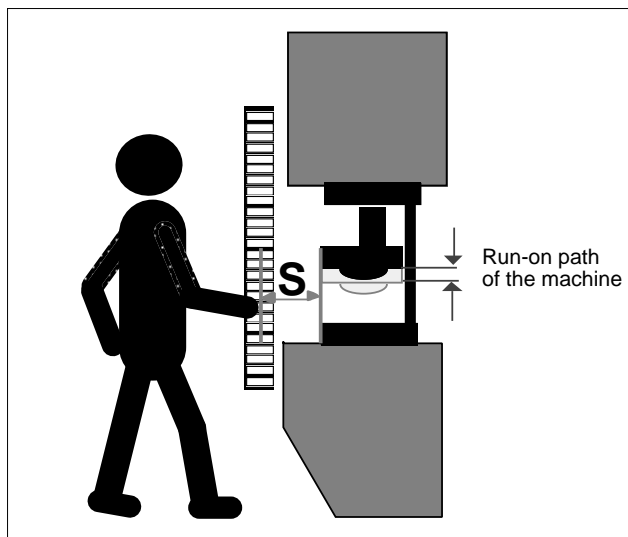
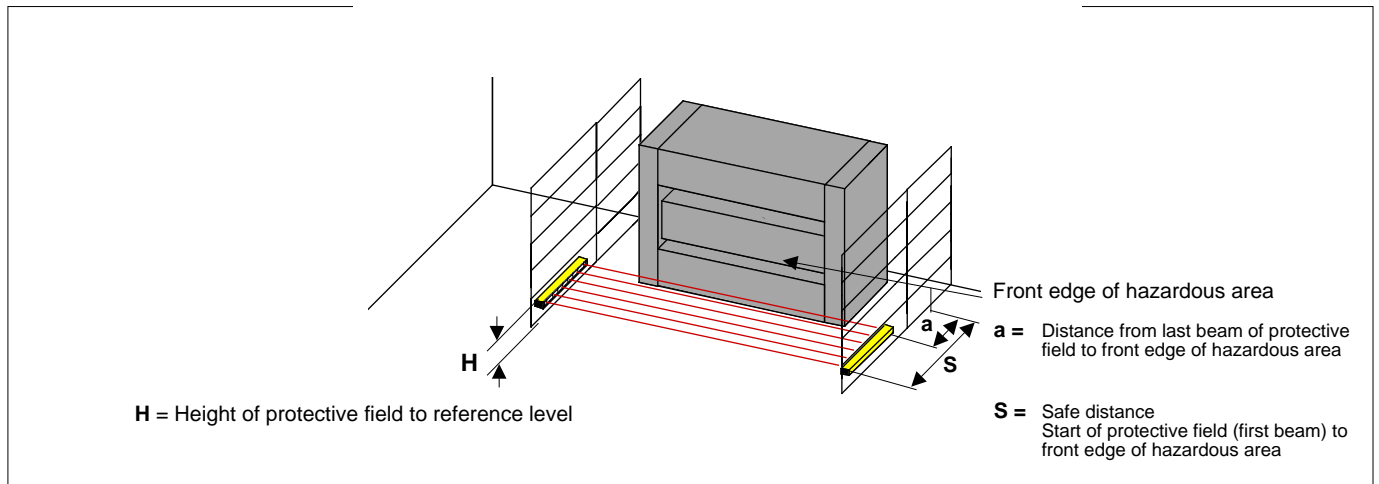


Fig. 10/1 Vertical protection of hazardous areas

4.2 Horizontal protection of hazardous areas



Formula for calculating the safe distance with horizontal protection of hazardous areas using a light barrier:

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

Here:

$K = 1600 \text{ mm/s}$

$C = 1200\text{mm} - 0.4H$, but smaller than 850 mm, whereby H is the height in mm of the protective field above the reference level, e.g. floor.

$$S = (1600 \text{ mm} / s \times T) + (1200 \text{ mm} - 0,4 H)$$

With a height of the protective field above the floor of > 300 mm, a risk of crawling under exists. This must be considered in risk assessment.

The following condition thus applies for $H \geq 300 \text{ mm}$:

$$1200 - 0.4 \times H > 850 \text{ mm}$$

The distance a of the end of the protective field (last beam to front edge of hazardous area) must be no more than:

$$a = H / 15 + 40 \text{ mm}$$

Example:
Height 200 mm

$$a = 200 / 15 + 40 \text{ mm}$$

$$a = 53 \text{ mm}$$

Calculation examples for the safe distance with horizontal protection of hazardous areas using ULVT light barrier:

Example:

ULVT1200/156 light barrier

Response time t_1 of light barrier: **18 ms**

Run-on time t_2 of machine: **50 ms**

$H = 200 \text{ mm}$

The safe distance is:

$$S = (1600 \text{ mm} / s \times (0.050 \text{ s} + 0.018)) + (1200 \text{ mm} - 0.4 \times 200 \text{ mm})$$

$$S = 1229 \text{ mm}$$

With the ULVT 1200/156, the protective field depth is 1200 mm.

A distance a between protective field and machine of 53 mm provides a safe distance

$$S = 1253 \text{ mm}$$

4.2.1 Installation without additional screening

The light transmitter (a) (Fig. 12/1) and the light receiver (b) form the light barrier (c). If the light beams are interrupted, e.g. by a hand, a pilot circuit is opened and the closing action is prevented / stopped. In the opposite example, it is not possible to avoid the ULVT light barrier from the working side, which means that additional screening is not required.



In order to prevent the walking behind the protective field, the distance between the ULVT safety light barrier and the machine must be ≥ 75 mm.

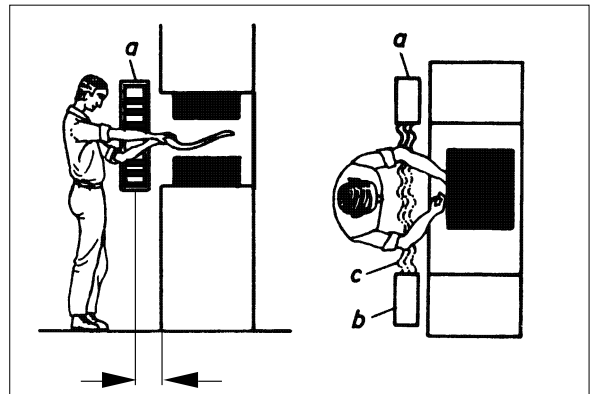


Fig. 12/1 Installation without additional screening

4.2.2 Protection against reaching under and over

In a normal working process (Fig. 12/2a), the operator inserts the workpiece when sitting down. Due to the run-on time of the machine, the ULVT safety light barrier (a) is mounted slightly in front of the hazardous area (refer to Section 4.1). However, the light barrier height selected here leaves an unprotected gap at the top of the light barrier. Fig. 12/2b shows how reaching over the light barrier can lead to an accident. The proper rectification of this problem is illustrated in Fig. 12/2c, where a ULVT safety light barrier with a larger protective field height has been attached.

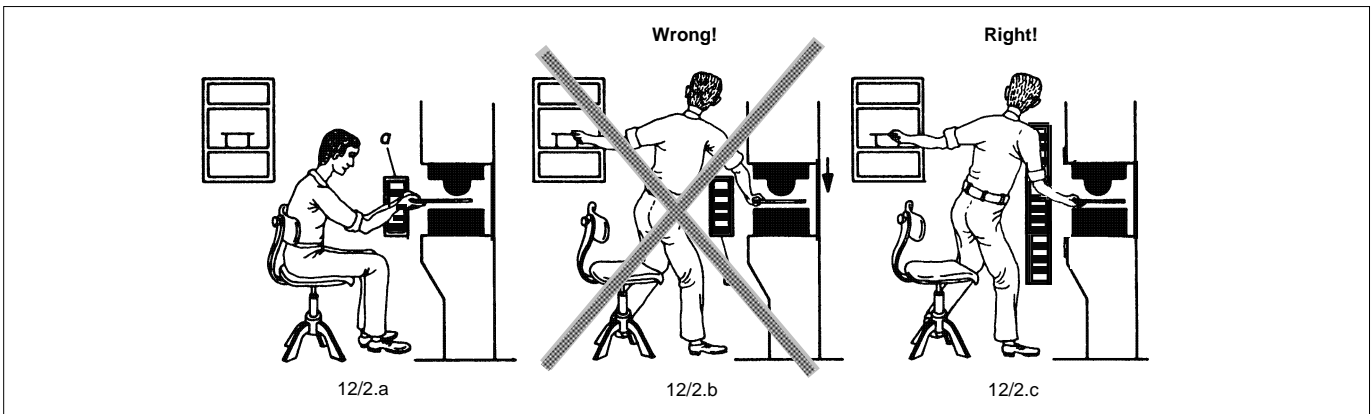


Fig. 12/2a.b.c Protection against reaching under or over.

4.2.3 Protection against walking behind through cascading or additional screening



If the distance between the vertical ULVT safety light barrier and the machine needs to be greater than 75 mm (e.g. in order to maintain the safe distance to the hazardous area), the possibility of walking behind the protective field must be eliminated through an additional ULVT safety light barrier and/or cascading of two light barriers (Fig. 12/3 and 12/4) or a protective bar.

In cascading, varying form factors can be combined (e.g. main sensor with 1100 mm protective field height and succeeding sensor with 200 mm protective field).

When combining main and succeeding sensors, the max. beam number of 247 must be observed

The main and succeeding sensors are supplied with premanufactured connecting cable.

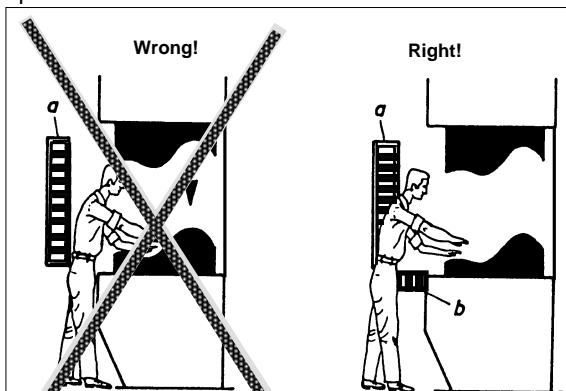


Fig. 12/3 Protection against walking behind through cascading of two light barriers

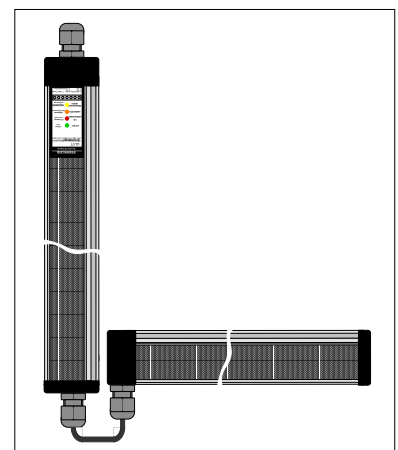


Fig. 12/4 Cascading of two safety light barriers

4.2.4 Distance from reflective surfaces
To prevent the avoidance and non-detection of an obstacle due to reflecting objects, the ULVT safety light barrier must be assembled with a minimum distance **a**



reflecting objects, the ULVT safety light barrier must be assembled with a minimum distance **a** (Fig. 13/1) from the reflective object.

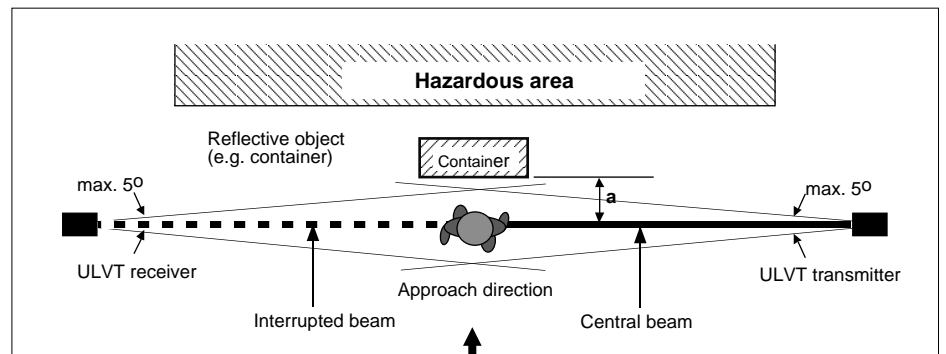


Fig. 13/1 Distance from reflective surfaces

The minimum distance **a** can be established from the table:

Installation range in m	Up to 3	4	5	6	7
Distance a in mm	130	175	219	262	306

4.2.5 Arrangement of two ULVT... safety light barriers



To eliminate the mutual clashing of two ULVT... safety light barriers, the following must be observed when arranging two light barriers:

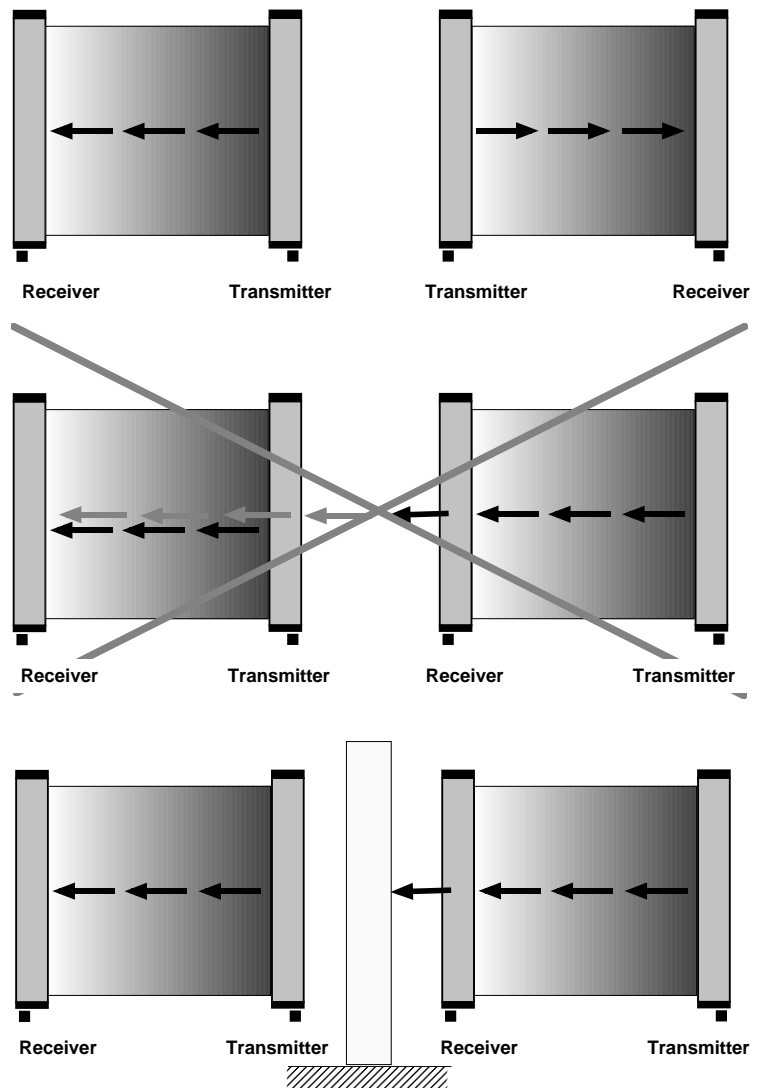


Fig. 13/2 Arrangement of 2 light barriers

4.3 Installation of transmitter and receiver

When installing the transmitter and receiver, it must be ensured that connectors of both devices are located on the same side. The receiver and transmitter must be installed with **parallel faces**.

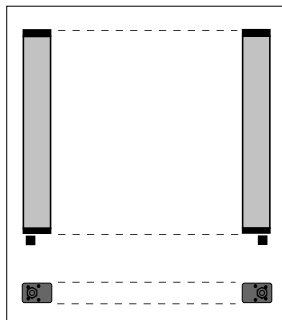


Fig. 14/1 Installation with parallel faces

Important:



In order to ensure error-free operation, both the light transmitter and light receiver must be attached to stable, distortion-free and face-parallel constructions. Install the fastening brackets so that the adjusting screws remain easily accessible. Make sure that the shape is not distorted. Otherwise a perfect visual adjustment will not be possible. Adjust one fastening bracket whilst the adjusting screws on the other fastening bracket are loose.

Attachment and adjustment

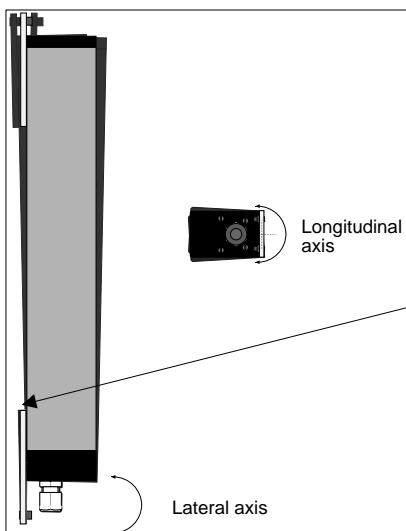
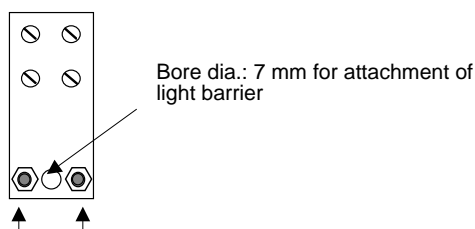


Fig. 14/2 Swivelling along longitudinal and lateral axis

The supplied fastening brackets serve the attachment and adjustment of the light barrier. Together with the shifting tenon blocks, the latches enable a universal attachment.

To swivel the longitudinal axis, turn the respective adjusting screw on one of the fastening brackets whilst both screws on the other fastening bracket are loose. To swivel the lateral axis, turn both screws of a fastening bracket at the same time whilst both screws on the other fastening bracket are loose.

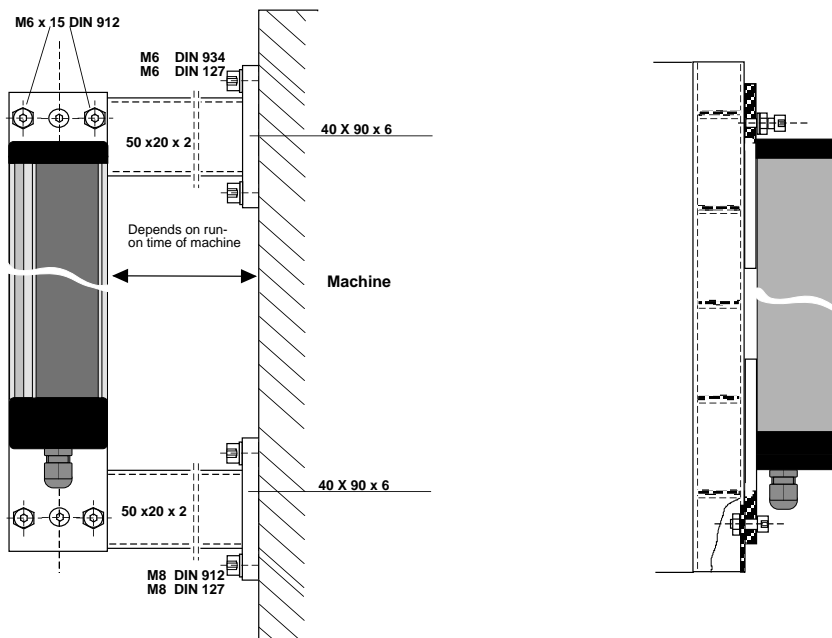


adjusting screws with counter nuts for swivelling along longitudinal and lateral axes. Further adjustment information is provided in Section 6, "Commissioning".

Rubber-metal connection

In the event of intense vibrations, please use rubber-metal connections which can be obtained as optional accessories.

Wall mounting example



4.4 Multi-sided screening through tilted mirrors

Using tilted mirrors, the protective field can be "wrapped around" a hazardous area, thus providing protection from several sides (Fig. 15/1 and Fig. 15/2). Here, the law of reflection applies, whereby the angle of incidence is the same as the angle of reflection. This means for that tilting of 90° requires the mirror to be installed at an angle of 45°. For this purpose, the tilted mirrors for ULVT feature swivelling attachments.

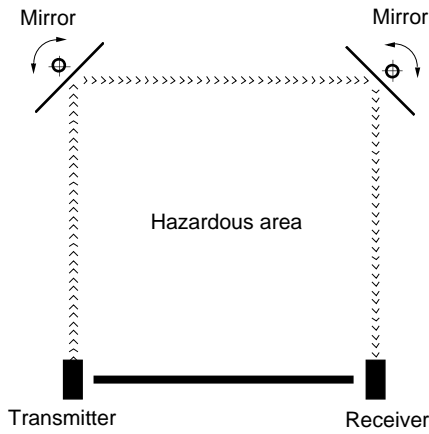


Fig. 15/1 Arrangement of 2 tilted mirrors

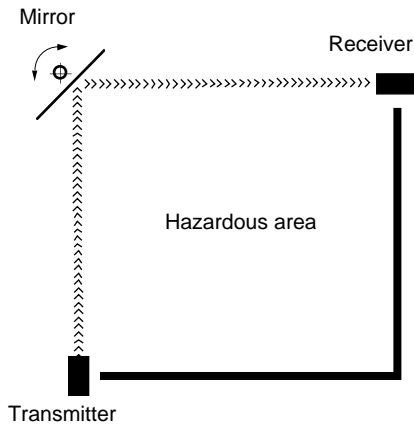


Fig. 15/2 Arrangement of 1 tilted mirror

Reflection loss: Each reflection via a mirror weakens the transmitted signal. For this reason, the max. range and number of mirror reflections must be observed when using mirrors. The transmitter, receiver and mirrors must always be assembled vertically and checked using a spirit level.



Operational reliability can only be ensured when the mirrors are assembled in a stable manner. Refer to Section 6 for precise adjusting information.

4.5 Assembly columns

For installation in an open area (e.g. for the multi-sided protection of hazardous areas), the ULVT light barriers and titled mirrors can be supplied as premanufactured assembly columns.

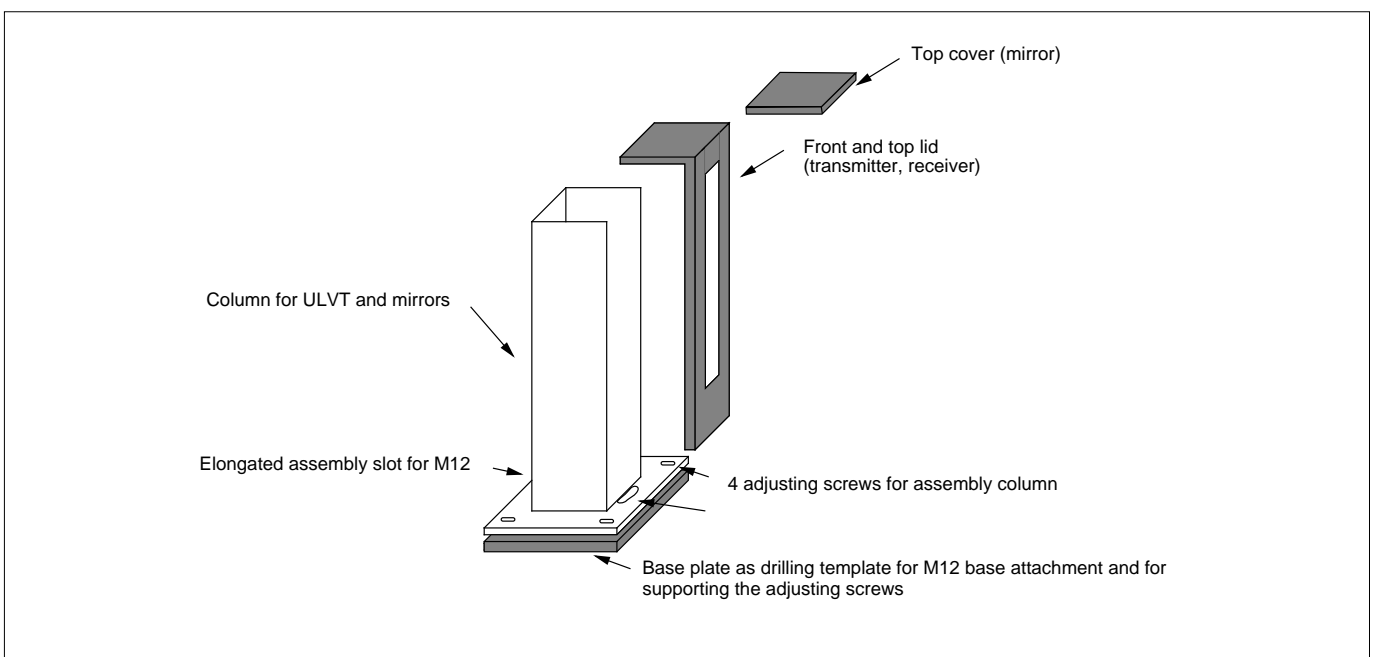


Fig. 15/3 Assembly columns for light barrier and mirrors

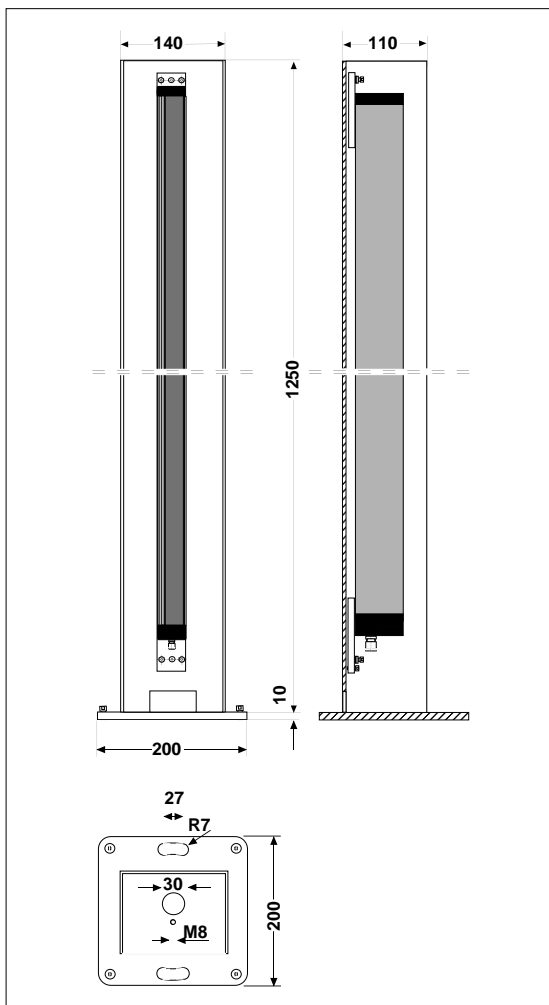


Fig. 16/1 Assembly column with ULVT light barrier

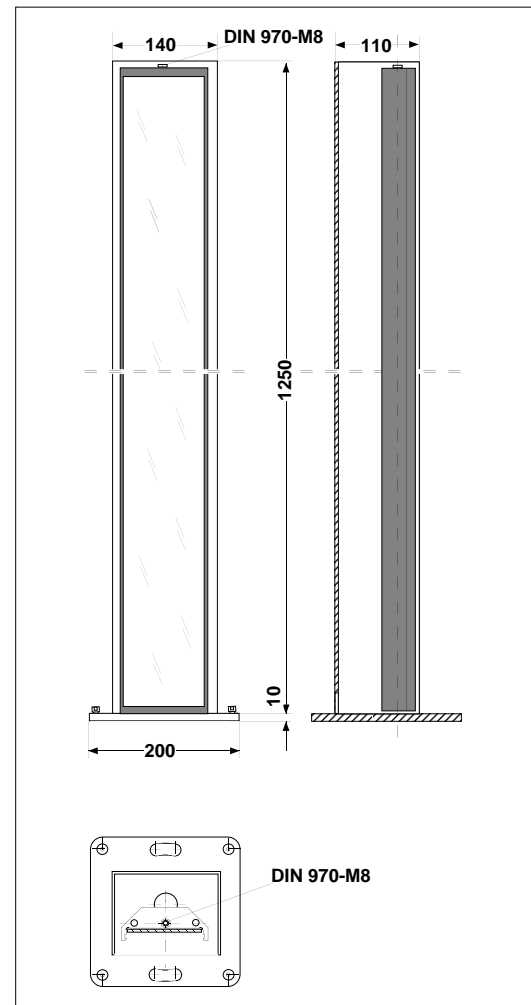


Fig. 16/2 Assembly column with mirrors

Installation of the columns

1. Provide electric connection of transmitter and receiver
2. Optically align the transmitter, receiver and mirrors
3. Check for correct function
4. Drill the holes and attach the columns

The transmitter, receiver and mirror columns are attached horizontally at the same height. A precise spirit level must be used to check this. With vertical arrangement, the 4 adjusting screws are used on the respective posts. The columns can be rotated using the elongated assembly slots. In addition, the mirror can be rotated by loosening the M8 hexagon nut on the connecting rod located below the top cover. The supplied black base plate assists the fitter in drilling the M12 holes in the floor for the columns. It must be ensured that the columns are aligned as shown in the opposite drawing.

Fine tuning is carried out as described in Section 6, "Commissioning". The front and top covers must be removed for this purpose. The front cover must be reattached once assembly and adjustment has been completed.

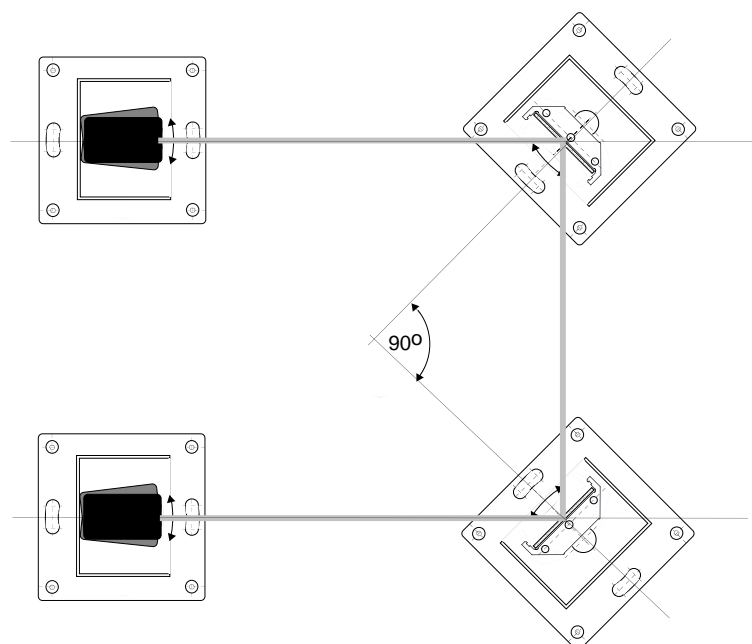


Fig. 16/3 Installation of the columns

5.1 Integrated connector plug

The ULVT construction series is supplied with PG threaded joints as standard. Various conventional connector plugs can also be obtained as optional accessories.



The electric connection must only be carried out when no voltage is present.

The electric connection is implemented via terminal screws in the connector cover (Fig. 17/1). The cover can be removed once the 4 screws have been loosened.

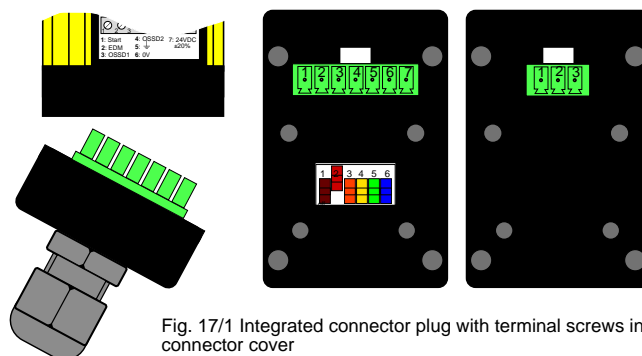


Fig. 17/1 Integrated connector plug with terminal screws in connector cover
Receiver 7-pin, transmitter 3-pin.

The transmitter and receiver require a power supply of 24 V DC. The ULSG switchgear performs the power failure bridging of 20 ms pursuant to EN 60204 and is thus suitable as the power supply for ULVT light barriers. The receiver is equipped with 2 inputs and 2 outputs. The transmitter is connected via one 3-pin cable and the receiver via one 5 to 7-pin cable (depending on operating mode). The permissible cable cross-section is max. 1.5 mm². The cables must be routed separately from power lines.

5.2 Electric connection ratings

	ULVTS transmitter	ULVTE receiver
Power supply	24 V DC, + 20% - 10%, SELV	24 V DC, ±20%, SELV
Current draw	max. 250 mA	max. 250 mA (without load)
Outputs	-	OSSD 1 and 2: Failsafe PNP outputs, max. 0.5 A, short-circuit and cross-circuit monitoring (in operating mode with <i>antivalent outputs</i> , output 2 is a non-failsafe PNP output, max 20 mA)
Inputs	-	Inputs contactor check and start button: 0 V to 24 V DC + 20%, 10 mA
Electric connection	Integrated connector plug with PG9 as strain relief, alternatively conventional connector plug.	Integrated connector plug with PG9 as strain relief, alternatively conventional connector plug.
Connecting cable	3-pin max. 1.5 mm ²	5 to 7-pin (depending on operating mode) max. 1.5 mm ²
Protection category	IP 65	IP 65

5.3 Connectors

- Outputs 1 and 2 (OSSD 1 and OSSD 2)

The outputs are not potential-free and must not be switched in series or parallel, but must be connected and processed separately!

In the **operating mode with equivalent outputs**, both PNP outputs are failsafe and feature internal short-circuit and cross-circuit monitoring. Both outputs are high (+24 V) when the light path is free.

In the **operating mode with antivalent outputs**, output 1 is high (+24 V) and output 2 low (0 V) when the light path is free. **Output 2 is not failsafe in this operating mode. This operating mode is only permissible in conjunction with the safety switchgears LSUW NSR 3-1K, LSUW N1-Muting K, or another safe sequential phase control device which monitors output 2!**

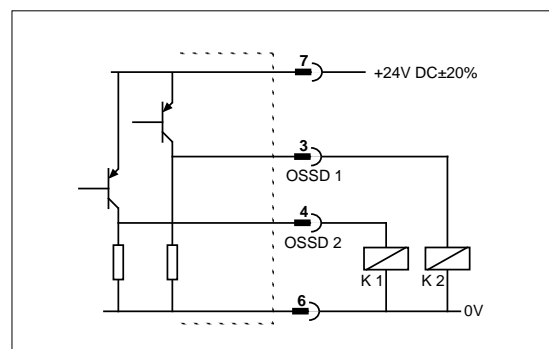


Fig. 17/2 Outputs 1 and 2

- Input contactor check (EDM)

If the **operating mode with contactor check** is set, the auxiliary contacts k1 and k2 of the driven contactors k1 and k2 must be connected to the contactor check input in series and with +24 V as shown in Fig. 17/2.

The OSSD1 and OSSD 2 of the ULVT will only switch on the two contactors when contactor check input has detected the idle status of the contactors (+24 V at contactor check input).

Once the contactors have been driven, both of them must respond within 300 ms. The two auxiliary contacts must then be open (0 V at contactor check input).

If the **operating mode without contactor check** is set, the input contactor check must be unoccupied.

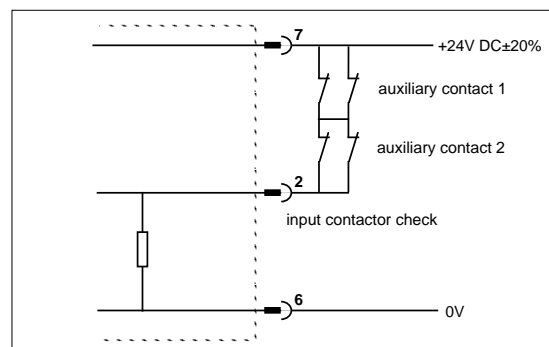


Fig. 17/3 Input contactor check

- Input start button

If the operating mode with **restart interlock** is set, a button must be connected on the start button input for the start release of the operating movement (Fig. 18/1).

With a free protective field, the yellow LED on the receiver lights up as a start prompt. Only once the start button has been pressed will the two outputs OSSD1 and 2 of the ULVTE receiver be switched to active.

If the operating mode **without restart interlock** is set, the start button input (start) must be unoccupied.

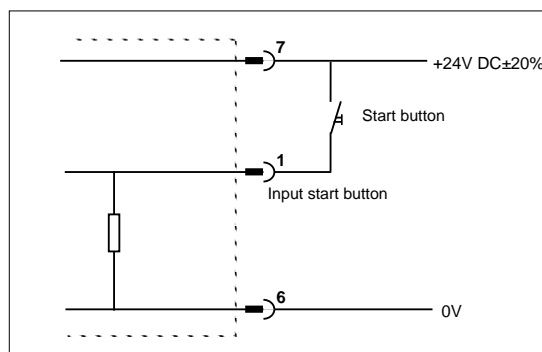
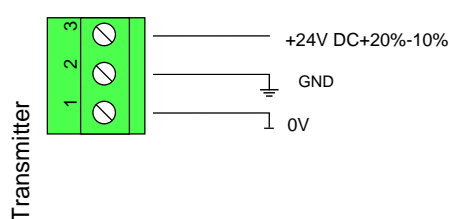
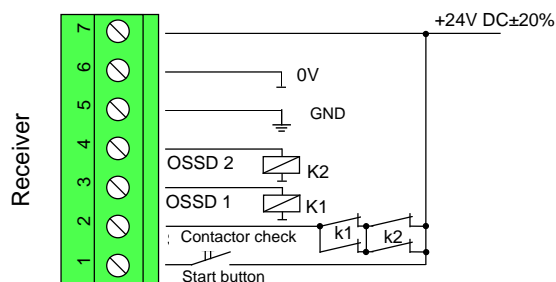


Fig. 18/1 Start button input

Caution! Error-free operation can only be ensured when the safety light barrier is connected according to one of the following connection diagrams (and/or as shown in Section 7), and also complies with effective national and international accident prevention regulations!
Any deviation from these connection specifications can lead to hazardous conditions and is therefore not permitted.

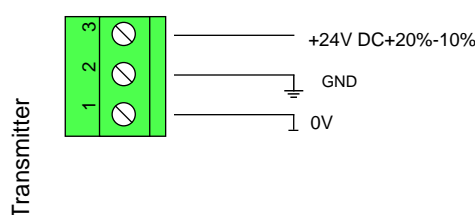
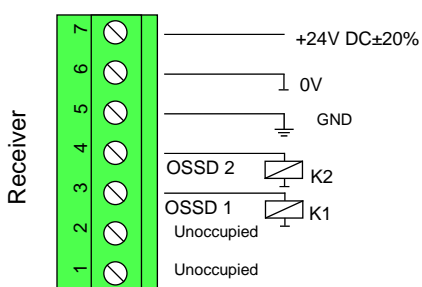
5.4 Connection examples

5.4.1 Operating mode with restart interlock / contactor check



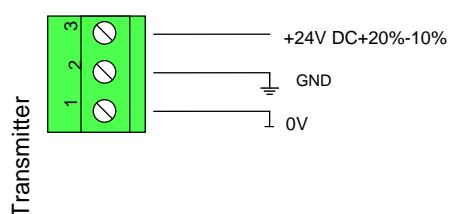
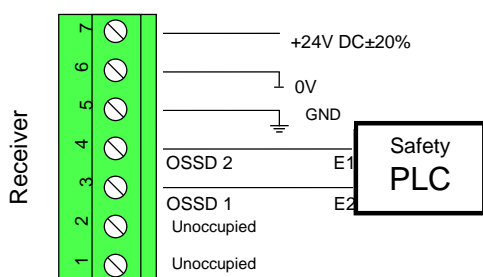
Note:
The functional ground (marked GND in the opposite connection examples) must be connected at the transmitter and receiver in order to ensure EMC resistance.

5.4.2 Operating mode without restart interlock / contactor check



5.4.3 PLC drive

When connecting to a safe stored program control (PLC) the outputs of the ULVT must be connected to separate inputs of the PLC



6.1 Commissioning

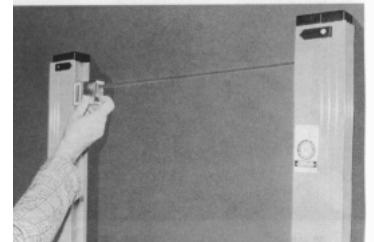
Prior to commissioning, the appropriate operating mode for the respective application case must be set via the DIP switches in the terminal strip compartment (refer to Section 3.5). When delivered, the operating mode with restart interlock, contactor check and equivalent outputs is set (refer to Section 5).

6.1 Adjustment information

The visual alignment is advantageously carried out with intensely dimmed ambient lighting in order to be able to better detect the LED indications of the receiver even from a long range.

When aligning, it must be ensured that the housing shapes do not become distorted.

An **adjustment laser** can be obtained for the precise alignment of the ULVT light barriers, particularly where large distances are involved. The device is attached to the front panel of the transmitter and receiver. When the button is pressed, the laser lights up red light spot which can also be seen from long distances. The light spot must hit the centre of the opposite device. This test should be performed at both ends of the transmitter and receiver. The arrangement must be adjusted if necessary.



Adjustment with operation via tilted mirrors: Place the adjustment laser onto the front panel of the transmitter, switch it on and swivel the transmitter until the light spot hits the centre of the mirror. Then adjust the mirror so that the light spot also hits the centre of the second mirror / receiver.

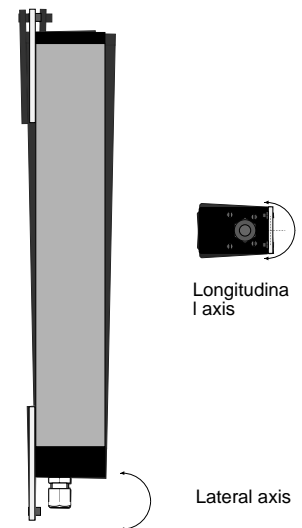
Adjustment LED: The orange LED extinguishes when sufficient light reserve is present.

Fine tuning

Subsequent to face-parallel installation and/or alignment using the adjustment laser, fine tuning is carried out by means of the adjusting screws on the supplied fastening brackets, provided that the orange LED is lit.

The swivel along the longitudinal axis, the respective adjusting screw on one of the fastening brackets is turned whilst both screws on the other fastening bracket are loose. To swivel the lateral axis, both screws of a fastening bracket are turned at the same time whilst both screws on the other fastening bracket are loose.

Subsequently, the green or yellow LED on the receiver should light up, and the orange LED must have extinguished.





Operating mode	Without restart interlock		With restart interlock	
Light barrier free and correctly adjusted	LS frei LC free libre LS unterbrochen LC interrupt interrompu Justierhilfe adjustment Aide d'ajustement Wiederanlauf sperre restart interlock interdiction de redémarrage	Outputs active	LS frei LC free libre LS unterbrochen LC interrupt interrompu Justierhilfe adjustment Aide d'ajustement Wiederanlauf sperre restart interlock interdiction de redémarrage	Outputs not active, (Prompt for start release with start button)
Light barrier free, but insufficient reserve	LS frei LC free libre LS unterbrochen LC interrupt interrompu Justierhilfe adjustment Aide d'ajustement Wiederanlauf sperre restart interlock interdiction de redémarrage	Outputs active To swivel along longitudinal or lateral axis until orange LED extinguishes	LS frei LC free libre LS unterbrochen LC interrupt interrompu Justierhilfe adjustment Aide d'ajustement Wiederanlauf sperre restart interlock interdiction de redémarrage	Outputs not active, (Prompt for start release with start button) To swivel along longitudinal or lateral axis until orange LED extinguishes



















Test rod: Using the test rod, the light barrier is to be interrupted on the transmitting side from start to finish in such a way that the light field is only covered by this part. The green LED must not light up from start to finish. The diameter of the test rod must correspond to the obstacle size specified on the nameplate of the receiving side.

6.3 Troubleshooting

The prerequisite for the troubleshooting process is a correctly adjusted light barrier (refer to Section 6.2)

Transmitter			
Operating / fault status		Possible causes	Remedy
Yellow LED off	Sender ein  Transmitter on Emetteur en marche	No power supply	Check power supply
Yellow LED flashing	Sender ein  Transmitter on Emetteur en marche	Internal error, transmitter inactive	Switch off power supply and then switch on again. If yellow LED still flashes: Transmitter defective, replace transmitter

Receiver			
Operating / fault status		Possible causes	Remedy
No LED illuminated		No power supply	Check power supply
Green LED off	LS frei  LC free libre	a) Transmitter inactive	a) Check transmitter
Red LED on	LS unterbrochen  LC interrupt interrompu	b) Light path interrupted	b) Remove obstacle from light path
Orange LED on	Justierhilfe  adjustment Aide d'ajustement	c) Light barrier maladjusted or very dirt	c) Readjust and/or clean system
Yellow LED off	Wiederanlauf sperre  restart interlock interdiction de redémarrage	d) Max. range exceeded	d) Check range
Green LED off	LS frei  LC free libre	(no fault)	Press start button
Red LED on	LS unterbrochen  LC interrupt interrompu	Operating mode with restart interlock active, prompt for start release	
Orange LED off	Justierhilfe  adjustment Aide d'ajustement		
Yellow LED on	Wiederanlauf sperre  restart interlock interdiction de redémarrage		
Green LED off	LS frei  LC free libre	a) Insufficient reserve, light barrier maladjusted or slightly dirty	a) Readjust and/or clean system
Red LED off	LS unterbrochen  LC interrupt interrompu	b) Max. range exceeded a) Readjust and/or clean system	b) Check range
Orange LED on	Justierhilfe  adjustment Aide d'ajustement		
Yellow LED off	Wiederanlauf sperre  restart interlock interdiction de redémarrage		
Green LED and/or Orange LED flashing	LS frei  LC free libre	a) In operating mode with contactor check: Contactors not responding or fal- len	a) Check auxiliary contact k1 and k2 and/or wiring
	LS unterbrochen  LC interrupt interrompu	b) Operating mode setting does not match the electric wiring and/or DIP switches are not set as specified in Sect. 3.5.	b) Check operating mode setting
	Justierhilfe  adjustment Aide d'ajustement	c) Internal error	c) Switch off power supply and then switch on again
	Wiederanlauf sperre  restart interlock interdiction de redémarrage		If LED still flashes: Check operating mode setting; if correct mode set - receiver defective, replace receiver.

Please observe: Solvents can damage the plexiglass panels of the transmitter and receiver. **As an alternative, light barriers with silicate glass can be delivered.** Welding spots can burn into the silicate glass panels. This is prevented by a replaceable protective panel made out of PVC.

Maintenance information: The ULVT... system is maintenance-free depending on the construction. The protective panels in front of the transmitter and receiver should simply be cleaned at regular intervals with a solvent-free detergent. This does not, however, release the obligation to carry out the prescribed annual inspection pursuant to EN 61496, ZH 1/281 and/or ZH 1/597.

LSUW N1 Muting K switchgear

We will be happy to provide you with individual advice for planning your application with muting function. The applications shown here are examples only.

7.1 Muting

(Bridging unit) for the short-term bridging of a safety light barrier during a material movement into and out of a manufacturing cell and/or for the safe differentiation between a human operator and fork-lift truck (Fig. 21/1).

Application: The NSUW N1 Muting switchgear is used if a safety light barrier needs to be bridged or differentiate between man and material flow for a certain period of time during an operating cycle, e.g. for protection against bending machines, palletizing machines, narrow-passage high-bay storage, certain types of presses.

Functional description: In combination with a vertical ULVT safety light barrier and four muting sensors, the LSUW N1 Muting switchgear enables a differentiation between man and material flow to be made.

Fig. 21/1 Muting application example

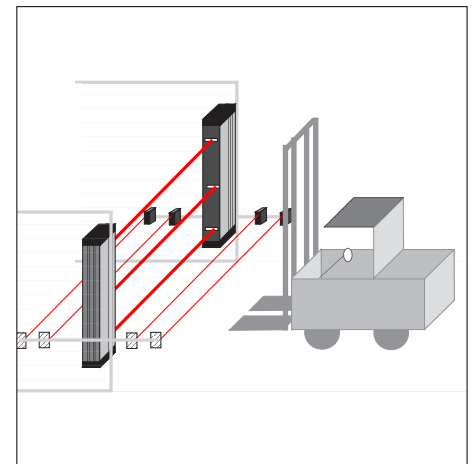


Fig. 21/1 Muting application example

For the muting functions, the following components are required and can be obtained from us:

1. LSUW N1 Muting K switchgear
2. Safety light barrier, e.g. ULVT 900
3. Four muting sensors, e.g. light barriers, inductive sensors, camshaft controller.
4. Muting lamp (max. 230 V, 60 W, min. 24 V AC or DC max. 0.5 A, min. 50 mA)

In order to prevent the safety light barrier from being constantly bridges through intentional manipulation, a twin-channel time-out is provided which withdraws the muting function after a configurable time between 3 and 90 seconds. This time is set by Fessler Elektronik in accordance with customer specifications. A switching option is also available, whereby operation without time-out is possible.

The muting lamp, which indicates the bridging status, is monitored. If the muting lamp is connected or is defective, bridging will not be possible.



Both muting sensor channels must be connected via separate cables in order to rule out a short-circuit. If the muting sensors require a power supply, the power supplies of the two muting channels must also be routed via separate cables. The connection to the intended + supply terminals and - terminal strip must be implemented separately.

For application which do not permit the interruption of a hazardous movement, which only the sounding of an alarm, a key switch must be used as the start button. It must only be possible to remove the key in open status.

The alarm is activated when the mains voltage is applied to this system. The alarm can be deactivated by pressing the key start button.

Before pressing the key start button, it must be checked whether any person is located within the hazardous area. The key start button must be installed at a point where the protected area can be seen.

To ensure the error-free function of the bridging, the **distance S** (Fig. 21/2) must be the same or smaller than the length of the pallet, the fork-lift truck or the reflector band.

However, the distance S must also be large enough to prevent the simultaneous interruption of the muting sensors LS 2A and LS 1B / LS 2B by a human operator.

If necessary, the distance H to the accessible area, or distance S, must be enlarged.

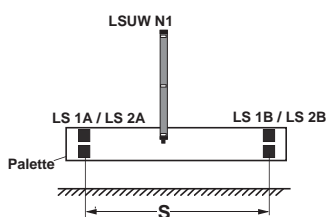


Fig 21/2 Distance S must be smaller than the length of the pallet, the fork-lift truck or the reflector band

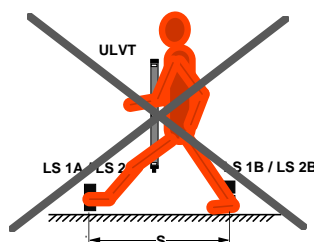
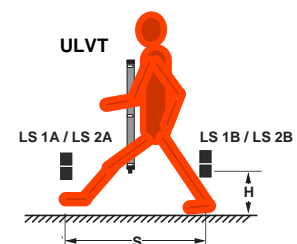


Fig. 21/3 and Fig 21/4 Distance S must be large enough to prevent the simultaneous interruption of the muting sensors



LSUW N1 Muting K switchgear

We will be happy to provide you with individual advice for planning your application with muting function. The applications shown here are examples only.

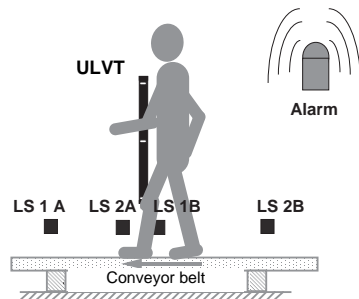
7.1.1 Muting function with four muting sensors and time-out

e.g. high-bay protection, pallet conveyor systems

Function: During bridging, the ULVT safety light barrier can be interrupted without the alarm being activated and/or the entire system being switched off.

Bridging continues for as long as either the contacts of the two muting sensors LS 1A and LS 2A or LS 1B and LS 2B, or all four, are **open**, but for no longer than the set time.

If the ULVT safety light barrier is interrupted and not bridged at the same time by the muting sensors, the alarm is activated via contact B-11 (potential-free break contact) and the system switched off via the output contacts 20-21 and 16-17. This enables differentiation between man and material flow.

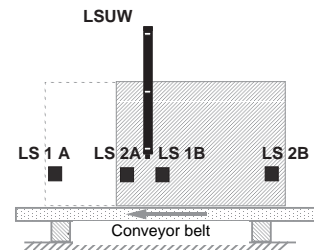


A restart and deactivation of the alarm is possible by pressing the start button when the ULVT safety light barrier is free.

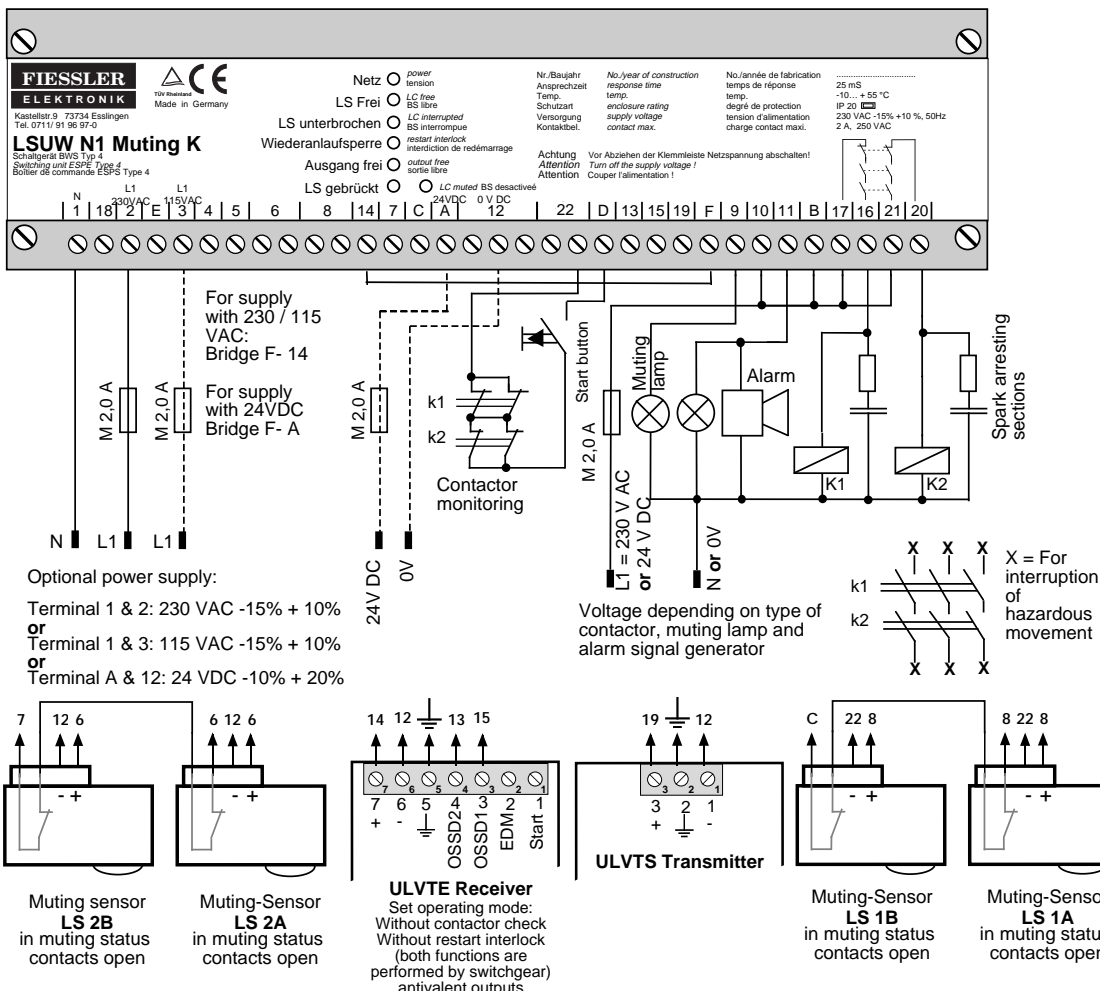


Before pressing the key start button, it must be ensured that no person is located within the hazardous area.

For safety reasons, the minus and plus lines must be routed as shown in the connection diagram. The cabling for muting channels 1 (LS 1A/B) and 2 (LS 2A/B) must be implemented separately.



Connection diagram for muting function with four muting sensors and time-out



Cable routing: Separately from power lines. The cable routing for the contactor check (terminals D & 22) must prevent short-circuiting of wires.

If the sum of the currents to terminals B, 10, 17 & 21 exceeds 2A, separate fuse protection of M 2.0 A must be provided for the contacts.

The hazardous movement must only be activated via output contacts 16-17 and 20-21.

The output contacts are potential-free, monitored, guided make contacts are must be loaded with max. 2 A/250 VAC or 60 VDC, 30 W.

With inductive load, the load (not the contacts) is to be switched at the same time as the spark arresting sections (e.g. 0.22 uF, 220 Ω).

The contact B-11 serves as an alarm path and is not permitted to activate the hazardous closing movement.

When performing electric welding work on the machine, the terminal strip of the switchgear is to be removed, otherwise the vagrant welding currents may cause destruction of the installed electronics.

We will be happy to provide you with individual advice for planning your application with muting function. The applications shown here are examples only.

7.1.2 Muting function with four muting sensors without time-out

e.g. high-bay protection, when the loading vehicle can be parked in the entrance area

Function: During bridging, the ULVT safety light barrier can be interrupted without the alarm being activated and/or the entire system being switched off.

Bridging continues for as long as either the contacts of the two muting sensors LS 1A and LS 2A or LS 1B and LS 2B, or all four, are **closed**.

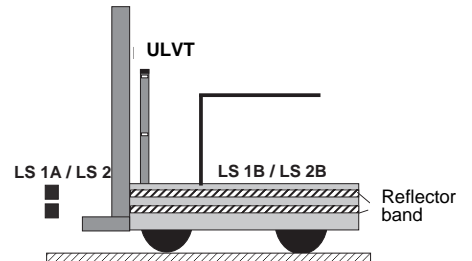
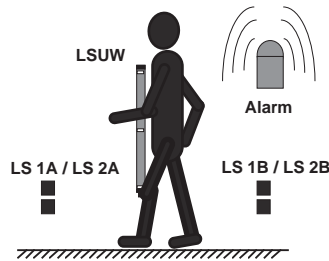
If the ULVT safety light barrier is interrupted and not bridged at the same time by the muting sensors, the alarm is activated via contact B-11 (potential-free break contact) and the system switched off via the output contacts 20-21 and 16-17. This enables differentiation between man and material flow.

A restart and deactivation of the alarm is possible by pressing the start button when the ULVT safety light barrier is free.

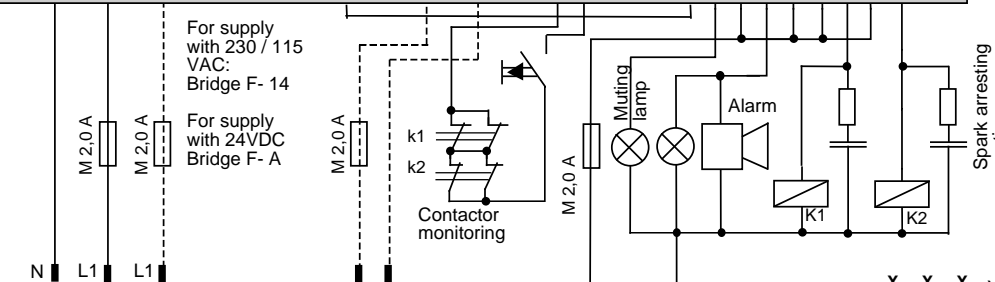
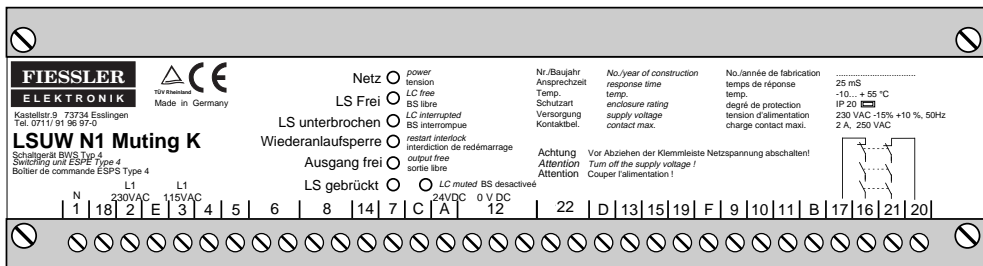


Before pressing the key start button, it must be ensured that no person is located within the hazardous area.

For safety reasons, the minus and plus lines must be routed as shown in the connection diagram. The cabling for muting channels 1 (LS 1A/B) and 2 (LS 2A/B) must be implemented separately.



Connection diagram for muting function with four muting sensors without time-out

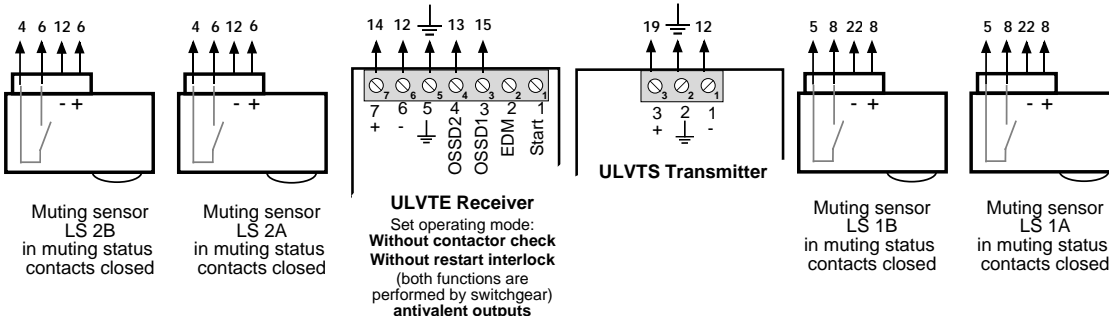


Optional power supply:
Terminal 1 & 2: 230 VAC -15% + 10%
or
Terminal 1 & 3: 115 VAC -15% + 10%
or
Terminal A & 12: 24 VDC -10% + 20%

Voltage depending on type of contactor, muting lamp and alarm signal generator

Spark arresting sections

X = For interruption of hazardous movement



Cable routing: Separately from power lines. The cable routing for the contactor check (terminals D & 22) must prevent short-circuiting of wires.

If the sum of the currents to terminals **B, 10, 17 & 21** exceeds 2A, separate fuse protection of M 2.0 A must be provided for the contacts.

The hazardous movement must only be activated via output contacts **16-17 and 20-21**.

The output contacts are potential-free, monitored, guided make contacts are must be loaded with max. 2 A/250 VAC or 60 VDC, 30 W.

With inductive load, the load (not the contacts) is to be switched at the same time as the spark arresting sections (e.g. 0.22 uF, 220 Ω).

The contact B-11 serves as an alarm path and is not permitted to activate the hazardous closing movement.

When performing electric welding work on the machine, the terminal strip of the switchgear is to be removed, otherwise the vagrant welding currents may cause destruction of the installed electronics.

7.2.1 Cycle mode "A"

(Safety and control mode through cyclic penetration of the protective field)

e.g. Manual insertion work with 30 sec. work monitoring for controlling presses with a table height of 750 mm.

Functional example: (Press: 1-cycle and 2-cycle mode)

Having switched on the safety facility, the protective field must be penetrated in order to carry out a startup test. Having subsequently pressed the start button with the protective field free and one or two interruptions and re-release, the output contacts (16-17, 20-21) close and the machine movement is started.

If the protective field is penetrated during a hazardous movement of the press, this returns immediately to the upper dead centre. A new operating stroke will only be performed once the start button has been pressed and the light barrier tested by means of one or two penetrations of the protective field.

The checking path 6-7 is used to perform an additional check of the hydraulic valves or the contactor. The activation of a new operating stroke or a hazardous movement will only be performed if both or valves K1 and K2 had fallen when the protective field, and the protective field is subsequently free again.

After 30 sec., the operating monitoring activates the restart interlock if the protective field was not penetrated or re-released in the meantime.

A reset of the cycle counter circuit is performed through the short-term interruption of terminal 10 - 11 (approx. 20 ms) via a switch on the machine.

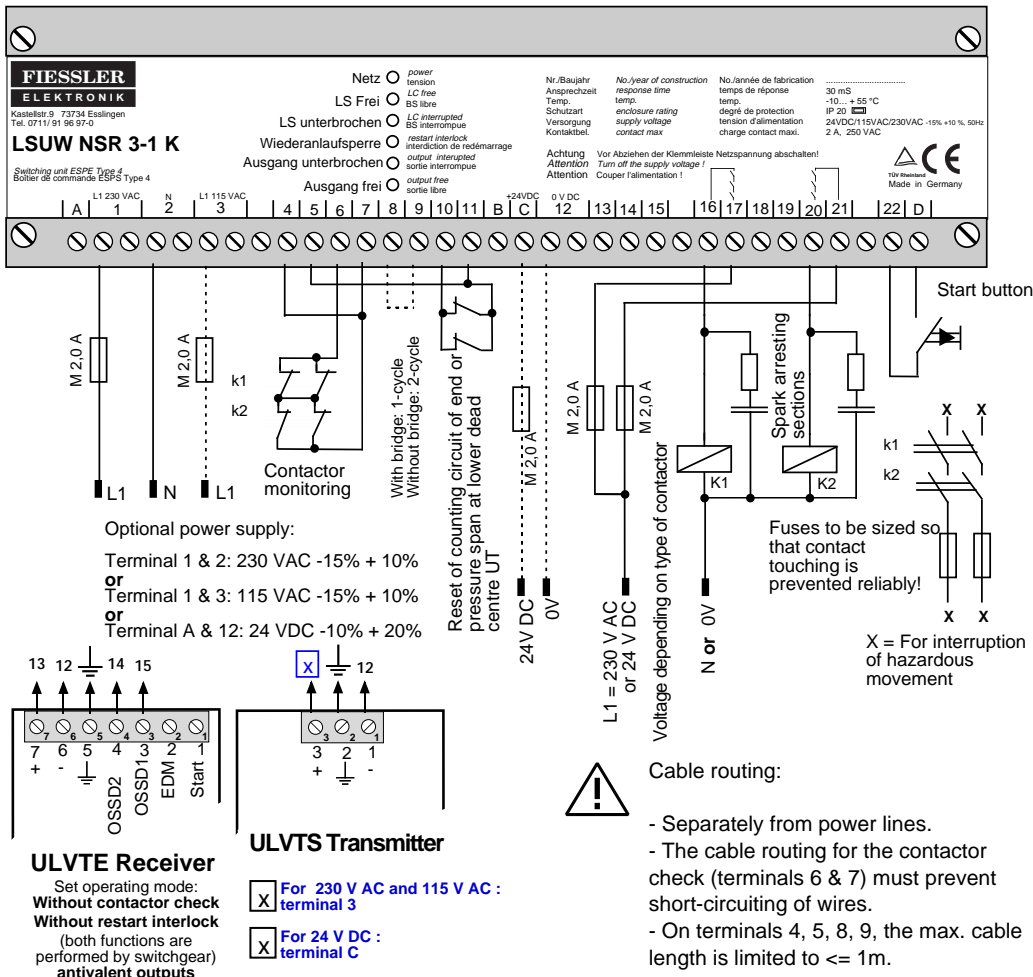
When activating the closing movement via contactors K1 and K2, the respective make contacts of K1 and K2 must be switched in series!

When switching between the operating modes with 1-cycle and 2-cycle mode, the restart interlock must be activated in accordance with EN 61496. This can be implemented by switching off the transmitter during the switchover.



In this operating mode, it must be ensured that it is not possible to walk behind the light barrier!
(Refer to Section 4.2)

Connection diagram for operating mode "A"



The hazardous movement must only be activated via output contacts 16-17 and 20-21.

The output contacts are potential-free, monitored, guided make contacts are must be loaded with max. 2 A/250 VAC or 60 VDC, 30 W. With inductive load, the load (not the contacts) is to be switched at the same time as the spark arresting sections (e.g. 0.22 μ F, 220 Ω). Optional power supply:

The contact 18 - 19 serves as an alarm path and is not permitted to activate the hazardous closing movement.

To increase the switching reliability, collateral contacts should be used on terminals 5, 6, 7, 8, 9, 10, 11, D and 22. No external potential must be connected to these terminals.

When performing electric welding work on the machine, the terminal strip of the switchgear is to be removed, otherwise the vagrant welding currents may cause destruction of the installed electronics.

7.2.2 Safety mode with restart interlock during the entire "B" cycle

(Only when changing systems from LSUW to ULVT and retaining the switchgear)

- e.g. For applications with manual cyclic penetrations of the protective field and restart via start button. (Refer to ZH 1/281 and ZH 1/597 for example)
- Presses with table heights below 750 mm with additional safety devices. Presses without control.
- Rapid stamping machines which do not require cyclic testing.

Functional example

Having switched on the safety facility, the protective field must be penetrated in order to carry out a startup test. Having subsequently pressed the start button with the protective field free, the output contacts 16-17 and 20-21 close and the machine movement is started.

If the protective field of the light barrier is penetrated, the contacts 16-17 and 20-21 are opened and the machine stopped.

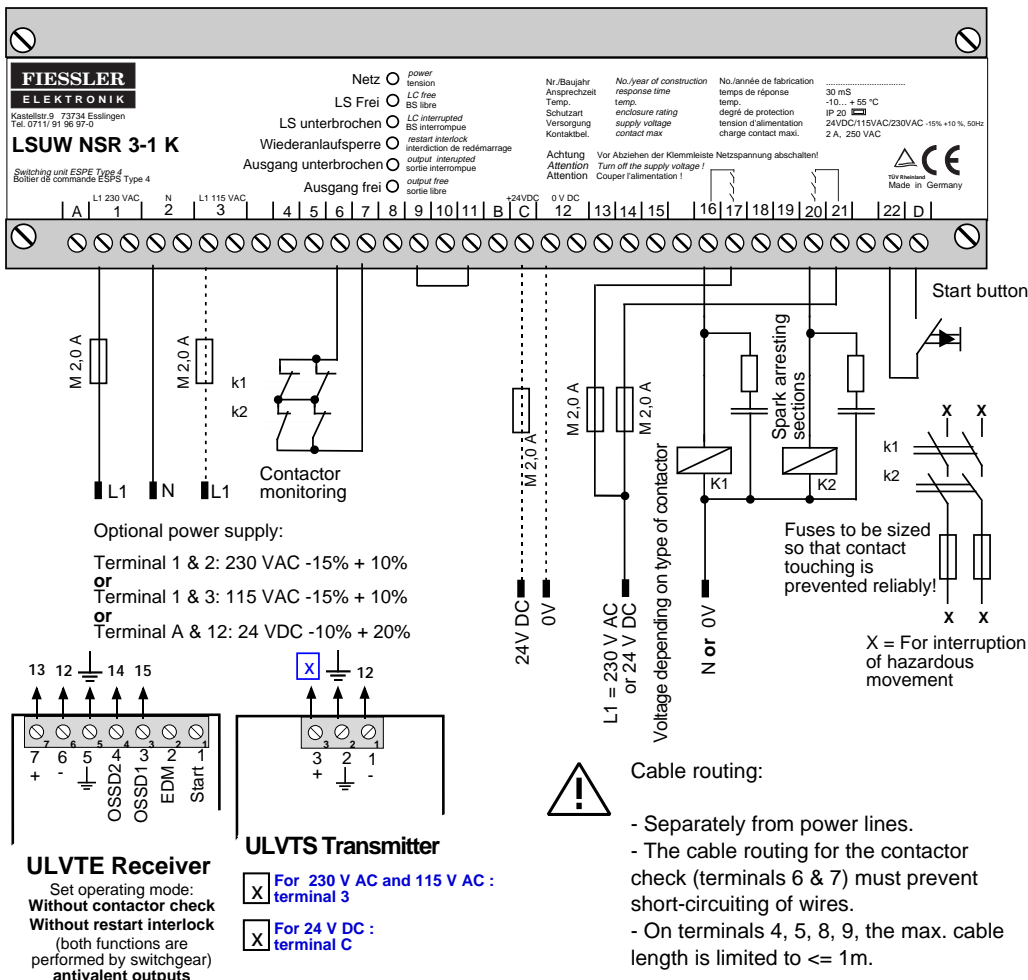
The checking path 6-7 is used to perform an additional check of the hydraulic valves or the contactor. The activation of a new operating stroke or a hazardous movement will only be performed if both or valves K1 and K2 had fallen when the protective field, and the protective field is subsequently free again.

When activating the closing movement via contactors K1 and K2, the respective make contacts of K1 and K2 must be switched in series!



The start button must be installed at point where the hazardous area can easily be seen, and where it cannot be actuated from within the hazardous area without the light barrier being interrupted.

Connection diagram for operating mode "B"



The hazardous movement must only be activated via output contacts 16-17 and 20-21.

The output contacts are potential-free, monitored, guided make contacts are must be loaded with max. 2 A/250 VAC or 60 VDC, 30 W. With inductive load, the load (not the contacts) is to be switched at the same time as the spark arresting sections (e.g. 0.22 uF, 220 Ω. Optional power supply:

The contact 18 - 19 serves as an alarm path and is not permitted to activate the hazardous closing movement.

To increase the switching reliability, collateral contacts should be used on terminals 5, 6, 7, 8, 9, 10, 11, D and 22. No external potential must be connected to these terminals.

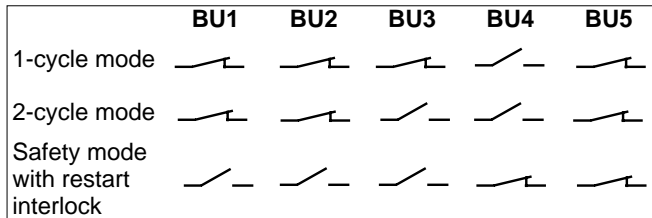
When performing electric welding work on the machine, the terminal strip of the switchgear is to be removed, otherwise the vagrant welding currents may cause destruction of the installed electronics.

7.2.3 Selection mode (between cycle mode and safety mode with restart interlock, switchable operation)

Function

(1-cycle and 2-cycle mode "A", refer to Section 7.2)
 (Safety mode with restart interlock "B", refer to Section 7.3)

Using the BU operating mode selector, one of the three operating modes, 1-cycle, 2-cycle or safety mode with restart interlock, can be selected.

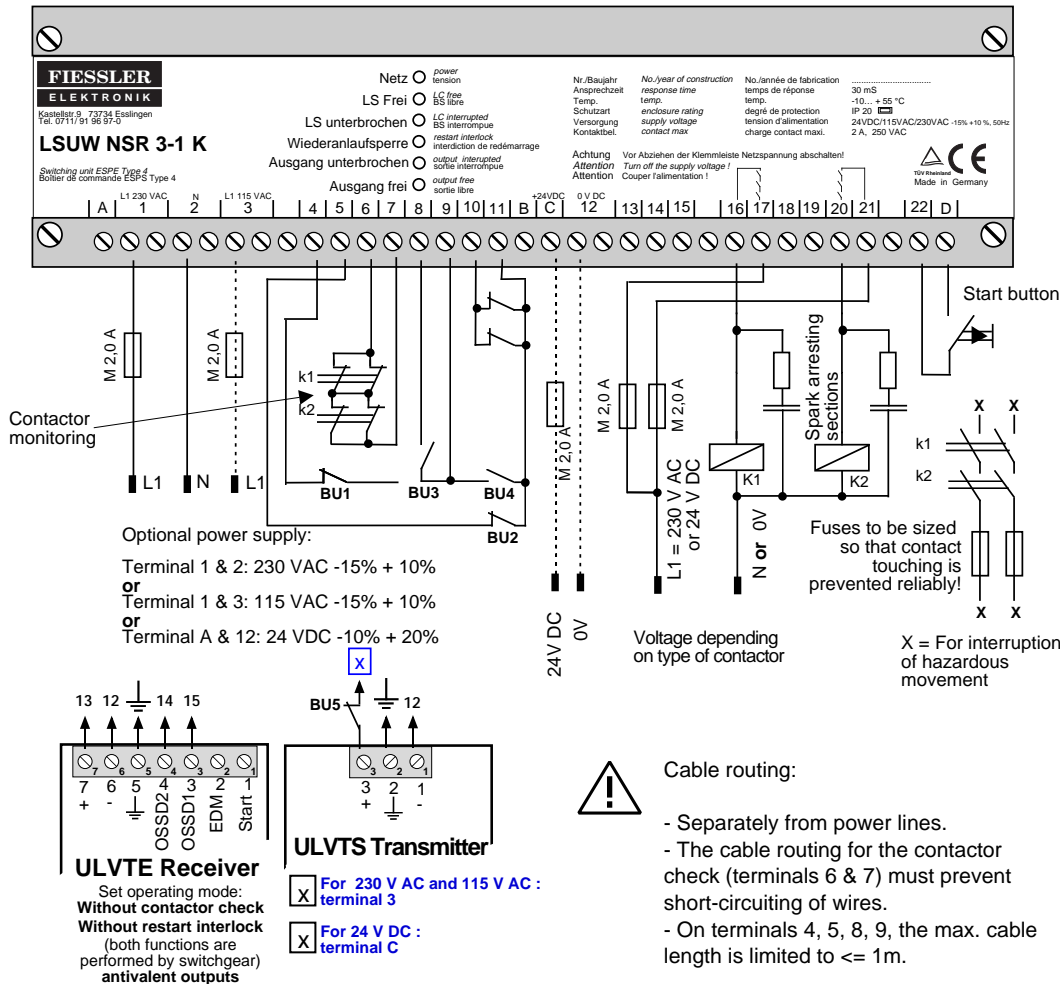


When switching between the operating modes, the restart interlock must be activated in accordance with EN 61494. This can be implemented by switching off the transmitter during the switchover.



In the 1-cycle and 2-cycle operating modes, it must be ensured that it is not possible to walk behind the light barrier! (Refer to Section 4.4)

Connection diagram for operating mode "AB"



The hazardous movement must only be activated via output contacts 16-17 and 20-21.

The output contacts are potential-free, monitored, guided make contacts are must be loaded with max. 2 A/250 VAC or 60 VDC, 30 W. With inductive load, the load (not the contacts) is to be switched at the same time as the spark arresting sections (e.g. 0.22 uF, 220 Ω).
 Optional power supply:

The contact 18 - 19 serves as an alarm path and is not permitted to activate the hazardous closing movement.

To increase the switching reliability, collateral contacts should be used on terminals 5, 6, 7, 8, 9, 10, 11, D and 22. No external potential must be connected to these terminals.

When performing electric welding work on the machine, the terminal strip of the switchgear is to be removed, otherwise the vagrant welding currents may cause destruction of the installed electronics.

7.2.4 Safety mode with restart interlock during the hazardous movement "B1"

e.g. For applications with manual cyclic penetrations of the protective field during a non-hazardous movement or machine standstill.

Functional example

Having switched on the safety facility, the protective field must be penetrated in order to carry out a startup test. Having subsequently pressed the start button with the protective field free, the output contacts 16-17 and 20-21 close and the machine movement is started.

If the protective field of the light barrier is penetrated **during the hazardous movement**, the contacts 16-17 and 20-21 are opened and the machine stopped.

The checking path 6-7 is used to perform an additional check of the hydraulic valves or the contactor. The activation of a new operating stroke or a hazardous movement will only be performed if both or valves K1 and K2 had fallen when the protective field, and the protective field is subsequently free again.

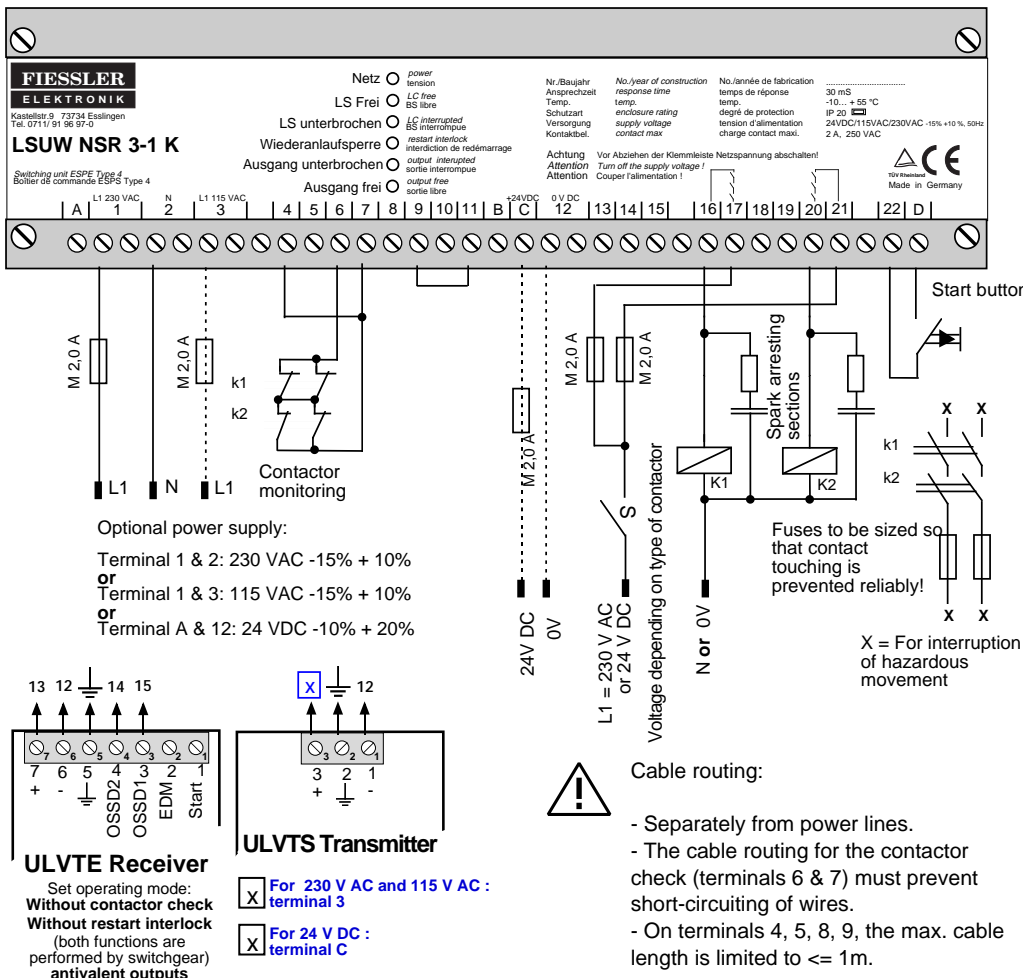
During the idling status of the operating materials, or during a non-hazardous opening movement (opened switch "S"), its is possible to access the operating materials at any time without having to press the start button.

When activating the closing movement via contactors K1 and K2, the respective make contacts of K1 and K2 must be switched in series!



In this operating mode, it must be ensured that it is not possible to walk behind the light barrier!
(Refer to Section 4.4)

Connection diagram for operating mode "B1"



The hazardous movement must only be activated via output contacts 16-17 and 20-21.

The output contacts are potential-free, monitored, guided make contacts are must be loaded with max. 2 A/250 VAC or 60 VDC, 30 W. With inductive load, the load (not the contacts) is to be switched at the same time as the spark arresting sections (e.g. 0.22 uF, 220 Ω. Optional power supply:

The contact 18 - 19 serves as an alarm path and is not permitted to activate the hazardous closing movement.

To increase the switching reliability, collateral contacts should be used on terminals 5, 6, 7, 8, 9, 10, 11, D and 22. No external potential must be connected to these terminals.

When performing electric welding work on the machine, the terminal strip of the switchgear is to be removed, otherwise the vagrant welding currents may cause destruction of the installed electronics.

7.2.5 Safety mode without restart interlock with valve or contactor check

(Only when changing systems from LSUW to ULVT and retaining the switchgear)

e.g. For the protection of force-driven operating materials or the implementation of the restart interlock in the machine

Function

Having switched on the safety facility, the protective field must be penetrated in order to carry out a startup test. Subsequent to the re-release of the protective field, the output contacts 16-17 and 20-21 close and check contact 18-19 is interrupted. The output 18-19 serves as a check contact and is thus not permissible as a contact for activating the hazardous movement.

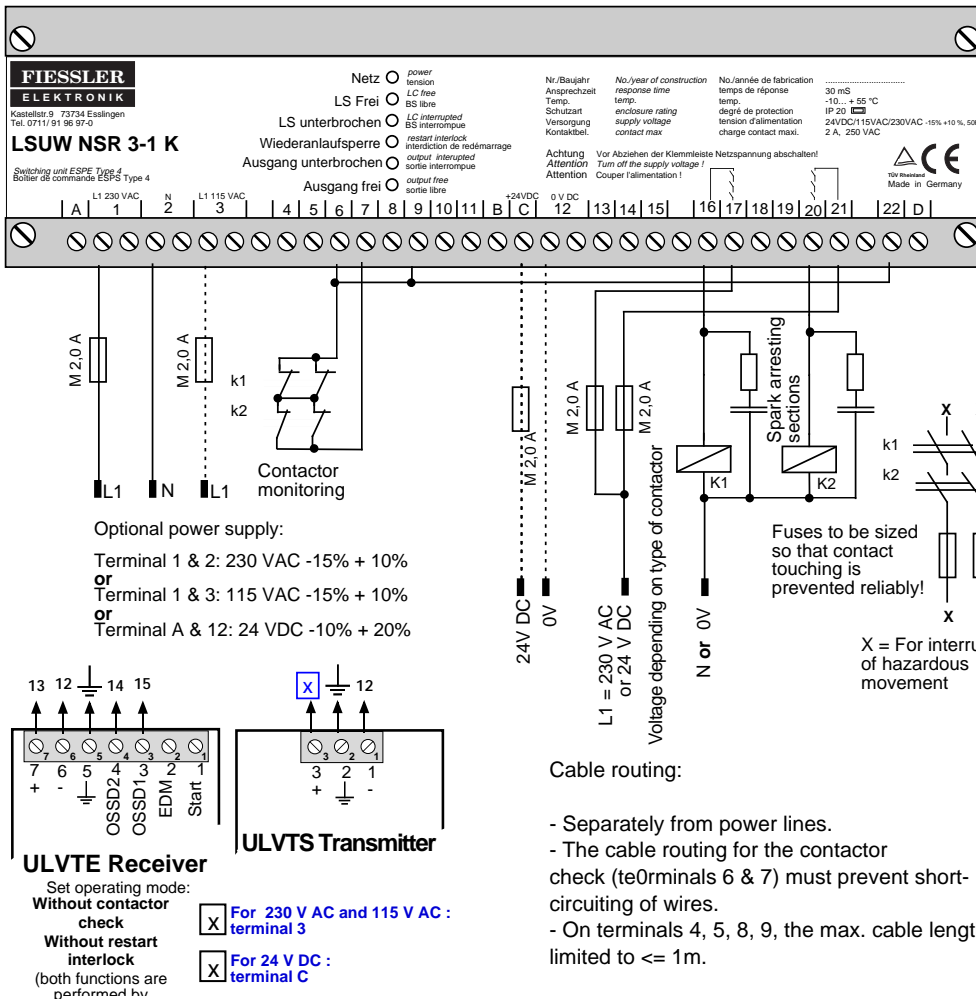
When the protective field is penetrated, the output contacts 16-17 and 20-21 open the check contact 18-19 closes.

The connecting contactor 6-7 also provides an additional check of the contactors which activate the hazardous movement.



In this operating mode, it must be ensured that it is not possible to walk behind the light barrier!
(Refer to Section 4.4)

Connection diagram for operating mode "C"



The hazardous movement must only be activated via output contacts 16-17 and 20-21.

The output contacts are potential-free, monitored, guided make contacts are must be loaded with max. 2 A/250 VAC or 60 VDC, 30 W. With inductive load, the load (not the contacts) is to be switched at the same time as the spark arresting sections (e.g. 0.22 uF, 220 Ω. Optional power supply:

The contact 18 - 19 serves as an alarm path and is not permitted to activate the hazardous closing movement.

To increase the switching reliability, collateral contacts should be used on terminals 5, 6, 7, 8, 9, 10, 11, D and 22. No external potential must be connected to these terminals.

When performing electric welding work on the machine, the terminal strip of the switchgear is to be removed, otherwise the vagrant welding currents may cause destruction of the installed electronics.

7.3 Potential-free switching contacts and universal power supply

The ULSG switchgear provides potential-free output contacts and a universal power supply (either 230 VAC, 115 VAC, or 24VDC connection). The ULSG switchgear performs the power failure bridging of 20 ms pursuant to EN 60204 and is thus suitable as the power supply for ULVT light barriers.

Connection examples

230 VAC connection / external contactors control hazardous movement

Having pressed the start button with a free protective field, the potential-free output contacts 13-14 and 15-16 close and the connected contactors K1 and K2 respond. When activating the closing movement via contactors K1 and K2, the respective make contacts of K1 and K2 must be switched in series!

The connecting pin 2 (EDM = contactor check) on the receiver also provides an additional check of the contactors or hydraulic valves which activate the hazardous movement. If the protective field is penetrated, the output contacts are opened and the movement interrupted. Operation can only be continued once the start button has been pressed. The activation of a new operating stroke or a hazardous movement will only be performed if both or valves K1 and K2 had fallen when the protective field, and the protective field is subsequently free again.

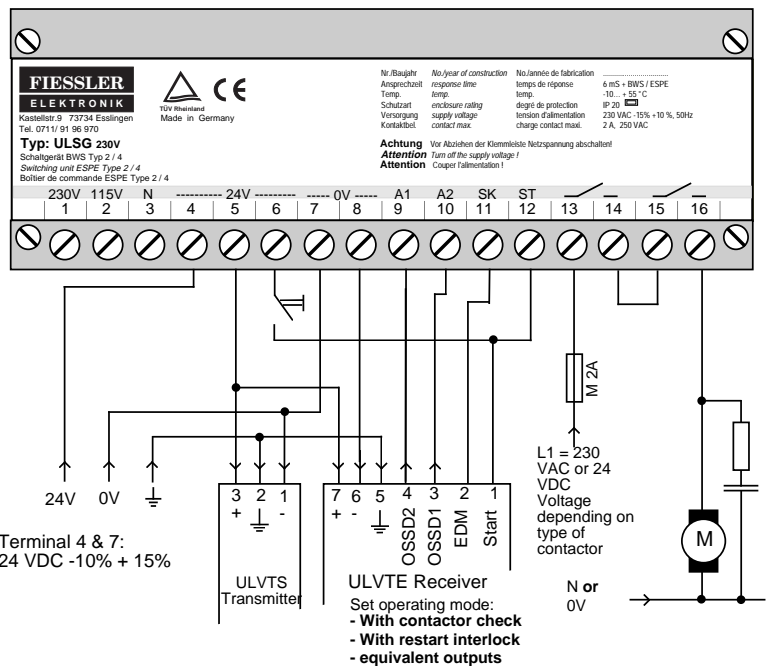
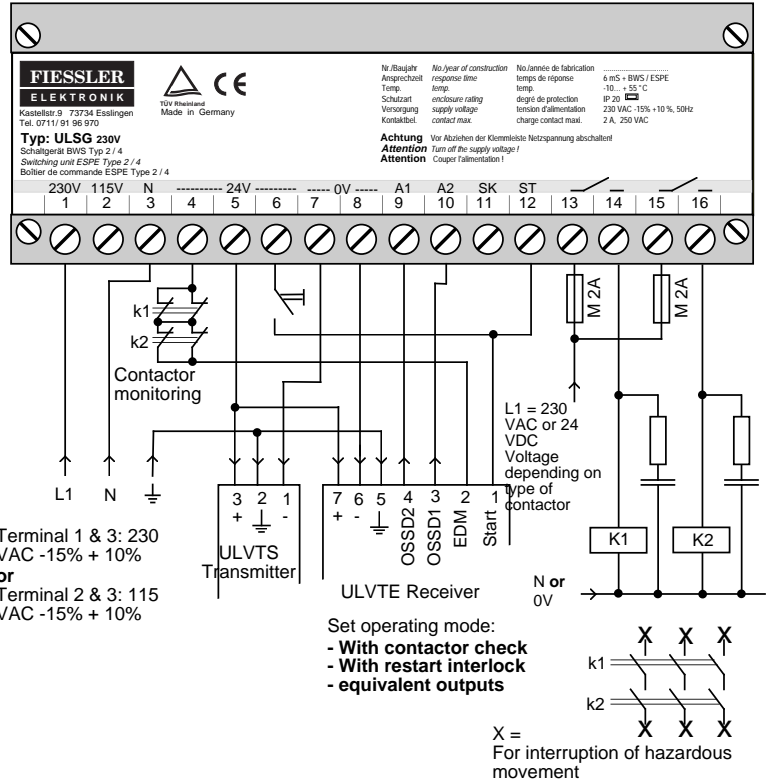
In the operating mode without restart interlock, the connecting pin 1 (start) on the receiver must be left free.

24 VDC connection / the output contacts 13-14 and 15-16 directly control the hazardous movement

Control of the hazardous movement of the operating material is performed directly via the potential-free output contacts 13-14 and 15-16.

The activation of the hazardous movement is implemented as described in the above example.

In the operating mode without restart interlock, the connecting pin 1 (start) on the receiver must be left free.



Cable routing: Separately from power lines.

The hazardous movement must only be activated via output contacts 16-17 and 20-21. The output contacts are potential-free, monitored, guided make contacts are must be loaded with max. 2 A/250 VAC or 60 VDC, 30 W. With inductive load, the load (not the contacts) is to be switched at the same time as the spark arresting sections (e.g. 0.22 uF, 220 Ω. hazardous closing movement. To increase the switching reliability, collateral contacts should be used on

When performing electric welding work on the machine, the terminal strip of the switchgear is to be removed, otherwise the vagrant welding currents may cause destruction of the installed electronics.

Start interlock

Subsequent to commissioning and/or a power interruption, the start interlock prevents a "re-release". A re-release is only possible once the protective field has been interrupted and reactivated.

Response time

The time period between penetration of the protective field and the switching process.

EPSE Type 4

The ULVT... safety light barriers comprise photo-electric guards. These devices are characterized by the fact that when the protective field generated by the transmitter and receiver is interrupted, a hazardous movement is interrupted or prevented.

One-cycle (two-cycle operating mode)

Subsequent to one (two) penetrations, the machine automatically performs an operating cycle and then waits for a maximum 30 seconds for one (two) penetrations. If the time period exceeds 30 seconds, the restart interlock is activated.

Installation range (Fig. 30/1)

The minimum and/or maximum permissible distance between the transmitter and receiver. The permissible installation range is specified on the ULVT receiver.

Obstacle size (Fig. 30/1)

The obstacle size indicates the minimum obstacle diameter that will definitely interrupt a hazardous movement through the safety light barriers.

The following obstacle sizes are provided by the beam distances for the ULVT... safety light barriers:

Min. / max. installation range	0,3m / 7 m	0,3m / 24 m
min. obstacle size	14 mm	30 mm
min./max. protective field height	100 mm / 1900 mm	100 mm / 1900 mm

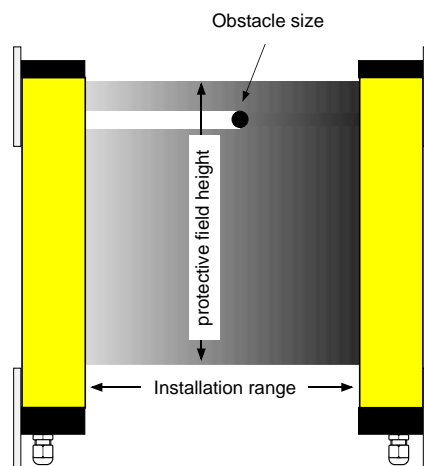


Fig. 30/1 Installation range, obstacle size, protective field height

Muting

Temporary and safe bridging of the ULVT safety light barriers during a material movement, e.g. into and out of a manufacturing cell, or in high-bay storage. Reliable differentiation between man and material flow is ensured.

Overrun

The section of hazardous movement which occurs after penetration of the protective field.

Overrun traverse (Fig. 30/2)

The path traversed during the run-on period (e.g. path of a ram, path of a point on a roller surface).

Overrun period

Duration of the run-on period.

Protective field height (Fig. 30/1)

Height of the protective field generated by the transmitter and receiver.

Safety mode

When the protective field is interrupted, the switching outputs are blocked, then automatically released subsequent to re-release of the protective field.

Self-monitoring

The automatic response of the photo-electric guard in the event of an internal malfunction.

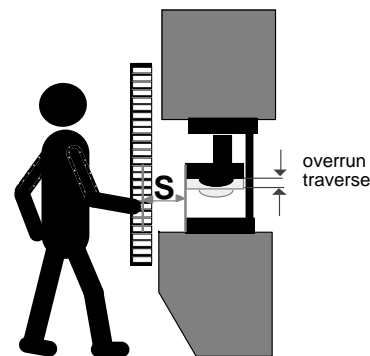


Fig. 30/2 Safe distance and overrun traverse

Safe distance (Fig. 30/2)

The minimum distance S between safety light barrier and the nearest hazardous area, required in order to prevent injuries. In order to establish the minimum safe distance, the formulas from standard EN 999, the machine-specific C standards and the effective ZH guidelines are to be used.

Safety category 4

The ULVT safety light barriers belong to safety category 4 as per EN 945-1 and IEC 61496 / EN 61496.

Devices of safety category 4 comprise self-monitoring photo-electric guards and represent the highest safety class for photo-

electric guards.

Beam spacing

The distance (gap) between the centres of the individual lenses on ULVT... safety light barriers is called the beam distance. The ULVT... safety light barriers are supplied with a lens grid of 7.5 mm.

Valve or contactor check

Prior to each release of the switching outputs, the contactor identifies whether the connected switching elements (relays, contactors or valves) have fallen. Only when this is so can a new release of the switching inputs be performed. This also prevents the dangerous failure of the switching elements (relays, contactors, valves) of the hazardous movement.

Restart interlock

The restart interlock prevents the automatic release of the switching outputs subsequent to the interruption and reactivation of the protective field (e.g. due to walking through the protective field).

Characteristic data
ULVTS / ULVTE

Safety category	4 pursuant to EN 954-1 and IEC 61496 / EN 61496
Protective field heights	100 mm ... 3000 mm (depending on number of beams)
Protective field width	0,3... 7 m , 0,3...24 m
Construction lengths	196 mm ... 1996 mm (depending on number of beams)
Definition	14 mm
Number of beams	13 ... 247 beams
Operating modes (selected via DIP switches, see also Sections 3.5 and 7)	<ul style="list-style-type: none"> - With / without restart interlock - With / without contactor check - equivalent / antivalent outputs - Muting (only with optional LSUW N1 Muting K switchgear) - Cycle mode with 1 cycle / 2 cycles (only with optional LSUW NSR3-1 K switchgear) - Safety mode with restart interlock only during the hazardous movement (only with optional LSUW NSR3-1 K switchgear)

Mechanical data

Housing design	Aluminium profile, plastic-coated RAL 1020, yellow, end pieces made from non-corrosive, spherically reinforced plastic (polyamide). Plexiglass light outlet and inlet, optional with solvent-resistant silicate glass.
Attachment	Shifting fastening brackets on rear side of housing
Weight	Transmitter: 0.45 kg to 4.5 kg depending on construction length Receiver: 0.5 kg to 5.0 kg depending on construction length

Operating data

Protection category	IP 65
Protection class	III
Operating ambient temperature	-10 bis 55 °C
Storage temperature	-25 bis 70 °C

Electric data

	ULVTS Transmitter	ULVTE Receiver
Power supply	24 V DC, + 20 % - 10 %, SELV	24 V DC, ±20%, SELV
Current draw	max. 250 mA	max. 250 mA (no load)
Outputs	-	OSSD 1 and 2: Failsafe PNP outputs, max. 0.5 A, short-circuit and cross-circuit monitoring (in operating mode with antivalent outputs, output 2 is not failsafe, max. 20 mA)
Inputs	-	Contacteur check and start button inputs: 0 V to 24 VDC
Electric connection	Integrated connector plug with PG9 as strain relief, alternatively conventional connector plug	Integrated connector plug with PG9 as strain relief, alternatively conventional connector plug
Connecting cable	3-pol. max. 1,5 mm ²	5 to 7-pin (depending on operating mode), max. 1.5 mm ²

Characteristic data
Optional LSUW NSR 3-1K / LSUW N1 Muting K / ULSG switchgears

Safety category	4 pursuant to EN 954-1 and IEC 61496 / EN 61496
Operating modes (selected via DIP switches, see also Sections 3.5 and 7)	- Muting (only with LSUW N1 Muting K switchgear) - Cycle mode with 1 cycle / 2 cycles (only with LSUW NSR3-1 K switchgear) - Safety mode with restart interlock only during the hazardous movement (only with LSUW NSR3-1 K switchgear)
Response time	LSUW N1 Muting K: 29 ms - LSUW NSR3-1 K: 25 ms - ULSG: 6 ms

Mechanical data

Housing design	Insulated black housing, curved lid
Attachment	Snap-on mounting on top hat rail DIN EN 50022-35, threaded mounting
Weight	ULSG: 1200 g LSUW NSR 3-1K / LSUW N1 Muting K: 1700 g

Operating data

Protection category	IP 20
Protection class	Shockproof
Operating ambient temp.	-10 bis 55 °C
Storage temperature	-25 bis 70 °C

Electric data

Power supply	Optionally 230 VAC/50 Hz + 10% -15%, 115 VAC/50 Hz + 10% - 15%, 24 VDC, +20% - 10%, reverse polarity protected
Current draw	max. 250 mA
Outputs	The output contacts are potential-free, monitored (with ULSG only in conjunction with ULVT), guided make contacts are must be loaded with max. 2 A/250 VAC or 60 VDC, 30 W.
Inputs	Contact check and start button inputs: 0 V to 24 VDC \pm 20%
Electric connection	Plug-on terminal strip
Connecting cable	max. 1,5 mm ²

ULVT transmitter / receiver

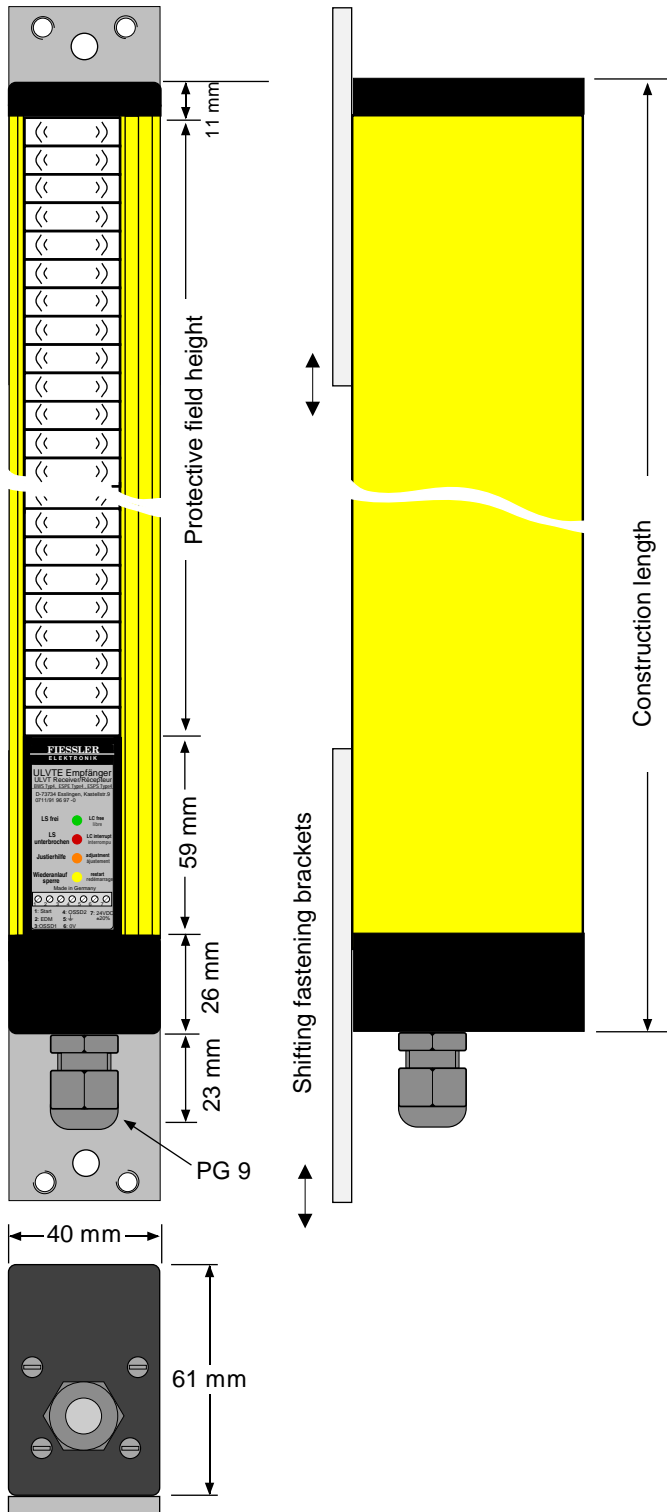


Fig. 34/1 Dimensions of transmitter / receiver

Housing design:

Aluminium profile, plastic-coated RAL 1020, yellow, end pieces made from non-corrosive, spherically reinforced plastic (polyamide). Plexiglass light outlet and inlet, optional with solvent-resistant silicate glass.

Attachment:

Shifting fastening brackets on rear side of housing

Fastening brackets

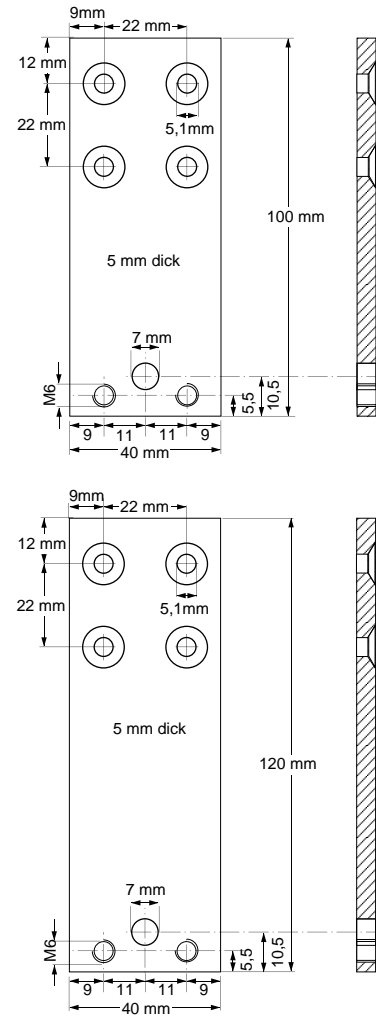
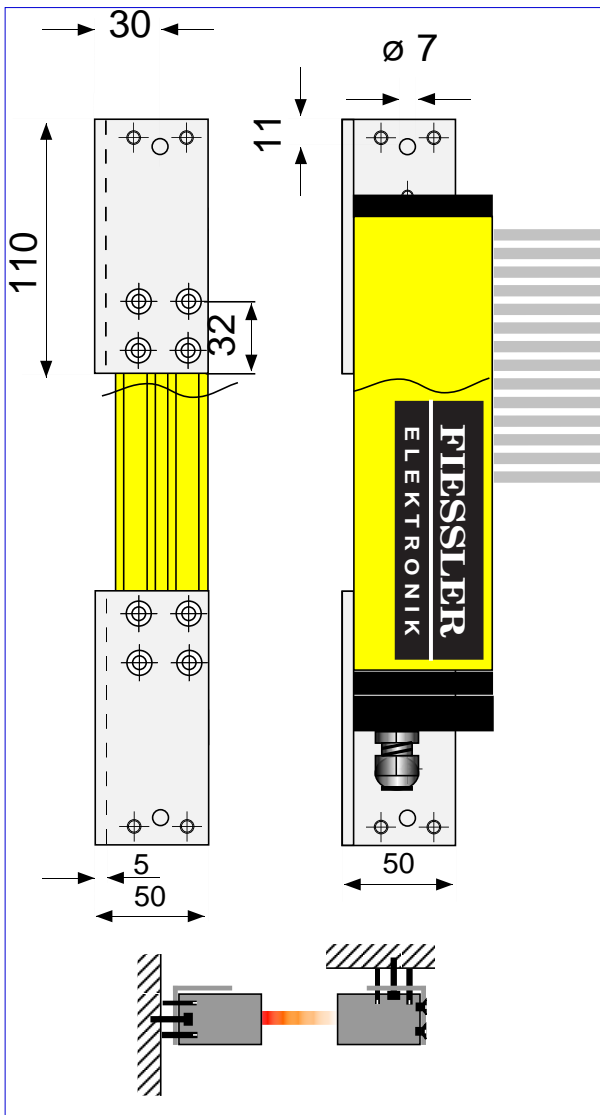


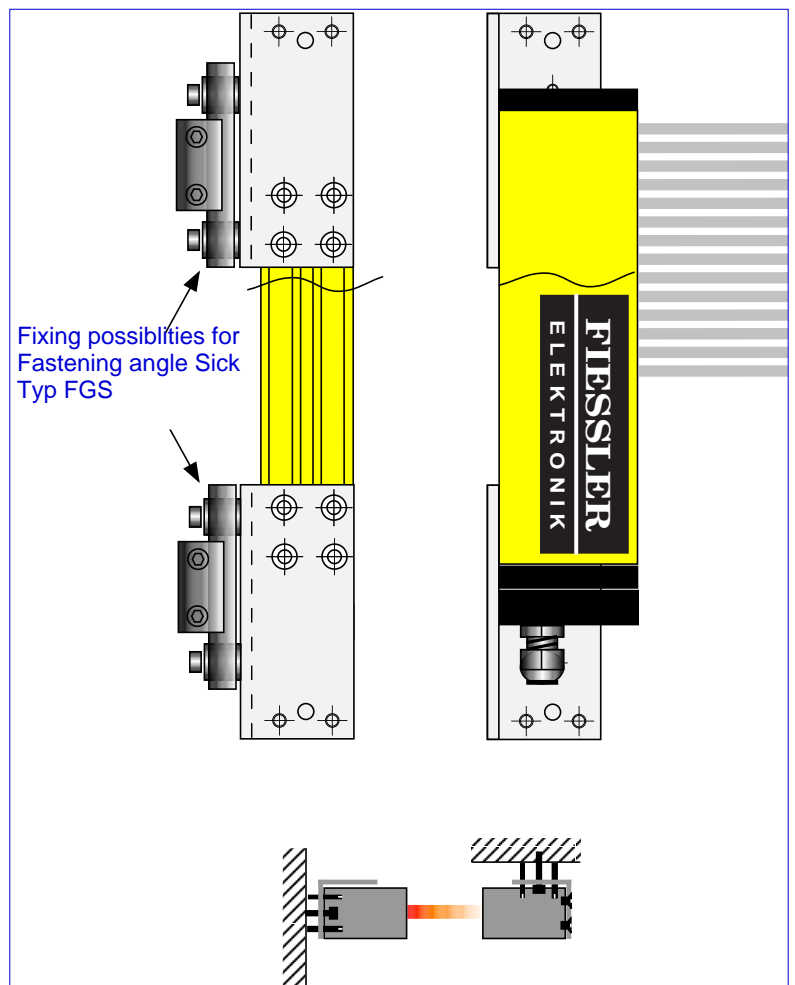
Fig.34/2 Fastening brackets

Protective field height (mm) / no. of beams	Construction length (mm)
100 / X	196
200 / X	296
300 / X	396
400 / X	496
500 / X	596
600 / X	696
700 / X	796
800 / X	896
900 / X	996
1000 / X	1096
1100 / X	1196
1200 / X	1296
1300 / X	1396
1400 / X	1496
1500 / X	1596
1600 / X	1696
1700 / X	1796
1800 / X	1896
1900 / X	1996

Mounting with optional mounting angle



Mounting with optional mounting angle for fastening angle, Sick Typ FGS



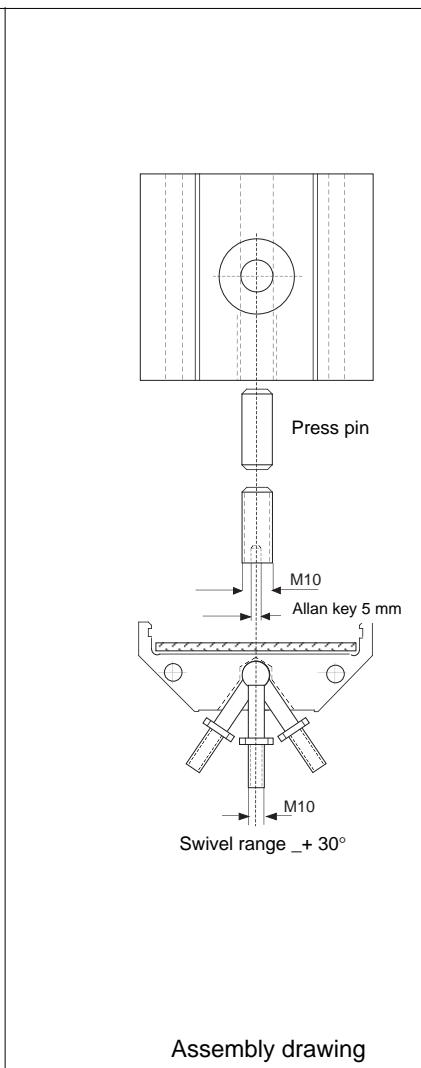
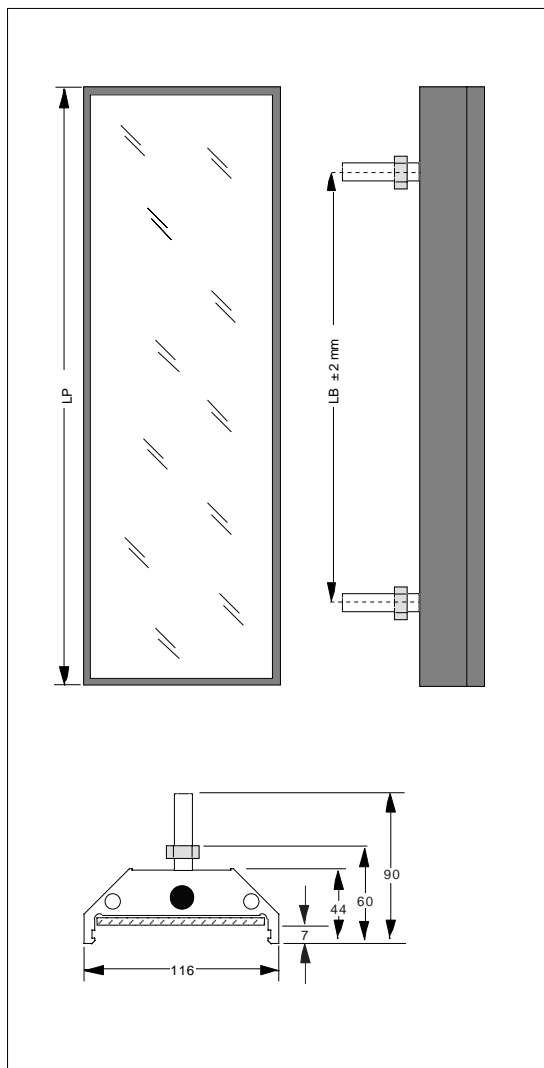
Housing design:

Distortion-free aluminium dual-chamber profile, plastic-coated RAL 1021, yellow

Attachment:

Spherical head screw

Dimensions drawing



Form factors

For protective field height	Profile length LP	Attachment distance LB	Weight g	order no.
100	200	Central*	1667	usp100
200	300	195	2297	usp200
300	400	295	2927	usp300
400	500	395	3557	usp400
500	600	495	4187	usp500
600	700	595	4817	usp600
700	800	695	5447	usp700
800	900	795	6077	usp800
900	1000	895	6707	usp900
1000	1100	995	7337	usp1000
1100	1200	1095	7967	usp1100
1200	1300	1195	8597	usp1200
1300	1400	1295	9227	usp1300
1400	1500	1395	9857	usp1400
1500	1600	1495	10487	usp1500
1600	1700	1595	11117	usp1600
1700	1800	1695	11747	usp1700
1800	1900	1795	12377	usp1800
1900	2000	1895	13007	usp1900

* Attachment only via ball joint

Installation information:

1. Insert the spherical head screw into the pocket hole as shown in the drawing.
2. Insert the press pin.
3. Screw in the hexagon screw and tighten using a 5 mm Allan key.

The mirror can be attached to a holder with the aid of the spherical head screw. Further installation options are provided by the threaded bores on the mirror profile.

Housing design:

Insulated black housing, curved lid

Attachment:

Snap-on mounting on top hat rail DIN EN 50022-35, threaded mounting

Protection category:

IP 20

(For the ULSG and LSUW N1 Muting K switchgears, an attachment housing with protection category IP 55 is available.)

Electric connection:

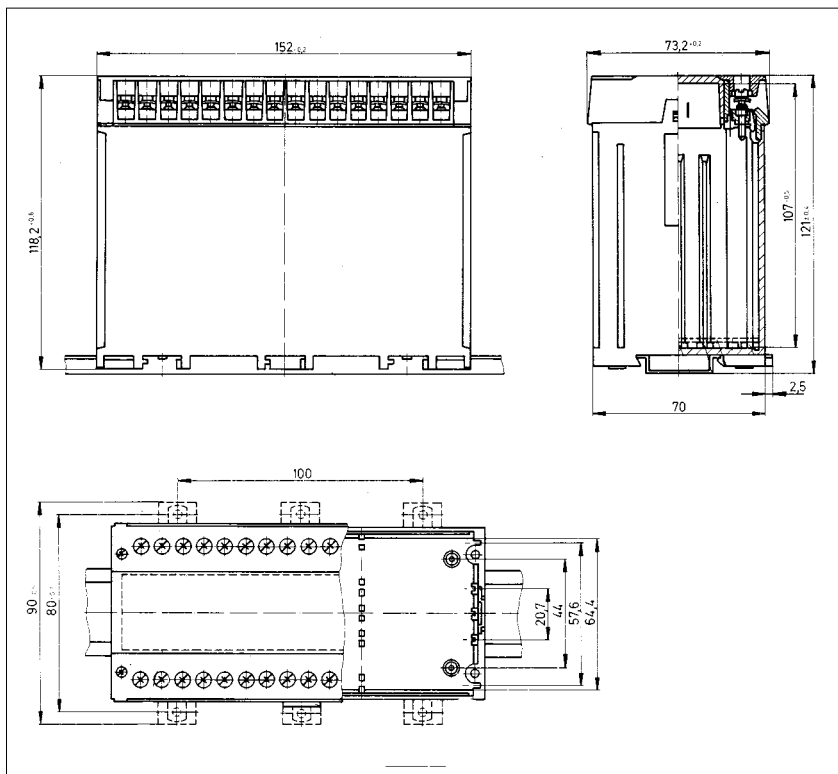
Plug-on terminal strip

Weight:

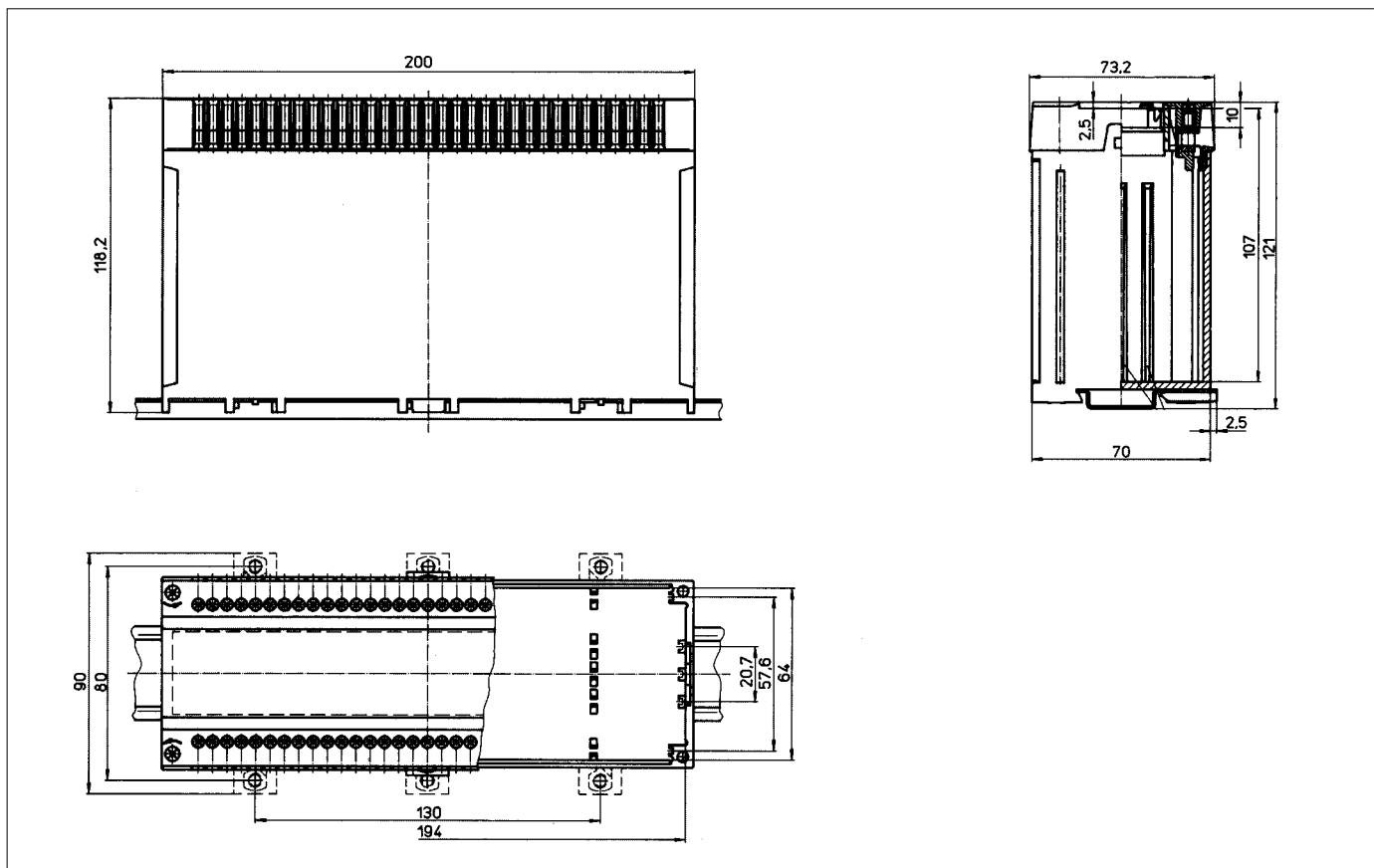
ULSG: 800 g

LSUW NSR 3-1K: 2500 g

LSUW N1 Muting K: 2500 g



Optional LSUW NSR 3-1k / LSUW N1 Muting K safety switchgears



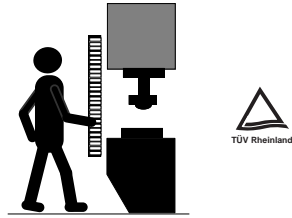
Accessories

Order designation

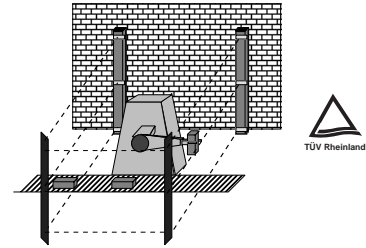
Rubber-metal connection (for intense vibrations)	Refer to Page 14	Per bracket	SM
mounting angle	Refer to Page 35		BW-K
Test rod (for daily function inspection)	Refer to Page 19	14 mm	PS 14
Tilted mirror	Refer to Page 35		SP 100 ... SP 2000
Silicate glass (solvent-resistant)	Refer to Page 20		UGL 100 ... UGL 2000
Assembly columns for transmitter and receiver	Refer to Page 15/16		MS 1250 SE
Assembly columns complete with tilted mirrors	Refer to Page 15/16		MS 1250 US
Adjustment laser	Refer to Page 19		JL2
EX-protection	Refer to Page 19		EXP

Product range:

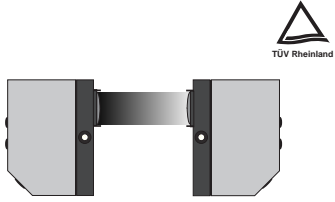
Fiessler Elektronik
 Kastellstr. 9 D-73734 Esslingen
 Telefon: +49 711 / 91 96 97-0
 Telefax: +49 711 / 91 96 97-50
 www.fiessler.de
 E-Mail: info@fiessler.de



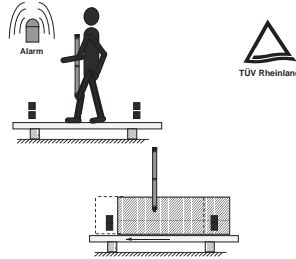
Safety light barriers



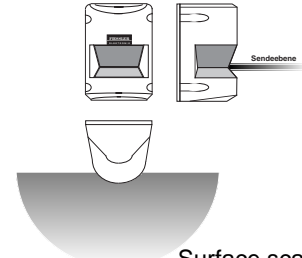
Safety light bars



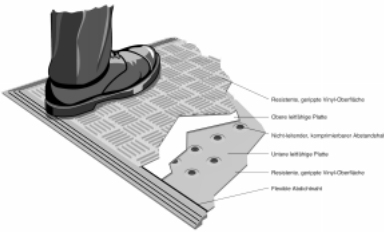
Single-beam safety light barriers



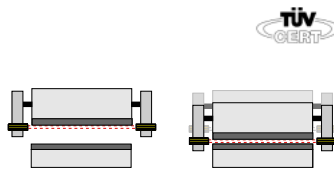
Safety light bars with muting function



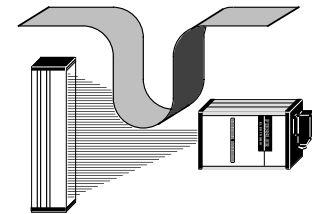
Surface scanner



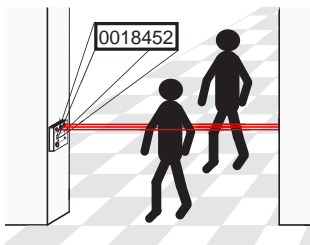
Safety switching mats



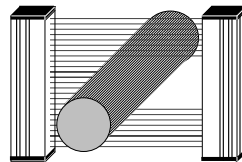
Folding press protection



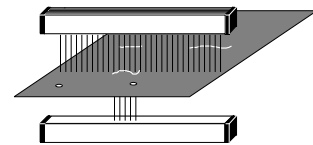
Analog sag sensor



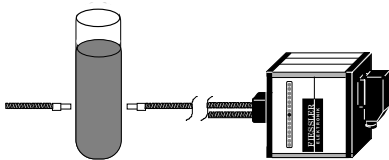
Counting barriers



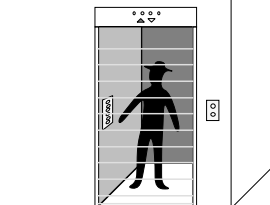
Switching end and measuring light barriers



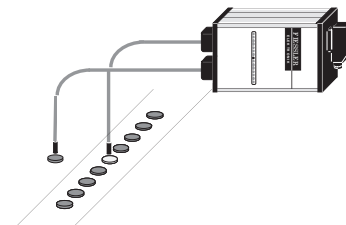
Hole seeking device



Turbidity sensors



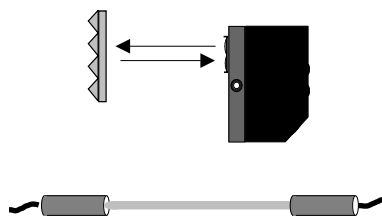
Elevator light bars



Reference sensor



EX-Light - Barrier



Light-Barrier for general applications



Your application