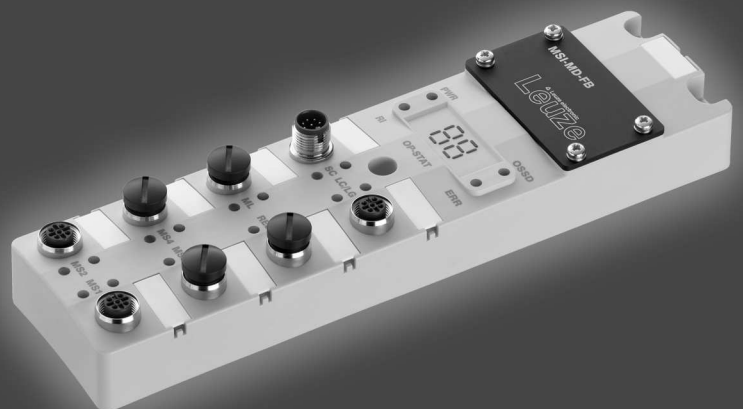




## MSI-MD-FBX Muting Controller



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<b>1</b>	<b>About this document .....</b>	<b>5</b>
1.1	Checklists.....	5
1.2	Downloading the diagnostics software from the Internet .....	5
1.3	Used symbols and signal words .....	5
<b>2</b>	<b>Safety .....</b>	<b>7</b>
2.1	Intended use and foreseeable misuse .....	7
2.1.1	Intended use.....	7
2.1.2	Foreseeable misuse .....	8
2.2	Necessary competencies.....	8
2.3	Responsibility for safety .....	9
2.4	Disclaimer .....	9
<b>3</b>	<b>Device description .....</b>	<b>10</b>
3.1	Device construction .....	11
3.2	Display elements .....	12
3.3	Connection technology .....	13
<b>4</b>	<b>Functions .....</b>	<b>14</b>
4.1	Timing controlled 2-sensor muting.....	14
4.1.1	Timing controlled 2-sensor muting with Muting-enable .....	15
4.2	Overriding and muting restart .....	15
4.3	Error reset.....	16
4.4	Restart .....	17
4.5	Acknowledging/resetting .....	17
<b>5</b>	<b>Applications .....</b>	<b>18</b>
5.1	Access guarding with timing controlled muting .....	18
<b>6</b>	<b>Mounting .....</b>	<b>19</b>
6.1	Mounting the muting controller .....	19
6.1.1	Mounting in the UDC device column .....	19
6.1.2	Mounting on the UDC device column.....	20
6.1.3	Mounting on the system .....	20
6.2	Arrangement of the muting sensors.....	20
6.2.1	Basic information .....	21
6.2.2	Selecting optoelectronic muting sensors.....	21
6.2.3	Minimum distance for optoelectronic muting sensors .....	21
6.2.4	Arrangement of the muting sensors for timing controlled 2-sensor muting .....	22
<b>7</b>	<b>Electrical connection .....</b>	<b>25</b>
7.1	Connecting the muting controller .....	25
7.2	Pin assignment of the machine interface .....	27
7.3	Pin assignment of safety sensor .....	27
7.4	Pin assignment of the acknowledgment unit .....	28
7.5	Pin assignment of muting indicator.....	28
7.6	Pin assignment of muting sensors .....	29
7.7	Circuit diagram examples .....	29
7.7.1	Timing controlled 2-sensor muting .....	29

<b>8</b>	<b>Starting up the device - Configuration.....</b>	<b>30</b>
8.1	Overview .....	30
8.2	Setting the operating mode.....	31
<b>9</b>	<b>Testing .....</b>	<b>33</b>
9.1	Before the initial start-up and following modifications .....	33
9.2	Regularly by qualified persons.....	33
9.3	Periodically by the operator .....	34
9.3.1	Checklist – periodically by the operator.....	34
<b>10</b>	<b>Care, maintenance and disposal .....</b>	<b>35</b>
<b>11</b>	<b>Diagnostics and troubleshooting .....</b>	<b>36</b>
11.1	What to do in case of failure? .....	36
11.2	Error messages 7-segment display .....	36
<b>12</b>	<b>Service and support .....</b>	<b>40</b>
<b>13</b>	<b>Technical data .....</b>	<b>41</b>
13.1	General specifications .....	41
13.2	Dimensioned drawings .....	43
13.3	Dimensioned drawings - Accessories .....	43
<b>14</b>	<b>Order guide and accessories.....</b>	<b>45</b>
14.1	Type overview.....	45
14.2	Accessories.....	45
<b>15</b>	<b>EC Declaration of Conformity .....</b>	<b>47</b>

## 1 About this document

### 1.1 Checklists



The checklists (see chapter 9 "Testing") serve as a reference for the machine manufacturer or supplier. They replace neither testing of the complete machine or system prior to the initial start-up nor their periodic testing by a competent person. The checklists contain minimum testing requirements. Depending on the application, other tests may be necessary.

### 1.2 Downloading the diagnostics software from the Internet




- ↳ Call up the Leuze home page: **www.leuze.com**
- ↳ Enter the type designation or part number of the device as the search term.
- ↳ The diagnostics software can be found on the product page for the device under the *Downloads* tab.

### 1.3 Used symbols and signal words

Tab. 1.1: Warning symbols and signal words

	Symbol indicating dangers to persons
	Symbol indicating possible property damage
NOTE	Signal word for property damage Indicates dangers that may result in property damage if the measures for danger avoidance are not followed.
CAUTION	Signal word for minor injuries Indicates dangers that may result in minor injury if the measures for danger avoidance are not followed.
WARNING	Signal word for serious injury Indicates dangers that may result in severe or fatal injury if the measures for danger avoidance are not followed.
DANGER	Signal word for life-threatening danger Indicates dangers with which serious or fatal injury is imminent if the measures for danger avoidance are not followed.

Tab. 1.2: Other symbols

	Symbol for tips Text passages with this symbol provide you with further information.
	Symbol for action steps Text passages with this symbol instruct you to perform actions.
	Symbol for action results Text passages with this symbol describe the result of the preceding action.

Tab. 1.3: Terms and abbreviations

AOPD	Active Optoelectronic Protective Device ( <b>A</b> ctive <b>O</b> ptoelectronic <b>P</b> rotective <b>D</b> evice)
Blanking	Deactivation of the protective function of individual beams or beam areas with monitoring for interruption
CS	Switching signal from a control or a machine interface ( <b>C</b> ontroller <b>S</b> ignal)
EDM	Contacting monitoring ( <b>E</b> xternal <b>D</b> evice <b>M</b> onitoring)
FG	Function group ( <b>F</b> unction <b>G</b> roup)
LED	LED, display element in transmitter and receiver
MS1, MS2	Muting sensor 1, 2
MTTF <sub>d</sub>	Mean time to dangerous failure ( <b>M</b> ean <b>T</b> ime <b>T</b> o dangerous <b>F</b> ailure)
Muting	Temporary automatic suppression of the safety functions
OSSD	Safety-related switching output ( <b>O</b> utput <b>S</b> ignal <b>S</b> witching <b>D</b> evice)
PFH <sub>d</sub>	Probability of a dangerous failure per hour ( <b>P</b> robability of dangerous <b>F</b> ailure per <b>H</b> our)
PL	<b>P</b> erformance <b>L</b> evel
Reduced resolution	Reduction of the detection capability of the protective field without monitoring for tolerating small objects in the protective field
RES	Start/restart interlock (Start/ <b>RE</b> start interlock)
Scan	Consecutive scans of the protective field from the first to the last beam
Safety sensor	System consisting of transmitter and receiver
SIL	<b>S</b> afety <b>I</b> ntegrity <b>L</b> evel
State	ON: device intact, OSSD switched on OFF: device intact, OSSD switched off Locking: device, connection or control / operation faulty, OSSD switched off (lock-out)

## 2 Safety

For mounting, operating and testing, this document as well as all applicable national and international standards, regulations, rules and directives must be observed. Relevant and supplied documents must be observed, printed out and handed to affected persons.

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

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

- Machinery directive 2006/42/EC
- Low voltage directive 2014/35/EU
- EMC directive 2014/30/EU
- Use of work equipment directive 89/655/EEC supplemented by directive 95/63 EC
- OSHA 1910 Subpart O
- Safety regulations
- Accident-prevention regulations and safety rules
- Ordinance on Industrial Safety and Health and employment protection act
- Product Safety Law (ProdSG and 9. ProdSV)

### NOTICE



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

## 2.1 Intended use and foreseeable misuse



### DANGER



#### Electrically live systems pose a risk of electric shock!

- ↳ Make certain that, during all conversions, maintenance work and inspections, the system is securely shut down and protected against being restarted.
- ↳ Only have work on the electrical system and electronics performed by a competent person (see chapter 2.2 "Necessary competencies").

### 2.1.1 Intended use



### WARNING



#### A running machine may result in serious injury!

- ↳ Make certain that the safety relay is correctly connected and that the protective function of the protective device is ensured.
- ↳ Make certain that, during all conversions, maintenance work and inspections, the system is securely shut down and protected against being restarted.

Only if the safety relay is correctly connected and correctly started up is the protective function of the protective device ensured. To prevent misuse and resulting dangers, the following must be observed:

- These operating instructions are included in the documentation of the system on which the protective device is mounted and are available to the operating personnel at all times.
- The safety relay is used as a safety monitoring device in combination with one or more safety sensors for safeguarding danger zones or points of operation on machines and systems.
- The safety relay 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 (see chapter 2.2 "Necessary competencies").
- The safety relay must only be connected and commissioned in accordance with its specifications (technical data, environmental conditions, etc.).

- The acknowledgment unit for unlocking the start/restart interlock must be located outside of the danger zone.
- The entire danger zone must be visible from the installation site of the acknowledgment unit.
- When selecting the safety relay it must be ensured that its safety-related capability meets or exceeds the required performance level  $PL_r$  ascertained in the risk assessment (see chapter 13 "Technical data").
- The machine or system control must be electrically influenceable so that a switch command sent by the safety relay results in the immediate shutdown of the dangerous movement.
- The construction of the safety relay must not be altered. When manipulating the safety relay, the protective function is no longer guaranteed. Manipulating the safety relay also voids all warranty claims against the manufacturer of the safety relay.
- The safety relay must be inspected regularly by a competent person to ensure proper integration and mounting (see chapter 2.2 "Necessary competencies").
- The safety relay must be exchanged after a maximum of 20 years. Repairs or the exchange of wear parts do not extend the mission time.

### 2.1.2 Foreseeable misuse

Any use other than that defined under the "Approved purpose" or which goes beyond that use is considered improper use.

Alone, the safety relay is not a complete protective device. It is **not** suitable for use in the following cases:

- Applications in explosive or easily flammable atmospheres
- On machines or systems with long stopping times

## 2.2 Necessary competencies

The safety relay may only be configured, installed, connected, commissioned, serviced and tested in its respective application by persons who are suitably qualified for the given task. General prerequisites for suitably qualified persons:

- They have a suitable technical education.
- They are familiar with the relevant parts of the operating instructions for the safety relay and the operating instructions for the machine.

Task-specific minimum requirements for suitably qualified persons:

### Configuration

Specialist knowledge and experience in the selection and use of protective devices on machines as well as the application of technical rules and the locally valid regulations on labor protection, safety at work and safety technology.

### Mounting

Specialist knowledge and experience needed for the safe and correct installation and alignment of the safety relay with regard to the respective machine.

### Electrical installation

Specialist knowledge and experience needed for the safe and correct electrical connection as well as safe integration of the safety relay in the safety-related control system.

### Operation and maintenance

Specialist knowledge and experience needed for the regular inspection and cleaning of the safety relay – following instruction by the person responsible.

### Servicing

Specialist knowledge and experience in the mounting, electrical installation and the operation and maintenance of the safety relay in accordance with the requirements listed above.



### **Commissioning and testing**

- Experience and specialist knowledge in the rules and regulations of labor protection, safety at work and safety technology that are necessary for being able to assess the safety of the machine and the use of the safety relay, including experience with and knowledge of the measuring equipment necessary for performing this work.
- In addition, a task related to the subject matter is performed in a timely manner and knowledge is kept up to date through continuous further training - *Competent person* in terms of the German Betriebs-sicherheitsverordnung (Ordinance on Industrial Safety and Health) or other national legal regulations.

## **2.3 Responsibility for safety**

Manufacturer and operating company must ensure that the machine and implemented safety relay 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 relay, verified by the initial test performed by a competent person (see chapter 2.2 "Necessary competencies")
- 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 operator
- Maintaining the safe operation of the machine
- Adhering to all regulations and directives for labor protection and safety at work
- Periodic testing by a competent person (see chapter 2.2 "Necessary competencies")

## **2.4 Disclaimer**

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

- Safety relay 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 9 "Testing").
- Changes (e.g., constructional) are made to the safety relay.

### 3 Device description

The MSI-MD-FB muting controller is used as a safety-relevant link between an active opto-electronic protective device (AOPD) and the machine control. The muting controller enables muting through intentional and temporary suppression of the protective function of the safety sensor, e.g., if objects are to be transported through the protective field.

The muting controller is mounted on machine parts or on a device column.

#### Safety sensors and muting sensors

The muting controller supplies the safety sensor and the muting sensors with 24 V supply voltage.

The following safety sensors from Leuze electronic are released for connection to the muting controller:

- Safety light barriers of the MLD series
- Safety light curtains of the MLC series

#### NOTICE



The MSI-MD-FB muting controller is only released for the connection of the safety sensors from Leuze electronic, e.g., MLC 510 or MLD 510.

The following muting sensors from Leuze electronic are released for connection to the muting controller:

- All common series: 3 series, 5 series, 8 series, 25 series, 46 series, 49 series, 96 series

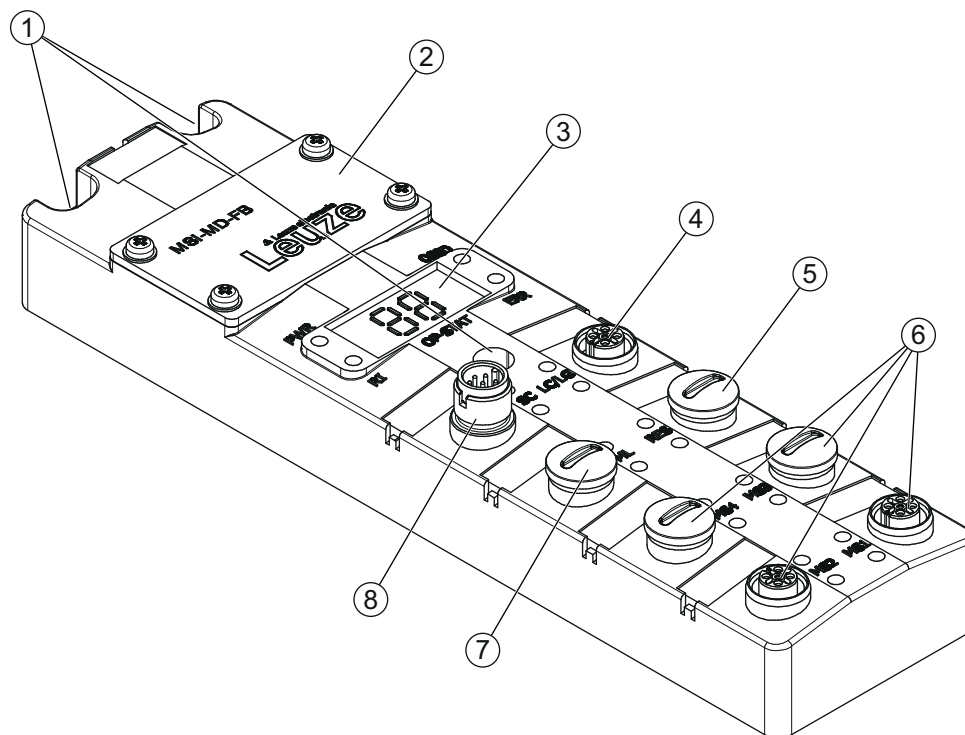
#### Degree of protection and standards

The muting controller is designed in degree of protection IP67

The muting controller meets the following standards:

- Performance Level PL e in accordance with EN ISO 13849
- Safety Integrity Level SIL 3 in accordance with IEC 61508

### 3.1 Device construction



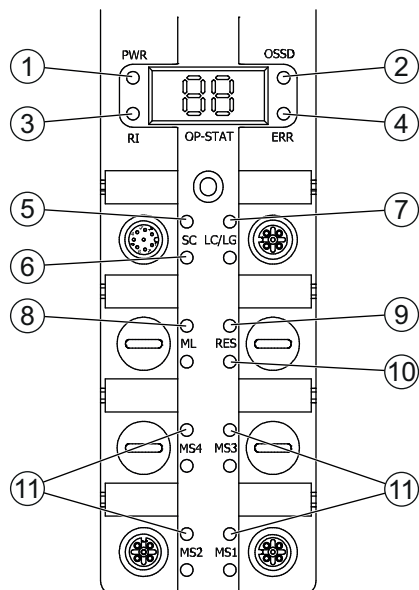
- 1 Mounting eyes for M4 screws
- 2 Cover for the DIP switch blocks for configuring the muting function and the Micro USB connection for reading out diagnostics.
- 3 7-segment display
- 4 Connection for the safety sensor
- 5 Connection for acknowledgment unit
- 6 Connections for muting sensors
- 7 Connection for external muting indicator
- 8 Connection to the machine interface (OSSDs and supply voltage)

Fig. 3.1: Device construction of the muting controller

## 3.2 Display elements

The muting controller is equipped with the following display elements:

- LED indicators for the status of the assigned input signals



- 1 PWR LED
- 2 OSSD LED
- 3 RI LED
- 4 ERR LED
- 5 SC LED (1)
- 6 SC LED (2)
- 7 LC/LG LED
- 8 ML LED
- 9 RES LED (1)
- 10 RES LED (2)
- 11 LED MS1 ... MS4

Fig. 3.2: LED indicators of the muting controller

LED		Color	Description
1	PWR	Green	Power (PWR)
2	OSSD	Red	OSSDs in the OFF state
		Green	OSSDs in the ON state
3	RI	Yellow	Restart active Safety sensor on The system is waiting for actuation of the acknowledgment unit
4	ERR	Red	Fault
5	SC	Green	Muting sensor alternative active
6		White	Muting signal from the machine interface active
7	LC/LG	OFF	OSSDs of the safety sensor in the OFF state
		Green	OSSDs of the safety sensor in the ON state
8	ML	Blue	Muting indicators: <ul style="list-style-type: none"> <li>• OFF: no muting active</li> <li>• Continuous light: muting active; safety sensor is bypassed by means of muting</li> <li>• Flashing: muting error; e.g., timeout</li> </ul>
9	RES	Yellow	Acknowledgment unit pressed (reset signal)
10		Red	Ready for reset (ReadyForReset signal) The system is waiting for actuation of the acknowledgment unit
11	MS1 ... MS4	Green	Muting sensor 1 ... 4 active

### 3.3 Connection technology

#### NOTICE



**Sockets and connectors that are not connected are to be covered with end caps!**

→ Cover unconnected sockets and connectors with end caps.

## 4 Functions

By means of muting, the protective function of the safety sensor can be temporarily and properly suppressed, e.g. if objects are to be transported through the protective field. The OSSDs of the muting controller remain in the ON state in spite of interruption of one or more beams of the safety sensor.

### Muting mode

The muting controller supports the following muting mode:

- Timing controlled 2-sensor muting (see chapter 4.1 "Timing controlled 2-sensor muting")

### Muting timeout

Configurable time limit for the muting function (muting timeout):

- 20 seconds
- 2 minutes
- 10 minutes
- 100 hours

Muting timeout is set via the DIP switch blocks (see chapter 8 "Starting up the device - Configuration").

### Muting sensors

Muting is initiated automatically and via mutually independent muting signals by muting sensors.

- Photoelectric sensors or scanning sensors can be connected to the muting controller as muting sensors (see chapter 14 "Order guide and accessories").
- The state of a muting sensor is transferred on pin 4 of the connection on the muting controller.
- The muting signals of the muting sensors are debounced:
  - Pickup delay: 60 ms
  - Slow release: 300 ms

#### NOTICE



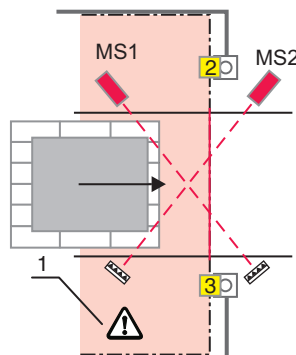
**Do not use muting signal MS1 via machine interface and local socket simultaneously!**

↳ If muting signal MS1 is used via the machine interface, MS1 must not be used simultaneously on the local socket.

### 4.1 Timing controlled 2-sensor muting

Muting is initiated automatically and via two mutually independent muting signals. These signals must be active during the entire duration of the muting operation. Muting may not be initiated by a single sensor signal, nor may it be fully initiated by software signals.

The protective function of the entire protective field is deactivated during timing controlled muting.



- 1 Danger zone
- 2 Receiver of the safety sensor
- 3 Transmitter of the safety sensor
- MS1 Muting sensor 1
- MS2 Muting sensor 2

Fig. 4.1: Arrangement of muting sensors for timing controlled 2-sensor muting in an exit application

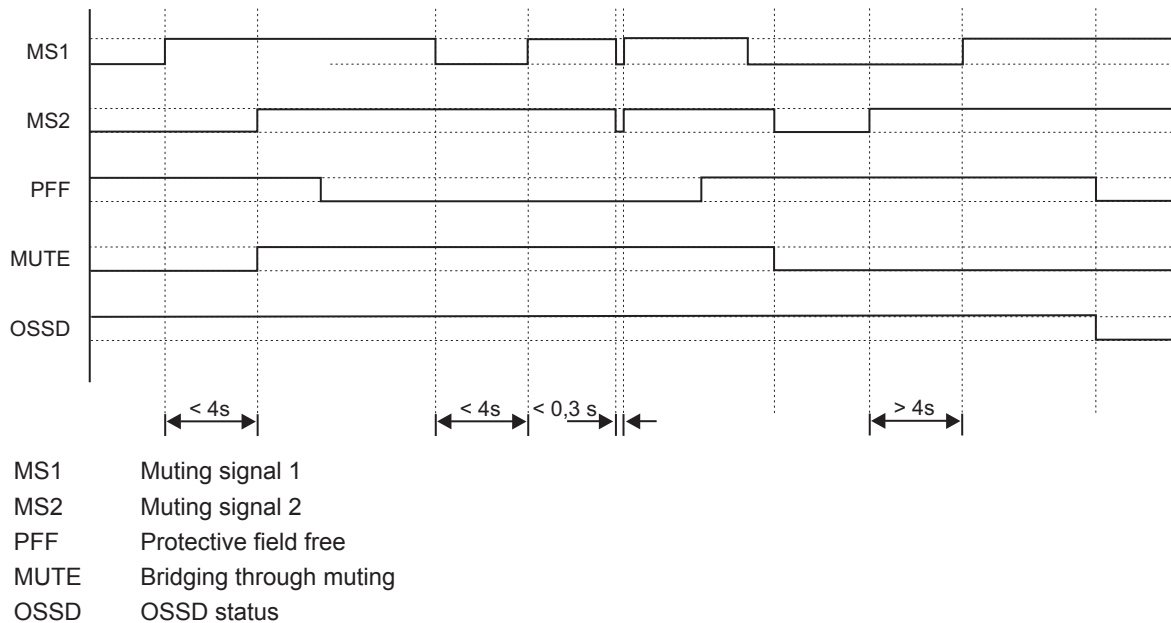


Fig. 4.2: Timing controlled muting - timing

The material can move in both directions. Often, an arrangement consisting of crossed beams from retro-reflective photoelectric sensors is used (see chapter 6.2 "Arrangement of the muting sensors").

Timing controlled muting is used in the following cases:

- Moving-in applications: diffuse sensors in the danger zone detect the muting object through the protective field. The scanning range must be set to a sufficiently small value (see chapter 6 "Mounting").
- Exit applications: a photoelectric sensor in the danger zone works diagonally to the transport direction together with a simultaneously activated machine interface signal, which derives from the drive of the transport equipment, for instance (see chapter 6 "Mounting").

**DANGER**

**Risk of death if installation is not performed correctly!**

➔ Follow the instructions for the correct arrangement of the muting sensors (see chapter 6.2 "Arrangement of the muting sensors").

#### 4.1.1 Timing controlled 2-sensor muting with Muting-enable




With the muting enable function, muting is enabled or disabled via an external muting enable signal. The muting enable function is activated and deactivated via the DIP switch blocks (Starting up the device - Configuration).

- If the muting enable signal is applied, a valid muting sequence initiates muting.  
The muting enable signal must be applied at least 60 ms before muting is initiated.  
The muting enable signal must not be applied for more than 100 hours.
- If the muting enable signal is not applied, no muting is possible, even with a valid muting sequence.

## 4.2 Overriding and muting restart

Following malfunctions or operationally related interruptions (e.g. power failure, violation of the simultaneity condition during timing controlled 2-sensor muting on activation of the muting sensors), the system can be manually reset with the acknowledgment unit and overridden.

- Muting override must only be initiated if at least one muting sensor is activated and the OSSDs of the muting controller are switched off.
- Muting override is maintained only if at least one muting sensor is activated.
- The muting controller switches on its OSSDs when muting override is activated.
- For muting override or muting restart, the maximum muting timeout time is 10 minutes.

 <b>WARNING</b>	
	<b>Unauthorized muting restart may result in serious injury!</b>
	<p>✎ A qualified person (see chapter 2.2 "Necessary competencies") must observe the procedure exactly.</p>
	<p>✎ Make certain that the danger zone can be viewed from the acknowledgment unit and that the entire process can be observed by the responsible person.</p>
	<p>✎ Before and during the muting restart, ensure that there are no people in the danger zone.</p>
<b>NOTICE</b>	
	<p>If the safety sensor or the muting controller responds with an error message, perform an error reset (see chapter 4.3 "Error reset").</p>

- ✎ Press and release the acknowledgment unit within 0.2 to 4 s.
- ✎ Press the acknowledgment unit again and keep the acknowledgment unit pressed down.
- ⇒ The muting controller switches on.

#### Both muting signals are activated:

The muting controller switches to muting mode.

#### A muting signal is activated:

Muting is initiated when the acknowledgment unit is released. The second muting signal must be activated within a maximum of 4 s in order to continue muting. If the second muting signal is not activated within this time, muting is ended.

#### No muting signal is activated:

Muting is ended immediately even if the acknowledgment unit is not released.

#### Muting controller with muting enable; a muting signal is activated:

Muting is initiated when the acknowledgment unit is released. The second muting signal must be activated within a maximum of 4 s in order to continue muting. If the second muting signal is not activated within this time, muting is ended.

#### Muting controller with muting enable; without extension of the muting timeout:

Overriding is only possible with acknowledgment unit permanently pressed down.

## 4.3 Error reset

If an internal or external error is detected by the safety sensor or the muting controller, the muting controller switches to the interlock state.

To reset the safety circuit to the initial state, reset the muting controller via the reset signal.

- The reset signal can be set via the connected acknowledgment unit or via a component in the machine interface.
- When overriding, the reset signal may only come from one source, i.e., either from the connection socket of the acknowledgment unit or from the RES signal of the machine interface.
- Duration of the reset signal: 0.2 s to 4 s

#### Manual error reset

Reset signal via the connected acknowledgment unit

- ✎ Press and release the acknowledgment unit within 0.2 to 4 s.



#### **4.4 Restart**

Following a violation of the protective field, the OSSDs are re-enabled via the reset signal.

- The restart can be started manually via the connected acknowledgment unit or via a component in the control (Starting up the device - Configuration).
- The reset signal can be set via the connected acknowledgment unit or via a component in the machine interface.
- Duration of the reset signal: 0.2 s to 4 s

#### **4.5 Acknowledging/resetting**

The ReadyForReset signal signals via the RES LED that the system is waiting for actuation of the acknowledgment unit/reset button.

- The RES LED illuminates red if the OSSDs of the safety sensor are switched on and the OSSDs of the muting controller are switched off.
- The RES LED flashes red if the system is expecting a muting restart, depending on the status of the muting sensors. The OSSDs of the safety sensor must be switched off.
- The RES LED flashes red if a muting error occurs.
  - If a muting error occurs together with a protected field violation, the OSSDs are switched off when muting is terminated.
  - If a muting error occurs in a free protective field, the OSSDs remain switched on.

## 5 Applications

### 5.1 Access guarding with timing controlled muting



- 1 Safety sensor
- 2 Muting controller
- 3 Muting sensors
- 4 Acknowledgment unit

Fig. 5.1: Access guarding with timing controlled muting for an application with a pallet wrapping machine

## 6 Mounting

- ↪ Mount the muting sensors (see chapter 6.2 "Arrangement of the muting sensors").
- ↪ Mount the muting controller (see chapter 6.1 "Mounting the muting controller").
- ↪ Make the electrical connection of the muting controller (see chapter 7 "Electrical connection").

### NOTICE



↪ When mounting and aligning the safety sensor, observe the respective operating instructions.

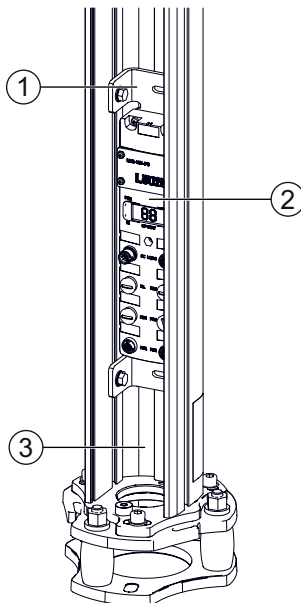
### 6.1 Mounting the muting controller

You can mount the muting controller as follows:

- Mount in the UDC device column of the receiver of the safety sensor
- Mount on the UDC device column of the receiver of the safety sensor
- Mount on the system via M4 fastening holes

#### 6.1.1 Mounting in the UDC device column

Mount the muting controller in the UDC device column of the receiver of the safety sensor, e.g., below the receiver. The necessary mounting bracket is available as an accessory (see chapter 14 "Order guide and accessories").

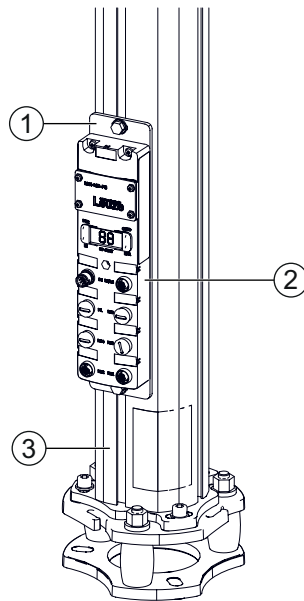


- 1 Mounting bracket BT-MSI-MD-FB-L
- 2 Muting controller
- 3 UDC device column

Fig. 6.1: Mounting in the UDC device column

### 6.1.2 Mounting on the UDC device column

Mount the muting controller on the side or on the rear of the UDC device column of the receiver of the safety sensor. The required mounting plate is available as an accessory (see chapter 14 "Order guide and accessories").



- 1 Mounting plate BT-MSI-MD-FB
- 2 Muting controller
- 3 UDC device column




Fig. 6.2: Mounting on side/rear on the UDC device column

### 6.1.3 Mounting on the system

Mount the muting controller on the system via three mounting eyes for M4 screws.

## 6.2 Arrangement of the muting sensors



Muting sensors detect material and supply the signals necessary for muting. Standard IEC/TS 62046 provides basic information on arranging the muting sensors. This information must be observed when mounting the muting sensors.

 <b>WARNING</b>	
	<b>Improper installation may result in serious injury!</b> If the distance between transmitter and receiver is larger than the width of the object so that gaps of more than 180 mm are created, suitable measures, e.g. through additional guarding, must be taken to stop the dangerous movement before persons enter the area.
	<ul style="list-style-type: none"> <li>✎ Make sure that no persons can reach the danger zone alongside the transport material during muting.</li> <li>✎ Make sure that muting is only temporarily activated and only as long as the access to the danger zone is blocked by the transport material.</li> </ul>
<b>NOTICE</b>	
	If accessible distances exist between the transport material and the safety sensor, PS mats or wicket gates monitored with safety switches have been tried, tested and proven as additional safeguards. Such measures prevent injuries caused, for example, by crushing in the access area.

### 6.2.1 Basic information

Before you begin with the selection and mounting of the muting sensors (Selecting optoelectronic muting sensors), please note the following:

- Muting must be triggered by two independent muting signals and must not be fully dependent on software signals, e.g. from a PLC.
- Always mount muting sensors so that the minimum distance to the protective device is maintained (see chapter 6.2.3 "Minimum distance for optoelectronic muting sensors").
- Always mount the muting sensors so that the material is detected and not the transport device, e.g. the pallet.
- Material must be allowed to pass through unimpeded.

 <b>WARNING</b>	
	<p><b>Unintentionally triggered muting may result in serious injury!</b></p> <ul style="list-style-type: none"> <li>↳ Mount the muting sensors in such a way that muting cannot be unintentionally triggered by a person, e.g. by simultaneously activating the muting sensors with a foot.</li> <li>↳ Mount the muting indicator so that it is always visible from all sides.</li> </ul>


### 6.2.2 Selecting optoelectronic muting sensors

Muting sensors detect material and supply the signals necessary for muting. If muting conditions are fulfilled, the safety sensor can use the signals from the muting sensors to bridge the protective function. The signals can be generated by e.g. optoelectronic sensors from Leuze electronic.

Any transducers which output a +24 VDC switching signal when detecting the permitted transport material can still be used as muting sensors:

- Photoelectric sensors (transmitter/receiver or retro-reflective photoelectric sensors) whose beam paths intersect behind the protective field within the danger zone.
- Diffuse sensors that scan along the side of the transport material (make sure scanning range is set correctly).
- A photoelectric sensor and an acknowledgment signal from the conveyor drive or a PLC signal, provided they are activated independently of each other and fulfill the simultaneity conditions.
- Switching signals from induction loops that are activated e.g. by a high-lift truck.
- Roller conveyor switches which are activated by the transport material and arranged so that they cannot be simultaneously actuated by a person.

↳ When arranging the muting sensors, take the filter times of the signal inputs into account (switch on filter time approx. 60 ms, switch-off filter times approx. 300 ms).

<b>NOTICE</b>	
	<p>When using muting sensors with push-pull output, a time difference of at least 20 ms is necessary for the muting signals.</p>

### 6.2.3 Minimum distance for optoelectronic muting sensors

The minimum distance is the distance between the protective field of the AOPD and the detection points of the muting sensor light beams. This distance must be maintained when mounting the muting sensors to prevent the pallet or material from reaching the protective field before the muting signals can bridge the protective function of the AOPD. The minimum distance is dependent on the time needed by the system to process the muting signals (approx. 120 ms).

- ↳ Calculate the minimum distance depending on the application case for the timing controlled 2-sensor muting (see chapter 6.2.4 "Arrangement of the muting sensors for timing controlled 2-sensor muting").
- ↳ When arranging the muting sensors, make certain that the calculated minimum distance to the protective field is maintained.

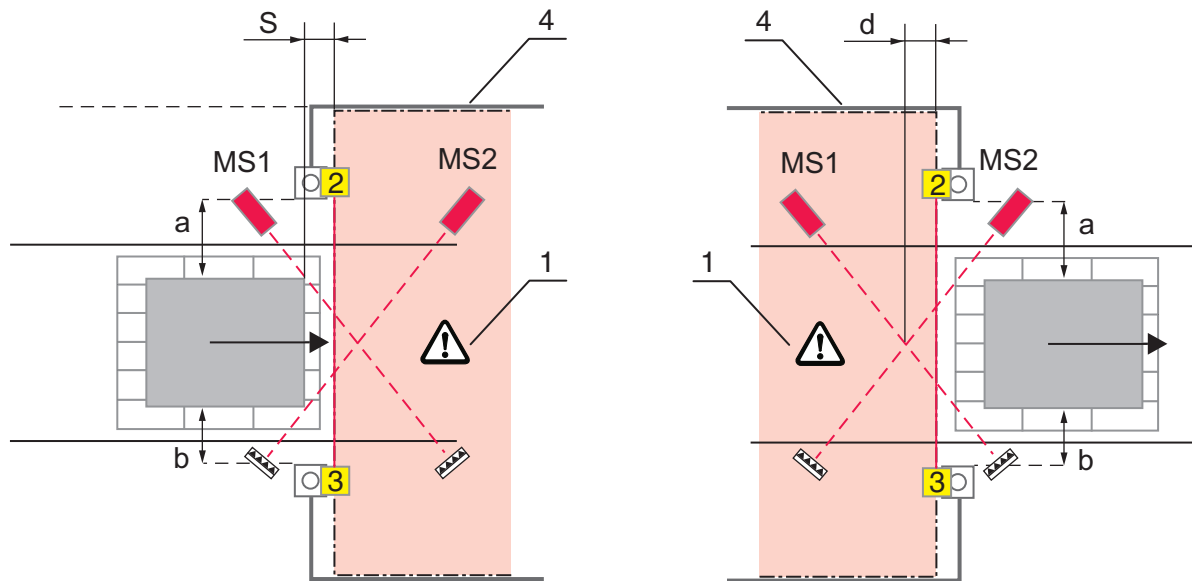
#### 6.2.4 Arrangement of the muting sensors for timing controlled 2-sensor muting

When doing so, both the MS1 and MS2 sensors must be arranged so that they can be activated simultaneously within 4 s by the transport material but cannot be simultaneously activated by a person within this time. Arrangements with crossed beams are often used. The intersection point is located here within the danger zone. This prevents muting from being triggered unintentionally. With this arrangement, an object can be transported through the protective field in both directions.

##### NOTICE



Muting accessories from Leuze electronic, for example muting sensor sets and matching device columns, facilitate the installation of muting applications significantly.



- 1 Danger zone
- 2 Receiver
- 3 Transmitter
- MS1 Muting sensor 1
- MS2 Muting sensor 2
- S Minimum distance between the protective field of the AOPD and the detection points of the muting-sensor light beams
- a,b Distance between muting object and other fixed edges or objects (<200 mm)
- d Distance from the intersection point of the muting-sensor light beams to the protective-field plane (<50 mm)

Fig. 6.3: Typical arrangement of the muting sensors for timing controlled 2-sensor muting (example acc. to IEC TS 62046)

With timing controlled 2-sensor muting, the beams from the muting sensors should intersect behind the protective field of the safety sensor, i.e. within the danger zone, to prevent muting from being triggered unintentionally.

Distances a and b between fixed edges and the muting object (e.g. transport material) must be such that a person cannot enter through these openings undetected while the pallet passes through the muting zone. However, if it is assumed that persons are located here, the risk of crushing must be prevented, e.g. with wicket gates, which are integrated electrically into the safety circuit.

### Minimum distance S

$$S \geq v \cdot 0,12 \text{ s}$$

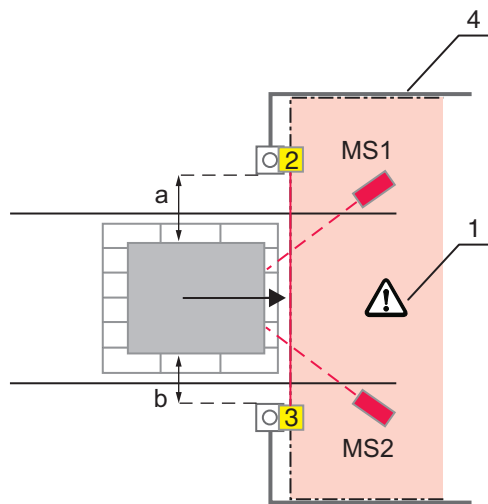
S [mm] = Minimum distance between the protective field of the AOPD and the detection points of the muting-sensor light beams  
 v [m/s] = Speed of the material

### Distance d should be as small as practical

d [mm] = Distance from the intersection point of the muting-sensor light beams to the protective-field plane < 200 mm

### Arrangement of diffuse sensors

An additional option for arranging the muting sensors is shown in the following figure. The diffuse sensors are arranged and set within the danger zone so that their scanning points detect a valid, approaching muting object within the danger zone, but a person is not able to reach both scanning points simultaneously.



- 1 Danger zone
- 2 Receiver
- 3 Transmitter
- MS1 Muting sensor 1
- MS2 Muting sensor 2
- a,b Distance between muting object and other fixed edges or objects (<200 mm)

Fig. 6.4: Muting with two diffuse sensors

### Height of the muting-sensor light beams

The two light beams of the muting sensors must have a minimum height of  $H$ .

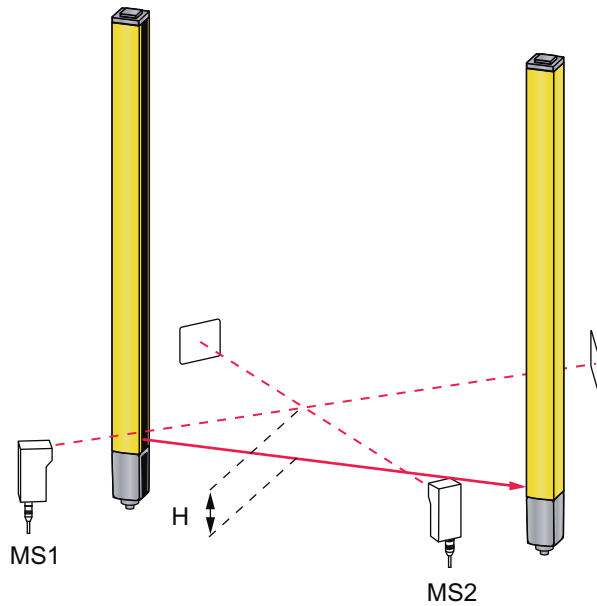


Fig. 6.5: Arrangement of the muting sensors with respect to height

- ↳ Mount the muting sensors so that the intersection point of their light beams is at the same height or higher than the lowest light beam of the safety sensor.
- ⇒ This prevents—or hinders—manipulation with the feet since the protective field is interrupted before the muting-sensor light beam.








#### NOTICE



To increase safety and make manipulation more difficult, MS1 and MS2 should, if possible, be mounted at different heights (i.e. no point-shaped intersection of the light beams).



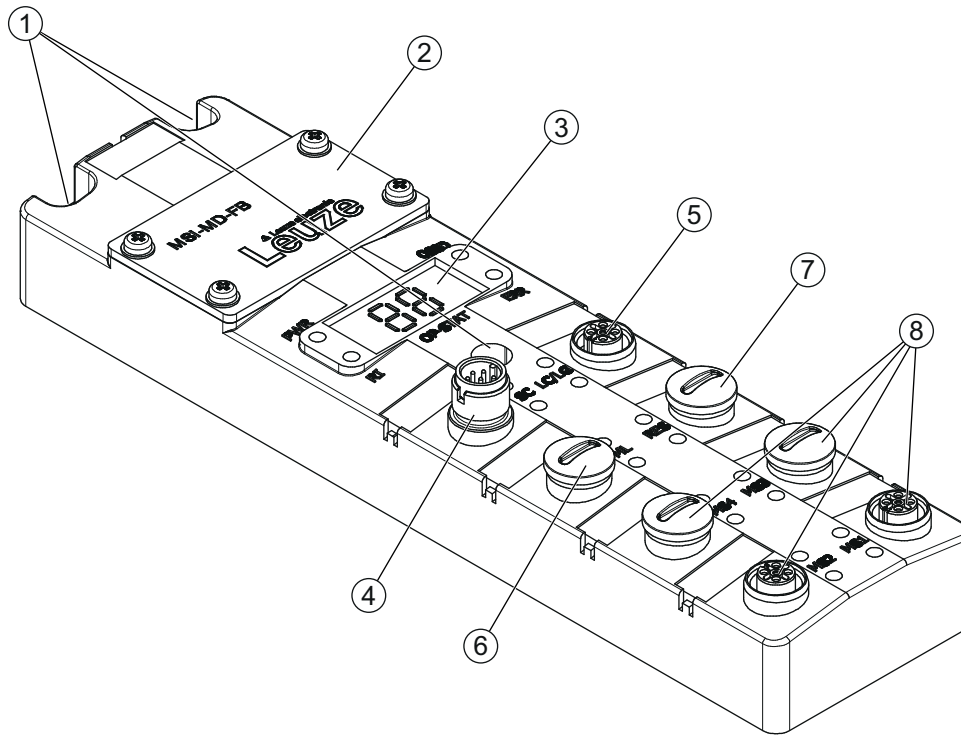
## 7 Electrical connection

 <b>WARNING</b>	
	<b>Faulty electrical connection or improper function selection may result in serious injury!</b>
	✚ Only allow qualified persons (see chapter 2.2 "Necessary competencies") to perform the electrical connection.
	✚ For access guarding, activate the start/restart interlock and make certain that it cannot be unlocked from within the danger zone.
	✚ Select the safety-relevant functions for the safety sensor. Observe the operating instructions for the safety sensor.
	✚ Always loop both safety-related switching outputs OSSD1 and OSSD2 of the muting controller into the work circuit of the machine.
 <b>WARNING</b>	
	<b>Muting faults may result in serious injury!</b>
	✚ Connect the muting signals so that they are separated and protected and a short circuit between the cables is impossible.
<b>NOTICE</b>	
	<b>Laying cables!</b>
	✚ Lay all connection cables and signal lines within the electrical installation space or permanently in cable ducts.
	✚ Lay the cables and lines so that they are protected against external damages.
	✚ For further information: see EN ISO 13849-2, Table D.4.
<b>NOTICE</b>	
	<b>Protective Extra Low Voltage (PELV)</b>
	The muting controller is designed in accordance with protection class III for supply with PELV (Protective Extra-Low Voltage).
<b>NOTICE</b>	
	<b>Use in the USA and Canada</b>
	For use in the USA and Canada, use is only permitted in Class 2 circuits in accordance with the NEC (National Electric Code).

### 7.1 Connecting the muting controller

The muting controller is equipped with the following connections:

- One connection for the OSSDs of the safety sensor  
M12 socket, 5-pin, A-coded
- A connection for the machine interface  
M12 plug, 8-pin, A-coded
- Four connections for muting sensors 1 ... 4  
M12 socket, 5-pin, A-coded
- One connection for the reset button/acknowledgment unit  
M12 socket, 5-pin, A-coded
- One connection for an external muting indicator  
M12 socket, 5-pin, A-coded
- One service USB connection for reading out diagnostics  
USB port of type Micro-B



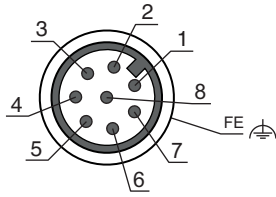
- 1 Mounting eyes for M4 screws
- 2 Cover for the DIP switch blocks for configuring the muting function and the Micro USB connection for reading out diagnostics.
- 3 7-segment display
- 4 Connection to the machine interface (OSSDs and supply voltage)
- 5 Connection for the safety sensor
- 6 Connection for external muting indicator
- 7 Connection for acknowledgment unit
- 8 Connections for muting sensors

Fig. 7.1: Muting controller connections

- ✚ Connect the muting controller to the machine interface (see chapter 7.2 "Pin assignment of the machine interface").
- ✚ Connect the safety sensor to the muting controller (see chapter 7.3 "Pin assignment of safety sensor").
- ✚ Connect the acknowledgment unit to the muting controller (see chapter 7.4 "Pin assignment of the acknowledgment unit").
- ✚ If necessary, connect the external muting indicator to the muting controller (see chapter 7.5 "Pin assignment of muting indicator").
- ✚ Connect the muting sensors to the muting controller (see chapter 7.6 "Pin assignment of muting sensors").

## 7.2 Pin assignment of the machine interface

SC: M12 plug, 8-pin, A-coded

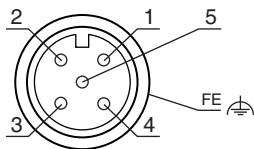


Tab. 7.1: Pin assignment of the machine interface

Pin	Color	Signal	IN/OUT	Description
1	White	Reset	IN	Reset signal from the machine interface
2	Brown	+24 V		Supply voltage
3	Green	MS1	IN	+24 V if muting 'good' detected Muting signal from the machine interface
4	Yellow	Error	OUT	Fault in the muting controller: <ul style="list-style-type: none"> <li>+24 V: fault in the muting controller</li> <li>0 V: no fault; muting controller in operation</li> </ul>
5	Gray	OSSD1	OUT	+24 V if OSSD1 of the muting controller is active
6	Pink	OSSD2	OUT	+24 V if OSSD2 of the muting controller is active
7	Blue	0 V		Supply voltage
8	Red	M-EN/TO	IN	Signal muting enable/muting timeout
FE				Housing of the M12 plug Functional earth/shield

## 7.3 Pin assignment of safety sensor

LC/LG: M12 socket, 5-pin, A-coded

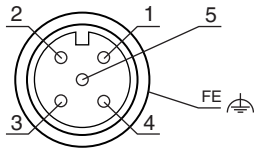


Tab. 7.2: Pin assignment of safety sensor

Pin	Color	Signal	IN/OUT	Description
1	Brown	+24 V		Supply voltage for safety sensor, short-circuit proof
2	White	OSSD1	IN	OSSD1 of the safety sensor; +24 V if OSSD1 is active
3	Blue	0 V		Supply voltage for safety sensor
4	Black	OSSD2	IN	OSSD2 of the safety sensor; +24 V if OSSD2 is active
5	Gray	FE		FE - functional earth, shield
FE				Housing of the M12 socket FE - functional earth, shield

## 7.4 Pin assignment of the acknowledgment unit

RES: M12 socket, 5-pin, A-coded

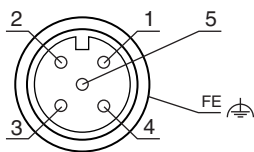


Tab. 7.3: Pin assignment of the acknowledgment unit

Pin	Color	Signal	IN/OUT	Description
1	Brown	+24 V		Supply voltage
2	White	ReadyForReset	OUT	LED lighting for the acknowledgment unit Signal indicating that the system is waiting for actuation of the acknowledgment unit.
3	Blue	GND		Supply voltage
4	Black	Reset	IN	Switching signal reset
5	Gray	n.c.		This pin is not contacted at the device
FE				Housing of the M12 socket FE - functional earth, shield

## 7.5 Pin assignment of muting indicator

ML: M12 socket, 5-pin, A-coded

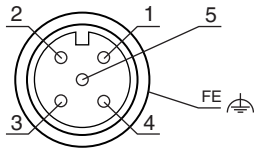


Tab. 7.4: Pin assignment of muting indicator

Pin	Color	Signal	IN/OUT	Description
1	Brown	+24 V		Supply voltage
2	White	Muting	OUT	+24 V if muting active
3	Blue	GND		Supply voltage
4	Black	Muting	OUT	+24 V if muting active
5	Gray	n.c.		This pin is not contacted at the device
FE				Housing of the M12 plug Functional earth/shield

## 7.6 Pin assignment of muting sensors

MS1, MS2, MS3, MS4: Four connections for muting sensors MS1 ... MS4; M12 socket, 5-pin, A-coded



Tab. 7.5: Pin assignment of muting sensor

Pin	Color	Signal	IN/OUT	Description
1	Brown	+24 V		Supply voltage
2	White	n.c.		This pin is not contacted at the device
3	Blue	GND		Supply voltage
4	Black	Muting	IN	+24 V if muting 'good' detected
5	Gray	n.c.		This pin is not contacted at the device
FE				Housing of the M12 socket FE - functional earth, shield

## 7.7 Circuit diagram examples

### 7.7.1 Timing controlled 2-sensor muting

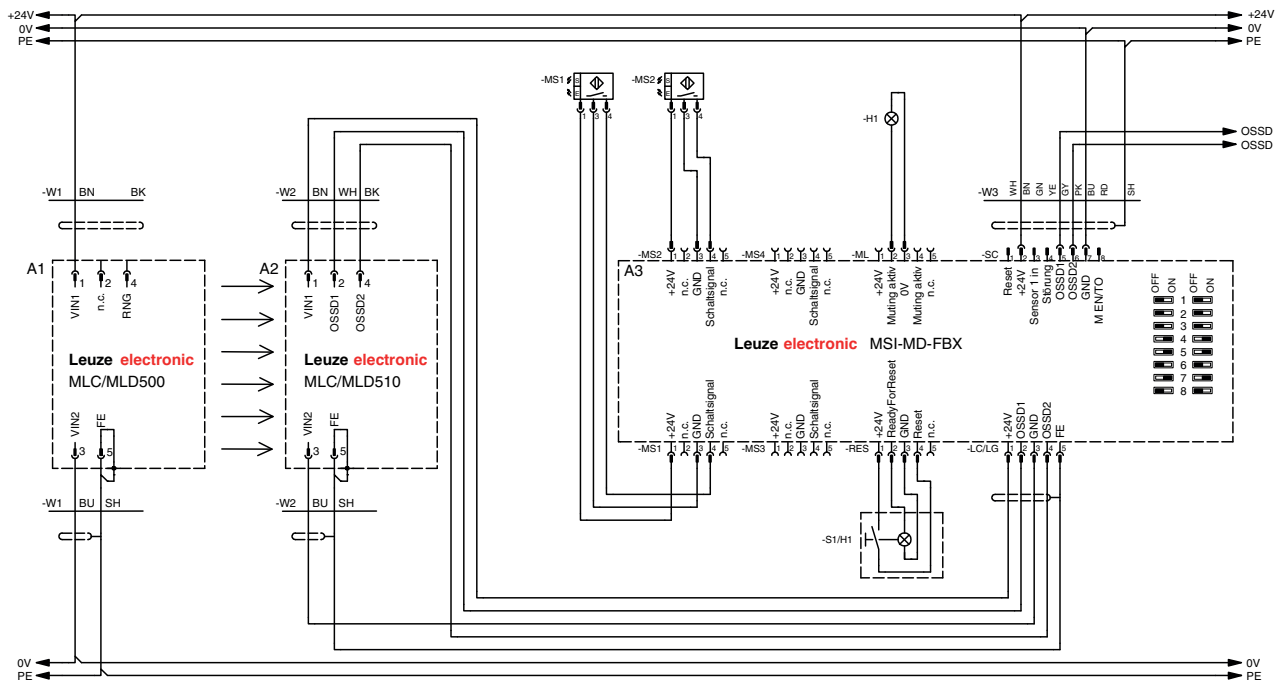


Fig. 7.2: Circuit diagram example: timing controlled 2-sensor muting

- Muting controller MSI-MSI-MD-FB and safety sensor MLC 510 or MLD 510
- Muting timeout: 10 minutes

## 8 Starting up the device - Configuration

### 8.1 Overview

The function of the muting controller is set via two DIP switch blocks, each of which has eight switches. The DIP switch blocks are located behind a cover in the housing of the muting controller and are not accessible in normal operation.

#### NOTICE



This muting controller can only be operated in operating mode 7 (see chapter 8.2 "Setting the operating mode").

#### Parameter

You can set the following parameters for the function of the muting controller:

DIP switch	Function	Settings
1	Number of the muting sensors	2-sensor muting 4-sensor muting (not permissible)
2	Muting mode	Timing controlled muting Sequence controlled muting (not permissible)
3	EDM	With EDM Without EDM
4	Restart	Automatically via machine interface signal Manually via acknowledgment unit
5	Muting-enable	With muting-enable Without muting-enable
6	Muting timeout	With muting-timeout extension Without muting-timeout extension

#### Procedure

- ✚ Disconnect the muting controller from voltage.
- ✚ Remove the cover from the housing of the muting controller (four screws; Operational controls).
- ✚ Set the operating mode of the muting controller via the DIP switch blocks (see chapter 8.2 "Setting the operating mode").
- ✚ Remount the cover on the housing on the muting controller.
  - ⇒ Tighten the screws with a torque wrench. Torque: 0.6 ... 0.8 Nm
- ✚ Connect the muting controller to the voltage supply
- ✚ Restart the muting controller.
  - ⇒ After the device is started, the 7-segment display shows the set operating mode.

#### NOTICE



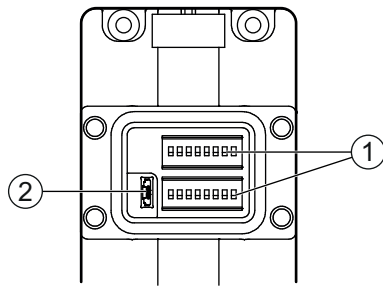
#### Error when configuring the muting controller in process mode!

If the switch position of the DIP switch blocks is changed in process mode, an error is triggered and the OSSDs switch off.

- ✚ Only set the configuration of the muting controller while the device is in a voltage-free state.

## 8.2 Setting the operating mode

The muting controller is equipped with two DIP switch blocks, each with eight switches for setting the configuration.



- 1 DIP switch blocks
- 2 Service USB connection

Fig. 8.1: Muting controller without cover

### Switch position of the DIP switch blocks

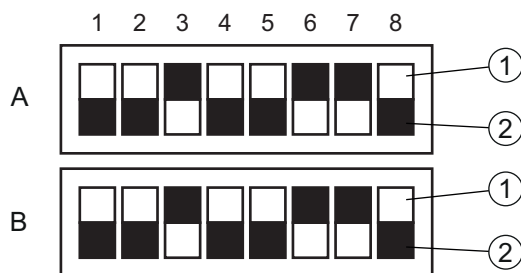
**NOTICE**

!

**Error for different switch positions in the DIP switch blocks!**

An error is triggered for different switch positions in the DIP switch blocks and the OSSDs switch off.

→ When configuring, make certain that the switch position is identical in both DIP switch blocks.



- A DIP switch block A
- B DIP switch block B
- 1 Switch position ON
- 2 Switch position OFF

Fig. 8.2: Example: switch position of the DIP switch blocks

Tab. 8.1: Assignment of the DIP switches


DIP switch	Function	ON	OFF
1	Number of the muting sensors	4-sensor muting (not permissible)	2-sensor muting
2	Muting mode	Sequence controlled muting (not permissible)	Timing controlled muting
3	EDM	With EDM	Without EDM
4	Restart	Manual restart	Automatic restart
5	Muting-enable	With muting-enable	Without muting-enable
6	Muting timeout	With muting-timeout extension	Without muting-timeout extension


DIP switch	Function	ON	OFF
7/8	Muting timeout	OFF/OFF: 20 seconds	
		OFF/ON: 2 minutes	
		ON/OFF: 10 minutes	
		ON/ON: 100 hours	


### Setting the operating mode

The following table lists the permissible operating modes that can be set via the DIP switch blocks.

After the device is started, the 7-segment display of the muting controller shows the set operating mode.

NOTICE	
	This muting controller can only be operated in operating mode 7.

NOTICE	
	<b>Error in event of impermissible setting of DIP switches!</b> If a DIP switch configuration is set that does not correspond to that of a permissible operating mode, an operating mode error is triggered and the OSSDs switch off. ↳ Only set one of the DIP-switch configurations listed in the operating mode table.




NOTICE	
	<b>Restart interlock for access guarding!</b> For access guarding, a restart interlock is required. ↳ If the <i>automatic restart interlock</i> is configured in the muting controller, you must carry out the restart interlock, e. g. via the machine interface.

Tab. 8.2: Operating modes



DIP switch	1	2	3	4	5	6
Function	Number of muting sensors	Muting mode	EDM	Restart	Muting-enabled	Muting-time-out extension
Operating mode						
7	2-sensor	Timing controlled	Without	Manual	With	Without



## 9 Testing

 <b>WARNING</b>	
	<p><b>A running machine may result in serious injury!</b></p> <ul style="list-style-type: none"> <li>↳ Make certain that, during all conversions, maintenance work and inspections, the system is securely shut down and protected against being restarted.</li> </ul>
<b>NOTICE</b>	
	<ul style="list-style-type: none"> <li>↳ The safety relays must be exchanged after a maximum of 20 years.</li> <li>↳ Always exchange the entire safety relay.</li> <li>↳ Observe any nationally applicable regulations regarding the tests.</li> <li>↳ Document all tests in a comprehensible manner.</li> </ul>

### 9.1 Before the initial start-up and following modifications

 <b>WARNING</b>	
	<p><b>Unpredictable machine behavior during initial start-up may result in serious injury!</b></p> <ul style="list-style-type: none"> <li>↳ Make certain that there are no people in the danger zone.</li> </ul>

- ↳ Before they begin work, train the operators on their respective tasks. The training is the responsibility of the operating company.

- ↳ Attach notes regarding daily testing in the respective national language of the operator on the machine in a highly visible location, e.g. by printing out the corresponding chapter (see chapter 9.3 "Periodically by the operator").

- ↳ Test the electrical function and installation according to this document.

Acc. to IEC/TS 62046 and national regulations (e.g. EU directive 2009/104/EC), tests are to be performed by qualified persons (see chapter 2.2 "Necessary competencies") in the following situations:

- Prior to initial commissioning
- Following modifications to the machine
- After longer machine downtime
- Following retrofitting or new configuration of the machine

- ↳ Before preparing, check the most important criteria for the optoelectronic safety device and the safety relay. This check does not replace testing by qualified persons (see chapter 2.2 "Necessary competencies").

- ⇒ Not until proper function of the optoelectronic safety device and the safety relay is ascertained may they be integrated in the control circuit of the system.

### 9.2 Regularly by qualified persons

The reliable interaction of safety sensor, safety relay and machine must be regularly tested by qualified persons (see chapter 2.2 "Necessary competencies") in order to detect changes to the machine or impermissible tampering.

Acc. to IEC/TS 62046 and national regulations (e.g., EU directive 2009/104/EC), tests of elements which are subject to wear must be performed by qualified persons (see chapter 2.2 "Necessary competencies") at regular intervals. Testing intervals may be regulated by nationally applicable regulations (recommendation acc. to IEC/TS 62046: 6 months).

- ↳ Only allow testing to be performed by qualified persons (see chapter 2.2 "Necessary competencies").


- ↳ Observe the nationally applicable regulations and the time periods specified therein.


### 9.3 Periodically by the operator

The function of the safety relay must be checked depending on the given risk according to the following checklist so that damage or prohibited tampering can be detected.


Depending on the risk assessment, the test cycle must be defined by the integrator or operating company (e.g., daily, on shift changes, ...) or is specified by national regulations or regulations of the employer's liability insurance association and may be dependent on the machine type.

Due to complex machines and processes, it may be necessary under certain circumstances to check some points at longer time intervals. Observe the classification in "Test at least" and "Test when possible".

<b>NOTICE</b>	
	For larger distances between transmitter and receiver of the safety sensor and when using deflecting mirrors, a second person may be necessary.

<b>WARNING</b>	
	<p><b>Unpredictable machine behavior during the test may result in serious injury!</b></p> <ul style="list-style-type: none"> <li>⚡ Make certain that there are no people in the danger zone.</li> <li>⚡ Before they begin work, train the operators on their respective tasks and provide suitable test objects and an appropriate test instruction.</li> </ul>

#### 9.3.1 Checklist – periodically by the operator

<b>NOTICE</b>	
	⚡ If you answer one of the items on the following check list with <b>no</b> , the machine must no longer be operated.

When possible, test during running operation:	Yes	No
Protective device with approach function: during machine operation, the protective field is interrupted with the test object – are the obviously dangerous machine parts stopped without noticeable delay?		
Protective device with presence detection: the protective field is interrupted with the test object – does this prevent operation of the obviously dangerous machine parts?		

## 10 Care, maintenance and disposal

### Cleaning

- ↳ Clean the device with a soft cloth as needed; use a cleaning agent (commercially available glass cleaner) if necessary.

#### NOTICE



#### **Do not use aggressive cleaning agents!**

- ↳ Do not use aggressive cleaning agents such as thinner or acetone for cleaning the device. Use of improper cleaning agents can damage the 7-segment display.

### Maintenance

The device does not normally require any maintenance by the operator.

Repairs to the device must only be performed by the manufacturer.

- ↳ For repairs, contact your responsible Leuze electronic subsidiary or Leuze electronic customer service (see chapter 12 "Service and support").

### Disposing


- ↳ For disposal observe the applicable national regulations regarding electronic components.

## 11 Diagnostics and troubleshooting

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

After switching on the muting controller, the display elements (see chapter 3.2 "Display elements") assist in checking the correct functionality and in fault-finding.

In case of failure, you can read a message from the 7-segment display. With the error message you can determine the cause of the error and initiate measures to rectify it.

NOTICE	
	<p><b>If the light curtain responds with an error display, you will often be able to eliminate the cause yourself!</b></p> <ul style="list-style-type: none"> <li>✚ Switch off the machine and leave it switched off.</li> <li>✚ Analyze and eliminate the cause of the fault using the following table.</li> <li>✚ If you are unable to rectify the fault, contact the Leuze electronic branch responsible for you or call the Leuze electronic customer service (see chapter 12 "Service and support").</li> </ul>

With the *Sensor Studio* diagnostics software, you can create a service file that you can send to Leuze electronic customer service in the event of service requests (Diagnostics software Sensor Studio). The service file contains all available information on the muting controller, as well as configuration and settings.

### 11.2 Error messages 7-segment display

User messages/notes and error messages are indicated by the alternating display of a letter and a two-digit number.

Tab. 11.1: Messages of the 7-segment display (F: internal device error, E: external error, U: usage info during application errors)

Error	Cause/description	Remedies and measures	Behavior of the muting controller
F[No. 0-255]	Internal error	In the event of an unsuccessful restart, contact customer service.	
OFF	Very high overvoltage ( $\pm 40$ V)	Supply the device with the correct voltage.	
E01	Cross connection between OSSD1 and OSSD2	Check the wiring between OSSD1 and OSSD2.	Automatic reset
E02	Overload on OSSD1	Check the wiring or exchange the connected component (reducing the load).	Automatic reset
E03	Overload on OSSD2	Check the wiring or exchange the connected component (reducing the load).	Automatic reset
E04	High-impedance short circuit to VCC OSSD1	Check the wiring. Exchange the cable, if applicable.	Automatic reset
E05	High-impedance short circuit to VCC OSSD2	Check the wiring. Exchange the cable, if applicable.	Automatic reset
E06	Short circuit against GND at OSSD1	Check the wiring. Exchange the cable, if applicable.	Automatic reset
E07	Short circuit against +24 V at OSSD1	Check the wiring. Exchange the cable, if applicable.	Automatic reset
E08	Short circuit against GND at OSSD2	Check the wiring. Exchange the cable, if applicable.	Automatic reset
E09	Short circuit against +24 V at OSSD2	Check the wiring. Exchange the cable, if applicable.	Automatic reset

Error	Cause/description	Remedies and measures	Behavior of the muting controller
E10, E11	OSSD error, source unknown	Check the wiring. Exchange the cable and the receiver if necessary.	Automatic reset
E14	Undervoltage (< +16 V)	Supply the device with the correct voltage.	Automatic reset
E15	Overvoltage (> +31 V)	Supply the device with the correct voltage.	Automatic reset
E16	Overvoltage (> +40 V)	Supply the device with the correct voltage.	Locking
E18	Ambient temperature too high (> 90°)	Ensure correct environmental conditions	Automatic reset
E19	Ambient temperature too low (< -35°)	Ensure correct environmental conditions	Automatic reset
E39	Actuation duration for the acknowledgment unit exceeded (local socket)	Press the acknowledgment unit. If the restart is unsuccessful, check the wiring of the reset button.	Automatic reset
E40	Actuation duration for the acknowledgment unit exceeded (cabinet socket)	Press the acknowledgment unit. If restart is unsuccessful, check the wiring.	Automatic reset
E42	Muting enable signal on +24 V for too long	Check the actuation of the muting enable signal	Acknowledgment unit
E80	Invalid operating mode	Check the configuration of the operating mode and restart.	Locking
E87	Operating mode changed	Check the configuration of the operating mode and restart.	Locking
E89	Switch position of the DIP switch blocks changed during operation.	Check the configuration of the operating mode and restart.	Locking
E97	Linkage of electronic safety-related switching outputs: OSSDs did not switch simultaneously	Check the wiring.	Locking
U10	Invalid command received via the interface	Check the connection to the USB interface	Automatic reset
U30	Sequence error between muting sensor 1 and muting sensor 2	Check the arrangement and alignment of the muting sensors.	Automatic reset
U31	Sequence error between muting sensor 2 and muting sensor 3	Check the arrangement and alignment of the muting sensors	Automatic reset
U32	Sequence error between muting sensor 3 and muting sensor 4	Check the arrangement and alignment of the muting sensors	Automatic reset
U33	Sequence error if all muting sensors are activated and muting sensor 1 should be free	Check the arrangement and alignment of the muting sensors	Automatic reset
U34	Sequence error if muting sensors 2 to 4 are activated and muting sensor 2 should be free	Check the arrangement and alignment of the muting sensors	Automatic reset

Error	Cause/description	Remedies and measures	Behavior of the muting controller
U35	Sequence error if muting sensor 3 and muting sensor 4 are activated and muting sensor 3 should be free	Check the arrangement and alignment of the muting sensors	Automatic reset
U41	Concurrency expectation of the muting signals not met: second signal outside tolerance of 4 s	Check the arrangement of the muting sensors or the programming of the machine interface if required.	Automatic reset
U43	Muting end before protective field release	Select a valid muting condition.	Automatic reset.
U44	Sequence error if muting sensor 1 and muting sensor 2 are activated and muting sensor 2 should be free	Check the arrangement and alignment of the muting sensors	Automatic reset
U45	Sequence error if muting sensors 1 to 3 are activated and muting sensor 3 should be free	Check the arrangement and alignment of the muting sensors	Automatic reset
U46	Sequence error if all muting sensors are activated and muting sensor 4 should be free	Check the arrangement and alignment of the muting sensors	Automatic reset
U47	Sequence error between muting sensor 2 and muting sensor 1	Check the arrangement and alignment of the muting sensors	Automatic reset
U48	Sequence error between muting sensor 3 and muting sensor 2	Check the arrangement and alignment of the muting sensors	Automatic reset
U49	Sequence error between muting sensor 4 and muting sensor 3	Check the arrangement and alignment of the muting sensors	Automatic reset
U50	Muting restart without valid muting configuration of the muting sensors	Check the mounting of the muting sensors and the activation of the muting signals.	Automatic reset
U51	Only one muting signal active in case of protective field violation, the second muting signal is missing	Check the mounting of the muting sensors and the activation of the muting signals.	Automatic reset
U52	Oscillating muting sensor detected	Check the wiring or whether the muting sensor is defective. Exchange the muting sensor if necessary.	Automatic reset.
U55	Time limit for override exceeded	Check the further processing of the OSSD signals and the design of the muting system.	Automatic reset
U56	Acknowledgment unit was actuated with interrupted protective field and without activated muting sensor	Check the arrangement and connections of the muting sensors and carry out muting restart again if required.	Automatic reset
U58	Muting timeout elapsed	Actuate the acknowledgment unit	Automatic reset
U59	A muting sensor has switched on and off again multiple times without muting having been triggered	Check the arrangement and alignment of the muting sensors.	Automatic reset

Error	Cause/description	Remedies and measures	Behavior of the muting controller
U60	Error at transition from one activated muting sensor to two activated muting sensors	Check the arrangement and alignment of the muting sensors.	Automatic reset
U61	Sequence error when clearing the first muting sensor	Check the arrangement and alignment of the muting sensors	Automatic reset
U62	Sequence error when clearing the second muting sensor	Check the arrangement and alignment of the muting sensors	Automatic reset
U63	Time limit from the activation of the first muting sensor to the activation of the second muting sensor exceeded	Check the arrangement and alignment of the muting sensors	Automatic reset
U64	Time limit for override exceeded	Check the further processing of the OSSD signals and the design of the muting system.	Automatic reset
U66	Sequence error	Check the connection of the muting sensors	Automatic reset
U67	No muting-enable signal before start of muting	Activate muting-enable before muting	Automatic reset
U73	Restarting the device	Only an entry in the error memory - no display	Automatic reset
U80	Acknowledgment unit actuated although none is configured	Check the setting for the acknowledgment unit	Automatic reset
U81	Incorrect reset signal, e.g., reset signal via acknowledgment unit, even though reset signal is configured via machine interface	Check the setting for the reset signal.	Automatic reset
U82	Muting enable activated even though not configured	Check the setting for muting enable.	Automatic reset
U83	Muting sensor 1 signal via muting sensor even though configured via machine interface	Check the setting for muting sensor 1.	Automatic reset
U84	Muting sensor 1 signal via machine interface even though configured via muting sensor	Check the setting for muting sensor 1.	Automatic reset
U85	Signals from muting sensor 3 or muting sensor 4 in 2-sensor muting	Check the design of the muting system.	Automatic reset

## **12 Service and support**

24-hour on-call service at:  
+49 7021 573-0

Service hotline:  
+49 7021 573-123

E-mail:  
**service.protect@leuze.de**

Return address for repairs:  
Servicecenter  
Leuze electronic GmbH + Co. KG  
In der Braike 1  
D-73277 Owen/Germany



## 13 Technical data

### 13.1 General specifications

Tab. 13.1: Safety-relevant technical data

Performance Level (PL)	PL e, Cat. 4 in accordance with EN ISO 13849
Safety Integrity Level (SIL)	SIL 3 in accordance with IEC 61508
SIL Claim Limit (SILCL)	SILCL 3 in accordance with IEC/EN 62061
Probability of a dangerous failure per hour (PFH <sub>d</sub> )	2.5+10E-9
Mission time (T <sub>M</sub> )	20 years

Tab. 13.2: General system data

Connection technology	M12 connectors, 5-pin, female M12 connectors, 8-pin, male
Supply voltage U <sub>v</sub>	+24 V, ± 20 %, compensation necessary at 20 ms voltage dip, min. 250 mA (+ external load)
Residual ripple of the supply voltage	± 5 % within the limits of U <sub>v</sub>
Current consumption	150 mA (without load)
Protection class	III
Degree of protection	IP 67 acc. to EN 60529
Reaction time	≤ 5 ms
Ambient temperature, operation	-30 ... +60 °C
Ambient temperature, storage	-40 ... +70 °C
Relative humidity (non-condensing)	0 ... 95 %
Vibration resistance	10 - 55 Hz in acc. with IEC/EN 60068-2-6; 0.35 mm amplitude
Shock resistance	100 m/s <sup>2</sup> acceleration, 16 ms acc. to IEC/EN 60068-2-6
Dimensions	(L x W x H) 225 mm x 60 mm x 37 mm
Weight	560 g
Maximum length of the connection cable to the machine interface	50 m Only permissible with a maximum additional current demand ≤ 160 mA
Torque for the screws of the cover	0.6 ... 0.8 Nm

Tab. 13.3: Technical data of the electronic safety-related switching outputs (OSSDs)

Safety-related PNP transistor outputs (short-circuit monitored, cross-circuit monitored)	Minimum	Typical	Maximum
Switching voltage high active ( $U_v - 1.5V$ )	18 V	24 V	27 V
Switching voltage low		0 V	+2.5 V
Switching current		300 mA	380 mA
Residual current		<2 $\mu A$	200 $\mu A$
Load capacity			0.3 $\mu F$
Load inductivity			2 H
Permissible wire resistance for load			<200 $\Omega$
	Note the additional restrictions due to cable length and load current.		
Permissible wire cross section		0.25 mm <sup>2</sup>	
Test pulse width		60 $\mu s$	340 $\mu s$
Test pulse distance	(5 ms)	60 ms	
OSSD restart delay time		100 ms	

Tab. 13.4: Status signals and control signals

Signal	Input/Output	Values
Reset	Input	24 V, 15 mA
ReadyForReset	Output	24 V, 80 mA
ML	Output	24 V, 80 mA Input and output currents
MS1 ... MS4	Input	24 V, max. 250 mA
Sum of the input/output currents: < 1 A		
Permissible leakage current for control outputs: max. 0.7 mA		

#### NOTICE



The safety-related transistor outputs perform the spark extinction. With transistor outputs, it is therefore neither necessary nor permitted to use the spark extinction circuits recommended by contactor or valve manufacturers (RC elements, varistors or recovery diodes), since these considerably extend the decay times of inductive switching elements.

## 13.2 Dimensioned drawings

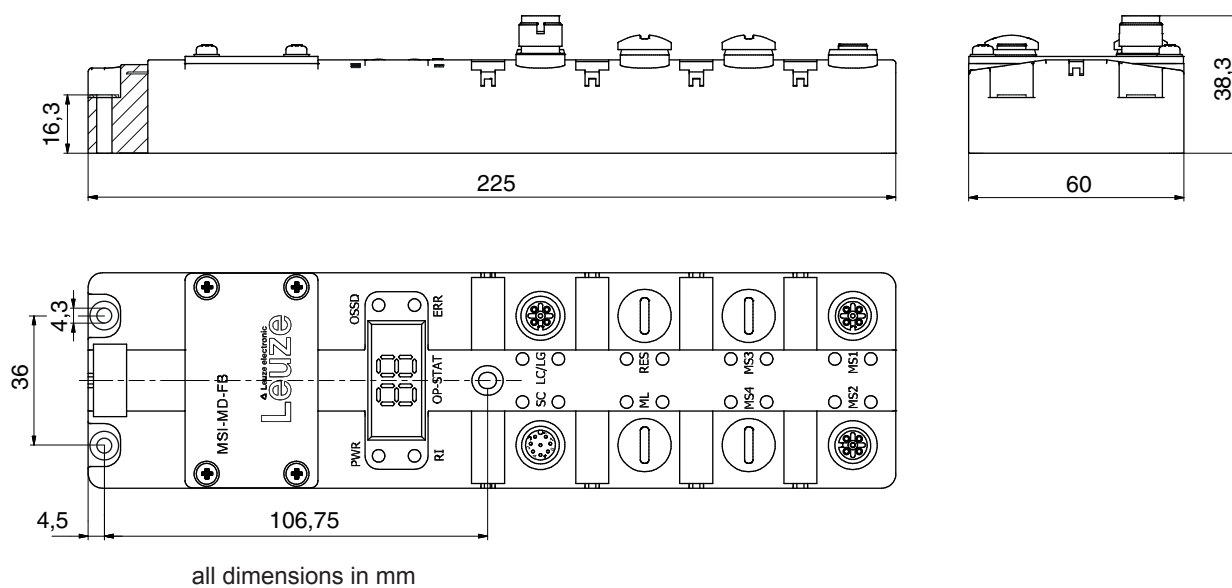


Fig. 13.1: Dimensioned drawing of MSI-MD-FB muting controller

## 13.3 Dimensioned drawings - Accessories

### Mounting plate BT-MSI-MD\_FB

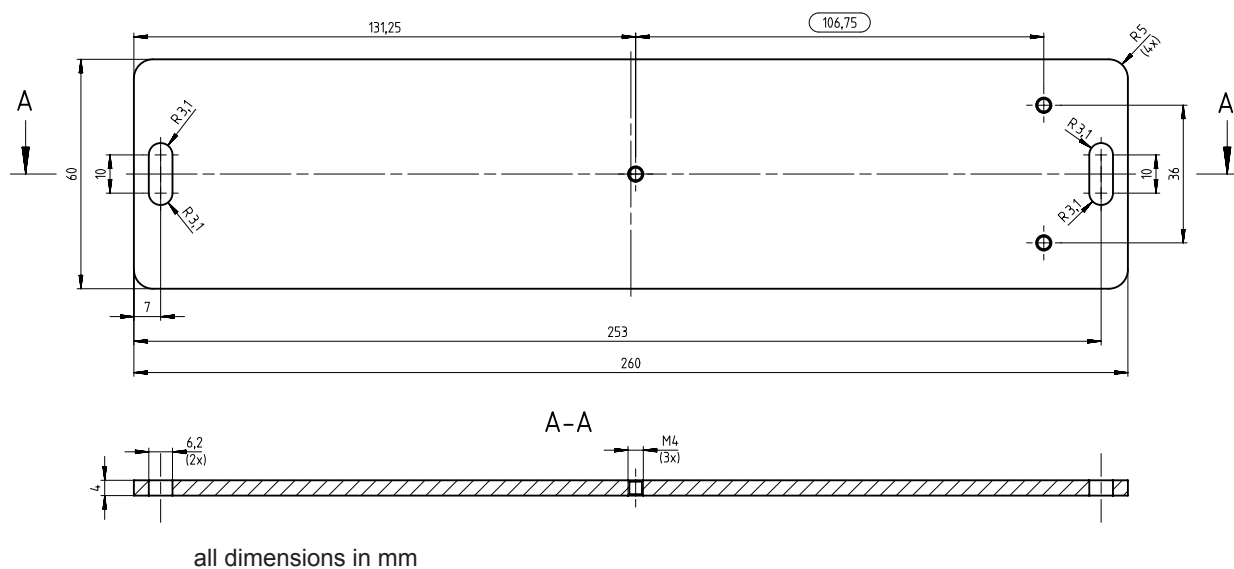
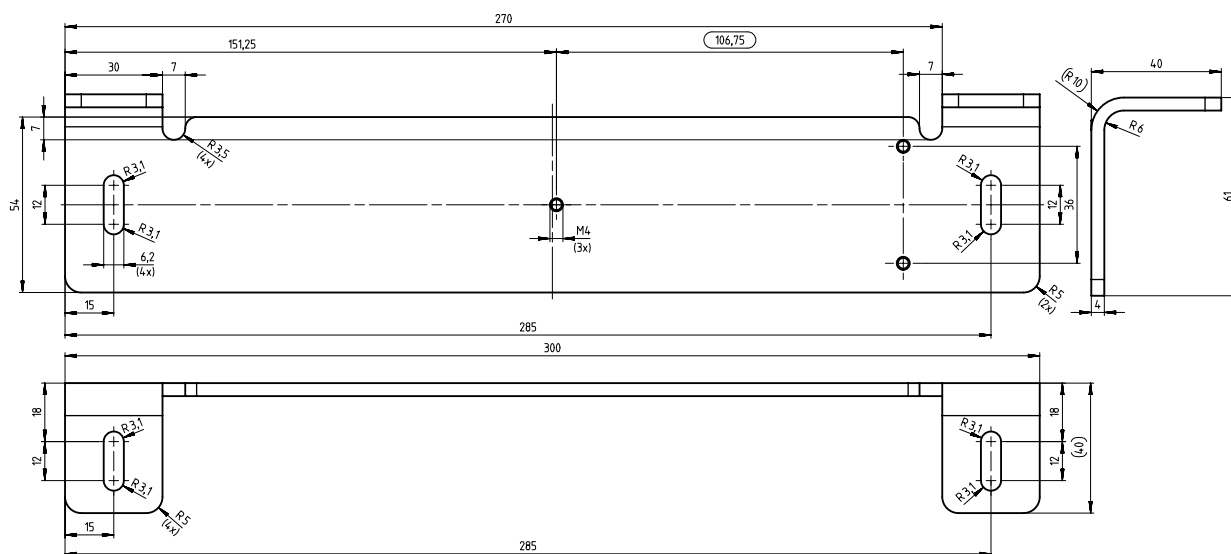


Fig. 13.2: Mounting plate BT-MSI-MD\_FB

### Mounting bracket BT-MSI-MD\_FB-L



all dimensions in mm

Fig. 13.3: Mounting bracket BT-MSI-MD\_FB-L

## 14 Order guide and accessories

### 14.1 Type overview

Tab. 14.1: Part numbers

Part no.	Part designation	Description
549954	MSI-MD-FBX	Muting controller

### 14.2 Accessories

Tab. 14.2: Connection cables

Part no.	Article	Description
Connection cables for connecting muting controller MSI-MD-FB to the machine interface		
678060	CB-M12-5000E-8GF	5 m connection cable with straight socket
678061	CB-M12-1000E-8GF	10 m connection cable with straight socket
678062	CB-M12-15000E-8GF	15 m connection cable with straight socket
678063	CB-M12-55000E-8GF	25 m connection cable with straight socket
678064	CB-M12-50000E-8GF	50 m connection cable with straight socket
678070	CB-M12-5000E-8WF	5 m connection cable with angled socket
678071	CB-M12-10000E-8WF	10 m connection cable with angled socket
678072	CB-M12-15000E-8WF	15 m connection cable with angled socket
678073	CB-M12-25000E-8WF	25 m connection cable with angled socket
678074	CB-M12-50000E-8WF	50 m connection cable with angled socket

Tab. 14.3: Interconnection cables

Part no.	Article	Description
Interconnection cables (Y-cable) for connecting transmitter and receiver of safety light barrier MLD and safety light curtain MLC to the muting controller		
548951	CB-M12-Y1A	Y interconnection cable with pin 4 on 24 V
548952	CB-M12-Y1B	Y interconnection cable with pin 4 open
678033	CB-M12-2500S-5GF/GM	Interconnection cable recommended for MLDx10-RTx connection
678035	CB-M12-5000S-5GF/GM	Interconnection cable recommended for MLDx10-RTx connection

Tab. 14.4: Display and confirmation units

Part no.	Article	Description
426290	AC-ABF10	Display and confirmation unit

Tab. 14.5: Mounting technology

Part no.	Article	Description
427302	BT-MSI-MD-FB	Mounting plate for mounting muting controller MSI-MD-FB on side or rear on UDC/DC columns or for wall mounting
427303	BT-MSI-MD-FB-L	Mounting bracket for interior mounting of muting controller MSI-MD-FB in UDC/DC columns

Tab. 14.6: Muting indicators

Part no.	Article	Description
660611	MS70/LED-M12-2000-4GM	LED muting indicator with connection cable 2 m

**15 EC Declaration of Conformity**



**EG-KONFORMITÄTS-  
ERKLÄRUNG**

**EC DECLARATION  
OF CONFORMITY**

**DECLARATION CE  
DE CONFORMITE**

Hersteller:

Manufacturer:

Constructeur:

**Leuze electronic GmbH + Co. KG**  
In der Braike 1, PO Box 1111  
73277 Owen, Germany

Produktbeschreibung:

Description of product:

Description de produit:

**Zubehörfunktion für  
berührungslos wirkende  
Schutzeinrichtung  
Sicherheitsbauteil nach  
2006/42/EG Anhang IV  
MSI-MD-FB  
Seriennummer siehe  
Typenschild**

**Accessory function for  
sensitive protective equipment  
safety component in acc. with  
2006/42/EC annex IV  
MSI-MD-FB  
Serial no. see name plates**

**Fonction accessoire pour  
équipements de protection  
sensibles Elément de sécurité  
selon 2006/42/CE annexe IV  
MSI-MD-FB  
N° série voir plaques  
signalétiques**

Die alleinige Verantwortung  
für die Ausstellung dieser  
Konformitätserklärung trägt  
der Hersteller.

This declaration of conformity  
is issued under the sole  
responsibility of the  
manufacturer.

La présente déclaration de  
conformité est établie sous la  
seule responsabilité du  
fabricant.

Der oben beschriebene  
Gegenstand der Erklärung  
erfüllt die einschlägigen  
Harmonisierungsrechts-  
vorschriften der Union:

The object of the declaration  
described above is in  
conformity with the relevant  
Union harmonisation  
legislation:

L'objet de la déclaration décrit  
ci-dessus est conforme à la  
législation d'harmonisation de  
l'Union applicable:

Angewandte EG-Richtlinie(n):  
**2006/42/EG (\*1)  
2014/30/EG**

Applied EC Directive(s):  
**2006/42/EC (\*1)  
2014/30/EC**

Directive(s) CE appliquées:  
**2006/42/CE (\*1)  
2014/30/CE**

Angewandte harmonisierte Normen / Applied harmonized standards / Normes harmonisées appliquées :  
**EN 55011: 2009 + A1: 2010      EN 61496-1: 2013 (Type 4) (\*1)      EN ISO 13849-1: 2008  
+ AC: 2009 (\*1)**

Angewandte technische Spezifikationen / Applied technical specifications / Spécifications techniques  
appliquées :

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EN 61508-4: 2010 (SIL1/SIL3) (\*1)**

**EN 61508-2: 2010 (SIL1/SIL3) (\*1)**

**EN 61508-3: 2010 (SIL1/SIL3) (\*1)**

Notified Body

**(\*1) TÜV-SÜD PRODUCT SERVICE GmbH Zertifizierungsstelle Ridlerstraße 65 D-80339 München / NB 0123**

Dokumentationsbevollmächtigter ist der genannte Hersteller, Kontakt: quality@leuze.de.

Authorized for documentation is the stated manufacturer, contact: quality@leuze.de.

Autorisé pour documentation est le constructeur déclaré, contact: quality@leuze.de

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Sitz Owen, Registergericht Stuttgart, HRB 230550

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