


EUCHNER

Operating Instructions

Field Evaluation Unit
CES-FD-AS2A-... (Unicode/Multicode)

EN

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1. About this document

1.1. Scope

This document is valid for all field evaluation units CES-FD-AS2A-... version 1.0.X.





These operating instructions, the document *Safety information* and any available data sheet form the complete user information for your device.

	<p>Important!</p> <p>Make sure to use the operating instructions valid for your product version. Please contact the EUCHNER support team if you have any questions.</p>
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1.2. Target group





Design engineers and installation planners for safety devices on machines, as well as setup and servicing staff possessing special expertise in handling safety components.


1.3. Key to symbols

Symbol/depiction	Meaning
	Printed document
	Document is available for download at www.euchner.com
 DANGER WARNING CAUTION	<p>Safety precautions</p> <p>Danger of death or severe injuries</p> <p>Warning about possible injuries</p> <p>Caution slight injuries possible</p>
 NOTICE Important!	<p>Notice about possible device damage</p> <p>Important information</p>
Tip	Useful information

1.4. Supplementary documents

The overall documentation for this device consists of the following documents:

Document title (document number)	Contents	
Safety information (2525460)	Basic safety information	
Operating instructions (MAN20001732)	(this document)	
Declaration of conformity	Declaration of conformity	
Possibly available data sheet	Item-specific information about deviations or additions	

	<p>Important!</p> <p>Always read all documents to gain a complete overview of safe installation, setup and use of the device. The documents can be downloaded from www.euchner.com. Simply enter the document number or the order number in the search box.</p>
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2. Correct use

Field evaluation units series CES-FD-AS... from EUCHNER are operated as slaves on the safety bus AS-Interface Safety at Work and are used to evaluate safety-related signals from EUCHNER key adapters and read heads in the field. The system can form an interlocking device without guard locking (type 4). The system meets the requirements according to EN IEC 60947-5-3. Devices with unicode evaluation possess a high coding level, devices with multicode evaluation possess a low coding level.

The system consists of field evaluation unit, read head/key adapter and actuator/key.

This safety component allows dangerous machine movements to be performed as long as a valid key is inserted. A stop command is triggered if the key is removed during the dangerous machine function.

This means:

- › Starting commands that cause a dangerous machine function must become active only when the guard is closed.
- › Opening the guard triggers a stop command.
- › Closing a guard must not cause automatic starting of a dangerous machine function. A separate start command must be issued. For exceptions, refer to EN 12100 or relevant C-standards.

Before use, a risk assessment must be performed on the machine, e.g. according to the following standards:

- › EN ISO 13849-1
- › EN ISO 12100
- › EN IEC 62061

Correct use includes observing the relevant requirements for installation and operation, e.g. according to the following standards:

- › EN ISO 13849-1
- › EN ISO 14119
- › EN IEC 60204-1

The following components can be connected to the field evaluation unit CES-FD-AS2A-...:

- › CES read heads
- › CKS key adapters

For further information, refer to the operating instructions of the corresponding component and to *Table 1: Possible combinations for CES components on page 5*.



Important!

- › The user is responsible for the proper integration of the device into a safe overall system. For this purpose, the overall system must be validated, e.g. in accordance with EN ISO 13849-1.
- › Correct use requires observing the permissible operating parameters (see chapter 11. *Technical data on page 14*).
- › If a data sheet is included with the product, the information on the data sheet applies.
- › It is only allowed to use components that are permissible in accordance with the table below.

Table 1: Possible combinations for CES components

Field evaluation unit	Key adapter/read head	Key/actuator
		Important: Key adapter CKS must not be used as a lockout bar in combination with multicode evaluation.
CES-FD-AS2A-...	CKS-A-LA1-SC	●
	CKS-A-L1B-SC	
Key to symbols	●	Combination possible

3. Description of the safety function

Devices from this series feature the following safety functions:

The following applies in combination with read heads without guard locking (CES read heads):

Monitoring of the position of a guard (interlocking device according to EN ISO 14119)

- › Safety function:
 - In combination with read head CES-A-LMN-SC: When the guard is open, no valid code sequence is sent.
 - In combination with key adapter CKS-A-L...: Safe detection of a key belonging to the system and checking the associated key code. When the key is removed, no valid code sequence is sent.
- › Safety characteristics: category, Performance Level, PFH_D (see chapter 11. *Technical data* on Page 15).

4. Exclusion of liability and warranty

In case of failure to comply with the conditions for correct use stated above, or if the safety regulations are not followed, or if any servicing is not performed as required, liability will be excluded and the warranty void.

5. General safety precautions



WARNING

Danger to life due to improper installation or due to bypassing (tampering). Safety components fulfill a personnel protection function.

- › Safety components must not be bypassed, turned away, removed or otherwise rendered ineffective. On this topic pay attention in particular to the measures for reducing the possibility of bypassing according to EN ISO 14119:2013, section 7.
- › The switching operation must be triggered only by actuators designated for this purpose.
- › Prevent bypassing by means of replacement actuators (only for multicode evaluation). For this purpose, restrict access to actuators and to keys for releases, for example.
- › Mounting, electrical connection and setup only by authorized personnel possessing the following knowledge:
 - specialist knowledge in handling safety components
 - knowledge about the applicable EMC regulations
 - knowledge about the applicable regulations on operational safety and accident prevention.



Important!

Prior to use, read the operating instructions and keep these in a safe place. Ensure the operating instructions are always available during mounting, setup and servicing. For this reason you should archive a printed copy of the operating instructions. You can download the operating instructions from www.euchner.com.

6. Function

The safety system consists of three components:

- › Key/actuator
- › Key adapter/read head
- › Field evaluation unit

1 key adapter/read head can be connected to the field evaluation unit.

Each key/actuator is supplied with unique electronic coding. The code of a key/actuator cannot be reprogrammed.

Whether the device learns the complete code (unicode) or not (multicode) depends on the respective version.

- › **Devices with unicode evaluation:** The key/actuator must be assigned to the evaluation unit by a teach-in operation so that it is detected by the system. This unambiguous assignment ensures a particularly high level of protection against tampering. The system thus possesses a high coding level.
- › **Devices with multicode evaluation:** Unlike systems with unicode evaluation, on multicode devices a specific code is not requested but instead it is only checked whether the key/actuator is of a type that can be detected by the system (multicode evaluation). There is no exact comparison of the key/actuator code with the taught-in code in the evaluation unit (unicode evaluation). The system possesses a low coding level.

The read head is fastened to the fixed part of the guard and is connected to the field evaluation unit via a two-core screened cable (H1/H2 and SH).

The actuator fastened to the movable part of the guard is moved towards the read head by closing the door. When the operating distance is reached, power is supplied to the actuator by the read head by induction and data can be transferred.

If a permissible code is detected, a bit sequence with 4 x 8 bits is sent via the AS-Interface bus to signal that the key is inserted or the actuator is detected.

The zero sequence is transmitted via the AS-Interface bus when the key/actuator is removed.

The zero sequence is sent via the AS-Interface bus when the key/actuator is removed. The machine cannot be started.

If there is a fault in the key adapter/the read head, the zero sequence is sent and the LED illuminates red.

The key adapter CKS can be used as a lockout bar, for example. As soon as the key is in the key adapter, this is reported via the AS-Interface bus. Each delivered key possesses unique electronic coding and so is a unique element in the system used.

The code of a key cannot be reprogrammed.

6.1. Limit-range monitoring

If the safety door with the actuator should settle over time, the actuator can drift out of the read head actuating range. The device recognizes this situation and indicates that the actuator is in the limit range by flashing the STATE LED. This allows the safety door to be readjusted in time. Also refer to the system status table in chapter 10.

6.2. Switching states

The detailed switching states for your key adapter can be found in the system status table in chapter 10. All indicator LEDs are described there.

7. Mounting



NOTICE




Device damage due to improper installation or unsuitable ambient conditions.

- › Read heads and actuators must not be used as a mechanical end stop.
- › Observe EN ISO 14119:2013, sections 5.2 and 5.3, for information about mounting the safety switch and the actuator.
- › Observe EN ISO 14119:2013, section 7, for information about reducing the possibilities for bypassing an interlocking device.


Note the following points:

- › Actuator and read head must be mounted such that they cannot be removed or tampered with using simple means.
- › Pay attention to the maximum tightening torque for the field evaluation unit mountings of 1 Nm.

8. Electrical connection

	<p>WARNING</p> <p>In the event of a fault, loss of the safety function due to incorrect connection.</p> <ul style="list-style-type: none"> › Monitoring outputs must not be used as safety outputs. › Lay the connecting cables with protection to prevent the risk of short circuits.
	<p>CAUTION</p> <p>Risk of damage to equipment or malfunctions as a result of incorrect connection.</p> <ul style="list-style-type: none"> › All the electrical connections must either be isolated from the mains supply by a safety transformer according to IEC 61558-2-6 with limited output voltage in the event of a fault, or by other equivalent insulation measures (PELV). › To avoid EMC interference, the physical environmental and operating conditions at the installation site of the device must comply with the requirements according to the standard EN 60204-1:2006 (EMC). › Please pay attention to any interference fields from devices such as frequency converters or induction heating systems. Observe the EMC instructions in the manuals from the respective manufacturer.
	<p>Important!</p> <p>If the device does not appear to function when operating voltage is applied (e.g. green STATE LED does not flash), the evaluation unit must be returned unopened to the manufacturer.</p>

8.1. Notes about

	<p>Important!</p> <ul style="list-style-type: none"> › This device is intended to be used with a Class 2 power source in accordance with UL1310. As an alternative an LV/C (Limited Voltage/Current) power source with the following properties can be used: <ul style="list-style-type: none"> - This device shall be used with a suitable isolating source in conjunction with a fuse in accordance with UL248. The fuse shall be rated max. 3.3 A and be installed in the 30 V DC power supply to the device as per the UL requirements. Please note possibly lower connection ratings for your device (refer to the technical data). › For use and application as per the requirements of UL ¹⁾ a connecting cable listed under the UL category code CYJV/7, min. 24 AWG, min. 80 °C, must be used. <p><small>1) Note on the scope of the UL approval: the devices have been tested as per the requirements of UL508 and CSA/C22.2 no. 14 (protection against electric shock and fire).</small></p>
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8.2. Setting the AS-Interface address

The address can be set prior to or after mounting.

The AS-Interface address of the key adapter is set using an AS-Interface programming device. Addresses 1 to 31 are valid.

The unit is programmed by connecting the programming device to the ASi connection on the key adapter using a programming cable.

The AS-Interface address can also be set directly on the AS-Interface bus with a master.

The default setting for the address on delivery is 0.

8.3. Configuration in the AS-Interface safety monitor

(see operating instructions for the AS-Interface safety monitor)

8.3.1. Dual-channel positively driven

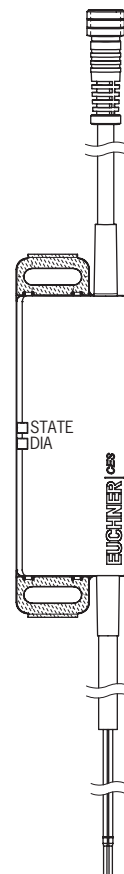
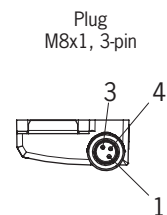
The key adapter is configured in the AS-Interface safety monitor with the AS-Interface address set as follows:

- › Dual-channel positively driven
- › With or without start-up test

8.4. Terminal assignment of field evaluation unit CES-FD-AS2A-...

8.4.1. Connection for key adapter/read head (M8, 3-pin)

Pin	Designation	Description	Conductor coloring
1	H1	Data line	BN
3	H2	Data line	WH
4	SH	Shield	-



8.4.2. Assignment of AS-Interface connecting cable

	Designation	Description	Conductor coloring
Flying lead	ASi+	AS-Interface +	BN
	ASi-	AS-Interface -	BU

9. Setup

9.1. LED displays

A detailed description of the signal functions can be found in the system status table in chapter 10.

LED	Color
STATE	green
DIA	red



9.2. Teach-in function for key/actuator (only for unicode evaluation)

The key/actuator must be assigned to the evaluation unit using a teach-in function before the system forms a functional unit. During a teach-in operation, the bit sequence 0000 is transmitted, i.e. the system is in the safe state.



Important!

- › The teach-in operation may be performed only if the device functions flawlessly. The red DIA LED must not be illuminated.
- › The evaluation unit disables the code of the previous key/actuator if teach-in is carried out for a new key/actuator. Teach-in is not possible again immediately for this device if a new teach-in operation is carried out. The disabled code is enabled again in the evaluation unit only after a third code has been taught-in.
- › The evaluation unit can be operated only with the last key/actuator taught-in.
- › After starting, the device remains in teach-in standby state for 3 min. If no new key/actuator is detected in this time, the device changes to normal operation. If the device detects the key/actuator that was most recently taught-in when in the teach-in standby state, this state is ended immediately and the device changes to normal operation.
- › If the key/actuator to be taught-in is within the actuating range for less than 60 s, it will not be activated and the most recently taught-in actuator will remain saved.

9.2.1. Preparing device for teach-in operation and teaching-in key/actuator

1. Connect AS-Interface bus to evaluation unit and insert a new key into the key adapter within 3 minutes.
 - ➔ Teach-in operation starts, green STATE LED flashes (approx. 1 Hz). During the teach-in operation, the evaluation unit checks whether the key/actuator is a disabled key/actuator. Provided this is not the case, the teach-in operation is completed after approx. 60 seconds, and the green STATE LED goes out. The new code has now been stored, and the old code is disabled.
2. To activate the new key/actuator code from the teach-in operation in the evaluation unit, the CES-FD-AS2A device must then be disconnected from the AS-Interface bus for min. 3 seconds.

9.3. Setup (only for multicode)

1. Connect AS-Interface bus to the device.
 - ➔ The green STATE LED flashes briefly, and a self-test is performed.
After this, the LED flashes cyclically one time and signals the standby state.

9.4. Functional check



WARNING

- Danger of fatal injury as a result of faults in installation and the functional check.
- › Before carrying out the functional check, make sure that there are no persons in the danger area.
 - › Observe the valid accident prevention regulations.

9.4.1. Electrical function test

After installation and any fault, the safety function must be fully checked. Proceed as follows:

1. Switch on operating voltage.
 - ➔ The machine must not start automatically.
 - ➔ The evaluation unit carries out a self-test. The green STATE LED then flashes at regular intervals.
2. Insert key into the key adapter.
 - ➔ The STATE LED illuminates green.
3. Enable operation in the control system.
4. Remove key.
 - ➔ The machine must switch off and it must not be possible to start it as long as a key is not inserted.
 - ➔ The LED illuminates green at regular intervals.

Repeat steps 2 ... 4 for each key adapter.

10. System status table

Operating mode	Key/actuator inserted	LED indicator Output		State
		STATE (green)	DIA (red)	
Normal operation	Yes		○	Normal operation, key/actuator inserted
	Yes	Flashes quickly 2 Hz	○	Normal operation, actuator in the limit range → re-adjust door
	No	1 x	○	Normal operation, key/actuator not inserted
	No	2 x	○	No actuator taught-in, teach-in operation not completed successfully
Teach-in standby	No	3 x	○	Key/actuator not inserted, device is ready for teach-in for another key/actuator (only short time after power up)
Setup	Yes	1 Hz	○	Teach-in operation
	X	○	○	Positive acknowledgment after completion of teach-in operation
Fault display	Yes	3 x		Defective key/actuator (e.g. error in code or code not readable)
	X	5 x		Internal fault (e.g. component fault, data error)

Key to symbols	○	LED not illuminated
		LED illuminated
	10 Hz (8 s)	LED flashes for 8 seconds at 10 Hz
	3 x	LED flashes three times, and this is then repeated
	X	Any state

After the cause has been remedied, faults can generally be reset by opening and closing the guard or by removing the key. If the fault is still displayed afterward, briefly interrupt the power supply. Please contact the manufacturer if the fault could not be reset after restarting.



Important!

If you do not find the displayed device status in the system status table, this indicates an internal device fault. In this case, you should contact the manufacturer.

11. Technical data

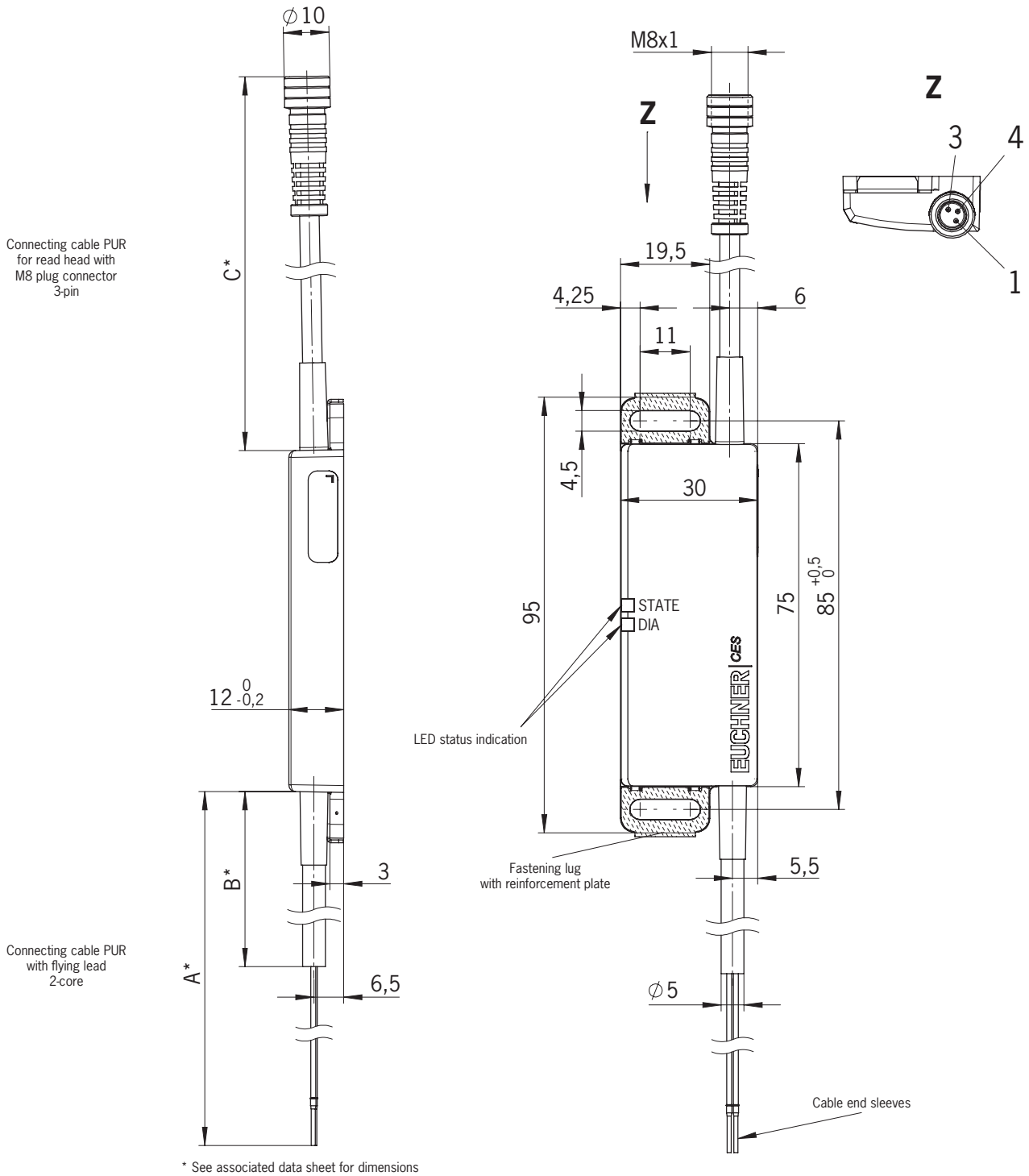


NOTICE

If a data sheet is available for the product, the information on the data sheet applies.

11.1. Technical data for field evaluation unit CES-FD-AS2A-...

Dimension drawing



Technical data

Parameter	Value			Unit
	min.	typ.	max.	
Housing material		PBT plastic		
Dimensions		95 x 30 x 12		mm
Weight		0.096		kg
Ambient temperature at $U_B = DC 24 V$	-20	-	+55	°C
Degree of protection		IP65/IP67		
Safety class		III		
Degree of contamination		3		
Installation position		Any		
Connection - Evaluation - Read head		Connecting cable PUR with flying lead, 2-core Connecting cable PUR with plug connector M8x1, 3-pin		
The following applies to the approval acc. to UL		Operation only with UL Class 2 power supply		
Rated insulation voltage U_i	-	-	300	V
Rated impulse withstand voltage U_{imp}	-	-	1.5	kV
Shock and vibration resistance		Acc. to EN IEC 60947-5-3		
Switching frequency	-	-	1	Hz
Ready delay	-	0.5	-	s
Risk time	-	-	260	ms
Turn-on time	-	-	300	ms
AS-Interface data		EA code: 0	ID code: B	
AS-i operating voltage	19	-	31.6	V DC
Total current consumption	-	-	50	mA
Valid AS-Interface addresses		1 - 31		
AS-Interface inputs		Acc. to AS-Interface Safety at Work		
Key/actuator detection		D0 - D3		
Characteristics acc. to EN ISO 13849-1				
Category		4		
Performance Level		PL e		
PFH_D		$4.5 \times 10^{-9} / h$		
Mission time		20		
				years

11.1.1. Typical system times

Please refer to the technical data for the exact values.

Ready delay: After switch-on, the device carries out a self-test. The system is ready for operation only after this time.

Turn-on time: The max. reaction time t_{on} is the time from the moment when the key/actuator is in the actuating range to the moment when the code sequence is sent.

Risk time according to EN 60947-5-3: If a key/actuator moves outside the actuating range, the zero sequence is sent via the AS-Interface bus.

11.2. Technical data for key adapter CKS-A-L...

See respective operating instructions.

12. Ordering information and accessories



Tip!

Suitable accessories, e.g. cables or assembly material, can be found at www.euchner.com. To order, enter the order number of your item in the search box and open the item view. Accessories that can be combined with the item are listed in *Accessories*.

13. Inspection and service



WARNING

Loss of the safety function because of damage to the device.
In case of damage, the related safety component must be replaced. The replacement of individual parts in a safety component is not permitted.

Regular inspection of the following is necessary to ensure trouble-free long-term operation:

- › Check the switching function (see chapter 9.4. *Functional check on page 12*)
- › Check the secure mounting of the devices and the connections
- › Check for contamination
- › Check for sealing of the plug connector on the safety switch
- › Check for loose cable connections on the plug connector
- › Check the release distance

No servicing is required. Repairs to the device are only allowed to be made by the manufacturer.



NOTICE

The year of manufacture can be seen in the lower right corner of the type label.

14. Service

If servicing is required, please contact:

EUCHNER GmbH + Co. KG
Kohlhammerstraße 16
70771 Leinfelden-Echterdingen

Service telephone:

+49 711 7597-500

E-mail:

support@euchner.de

Internet:

www.euchner.com

15. Declaration of conformity

The product complies with the requirements according to Machinery Directive 2006/42/EC.

The EU declaration of conformity can be found at www.euchner.com. Enter the order number of your device in the search box. The document is available under *Downloads*.

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