


EUCHNER

Operating Instructions

**Transponder-Coded Safety Switch With Guard Locking
CTM-LBI-BR Unicode/Multicode**

EN

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1. About this document





1.1. Scope

These operating instructions are valid for all CTM-LBI-BR... from version V1.0.0. These operating instructions, the document *Safety information* and any enclosed data sheet form the complete user information for your device.

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	Safety precautions Danger of death or severe injuries Warning about possible injuries Caution slight injuries possible
 NOTICE Important!	Notice about possible device damage Important information
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 information for safe setup and service	
Operating instructions (2525462)	(this document)	
Possibly enclosed data sheet	Item-specific information about deviations or additions	

	Important! 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 . For this purpose enter the doc. no. in the search box.
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2. Correct use

Safety switches series CTM-L-... are interlocking devices with guard locking (type 4). The device complies with 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.

In combination with a movable guard and the machine control, this safety component prevents the guard from being opened while a dangerous machine function is being performed.

This means:

- Starting commands that cause a dangerous machine function must become active only when the guard is closed and locked.
- The guard locking must not be released until the dangerous machine function has ended.
- Closing and locking a guard must not cause automatic starting of a dangerous machine function. A separate start command must be issued. For exceptions, refer to EN ISO 12100 or relevant C-standards.

Devices from this series are also suitable for process protection.

Before the device is used, a risk assessment must be performed on the machine, e.g. in accordance with the following standards:

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

Correct use includes observing the relevant requirements for installation and operation, particularly based on the following standards:

- EN ISO 13849-1
- EN ISO 14119
- EN 60204-1

The safety switch is allowed to be operated only in conjunction with the intended EUCHNER actuator and the related connection components from EUCHNER. On the use of different actuators or other connection components, EUCHNER provides no warranty for safe function.

Connection of several devices in a BR switch chain is permitted only using devices intended for series connection in a BR switch chain. Check this in the instructions of the device in question.



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 13849-2.
- It is only allowed to use components that are permissible in accordance with the table below.

Table 1: Possible combinations for CTM components

Safety switch	Actuator	
	A-B-A1-...	
CTM-... Unicode/Multicode	●	
Key to symbols	●	Combination possible

3. Description of the safety function

Devices from this series feature the following safety functions:

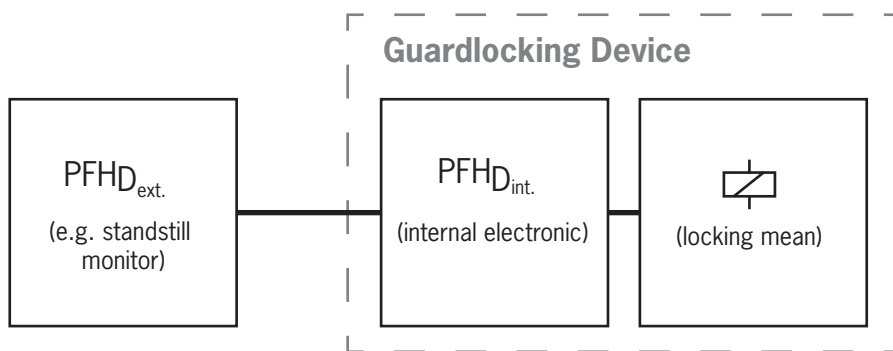
Monitoring of guard locking and the position of the guard (interlocking device with guard locking according to EN ISO 14119)

- Safety function (see chapter 6.9. *Switching states on page 9*):
 - The safety outputs are switched off when guard locking is released (monitoring of the locking element).
 - The safety outputs are switched off when the guard is open (monitoring of the door position).
 - Guard locking can be activated only when the actuator is located in the switch (prevention of inadvertent locking position (faulty closure protection)).
- Safety characteristics: category, Performance Level, PFH_D (see chapter 12. *Technical data on page 27*).

Control of guard locking

If the device is used as guard locking for personnel protection, the control of the guard locking must be regarded as a safety function.

The safety level of guard locking control is determined by the device PFH_{D_{int.}} and by the external control (e.g. PFH_{D_{ext.}} of the standstill monitor), but cannot be higher than PL d.



Safety characteristics: category, Performance Level, PFH_D (see chapter 12. *Technical data on page 27*).

Releasing the guard locking

- Safety functions
 - Guard locking remains activated until IMP requests releasing the guard locking.

The decisive criterion for a possible request to deactivate guard locking is a voltage of at least 5 V between the inputs IMP and 0 V or between IMP and IMM.

The external control system must recognize and react to short circuits on these control signals. Fault exclusion, e.g. by laying the cables with protection, can be considered as an alternative.

Voltage disconnection must apply to the machine (control system and device).

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

Safety switches fulfill personnel protection functions. Incorrect installation or tampering can lead to fatal injuries to personnel.

Check the safe function of the safeguard particularly

- › after any setup work
- › after the replacement of a system component
- › after an extended period without use
- › after every fault

Independent of these checks, the safe function of the safeguard should be checked at suitable intervals as part of the maintenance schedule.



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. You can download the operating instructions from www.euchner.com.

6. Function

The device permits the locking of movable guards.

The system consists of the following components: coded actuator (transponder) and switch.

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

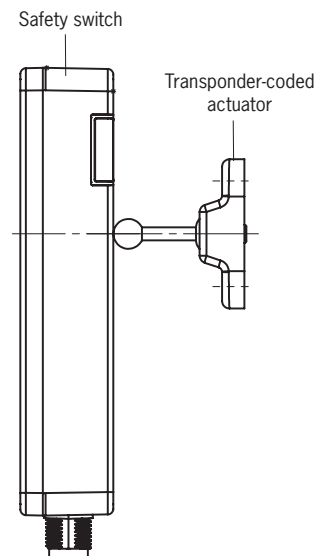
- › **Devices with unicode evaluation:** The actuator must be assigned to the safety switch by a teach-in operation so that it is detected by the system. This unambiguous assignment ensures a particularly high level of protection against tampering. The system thus possesses a high coding level.
- › **Devices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

When the guard is closed, the actuator is moved into the safety switch. When the operating distance is reached, power is supplied to the actuator by the switch and data are transferred.

Door monitoring output OD is set when a permissible code is detected. Guard locking is activated automatically if no voltage is present at IMP. The safety outputs are switched on when guard locking is active.

The safety outputs and the guard locking monitoring output/bit OL are switched off when the guard is released.

In the event of a fault in the safety switch, the safety outputs are switched off and the DIA LED illuminates red. The occurrence of faults is detected at the latest on the next demand to close the safety outputs (e.g. on starting).



6.1. Bistable guard locking

Guard locking of the switch functions according to the bistable principle. This means that guard locking is kept in its last position if the power supply is interrupted or when the machine is switched off for servicing, for example. As a result, the safety door is either constantly locked or it can be closed and opened as required without activating the guard locking. Guard locking is released via control input IMP. Also see chapter 6.8. *Guard locking on version CTM-LBI on page 9.*

6.2. Guard lock monitoring

All versions feature two safe outputs for monitoring guard locking. The safety outputs (FO1A and FO1B) are switched off when guard locking is released.

6.3. Door monitoring output OD

Door monitoring output OD is switched on as soon as the actuator is inserted into the switch (state: guard closed and not locked). Door monitoring output OD also remains switched on when guard locking is active.

6.4. Diagnostic output/bit OI

Evaluation via the BR evaluation unit.

The diagnostic output is switched on in the event of a fault (switch-on condition as for DIA LED).

6.5. Guard locking monitoring output/bit OL

Evaluation via the BR evaluation unit.

The guard locking monitoring output is switched on when guard locking is active.

6.6. Safety output status output/bit OM

Evaluation via the BR evaluation unit.

This status output is switched on if the safety outputs of all preceding devices in the series connection are switched on.

6.7. Locking element status output/bit OLS

Evaluation via the BR evaluation unit.

This status output is switched on if the locking element is stuck and guard locking therefore cannot be activated/deactivated.

6.8. Guard locking on version CTM-LBI

(guard locking actuated by spring force and released by power-ON)

Activating guard locking: close guard; no voltage at control input IMP or data bit switched off.

Releasing guard locking: apply voltage to control input IMP or switch on data bit.

The spring-operated guard locking functions in accordance with the closed-circuit current principle. If the voltage is interrupted at the solenoid, the guard locking remains active and the guard cannot be opened directly.

If the guard is open when the power supply is interrupted and is then closed, guard locking remains released. This prevents people from being locked in unintentionally.



Important!

Malfunctions due to incorrect use.

- The actuator must not be under tensile stress during release.
- Very strong jolts or vibration can cause the guard locking state to change unintentionally. This generally applies when the switch is electrically isolated.
 - The switch must not be used as a mechanical end stop.
 - In case of heavy doors, ensure that the impact energy is cushioned on closing.

6.9. Switching states

The detailed switching states for your switch can be found in the system status table. All safety outputs, monitoring outputs and display LEDs are described there.

	Guard closed and locked	Guard closed and not locked	Guard opening	Guard open
Control input IMP	off	on	on	off = Guard locking is activated immediately on closing on = Guard locking remains released on closing
Safety outputs F01A and F01B 	on	off	off	off
Guard locking monitoring output/bit OL	on	off	off	off
Door monitoring output OD	on	on	on	off

7. Manual release



Important!

- › All release functions latch when the device is electrically isolated.
- › Guard locking remains released when the release function is reset.

Some situations require the guard locking to be released manually (e.g. malfunctions or an emergency). A function test should be performed after release.

More information on this topic can be found in the standard EN ISO 14119:2013, section 5.7.5.1. The device can feature the following release functions:


7.1. Auxiliary release

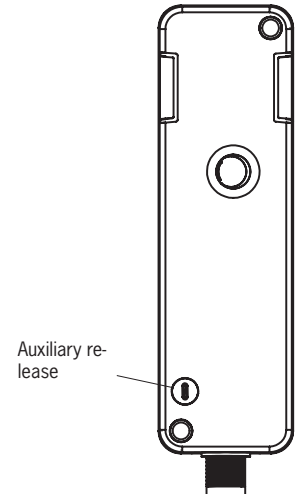
In the event of malfunctions, the guard locking can be released with the auxiliary release irrespective of the state of the solenoid.

The safety outputs are switched off when the auxiliary release is actuated. Use the safety outputs to generate a stop command.

Guard locking monitoring output/bit OL is switched off; door monitoring output OD can assume an undefined state. Open the guard and close it again after resetting the auxiliary release. The device will then operate normally again.

7.1.1. Actuating auxiliary release

1. Remove seal label or make a hole.
 2. Using a screwdriver, turn the auxiliary release to  in the direction of the arrow.
- ➔ Guard locking is released.



Important!

- › The actuator must not be under tensile stress during manual release.
- › Reset the auxiliary release and cover it with a new seal label after use.
- › Loss of the release function due to mounting errors or damage during mounting.
- › Check the release function every time after mounting.
- › After manual release, the solenoid must be energized briefly to re-establish the defined state.
- › Please observe the notes on any enclosed data sheets.
- › The auxiliary release must be reset at the control system level, e.g. by means of a plausibility check (status of the safety outputs does not match the guard locking control signal). See EN ISO 14119:2013, sec. 5.7.5.4.
- › The auxiliary release is not a safety function.
- › The machine manufacturer must select and use a suitable release (escape release, emergency release, etc.) for a specific application. A hazard assessment is required for this purpose. It may be necessary to take specifications from a product standard into account.
- › The correct function must be checked at regular intervals.
- › Loss of the release function due to mounting errors or damage during mounting. Check the release function every time after mounting.
- › Please observe the notes on any enclosed data sheets.

8. Mounting



CAUTION

Safety switches must not be bypassed (bridging of contacts), turned away, removed or otherwise rendered ineffective.

- › Observe EN ISO 14119:2013, section 7, for information about reducing the possibilities for bypassing an interlocking device.



NOTICE

Risk of damage to equipment and malfunctions as a result of incorrect installation.

- › Safety switches and actuators must not be used as an end stop.
- › Observe EN ISO 14119:2013, sections 5.2 and 5.3, for information about mounting the safety switch and the actuator.
- › Protect the switch against damage, as well as against penetrating foreign objects such as swarf, sand and blasting shot, etc.
- › Observe the min. door radii (see chapter 12.4.1. *Dimension drawing for actuator A-B-A1-A1-... on page 31*).
- › Observe the maximum permissible angle between switch and actuator (max. 5°).
- › Observe the tightening torque for fastening the switch and the actuator (max. 2.9 Nm).
- › The rear of the switch and the actuator's plate must lie flush on the mounting surface.
- › Actuator and safety switch must be mounted such that the actuator is correctly inserted into the switch when the guard is closed.

9. Electrical connection

The following connection options are available:

- › Separate operation
- › Series connection with Y-distributors
- › Series connection, e.g. with wiring in the control cabinet.



WARNING

- In the event of a fault, loss of the safety function due to incorrect connection.
- › To ensure safety, both safety outputs must always be evaluated.
 - › Monitoring outputs must not be used as safety outputs.
 - › Lay the connecting cables with protection to prevent the risk of short circuits.



CAUTION

- Risk of damage to equipment or malfunctions as a result of incorrect connection.
- › Do not use a control system with pulsing or switch off the pulsing function in your control system. The device generates its own test pulses on the safety outputs. A downstream control system must tolerate these test pulses, which may have a length of up to 300 µs. The test pulses are output only with the safety outputs switched off during device start. Depending on the inertia of the downstream device (control system, relay, etc.), this can lead to short switching processes.
 - › The inputs on a connected evaluation unit must be positive switching, as the two outputs on the safety switch deliver a level of +24 V in the switched-on state.
 - › 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 isolation measures (PELV).
 - › All electrical outputs must have an adequate protective circuit for inductive loads. The outputs must be protected with a free-wheeling diode for this purpose. RC interference suppression units must not be used.
 - › Power devices which are a powerful source of interference must be installed in a separate location away from the input and output circuits for signal processing. The cable routing for safety circuits should be as far away as possible from the cables of the power circuits.
 - › 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, section 4.4.2 (EMC).
 - › 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.





Important!

If the device does not appear to function when the operating voltage is applied (e.g. green STATE LED does not flash), the safety switch must be returned to the manufacturer.

9.1. Notes about



Important!

- › For use and operation as per the  requirements ¹⁾, a power supply with the feature *for use in Class 2 circuits* must be used.
Alternative solutions must comply with the following requirements:
Electrically isolated power supply unit in combination with fuse as per UL248. This fuse should be designed for max. 3.3 A and should be integrated into the 30 V DC voltage section.
- › For use and application as per the  requirements, ¹⁾ a connecting cable listed under the UL category code CYJV/7, min. 24 AWG, min. 80 °C, must be used.

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).

9.2. Safety in case of faults

- › The operating voltage UB and the control input IMP are reverse polarity protected.
- › The safety outputs FO1A/FO1B are short circuit-proof.
- › A short circuit between FO1A and FO1B is detected by the switch.
- › A short circuit in the cable can be excluded by laying the cable with protection.

9.3. Fuse protection for power supply

The power supply must be provided with fuse protection depending on the number of switches and current required for the outputs. The following rules apply:

Max. current consumption of an individual switch I_{max}

$$I_{max} = I_{UB} + I_{FO1A+FO1B} + I_{OD} + I_{IMP}$$

$$I_{UB} = \text{Switch operating current (max. 500 mA)}$$

$$I_{OL}/I_{OD} = \text{Load current of monitoring outputs (max. 50 mA per monitoring output)}$$

$$I_{FO1A+FO1B} = \text{Load current of safety outputs FO1A + FO1B (2 x max. 150 mA)}$$

Max. current consumption of a switch chain ΣI_{max}

$$\Sigma I_{max} = I_{FO1A+FO1B} + n \times (I_{UB} + I_{OD})$$

$$n = \text{Number of connected switches}$$

9.4. Requirements for connecting cables



CAUTION

Risk of damage to equipment or malfunctions as a result of incorrect connecting cables.

- › Use connection components and connecting cables from EUCHNER.
- › On the use of other connection components, the requirements in the following table apply. EUCHNER provides no warranty for safe function in case of failure to comply with these requirements.

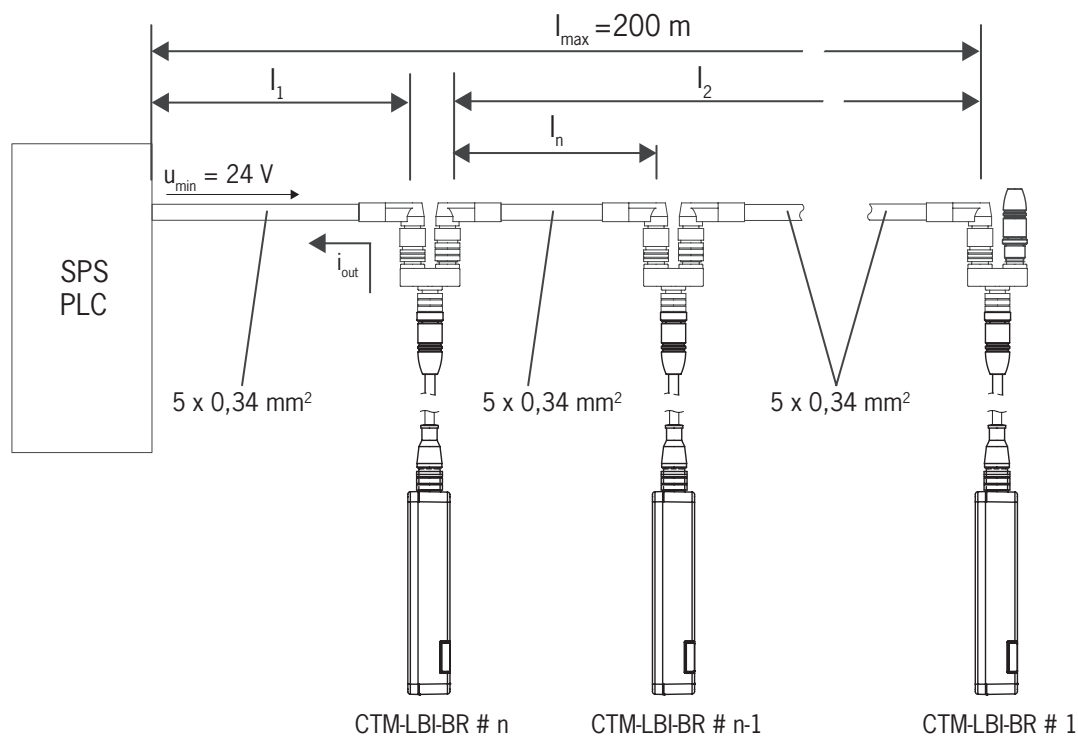
Observe the following requirements with respect to the connecting cables:

For safety switch CTM-...-BR-...-SA-... with plug connector M12, 8-pin

Parameter	Value	Unit
Conductor cross-section, min.	0.25	mm ²
R max.	80	Ω/km
C max.	120	nF/km
L max.	0.65	mH/km
Recommended cable type	LIYY 8 x 0.34 mm ²	

9.5. Maximum cable lengths

Switch chains are permitted up to a maximum overall cable length of 70 m taking into account the voltage drop as a result of the cable resistance (see table below with example data and case example).



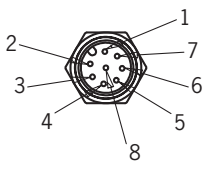


n Max. number of switches	I _{OD} (mA) Possible output current per channel F01A/F01B	l ₁ (m) Max. cable length from the last switch to the control system 0.34 mm ²
1	10	70
	25	
	50	
	100	
	150	
2	10	20
	25	
	50	
	100	
	150	
3	10	20
	25	
	50	
	100	
	150	

Contact EUCHNER in the following cases:

- If you connect more than 3 switches in series.
- If you plan to use a different cable design (cross-section, material, etc.).

9.6. Connector assignment, safety switch CTM-...-BR-...-SA-... with plug connector M12, 8-pin

Wiring diagram C

Plug connector (view of connection side)	Pin	Designation	Function	Conductor coloring Connecting cable ¹⁾
<p>1 x M12</p> 	1	F11B	Enable input, channel 2	WH
	2	UB	Operating voltage, 24 V DC	BN
	3	F01A	Safety output, channel 1 	GN
	4	F01B	Safety output, channel 2 	YE
	5	OD/C	Door monitoring output/communication	GY
	6	F11A	Enable input, channel 1	PK
	7	0 V	BR operating voltage 0 V / guard locking solenoid control input 0 V	BU
	8	IMP	Control input of guard locking solenoid	RD

1) Only for standard EUCHNER connecting cable.

9.7. Connector assignment, Y-distributor for series connection without BR evaluation unit



Important!

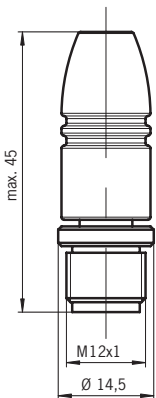
All guard locking solenoids are always controlled simultaneously on the use of Y-distributors in a series connection without BR evaluation unit.

Connector assignment of safety switch CTM-LBI-BR (8-pin plug) and Y-distributor (8-pin socket)

Pin	Function
X1.1	F11B
X1.2	U _B
X1.3	F01A
X1.4	F01B
X1.5	0 V
X1.6	F11A
X1.7	0 V
X1.8	IMP (RST *)

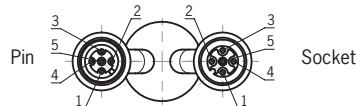
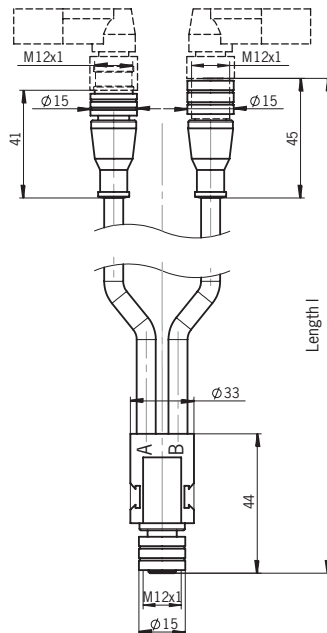
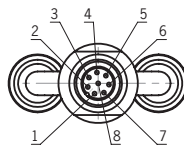
* as solenoid control input

Strapping plug 097645
4-pin, plug
(figure similar)



Y-distributor with connecting cable 111696 or 112395

Socket

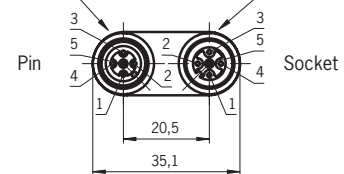
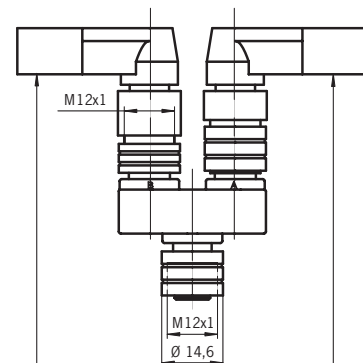
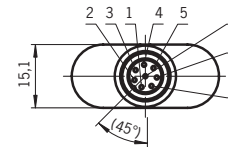


Pin	Function	Pin	Function
X2.1	U _B	X3.1	U _B
X2.2	F01A	X3.2	F11A
X2.3	0 V	X3.3	0 V
X2.4	F01B	X3.4	F11B
X2.5	IMP (RST *)	X3.5	IMP (RST *)

* as solenoid control input

Y-distributor 097627

Socket



Order no.	Length l [mm]
111696	200
112395	1,000

Pin	Function	Pin	Function
X2.1	U _B	X3.1	U _B
X2.2	F01A	X3.2	F11A
X2.3	0 V	X3.3	0 V
X2.4	F01B	X3.4	F11B
X2.5	IMP (RST *)	X3.5	IMP (RST *)

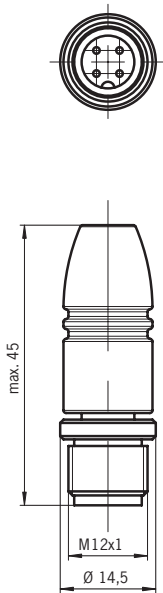
* as solenoid control input

9.8. Connector assignment, Y-distributor for series connection to a BR evaluation unit

Connector assignment of safety switch CTM-LBI-BR (8-pin plug) and Y-distributor (8-pin socket)

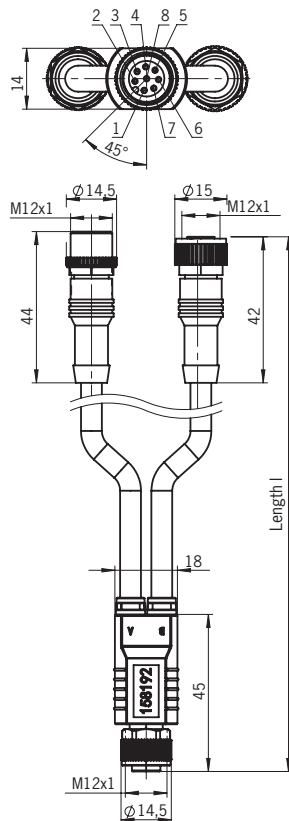
Pin	Function
X1.1	F11B
X1.2	U _B
X1.3	F01A
X1.4	F01B
X1.5	OD/C
X1.6	F11A
X1.7	0 V
X1.8	nc

Strapping plug 097645
4-pin, plug
(figure similar)



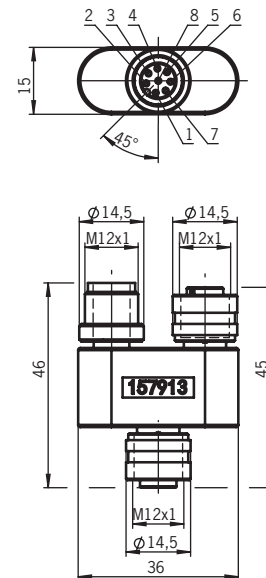
Y-distributor with connecting cable 158192 or 158193

Socket

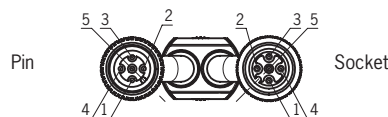
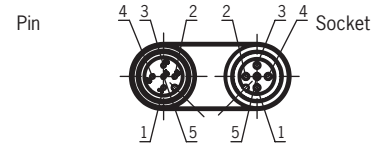


Y-distributor 157913

Socket



Order no.	Length l [mm]
158192	200
158193	1,000



Pin	Function	Pin	Function
X2.1	U _B	X3.1	U _B
X2.2	F01A	X3.2	F11A
X2.3	0 V	X3.3	0 V
X2.4	F01B	X3.4	F11B
X2.5	OD/C	X3.5	OD/C

Pin	Function	Pin	Function
X2.1	U _B	X3.1	U _B
X2.2	F01A	X3.2	F11A
X2.3	0 V	X3.3	0 V
X2.4	F01B	X3.4	F11B
X2.5	OD/C	X3.5	OD/C

9.9. Connection of several devices in a switch chain without BR evaluation unit



Important!

- › A BR switch chain may contain a maximum of 20 safety switches.
- › The example shows only an excerpt that is relevant for connection of the CTM system. The example illustrated here does not show complete system planning. The user is responsible for safe integration into the overall system. Detailed application examples can be found at www.euchner.com. Simply enter the order number of your switch in the search box. You will find all available connection examples for the device in *Downloads*.
- › Make sure you use the correct Y-distributor. See chapter 9.7. *Connector assignment, Y-distributor for series connection without BR evaluation unit on page 17*

The series connection is shown here based on the example of the version with plug connector M12. The switches are connected one behind the other with the aid of pre-assembled connecting cables and Y-distributors. If a safety door is opened or if a fault occurs on one of the switches, the system shuts down the machine. A higher-level control system cannot, however, detect which safety door is open or on which switch a fault has occurred with this connection technology.

The series connection can also be realized via additional terminals in a control cabinet.

The safety outputs are permanently assigned to the respective safety inputs of the downstream switch. FO1A must be routed to F11A and FO1B to F11B. If the connections are interchanged (e.g. FO1A to F11B), the device will switch to the fault state.

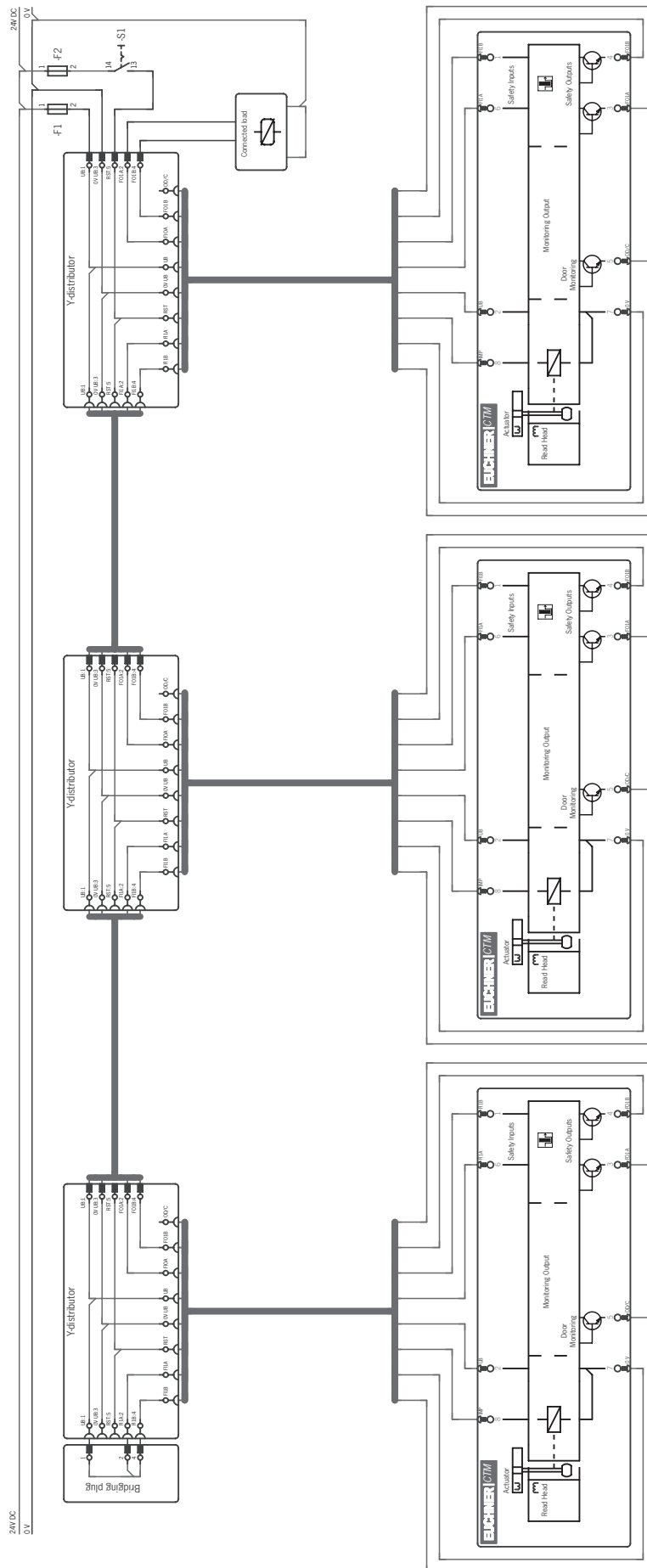


Figure 1: Connection example for series connection

9.10. Connection to a BR evaluation unit



Important!

- A BR switch chain may contain a maximum of 20 safety switches.
- The example shows only an excerpt that is relevant for connection of the CTM system. The example illustrated here does not show complete system planning. The user is responsible for safe integration into the overall system. Detailed application examples can be found at www.euchner.com. Simply enter the order number of your switch in the search box. You will find all available connection examples for the device in *Downloads*.

The series connection can be realized via additional terminals in a control cabinet.

The safety outputs are permanently assigned to the respective safety inputs of the downstream switch. FO1A must be routed to FI1A and FO1B to FI1B. If the connections are interchanged (e.g. FO1A to FI1B), the device will switch to the fault state.

To poll the communication data from the switches connected, the diagnostic output OD/C for each switch is routed to the BR evaluation unit via parallel wiring.

On the use of the BR evaluation unit ESM-CB or the BR evaluation unit GWY, the following applies:

The safety outputs for the last switch are routed to the corresponding inputs on the BR evaluation unit ESM-CB/GWY. If a safety door is opened or if a fault occurs on one of the switches, the BR evaluation unit ESM-CB/GWY shuts down the machine.

9.10.1. Overview of the communication data

The switches transmit both process data, which are continuously transmitted to the evaluation unit (cyclical data), and data that can be polled specifically as needed (acyclical data). For further information on connection and on the communication data, refer to the operating instructions for your BR evaluation unit.

9.10.2. Cyclical data (process data)

Table 2: Cyclical data (process data)

Data		Meaning
Guard position	OD	This signal indicates whether the guard is open or closed.
Safety outputs switched	OM	This signal indicates whether the safety outputs are switched on. The guard must be closed and all other conditions must be met for this purpose. The safety outputs of all preceding devices in the series connection are switched on, for example.
Message pending	OI	This signal indicates a pending message. You can retrieve it via the acyclical data.
State of the device preceding the switch	OR	Indicates whether the preceding switch in the series connection has switched on the safety outputs.
Status of guard locking	OL	This signal indicates whether guard locking is active or inactive.
Status of the locking element	OLS	This status output is switched on if the locking element is stuck and guard locking therefore cannot be activated/deactivated.

9.10.3. Acyclical data (device data and events)

Table 3: Acyclical data

Data	Meaning
Sensor order number, sensor version	This function reads the order number and the switch version. The safety switch provides all the data you need to order a replacement.
Number of devices in the switch chain	This information indicates the number of switches comprising the series connection. The information can be evaluated in the control system to identify whether the series connection was changed since the last query, for example. This can identify tampering, such as by shortening the chain.
Current diagnostic code	If OI indicates a pending message, the specific error can be read in detail via this code. This lets you know what to do to rectify faults promptly.
Stored diagnostic code	The sensor always saves the penultimate diagnostic signal, allowing you to identify a pending message even retroactively.
Code of current actuator	This function polls the currently read actuator code. <ul style="list-style-type: none"> ▸ On unicode switches: Any tampering attempt can be identified if this code differs from the taught-in actuator code. ▸ On multicode switches: The current actuator code is compared with one or more codes stored in the control system. Multiple actuators can thereby be permitted in the control system. In combination with the <i>enable signal</i> function (see below), the control system can turn off the safety equipment if the comparison results are implausible.
Code of blocked actuator	Function for polling the actuator code in the <i>blocked</i> memory. <ul style="list-style-type: none"> ▸ On unicode switches: This code can be displayed to the machine setter to aid teaching-in a new actuator during service and setup.
Code of taught-in actuator	This function polls the currently taught-in actuator code. <ul style="list-style-type: none"> ▸ On unicode switches: Any tampering attempt can be identified if this code differs from the current actuator code.
Voltage	This indicates the voltage value currently applied to the CTM. Preventive service can be requested if the voltage falls below a certain value, for example.
Temperature	This indicates the temperature currently measured in the CTM. Preventive service can be requested if the values are too high.
Number of switching cycles	Information about the cumulative switching cycles.
Log-data readout	The sensor internally logs relevant events. The log data can be read.

9.11. Notes on operation with safe control systems

Please observe the following requirements for connection to safe control systems:

- Use a common power supply for the control system and the connected safety switches.
- A pulsed power supply must not be used for U_B . Tap the supply voltage directly from the power supply unit. If the power supply is connected to a terminal of a safe control system, this output must provide sufficient electrical current.
- Always connect inputs FI1A and FI1B directly to a power supply unit or to outputs FO1A and FO1B of another EUCHNER BR device (series connection). Pulsed signals must not be present at inputs FI1A and FI1B.
- The safety outputs (FO1A and FO1B) can be connected to the safe inputs of a control system. Prerequisite: the input must be suitable for pulsed safety signals (OSSD signals, e.g. from light grids). The control system must tolerate test pulses on the input signals. This normally can be set up by parameter assignment in the control system. Observe the notes of the control system manufacturer. For the pulse duration of your safety switch, refer to chapter 12. *Technical data on page 27.*

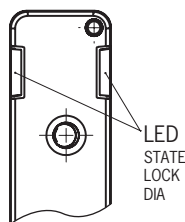
A detailed example of connecting and setting the parameters of the control system is available for many devices at www.euchner.com, in the area *Downloads/Applications/CTM*. The features of the respective device are dealt with there in greater detail.

10. Setup

10.1. LED displays

You will find a detailed description of the signal functions in chapter 11. *System status table on page 25.*

LED	Color
STATE	green
LOCK	yellow
DIA	red



10.2. Teach-in function for actuator (only for unicode evaluation)

The actuator must be allocated to the safety switch using a teach-in function before the system forms a functional unit.

During a teach-in operation, the safety outputs are switched off, i.e. the system is in the safe state.

The teach-in operation is fully automatic. The number of possible teach-in operations is unlimited.



Tip!

Prior to switching on, close the guard on which the actuator to be taught-in is installed. The teach-in operation starts immediately after switching on. This feature simplifies above all teach-in with series circuits and on large installations.



Important!

- › The teach-in operation may be performed only if the device does not have any internal fault.
- › Devices in the condition as supplied remain in teach-in standby state until you have successfully taught-in the first actuator. Once taught-in, switches remain in the teach-in standby state for approx. 3 min. after each switch-on.
- › The safety switch disables the code of the preceding device if teach-in is carried out for a new actuator. Teach-in is not possible again immediately for this device if a new teach-in operation is carried out. The disabled code is released again in the safety switch only after a third code has been taught-in.
- › The safety switch can be operated only with the last actuator taught-in.
- › If the switch detects the actuator that was most recently taught-in when in the teach-in standby state, this state is ended immediately and the switch changes to normal operation.
- › The actuator to be taught-in is not activated if it is within the actuating range for less than 30 s.

10.2.1. Actuator teach-in

1. Establish teach-in standby:
 - Devices in the condition as supplied: unlimited teach-in standby after switching on.
 - Switch already taught-in: teach-in standby is available for approx. 3 min after switching on.
- ➔ Teach-in standby indication, STATE LED flashes 3x repeatedly.
2. Insert the actuator during teach-in standby.
 - ➔ The automatic teach-in operation starts (duration approx. 30 s). During the teach-in operation the STATE LED flashes (approx. 1 Hz). Alternate flashing of the STATE and DIA LEDs acknowledges the successful teach-in operation. Teach-in errors are indicated by the illumination of the red DIA LED and a flashing code on the green State LED (see chapter 11. *System status table on page 25*).
3. Switch off operating voltage UB (min. 3 s).
 - ➔ The code of the actuator that was just taught-in is activated in the safety switch.
4. Switch on operating voltage UB.
 - ➔ The device operates normally.

10.3. Functional check



WARNING

Danger of fatal injury as a result of faults in installation and functional check.

- › Before carrying out the functional check, make sure that there are no persons in the danger zone.
- › Observe the valid accident prevention regulations.

10.3.1. Mechanical function test

The actuator must slide easily into the switch. Close the guard several times to check the function.



























10.3.2. 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 safety switch carries out a self-test. The green STATE LED then flashes at regular intervals.
2. Close all guards. In case of guard locking by solenoid force: activate guard locking.
 - ➔ The machine must not start automatically. It must not be possible to open the guard.
 - ➔ The green STATE LED and the yellow LOCK LED are illuminated continuously.
3. Enable operation in the control system.
 - ➔ It must not be possible to deactivate guard locking as long as operation is enabled.
4. Disable operation in the control system and deactivate guard locking.
 - ➔ The guard must remain locked until there is no longer any risk of injury.
 - ➔ It must not be possible to start the machine as long as the guard locking is deactivated.

Repeat steps 2 - 4 for each guard.

11. System status table

Operating mode	Actuator/door position	Safety outputs FO1A and FO1B 	Guard locking monitoring output/bit OL	Door monitoring output OD	LED indicator Output			State
					STATE (green)	D/A (red) and diagnostic output/bit OI	LOCK (yellow)	
Normal operation	off	off	off	off	 5 Hz	○	○	Power Up
	closed	on	on	on		○		Normal operation, door closed and locked
	closed	off	off	on	 1 x inverse	○	○	Normal operation, door closed and not locked
	open	off	off	off	 1 x	○	○	Normal operation, door open
	open	off	off	off	 1 x	○	 1 x	Normal operation, door open, ready for guard locking
Teach-in operation (only unicode)	open	off	off	off	 3 x	○	○	Device in teach-in standby
	closed	off	X	on	 1 Hz	○	○	Teach-in operation
	X	off	X	off	 ↔ 	○	○	Positive acknowledgment after completion of teach-in operation
Fault display	X	off	off	X	 1 x	 or  1 x inverse	○	Fault in the teach-in operation (only unicode) Actuator removed from the actuating range prior to the end of the teach-in operation or faulty actuator detected.
	X	off	X	X	 2 x		○	Input fault (e.g. missing test pulses, illogical switch state from previous switch in the switch chain)
	X	off	off	off	 3 x		○	Read error (e.g. actuator faulty)
	X	off	X	X	 4 x		○	Output fault (e.g. short circuit, loss of switching ability)
	X	off	X	X	 5 x		○	Environment error (e.g. operating voltage or operating temperature too high)
	X	off	X	X	○	 2 x	Solenoid control input fault	
	X	off	X	X	○	 1 x	Plausibility error	
	X	off	off	off	○		X	Internal fault
	X	off	off	off	○		 5 Hz	Operator error
	X	off	X	X	 1 x inverse	○	 1 x inverse	Locking element stuck

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

After the cause has been remedied, faults can generally be reset by opening and closing the guard (when DIA flashes inversely once). Otherwise, briefly disconnect the power supply. 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.

12. Technical data



NOTICE

If a data sheet is included with the product, the information on the data sheet applies.

12.1. Technical data for safety switch CTM-LBI-BR

Parameter	Value			Unit
	min.	typ.	max.	
General				
Material	Fluorinated rubber (FKM) Reinforced thermoplastic			
- Seals				
- Switch housing				
Installation orientation	Any			
Degree of protection	IP65/IP67/IP69/IP69K (screwed tight with the related mating connector)			
Safety class acc. to EN IEC 61140	III			
Degree of contamination (external, acc. to EN 60947-1)	3 (industrial)			
Mechanical life	1 x 10 ⁶ operating cycles			
Ambient temperature at UB = 24 V	-20	-	+60	°C
Actuator approach speed	-	-	20	m/min
Actuating/extraction force				N
- CTM...-161639, ...-161640	26/18			
- CTM...-161638, ...-161496	44/32			
Locking force F _{max}	1,300			N
Locking force F _{Zh} 1)	F _{Zh} = F _{max} /1.3 = 1,000			N
Weight	Approx. 0.16			kg
Connection (depending on version)	1 plug connector M12, 8-pin			
Operating voltage UB (reverse polarity protected, regulated, residual ripple < 5%)	24 ± 15% (PELV)			V DC
Current consumption I _{UB} at UB = 24 V	-	-	500	mA
For the approval acc. to UL the following applies	Operation only with UL class 2 power supply, or equivalent measures			
Switching load acc. to UL	DC 24 V, class 2			
External fuse (operating voltage UB)	0.7	-	8	A
External fuse (guard locking solenoid control input IMP)	0.1	-	2	A
Rated insulation voltage U _i	50			V
Rated impulse withstand voltage U _{imp}	0.5			kV
Rated conditional short-circuit current	100			A
Resilience to vibration	Acc. to EN 60947-5-3			
EMC protection requirements	Acc. to EN 60947-5-3			
Ready delay	-	5.5	-	s
Risk time for single device	-	-	200	ms
Risk time delay per device	10			ms
Turn-on time	-	-	400	ms
Discrepancy time between both safety outputs acc. to EN 60947-5-3	-	-	10	ms
Test pulse duration 2)	-	-	0.3	ms
Test-pulse interval	-	-	100	ms
Safety outputs FO1A/FO1B Semiconductor outputs, p-switching, short circuit-proof				
- Output voltage U _{FO1A} /U _{FO1B} 4)				V DC
HIGH U _{FO1A} /U _{FO1B}	UB - 1.5	-	UB	
LOW U _{FO1A} /U _{FO1B}	0	-	1	
Switching current per safety output	1	-	150	mA
Utilization category acc. to EN 60947-5-2	DC-13 24V 150 mA Caution: outputs must be protected with a free-wheeling diode in case of inductive loads			
Switching frequency	-	-	0.5	Hz
Monitoring outputs OD/C p-switching, short circuit-proof				
Output voltage	0.8 x UB	-	UB	V DC
Max. load	1	-	50	mA
Solenoid IMP (control input of guard locking solenoid)				
Input voltage				V DC
- Guard locking not active (open)	20.4	-	26.4	
- Guard locking active (closed)	0	-	5	
Solenoid current consumption I _{IMP}				mA
- Guard locking not active (open)	20	-	50	
Connection rating at max. switching frequency	3			W
Duty cycle	100			%
Reliability values acc. to EN ISO 13849-1				
Category	Guard lock monitoring		Control of guard locking	
	4		3	
Performance Level (PL)	PL e		PL d	
PFD _D	4.52 x 10 ⁻⁹		1.03 x 10 ⁻⁷	
Mission time	20		20	
			years	

1) Dependent on the actuator used

2) Applies to a load with C ≤ 30 nF and R ≤ 20 kΩ

12.1.1. Typical system times

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 of safety outputs: The max. reaction time t_{on} is the time from the moment when the guard is locked to the moment when the safety outputs switch on.

Risk time according to EN 60947-5-3: If an actuator moves outside the actuating range, the safety outputs (FO1A and FO1B) are switched off after the risk time at the latest.

Discrepancy time: The safety outputs (FO1A and FO1B) switch with a slight time offset. They have the same signal state no later than after the discrepancy time.

Test pulses at the safety outputs: The device generates its own test pulses on the safety outputs (FO1A and FO1B). A downstream control system must tolerate these test pulses.

This can usually be set up in the control systems by parameter assignment. If parameter assignment is not possible for your control system or if shorter test pulses are required, contact our support organization.

The test pulses are output only if the safety outputs are switched on.

12.2. Radio frequency approvals

FCC ID: 2AJ58-07

IC: 22052-07

FCC/IC-Requirements

This device complies with part 15 of the FCC Rules and with Industry Canada's licence-exempt RSSs. Operation is subject to the following two conditions:

- 1) This device may not cause harmful interference, and
- 2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

- (1) l'appareil ne doit pas produire de brouillage, et
- (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Supplier's Declaration of Conformity

47 CFR § 2.1077 Compliance Information

Unique Identifier:

CTM-LBI-BR series

CTM-IBI-BR series

CTM-L2-BR series

CTM-I2-BR series

CTM-LBI-BP series

CTM-IBI-BP series

CTM-L2-BP series

CTM-I2-BP series

CTM-L2-AS1B series

CTM-I2-AS1B series

CTM-LBI-AS1B series

CTM-IBI-AS1B series

Responsible Party – U.S. Contact Information

EUCHNER USA Inc.

6723 Lyons Street
East Syracuse, NY 13057

+1 315 701-0315

+1 315 701-0319

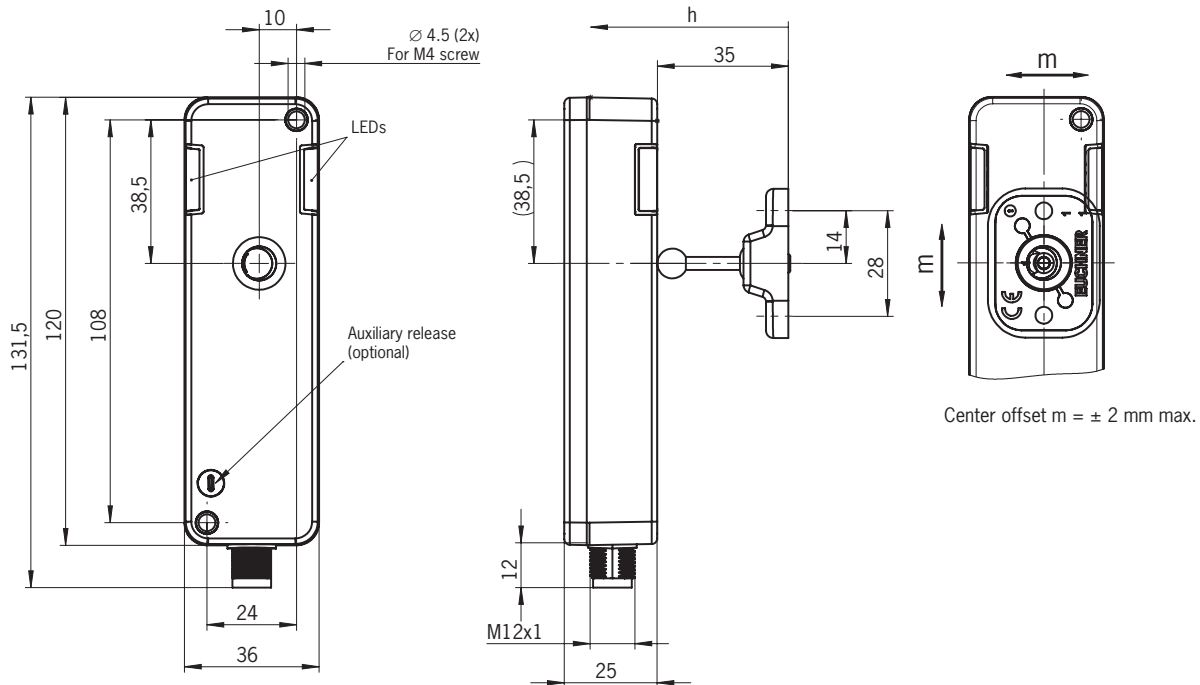
info(at)euchner-usa.com

http://www.euchner-usa.com

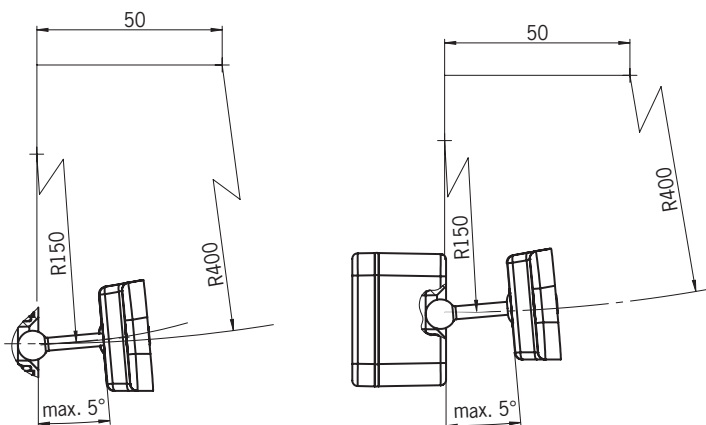
12.3. Dimension drawing for safety switch CTM...

Necessary minimum travel + permissible overtravel

Approach direction	
Horizontal (h)	21 + 2



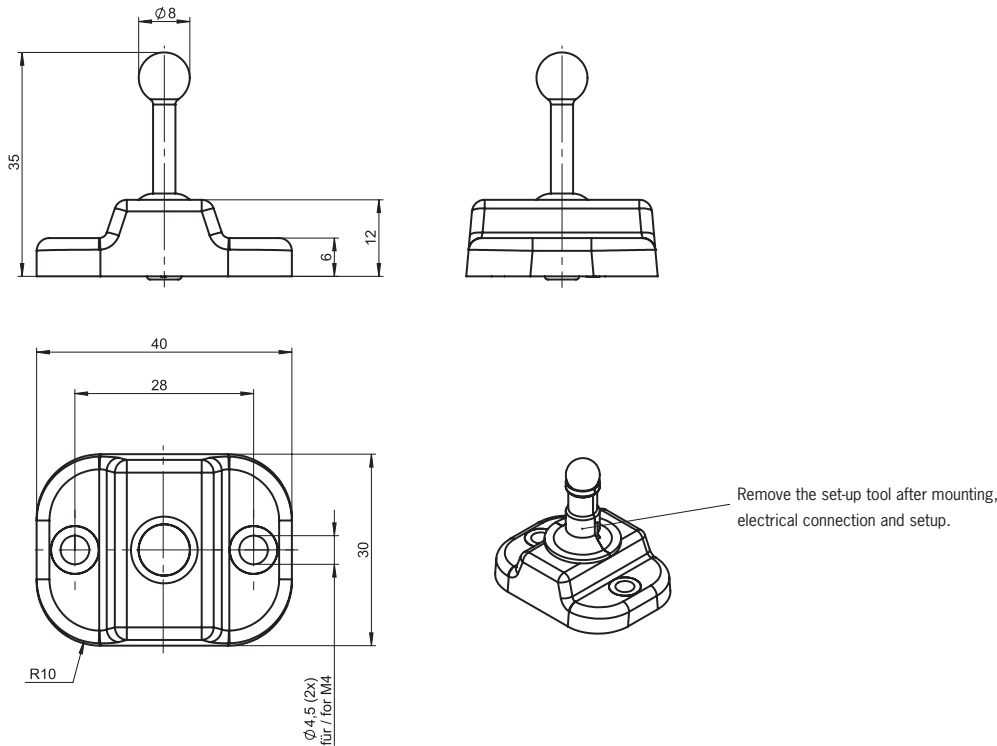
Min. door radius [mm]



12.4. Technical data for actuator A-B-A1-A1-...

Parameter	Value			Unit
	min.	typ.	max.	
Material	Ultradur black			
- Housing	Stainless steel			
- Ball holder	A-B-A1-161642: FKM red / A-B-A1-161643: FKM blue			
- Elastomer	Resistant to chemicals and oil			
Resistance	DIN EN 1672-2, DIN EN ISO 14159, PAH category 3			
Food safe	0.0194			kg
Weight	-20	-	+60	°C
Ambient temperature	IP67/IP69/IP69K			
Degree of protection	1 x 10 ⁶			
Mechanical life	1,300			N
Locking force, max.	1,000			N
Locking force F _{Zh}	Any			
Installation orientation	2			mm
Overtravel	Inductive via read head			
Power supply				

12.4.1. Dimension drawing for actuator A-B-A1-A1-...



Tip!

Remove the set-up tool after mounting the safety switch and actuator.

13. 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*.

14. Inspection and service



WARNING

Danger of severe injuries due to the loss of the safety function.

- › If damage or wear is found, the complete switch and actuator assembly must be replaced. Replacement of individual parts or assemblies is not permitted.
- › Check the device for proper function at regular intervals and after every fault. For information about possible time intervals, refer to EN ISO 14119:2013, section 8.2.

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

- › Check the switching function (see chapter 10.3. *Functional check on page 24*)
- › Check all additional functions (e.g. escape release, lockout bar, etc.)
- › Check the secure mounting of the devices and the connections
- › Check for soiling

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



NOTICE

The year of manufacture is given in the laser marking at the bottom right corner. The current version number in the format (V X.X.X) can also be found on the device.

15. Service

If servicing is required, please contact:

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

Service telephone:

+49 711 7597-500

E-mail:

support@euchner.de

Internet:

www.euchner.com

16. Declaration of conformity



EUCHNER

More than safety.

EU-Konformitätserklärung
EU declaration of conformity
Déclaration UE de conformité
Dichiarazione di conformità UE
Declaración UE de conformidad

Original DE
Translation EN
Traduction FR
Traduzione IT
Traducción ES

2525461-01-01/20

Die nachfolgend aufgeführten Produkte sind konform mit den Anforderungen der folgenden Richtlinien (falls zutreffend):
The beneath listed products are in conformity with the requirements of the following directives (if applicable):
Les produits mentionnés ci-dessous sont conformes aux exigences imposées par les directives suivantes (si valable)
I prodotti sotto elencati sono conformi alle direttive sotto riportate (dove applicabili):
Los productos listados a continuación son conforme a los requisitos de las siguientes directivas (si fueran aplicables):

I:	Maschinenrichtlinie <i>Machinery directive</i> <i>Directive Machines</i> <i>Direttiva Macchine</i> <i>Directiva de máquinas</i>	2006/42/EG 2006/42/EC 2006/42/CE 2006/42/CE 2006/42/CE
II:	Funkanlagen-Richtlinie (RED) <i>Radio equipment directive</i> <i>Directive équipement radioélectrique</i> <i>Direttiva apparecchiatura radio</i> <i>Directiva equipo radioeléctrico</i>	2014/53/EU 2014/53/EU 2014/53/UE 2014/53/UE 2014/53/UE
III:	RoHS Richtlinie <i>RoHS directive</i> <i>Directive de RoHS</i> <i>Direttiva RoHS</i> <i>Directiva RoHS</i>	2011/65/EU 2011/65/EU 2011/65/UE 2011/65/UE 2011/65/UE

Die Schutzziele der Niederspannungsrichtlinie 2014/35/EU und EMV Richtlinie 2014/30/EU werden gemäß Artikel 3.1 der Funkanlagen-Richtlinie eingehalten.
The safety objectives of the Low-voltage directive 2014/35/EU and EMC Directive 2014/30/EU comply with article 3.1 of the Radio equipment directive.
Les objectifs de sécurité de la Directive basse tension 2014/35/UE et Directive de CEM 2014/30/UE sont conformes à l'article 3.1 de la Directive équipement radioélectrique.
Gli obiettivi di sicurezza della Direttiva bassa tensione 2014/35/UE e Direttiva CEM 2014/30/UE sono conformi a quanto riportato nell'articolo 3.1 della Direttiva apparecchiatura radio.
Los objetivos de seguridad de la Directiva de bajo voltaje 2014/35/UE y Directiva CEM 2014/30/UE cumplen con el artículo 3.1 de la Directiva equipo radioeléctrico.

Folgende Normen sind angewandt: a: EN 60947-5-3:2013 f: EN 50581:2012 (RoHS)
Following standards are used: b: EN ISO 14119:2013
Les normes suivantes sont appliquées: c: EN ISO 13849-1:2015
Vengono applicate le seguenti norme: d: EN 50364:2018
Se utilizan los siguientes estándares: e: EN 300 330 V2.1.1

Bezeichnung der Bauteile <i>Description of components</i> <i>Description des composants</i> <i>Descrizione dei componenti</i> <i>Descripción de componentes</i>	Type <i>Type</i> <i>Type</i> <i>Tipo</i> <i>Typo</i>	Richtlinie <i>Directives</i> <i>Directive</i> <i>Direttiva</i> <i>Directivas</i>	Normen <i>Standards</i> <i>Normes</i> <i>Norme</i> <i>Estándares</i>	Zertifikats-Nr. <i>No. of certificate</i> <i>Numéro du certificat</i> <i>Numero del certificato</i> <i>Número del certificado</i>
Sicherheitsschalter <i>Safety Switches</i> <i>Interrupteurs de sécurité</i> <i>Finecorsa di sicurezza</i> <i>Interruptores de seguridad</i>	CTM...	I, II, III	a, b, c, d, e, f	UQS 2535187
Betätiger <i>Actuator</i> <i>Actionneur</i> <i>Azionatore</i> <i>Actuador</i>	A-B-A...	I, II, III	a, b, c, d, e, f	UQS 2535187

Genehmigung der umfassenden Qualitätssicherung (UQS) durch die benannte Stelle
Approval of the full quality assurance system by the notified body
Approbation du système d'assurance qualité complet par l'organisme notifié
Approvazione del sistema di garanzia di qualità totale da parte dell'organismo notificato
Aprobación del sistema de aseguramiento de calidad total por parte del organismo notificado

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TÜV Rheinland
Industrie Service GmbH
Alboinstr. 56 - 12103 Berlin
Germany

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:
La presente dichiarazione di conformità è rilasciata sotto la responsabilità esclusiva del fabbricante:
La presente declaración de conformidad se expide bajo la exclusiva responsabilidad del fabricante:

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



EUCHNER

More than safety.

Leinfelden, Januar 2020

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

i.A. Dipl.-Ing. Richard Holz
Leiter Elektronik-Entwicklung
Manager Electronic Development
Responsable Développement Electronique
Direttore Sviluppo Elettronica
Director de desarrollo electrónico

i.A. Dipl.-Ing. (FH) Duc Binh Nguyen
Dokumentationsbevollmächtigter
Documentation manager
Responsable documentation
Responsabilità della documentazione
Agente documenta

Euchner GmbH + Co. KG
Kohlhammerstraße 16
70771 Leinfelden-Echterdingen
Germany
info@euchner.de
www.euchner.com

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