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1. About this document

1.1. Scope

These operating instructions apply to all CKS2-K-BP/BR-CC-FLX of version 1.0.X. 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 safety information	
Operating instructions (MAN20001512)	(this document)	
Declaration of conformity	Declaration of conformity	
Possibly a 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. or the order number for the device in the search box.	

2. Correct use

Key adapters of series CKS2-K-BP/BR-CC-FLX are used to read and safely evaluate CKS2 keys. The keys have a high coding level according to EN ISO 14119. Only the keys listed in *Table 1: System components* may be used.

Among other applications, they can be used as part of a trapped key system according to ISO/TS 19837.

Table 1: System components

Key adapter	1 key per packaging unit	Several keys per packaging unit, with identical key code and different key identification
CKS2-K-BP-CC-FLX-... CKS2-K-BR-CC-FLX-...	A-FLX-K-OA-RD-168921	A-FLX-K-OB-...

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
- EN ISO 14119

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

- EN ISO 13849-1
- EN 60204-1

The key adapter must be used only in conjunction with the designated CKS2 keys from EUCHNER. On the impermissible use of different keys, EUCHNER provides no warranty for safe function.

The communication data that can be read via IO-Link must not be used for safety functions.

The user is responsible for the safe overall function, especially for the safe integration into an overall system.

Connection of several devices in a BR series connection is permitted only using devices suitable for this purpose. Check this in the specifications 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 <i>Table 1: System components</i>.
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3. Description of the safety function

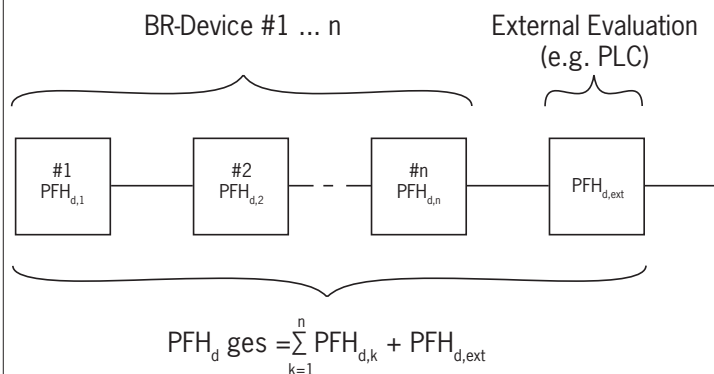
The safety function is defined by the related application.

- › Device safety function:
 - Safe detection of a key belonging to the system and checking the associated key code. The safety outputs are switched on if the key is valid.
 - The following additionally applies in a BR series connection: the safety outputs are switched only when the device receives a corresponding signal from its predecessor in the chain.
- › Safety characteristics: category, Performance Level, PFH_D (see chapter 15. *Technical data on page 34*).



NOTICE

You can regard the complete BR device chain as one subsystem during calculation. The following calculation method applies to the PFH_D value:



Alternatively, the simplified method according to section 6.3 of EN 13849-1:2015 can be used for calculation.

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

Check the safe function of the device 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 device should be checked at suitable intervals as part of the maintenance schedule.



DANGER

Danger to life due to selecting the wrong key or tampering.

- › When selecting the key version used, make sure that all measures for risk assessment for the intended application are performed.
- › Unused keys must be rendered unusable or protected against unauthorized access to prevent bypassing the safety function.



DANGER

- › If master keys or replacement keys are used, the operating organization must take suitable organizational measures and use a corresponding risk assessment to prevent the system's safety function from being bypassed. For this purpose, observe the information in ISO/TS 19837.



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 may be triggered only by keys specially designated for this purpose.
- › The key must be completely pulled out of the key adapter in order to switch the safety circuit off safely.
- › 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.

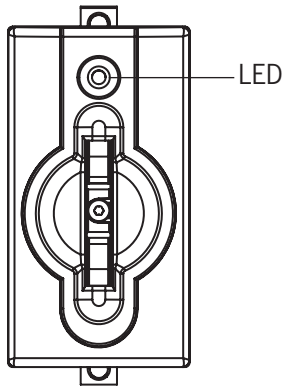


Important!

Prior to use, read the operating instructions and the supplementary documents and keep them 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.

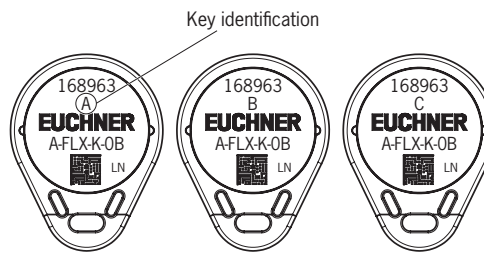
6. Function

**Key adapter
CKS2-K-BP/BR-CC-FLX**



Key A-FLX-K-0A-RD-168921

1 key per packaging unit



Key A-FLX-K-0B-RD-...

Several keys per packaging unit, with identical key code and different key identification

The key adapter with integrated evaluation electronics forms a safe system together with the corresponding key. The key determines the function. You will find further information in chapter 12.1. *Configuring the device and teaching-in the key for the first time on page 26.*

The safety outputs are switched on when there is a valid key in the key adapter. The safety outputs are switched off when the key is removed.

A key is valid if its key code was allocated to the key adapter in a teach-in operation, see chapter 12. *Setup on page 26.* Keys of the version A-FLX-K-0A-RD-168921 are unambiguously allocated to the key adapter in a teach-in operation. With keys of the version A-FLX-K-0B-RD-..., the taught-in key and all other keys from the same packaging unit are valid after the teach-in operation because they have the same key code. Only the key version with which the device was configured can be taught-in. A factory reset must be performed to reconfigure the device.

Each key is supplied with a unique electronic code. The high coding level ensures a high level of protection against tampering.

The key's code cannot be reprogrammed.

In case of a fault in the key adapter, the safety outputs are switched off and the LED signals a fault (see chapter 14.3. *Error messages on page 31*).

6.1. Monitoring output OD

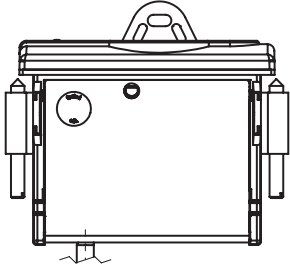
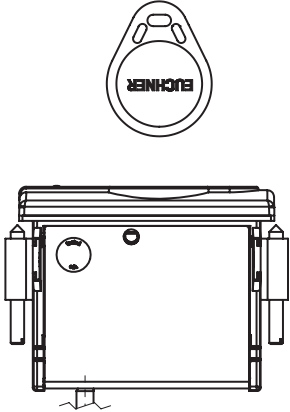
The device features a monitoring output for the signal OD. Depending on the application, the signal is available at the monitoring output or as a status bit. The status bit is evaluated via the BR/IO-Link Gateway. If no BR/IO-Link Gateway is connected, this output behaves like a monitoring output.

The signal OD is present when a valid key is detected.

6.2. Communication connection C

When the device is connected to a BR/IO-Link Gateway, the monitoring output functions as a communication connection. The key adapter supplies cyclical and acyclical data. You will find an overview of the communication data in chapter 11.3. *Overview of the communication data on page 24.*

6.3. Switching states

	Key inserted	Key removed
		
LED indicator	illuminates green	flashes green slowly
Safety outputs F01A and F01B	on	off
Signal OD	on	off

7. Mounting



NOTICE

- Risk of damage to equipment and malfunctions as a result of incorrect installation.
- › To achieve the degree of protection IP65/IP67, it is necessary to install the key adapter in a clean, flat metal plate at least 2 mm thick and to tighten the screws with a tightening torque of 0.25 ... 0.35 Nm.
 - › The device may be damaged if the tightening torque exceeds 0.35 Nm.
 - › Suitable strain relief must be provided to prevent damage to the connecting cables.

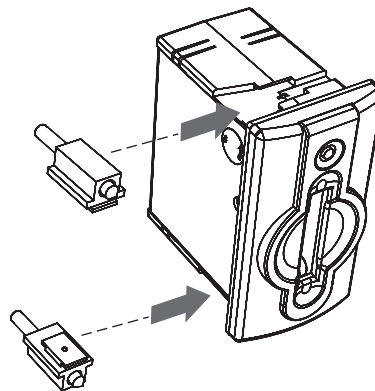
The key adapter is intended for mounting in control panels with a mounting cut-out measuring 33 x 68 mm according to DIN IEC 61554. The device is fastened using screw clamp elements on the rear side of the panel.



Important!

A pushbutton on the rear of the key adapter is used for the teach-in operation, see chapter 12.2. *Teaching-in a new key on page 27*. When mounting, ensure that the pushbutton is accessible for additional teach-in operations after the initial setup.

1. Insert the key adapter, with seal already bonded in place, into the mounting cut-out on the front.
2. Insert the supplied screw clamp elements as far as they will go into the housing cut-outs.



3. Tighten the screws with a tightening torque of 0.25 ... 0.35 Nm.
4. After mounting, check the key adapter for firm seating and correct sealing on the front panel.

8. Electrical connection

The following connection options are available:

- › Separate operation
- › Series connection with wiring in the control cabinet
- › Series connection with Y-distributors
- › Connection without IO-Link communication
- › Connection with IO-Link communication



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 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 0.3 ms. Depending on the inertia of the downstream device (control system, relay, etc.), this can lead to short switching processes. The test pulses are output only with the safety outputs switched off during device start.
- › The inputs on an evaluation unit connected must be positive-switching, as the two outputs on the key adapter 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 insulation 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 prevent 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 (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 operating voltage is applied (e.g. LED does not illuminate or flash), it must be returned unopened to the manufacturer.

8.1. Notes about



Important!

- › 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:
 - 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 max. 30 V DC power supply to the device in order to limit the available current to comply with 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  1) a connecting cable listed under the UL category code CYJV2 or CYJV 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). Only for applications as per NFPA 79 (Industrial Machinery).

8.2. Safety in case of faults

- › The operating voltage U_B is reverse polarity protected.
- › The safety outputs are short circuit-proof.
- › A short circuit between the safety outputs is detected on starting or when the safety outputs are activated by the device.
- › A short circuit in the cable can be excluded by laying the cable with protection.

8.3. Fuse protection for power supply

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

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

$$I_{max} = I_{UB} + I_{OD} + I_{F01A+F01B}$$

$$I_{UB} = \text{Device operating current (40 mA)}$$

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

$$I_{F01A+F01B} = \text{Load current of safety outputs F01A + F01B (2 x max. 150 mA)}$$

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

$$\Sigma I_{max} = I_{F01A+F01B} + n \times (I_{UB} + I_{OD})$$

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

8.4. 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:

Parameter	Value	Unit
Conductor cross-section, min.	0.25 ... 0.34	mm ²
R max.	80	Ω/km
C max.	120	nF/km
L max.	0.65	mH/km
Recommended cable type		
5-pin	5 x 0.34 mm ²	
8-pin	LIYY 8 x 0.34 mm ²	

8.5. Connector assignment of key adapter CKS2-K-BR-CC-FLX-F00-USA-... with plug connector M12, 8-pin

Plug connector (view of connection side)	Pin	Designation	Function	Conductor coloring of connecting cable 1)
	1	F11B	Enable input, channel B	WH
	2	UB	Operating voltage, 24 V DC	BN
	3	F01A	Safety output, channel A	GN
	4	F01B	Safety output, channel B	YE
	5	OD/C	Monitoring output/communication	GY
	6	F11A	Enable input, channel A	PK
	7	0V	Ground 0 V DC	BU
	8	-	n.c.	RD

1) Only for standard EUCHNER connecting cable

8.6. Connector assignment of key adapter CKS2-K-BP-CC-FLX-F00-USI-... with plug connector M12, 5-pin

Plug connector (view of connection side)	Pin	Designation	Function	Conductor coloring of connecting cable 1)
	1	UB	Operating voltage, 24 V DC	BN
	2	F01A	Safety output, channel A	WH
	3	0V	Ground 0 V DC	BU
	4	F01B	Safety output, channel B	BK
	5	-	n.c.	GY

1) Only for standard EUCHNER connecting cable

8.7. Notes on operation with safe control systems

Observe the following guidelines for connection to safe control systems:

- › Use a common power supply for the control system and the connected key adapters.
- › **The following applies to BP devices:** The device tolerates voltage interruptions at UB up to 5 ms in duration, provided that the time between two voltage interruptions is at least 500 ms.
- › **The following applies to BR devices:** A pulsed power supply must not be used for UB. 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 test pulse duration of your key adapter, see chapter 15. *Technical data on page 34.*

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/CKS2*. The features of the respective device are dealt with there in greater detail.

8.8. Connection without and with IO-Link communication

8.8.1. Connection without IO-Link communication

Only the safety and monitoring outputs are switched with this connection method.

With a series connection, the safety signals are looped through from device to device.

8.8.2. Connection with IO-Link communication

If, in addition to the safety function, detailed monitoring and diagnostic data are to be processed, a BR/IO-Link Gateway is required.

To poll the communication data from the connected device, communication connection C is routed to the BR/IO-Link Gateway. You will find further information in the operating instructions for your BR/IO-Link Gateway.

9. Connection of a single CKS2 (separate operation)

If a single CKS2 is used, connect the device as shown in *Fig. 1*. The monitoring output OD can be connected to a control system.

**WARNING**

In the event of a fault, loss of the safety function due to incorrect connection.

- To ensure safety, both safety outputs FO1A and FO1B must always be evaluated.



Important!

The example shows only an excerpt that is relevant for connection of the CKS2 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 device in the search box. You will find all available connection examples for the device in *Downloads*.

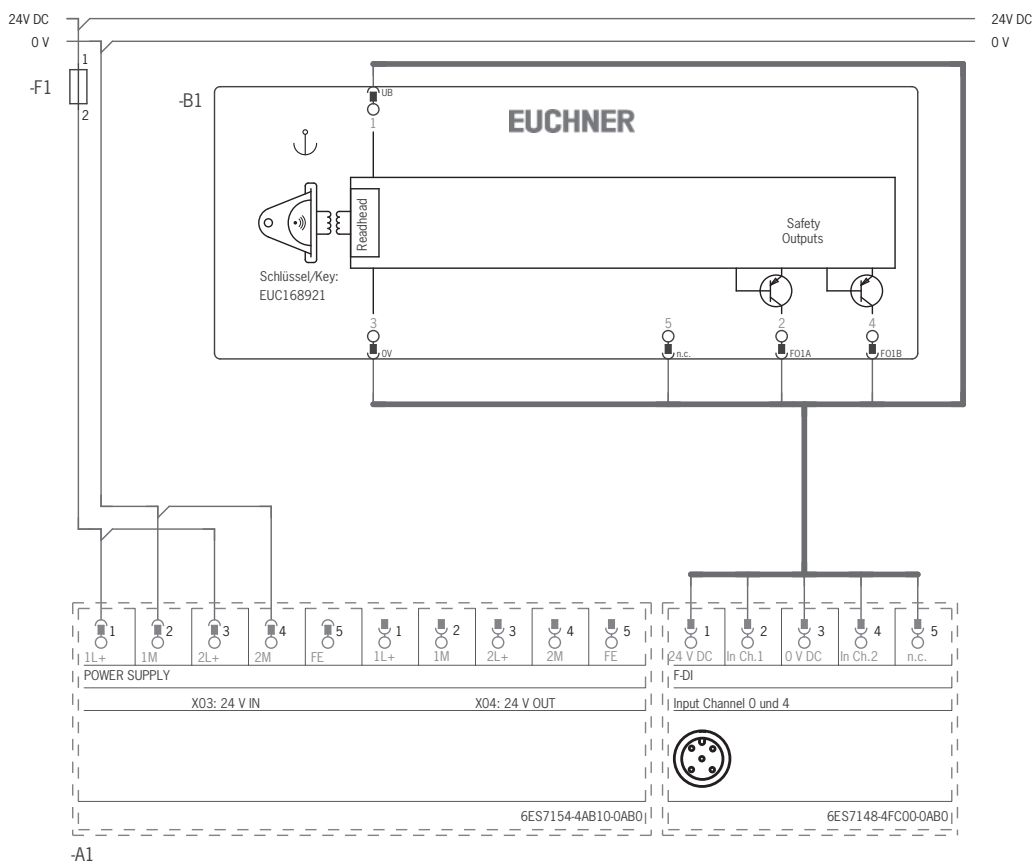


Fig. 1: Connection example for separate operation of a CKS2-K-BP-CC-FLX-... on a safe IP67 peripheral module

10. Connection of several devices in a chain (series connection)



WARNING

- In the event of a fault, loss of the safety function due to incorrect connection.
- To ensure safety, both safety outputs FO1A and FO1B must always be evaluated.



Important!

- A BR chain may contain a maximum of 20 key adapters.
- The following connection examples show only excerpts that are relevant for the connection of the CKS2 system. They do not represent 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 device in the search box. You will find all available connection examples for the device in *Downloads*.
- When using Y-distributors, make sure to use the correct Y-distributor version. See chapter 10.2.2. *Determining cable lengths using the example table on page 19 and 10.2.4. Connector assignment of Y-distributor for series connection with IO-Link communication on page 22.*

10.1. Series connection with wiring in the control cabinet

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



Important!

In case of series connection with IO-Link communication:

- ▶ The safety outputs are permanently assigned to the respective safety inputs of the downstream key adapter. F01A must be routed to F11A and F01B to F11B.
- ▶ If the connections are interchanged (e.g. F01A to F11B), the downstream device will enter the fault state.

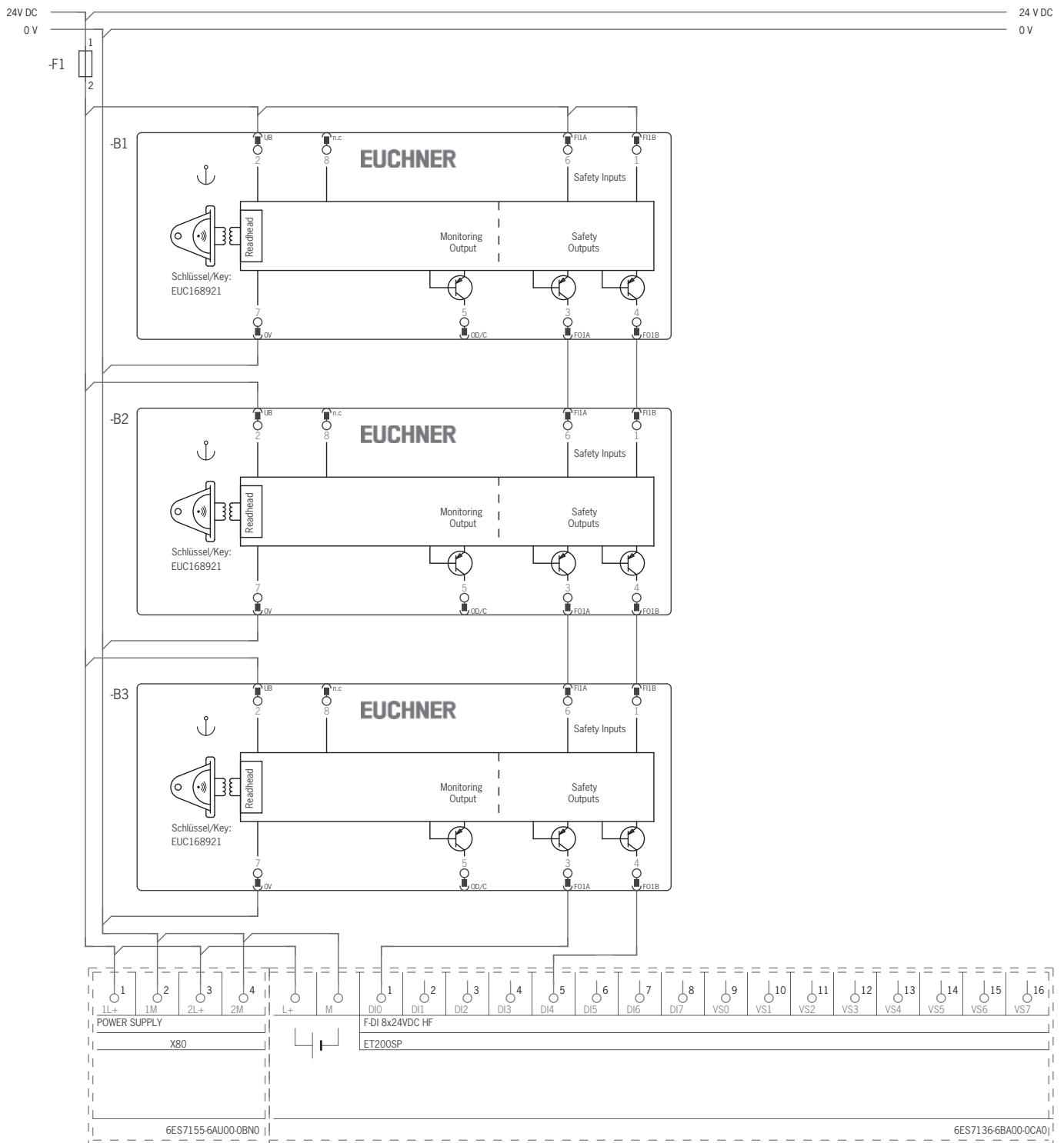


Fig. 2: Connection example for series connection with wiring in the control cabinet

10.2. Series connection with Y-distributors

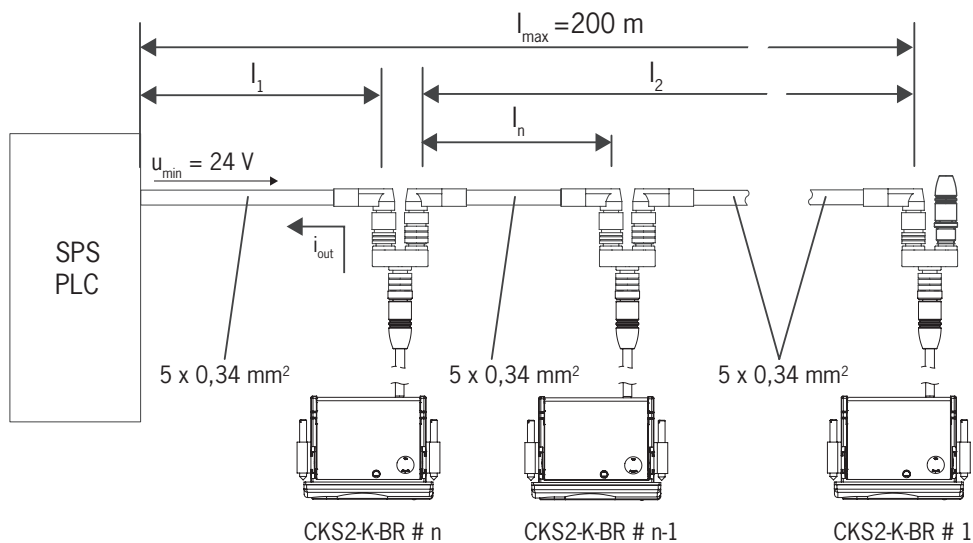
The series connection is shown here based on the example of the version with plug connector M12. The key adapters are connected one behind the other with the aid of pre-assembled connecting cables and Y-distributors. The safety outputs are switched off if the key is removed from the key adapter or if an error occurs on one of the key adapters.

10.2.1. Maximum cable lengths



Important!

The maximum number of devices in a BR switch chain depends on many factors, including the cable length. This case example shows a standard application. You will find further connection examples at www.euchner.com.



n Max. number of devices depending on the cable length	I _{F01A} /I _{F01B} (mA) Possible output current per channel F01A/F01B	l ₁ (m) Max. cable length f rom the last key adapter to the control system 0.34 mm ²
5	10	100
	25	100
	50	80
	100	50
	200	25
6	10	100
	25	90
	50	70
	100	50
	200	25
10	10	70
	25	60
	50	50
	100	35
	200	20

10.2.2. Determining cable lengths using the example table

Example: 6 devices are to be used in series. Cabling with a length of 40 m is routed from a safety relay in the control cabinet to the last device (#6). Cables with a length of 20 m each are connected between the individual devices.

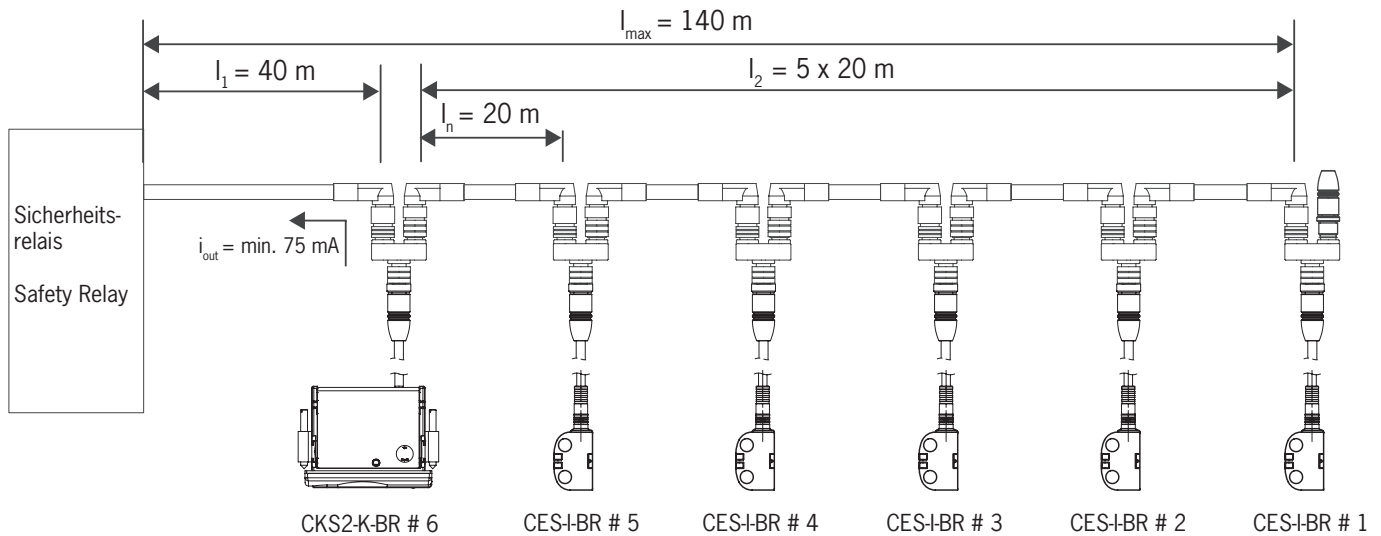


Fig. 3: Circuit example with six devices

A safety relay is connected downstream that consumes 75 mA at each of the two safety inputs.

All the relevant values can now be determined using the example table:

1. Select the corresponding section in the column n (max. number of devices). Here: 6 devices.
 2. In column I_{F01A}/I_{F01B} (possible output current per channel F01A/F01B), find a current greater than or equal to 75 mA. In this case: 100 mA.
- ➔ It is then possible to determine the maximum cable length from the last device (#6) to the control system from the column l_1 . In this case, a length of 50 m is permitted.

Result: The desired cable length l_1 of 40 m is below the permitted value from the table. The overall length of the switch chain l_{max} of 140 m is less than the maximum value of 200 m.

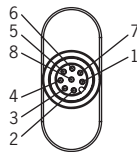
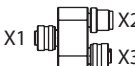
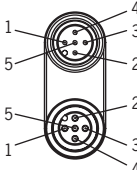
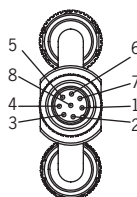
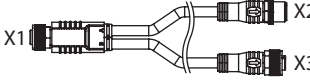
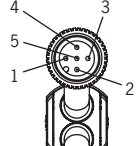
➔ The planned application is therefore functional in this form.

10.2.3. Connector assignment of Y-distributor for series connection without IO-Link communication



Important!

- › The switch chain must always be terminated with strapping plug 097645.
- › A higher-level control system cannot detect which key is removed or on which key adapter a fault has occurred with this connection technology.

Plug connector X1	Y-distributor	Plug connector X2/X3																																		
<table><tr><th colspan="2">X1</th></tr><tr><th>Pin</th><th>Function</th></tr><tr><td>X1.1</td><td>FI1B</td></tr><tr><td>X1.2</td><td>UB</td></tr><tr><td>X1.3</td><td>F01A</td></tr><tr><td>X1.4</td><td>F01B</td></tr><tr><td>X1.5</td><td>n.c.</td></tr><tr><td>X1.6</td><td>FI1A</td></tr><tr><td>X1.7</td><td>OVUB</td></tr><tr><td>X1.8</td><td>*</td></tr></table> X1 Socket 	X1		Pin	Function	X1.1	FI1B	X1.2	UB	X1.3	F01A	X1.4	F01B	X1.5	n.c.	X1.6	FI1A	X1.7	OVUB	X1.8	*	097627 	X2 Plug  X3 Socket  <table><tr><th colspan="2">X2</th></tr><tr><th>Pin</th><th>Function</th></tr><tr><td>X2.1</td><td>UB</td></tr><tr><td>X2.2</td><td>F01A</td></tr><tr><td>X2.3</td><td>0 V</td></tr><tr><td>X2.4</td><td>F01B</td></tr><tr><td>X2.5</td><td>*</td></tr></table>	X2		Pin	Function	X2.1	UB	X2.2	F01A	X2.3	0 V	X2.4	F01B	X2.5	*
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	111696 112395  with connecting cable	X2 Plug  X3 Socket  <table><tr><th colspan="2">X3</th></tr><tr><th>Pin</th><th>Function</th></tr><tr><td>X3.1</td><td>UB</td></tr><tr><td>X3.2</td><td>FI1A</td></tr><tr><td>X3.3</td><td>0 V</td></tr><tr><td>X3.4</td><td>FI1B</td></tr><tr><td>X3.5</td><td>*</td></tr></table>	X3		Pin	Function	X3.1	UB	X3.2	FI1A	X3.3	0 V	X3.4	FI1B	X3.5	*																				
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X3.4	FI1B																																			
X3.5	*																																			

* Function and compatibility are dependent on the connector assignment of the device connected.

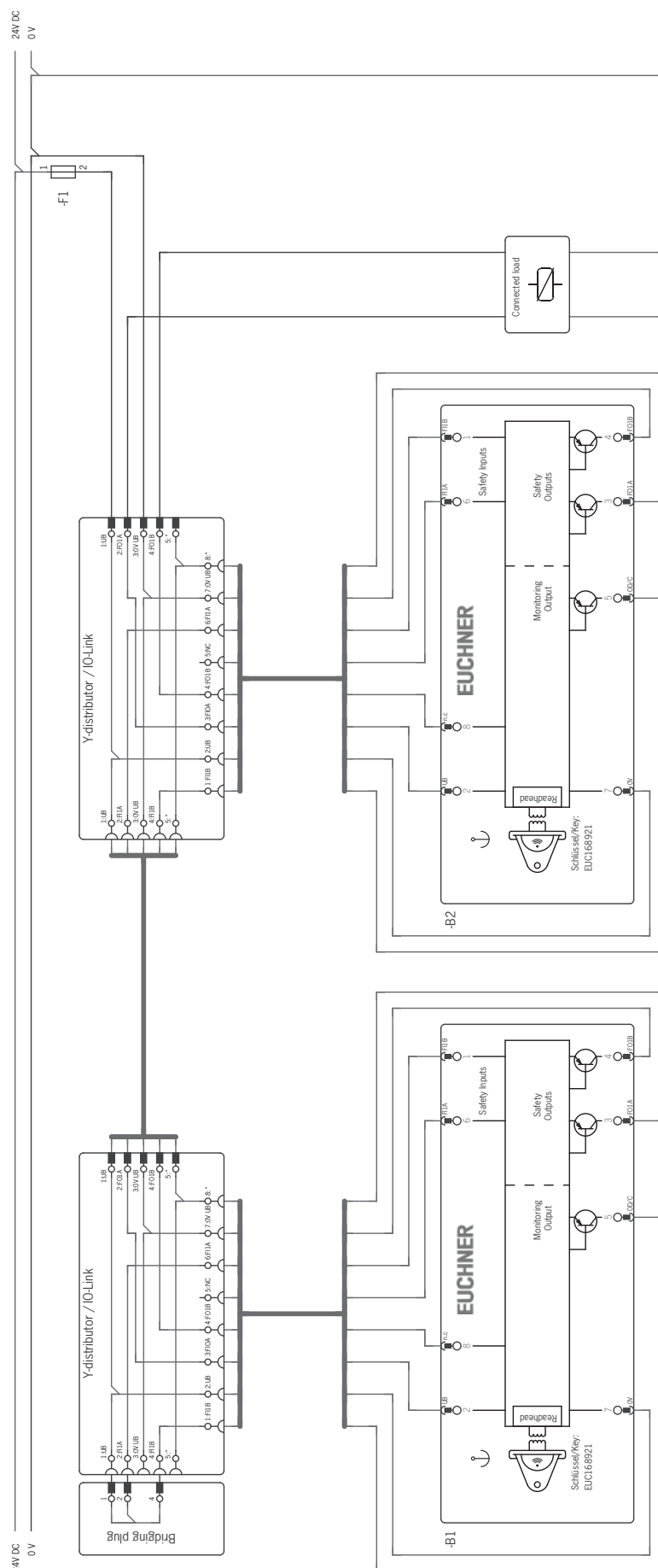


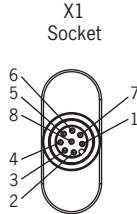
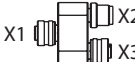
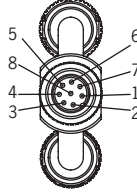
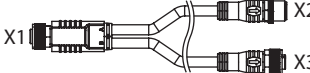
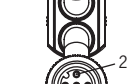
Fig. 4: Connection example for series connection without IO-Link communication

10.2.4. Connector assignment of Y-distributor for series connection with IO-Link communication



Important!

▸ The switch chain must always be terminated with strapping plug 097645.

Plug connector X1	Y-distributor	Plug connector X2/X3																																		
X1 Socket  <table><thead><tr><th colspan="2">X1</th></tr><tr><th>Pin</th><th>Function</th></tr></thead><tbody><tr><td>X1.1</td><td>FI1B</td></tr><tr><td>X1.2</td><td>UB</td></tr><tr><td>X1.3</td><td>F01A</td></tr><tr><td>X1.4</td><td>F01B</td></tr><tr><td>X1.5</td><td>C</td></tr><tr><td>X1.6</td><td>FI1A</td></tr><tr><td>X1.7</td><td>OVUB</td></tr><tr><td>X1.8</td><td>n.c.</td></tr></tbody></table>	X1		Pin	Function	X1.1	FI1B	X1.2	UB	X1.3	F01A	X1.4	F01B	X1.5	C	X1.6	FI1A	X1.7	OVUB	X1.8	n.c.	157913 	X2 Plug  X3 Socket  <table><thead><tr><th colspan="2">X2</th></tr><tr><th>Pin</th><th>Function</th></tr></thead><tbody><tr><td>X2.1</td><td>UB</td></tr><tr><td>X2.2</td><td>F01A</td></tr><tr><td>X2.3</td><td>0 V</td></tr><tr><td>X2.4</td><td>F01B</td></tr><tr><td>X2.5</td><td>C</td></tr></tbody></table>	X2		Pin	Function	X2.1	UB	X2.2	F01A	X2.3	0 V	X2.4	F01B	X2.5	C
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X1 Socket 	158192 158193  with connecting cable	X2 Plug  X3 Socket  <table><thead><tr><th colspan="2">X3</th></tr><tr><th>Pin</th><th>Function</th></tr></thead><tbody><tr><td>X3.1</td><td>UB</td></tr><tr><td>X3.2</td><td>FI1A</td></tr><tr><td>X3.3</td><td>0 V</td></tr><tr><td>X3.4</td><td>FI1B</td></tr><tr><td>X3.5</td><td>C</td></tr></tbody></table>	X3		Pin	Function	X3.1	UB	X3.2	FI1A	X3.3	0 V	X3.4	FI1B	X3.5	C																				
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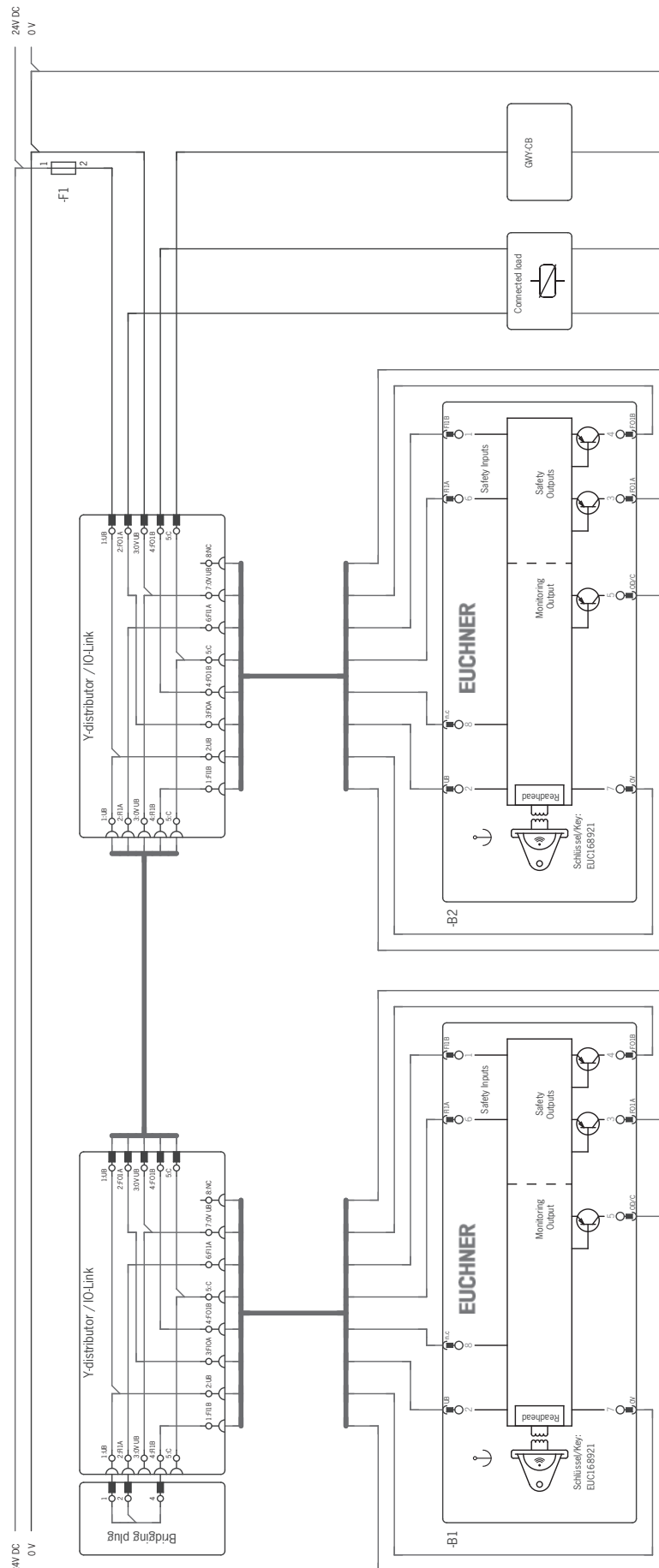


Fig. 5: Connection example for series connection with IO-Link communication

11. Using communication data

A BR/IO-Link Gateway is required to use the device's communication data and forward them to a higher-level bus system. The following devices are suitable:

- GWY-CB-1-BR-IO (BR/IO-Link Gateway)
- ESM-CB (safety relay with integrated BR/IO-Link Gateway)

11.1. Connection to a BR/IO-Link Gateway GWY-CB

The Gateway is an IO-Link device. Communication via IO-Link offers cyclical (process data) and acyclical (device data and events) data exchange (see chapter 11.3. Overview of the communication data on page 24).

The communication connection C on the device allows the diagnostic line to be connected to the Gateway. The OD/C connection represents a non-safety-related communication channel between the Gateway and the connected devices.

IO-Link communication can be used for the following functions as well:

- Reset for acknowledging error messages

You will find further information in the operating instructions for your BR/IO-Link Gateway.

11.2. Connection to a safety relay ESM-CB

The safety relay ESM-CB features an integrated BR/IO-Link Gateway. In addition to functioning as an IO-Link device (see chapter 11.1. Connection to a BR/IO-Link Gateway GWY-CB on page 24), the device can be used for connecting two monitored single- or dual-channel sensor circuits. The sensor circuits evaluate various signaling devices:

- Sensor circuit S1 with short circuit detection; suitable for single- or dual-channel safety sensors
- Sensor circuit S2, suitable for OSSD signals; short circuit detection by signaling device

When at least one sensor circuit is interrupted, the safety relay initiates the safe state. Different relay starting behaviors and various monitoring functions are possible.

The device's safety outputs FO1A and FO1B are routed to the OSSD inputs of the safety relay. The OD/C connection of the device allows the diagnostic line to be connected to the Gateway.

You will find further information in the operating instructions for your safety relay with integrated BR/IO-Link Gateway.

11.3. Overview of the communication data

The key adapter transmits 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/IO-Link Gateway.

11.3.1. Cyclical data (process data)

Table 2: Cyclical data (process data)

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 1	OI	-	-	-	OM	-	-	OD

Bit	Signal	Message
OI	Diagnostics	There is a fault, see 14.3. Error messages on page 31.
OM	Status	The safety outputs of the device are switched.
OD	Monitoring output	A valid key is detected in the actuating range. The safety inputs are switched on.

11.3.2. Acyclical data (device data and events)

After one of the commands listed below is sent, the requested data are provided via the IO-Link Gateway. The reply message always consists of 8 bytes in big endian format.

Example 1: Reply message in response to the command *Send device ID number/serial number*: 06 **02 68 E0 00 01 17 00**

In this example, the device's ID number is **157920** and its serial number is **279**.

Byte number	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Reply in hex	06	02	68	E0	00	01	17	00
Description	User data length in bytes	Device ID number			Serial number			Padding data
Reply in dec.	6 bytes	157920			279			–

Example 2: Reply message in response to the command *Send current key code*: 05 xx xx **00 5F** xx 00 00

In this example, the device's key code is **95**.

Byte number	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Reply in hex	05			00	5F		00	00
Description	User data length in bytes			Current key code			Padding data	
Reply in dec.	5 bytes			95			–	–

Command		Reply		
HEX	Meaning	Number of bytes	Bit sequences (big endian format)	
2	Send device ID number/serial number	6	Bytes 1 - 3	Device ID number
			Bytes 4 - 6	Serial number
3	Send version number of the device	5	Byte 1	{V}
			Bytes 2 - 4	Version number
5	Send number of devices in series connection	1		
8	Send number of starting processes	3		
12	Send current error code	1		
13	Send most recently saved error code	1		
14	Send size of log file	1		
15	Send entry from log file with index	1		
16	Send current key code	5	Bytes 3 - 4	Key A-FLX-K-0A... – 16 bit Key A-FLX-K-0B... – 10 bit
17	Send taught-in key code	5	Bytes 3 - 4	
18	Send disabled key code	5	Bytes 3 - 4	
19	Send applied voltage in mV	2		
0F	Send number of teach-in operations, factory resets and resets for acknowledging error messages	3	Byte 1	Number of teach-in operations
			Byte 2	Number of factory resets
			Byte 3	Number of resets for acknowledging error messages
1A	Send current temperature in °C ¹⁾	1		
1B	Send number of switching cycles	3		
1D	Reset for acknowledging error messages ²⁾	–		
1E	Factory reset	1	0x1E – Factory reset performed	
1F	Send key identification ^{3) 4)}	1	01 – Key identification A	
			02 – Key identification B	
			03 – Key identification C	

1) The read value is the internal operating temperature in the device. This value can exceed the ambient temperature. The device enters the fault state when the internal operating temperature exceeds 80 °C.

2) Each BR device must be addressed individually in a chain.

3) Applies only to the key A-FLX-K-0B-...

4) With different packaging units, the key identification is always the same.

For more information on these and other acyclical data, refer to the operating instructions for your BR/IO-Link Gateway.

12. Setup



DANGER

Danger to life due to tampering.

- › Unused keys must be rendered unusable or protected against unauthorized access to prevent bypassing the safety function.
- › If master keys or replacement keys are used, the operating organization must take suitable organizational measures and use a corresponding risk assessment to prevent the system's safety function from being bypassed. For this purpose, observe the information in ISO/TS 19837.

12.1. Configuring the device and teaching-in the key for the first time

The device must be configured and the key must be allocated to the key adapter before the system forms a functional unit. The function is defined during configuration using the key. Configuration and the teach-in operation occur simultaneously in the delivery state or after a factory reset.

Key	Function
A-FLX-K-0A-RD-168921	1 key per packaging unit
A-FLX-K-0B-...	Several keys per packaging unit, with identical key code and different key identification



WARNING

Danger to life due to improper use

- › During the initial configuration or reconfiguration after a factory reset, ensure that all risk assessment measures for the selected function are performed.



Important!

- › If the key to be taught-in is in the key adapter for less than 30 s, the device will not be configured and the key will not be activated.
- › For keys of version A-FLX-K-0B-RD-...: Only one key per packaging unit has to be taught-in. All other keys from the same package can be used without an additional teach-in operation.

Prerequisite:

- › The device is in the delivery state. A factory reset must be performed before a preconfigured device can be reconfigured (see chapter 13. *Factory reset on page 28*).
- › The device is isolated from the operating voltage.

1. Make sure that no key is inserted.
2. Connect operating voltage to the key adapter.
 - ➔ The LED flashes white quickly. The device is carrying out a self-test.
 - ➔ The LED flashes white slowly. The device is in unlimited teach-in standby.
3. Insert a key.
 - ➔ The teach-in operation begins. The LED alternately flashes white/violet slowly.
 - ➔ The teach-in operation ends after approx. 30 s. The LED alternately flashes green/blue quickly (approx. 3 Hz).
4. Switch off operating voltage U_B for at least 3 s.
 - ➔ The code of the taught-in key is activated in the key adapter. The key is valid.
5. Switch on operating voltage U_B .
 - ➔ The device operates normally.

12.2. Teaching-in a new key



Important!

- › The teach-in operation may be performed only if the device functions flawlessly. The LED flashes green slowly.
- › Only the key version with which the device was configured can be taught-in. To reconfigure the device, see chapter 12.1. *Configuring the device and teaching-in the key for the first time on page 26.*
- › During a teach-in operation, the safety outputs are switched off, i.e. the system is in the safe state.
- › The key adapter disables the code of the previous key if teach-in is carried out for a new key. 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 key adapter only after a third code has been taught-in.
- › The key adapter can be operated only with the last key taught-in.
- › The number of teach-in operations is unlimited.
- › If the key adapter recognizes the most recently taught-in key during teach-in standby, the teach-in operation will be continued and completed with positive acknowledgment. The LED alternately flashes green/blue quickly. Follow steps 5 and 6 to change to normal operation.
- › If the key to be taught-in is within the key adapter for less than 30 s, it will not be activated and the most recently taught-in key will remain saved.
- › In normal mode, it is not possible to start a teach-in operation by pressing the pushbutton.
- › For keys of version A-FLX-K-OB-RD-...: Only one key per packaging unit has to be taught-in. All other keys from the same package can be used without an additional teach-in operation.

Prerequisite:

- › The device is isolated from the operating voltage.
1. Make sure that no key is inserted.
 2. Connect operating voltage to the key adapter.
 - ➔ Only with BR device: The LED flashes white quickly (3 Hz). The device is carrying out a self-test.
 - ➔ The LED flashes green slowly. The device is ready for operation.
 3. Within 3 min, press the pushbutton on the rear of the device with a pointed object for at least 3 s.
 - ➔ The device is in teach-in standby for up to 3 minutes. The LED illuminates white.
 4. Insert a non-taught-in key.
 - ➔ The teach-in operation begins. The LED alternately flashes white/violet slowly.
 - ➔ The teach-in operation ends after approx. 30 s. The LED alternately flashes green/blue quickly (approx. 3 Hz).
 5. Switch off operating voltage U_B for at least 3 s.
 - ➔ The code of the newly taught-in key is activated in the key adapter. The key is valid.
 6. Switch on operating voltage U_B .
 - ➔ The device operates normally.

12.3. Electrical function test



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.

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 key adapter carries out a self-test. The LED then flashes green slowly.
2. Insert key.
 - ➔ The 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 flashes green slowly.

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

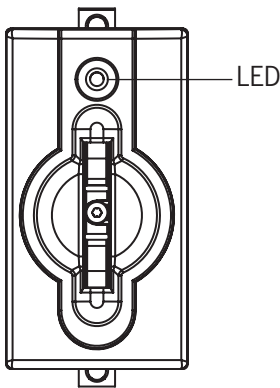
13. Factory reset

A factory reset deletes the configuration and restores the device's factory settings.

To perform a factory reset, connect the two outputs FO1A and FO1B to 0 V before switching on or send the command 0x1E via IO-Link communication (see chapter 11.3.2. *Acyclical data (device data and events)* on page 25).

14. Status and error messages

14.1. LED indicator



Important!
If you do not find the displayed device status in the following tables, this indicates an internal device fault. Contact the manufacturer.

Key to symbols	○		LED not illuminated
	☀		LED illuminated
	☀ quickly		LED flashes quickly (3 Hz)
	☀ slowly		LED flashes slowly (0.6 Hz)
	☀ ↔ ☀		LED flashes alternately
	X		Any state

14.2. Status messages

Operating mode	LED indicator	Safety outputs F01A / F01B	Monitoring output signal OD	Status
Self-test	 white quickly 3 Hz (only for CKS2-BR: 5 s)	off	off	Self-test after operating voltage is switched on.
	 green quickly			No communication with the BR/IO-Link Gateway.
Normal operation	 green slowly	off	off	Device is ready for operation. No key inserted.
	 green	on	on	Key inserted. The safety outputs of the preceding device in a series connection are switched on.
	 green/orange slowly	off	on	Key inserted. The safety outputs of the preceding device in a series connection are switched off.
Teach-in operation	 white	off	off	Device is in teach-in standby (see chapter 12.2. <i>Teaching-in a new key on page 27</i>).
	 white/violet slowly		on	Teach-in operation
	 green/blue quickly		off	Positive acknowledgment after successful teach-in operation.
Factory reset	 white/blue quickly	off	off	Factory reset
Error	depending on the error	off	depending on the error	Error message (see chapter 14.3. <i>Error messages on page 31</i>)

14.3. Error messages

Error code via IO-Link	LED indicator	Error	Troubleshooting	Acknowledg- ing errors	
				Remove key for 2 s	Reset
Teach-in error					
0x1F	 white/red slowly	No key detected during teach-in standby.	The key must be inserted within 3 minutes of the pushbutton being pressed.		●
		Key removed from the key adapter prior to the end of the teach-in operation.	Repeat teach-in operation.		●
0x28		The pushbutton was pressed for too long.	Press the pushbutton for no longer than 30 s.		●
0x25	 blue quickly	Disabled key detected during the teach-in operation: The key was taught-in during the penultimate teach-in operation and is disabled for the current teach-in operation.	Repeat the teach-in operation with a new key (see chapter 12.2. <i>Teaching-in a new key on page 27</i>).		●
0x42	 blue slowly	Invalid key detected: The key is not intended for the current device configuration.	- Perform the teach-in operation with a key intended for the current device configuration. - If the device is to be reconfigured, observe chapter 12.1. <i>Configuring the device and teaching-in the key for the first time on page 26</i>.		●
0x45	 blue	Faulty or incompatible key detected: The key's data structure cannot be read. The key is faulty or is not suitable for the device.	Repeat teach-in operation with a new key.		●
Input error					
0x2E	 violet slowly	Different signal states at the safety input F11A or F11B during operation.	- Check wiring. - Check preceding device in the chain.	●	
0x30		Different signal states at the safety inputs F11A and F11B during the self-test.	Check wiring.		●
0x31 0x32		- Test pulses not detected at safety input F11A or F11B during operation. - With a single device or the first switch in the switch chain: different signal states detected at safety inputs F11A and F11B during operation.		●	
Transponder/read error					
0x44	 blue slowly	Invalid key detected during operation: The key is not intended for the current device configuration.	Use a valid key.	●	
0x46	 blue	Faulty or incompatible key detected during operation: The key's data structure cannot be read. The key is faulty or is not suitable for the device.		●	
-0x47	 blue quickly	Disabled key detected during operation: The key is not the currently valid key.		●	
0x48	 white/blue slowly	Non-taught-in key detected during operation.	- Use the currently valid key. - Teach-in the key.	●	

Error code via IO-Link	LED indicator	Error	Troubleshooting	Acknowledg- ing errors	
				Remove key for 2 s	Reset
Output error					
0x4C 0x4D	 violet quickly	A short circuit or ground fault is detected at safety output FO1A or FO1B during the self-test.	Check wiring.		●
0x54		A short circuit or ground fault is detected at safety output FO1A or FO1B during operation.		●	
Environment error					
0x60	 orange/red slowly	Supply voltage too high	Decrease supply voltage.	●	
0x61		Supply voltage too low	› Increase supply voltage. › Check system configuration: cable length, number of devices in the switch chain.	●	
0x62	 orange/red quickly	Device temperature too high.	› Observe the specified temperature range, see chapter 15. <i>Technical data on page 34</i>		●
0x63		Device temperature too low.			
Internal error					
0x01	 red	In case of series connection with IO-Link communication: Safety input FI1A is routed to safety output FO1B of the previous device.	Check wiring.		●
		› Internal device error › Supply voltage extremely high or extremely low. › Device temperature extremely high or extremely low.	› Check supply voltage. › Check device temperature. › Restart the device. On repeated occurrence, contact the manufacturer.		●

14.4. Acknowledging error messages

Depending on the error type, the error message can be acknowledged by briefly removing the key or by a reset.
The reset can be performed as follows.

Reset	Centrally for all devices in a chain	Each device must be addressed individually	Further information
By briefly disconnecting the power supply	●	-	-
Via the cyclical data of IO-Link communication	●	-	See operating instructions for the IO-Link Gateway
Via the acyclical data of IO-Link communication	-	●	See chapter 11.3.2. <i>Acyclical data (device data and events)</i> on page 25

Resetting to acknowledge error messages does not delete the configuration.

	Important! Contact the manufacturer if the fault display is not reset after briefly disconnecting the power supply.
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15. Technical data



NOTICE

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

15.1. Technical data for key adapter CKS2-K-BP/BR-CC-FLX

Parameter	Value			Unit
	min.	typ.	max.	
Housing material	Plastic PA6-GF30 black			
Dimensions	75 x 40 x 73			mm
Weight (device without connecting cable)	0.08			kg
Ambient temperature at U _B = 24 V DC	-25	-	+55	°C
Storage temperature	-25	-	+70	
Degree of protection	IP65/IP67 in installed state			
Safety class	III			
Degree of contamination	2			
Installation orientation	On the front			
Mounting cut-out acc. to DIN IEC 61554	33 x 68			mm
Connection	Connecting cable 15 cm (static bending radius 25 mm) with CKS2-BP: plug connector M12, 5-pin CKS2-BR: plug connector M12, 8-pin			
Operating voltage U _B	24 -15/+20%, regulated, residual ripple < 5%) (PELV)			V DC
Current consumption	40			mA
External fuse (operating voltage)	0.25	-	8	A
Safety outputs F01A/F01B	Semiconductor outputs, p-switching, short circuit-proof			
- Output voltage U _{F01A} /U _{F01B} ¹⁾				
HIGH U _{F01A}	U _B /4	-	U _B	V DC
HIGH U _{F01B}				
LOW U _{F01A} /U _{F01B}	0		1	
Switching current per safety output	1	-	150	mA
Utilization category acc. to EN IEC 60947-5-2	DC-13 24 V 150 mA Caution: Outputs must be protected by a free-wheeling diode in the case of inductive loads.			
Off-state current I _r	≤ 0.25			mA
Door position monitoring output OD/C ¹⁾	p-switching, short circuit-proof			
- Output voltage				
HIGH	U _B /1.5	-	U _B	V DC
LOW	0	-	1	
- Switching current	1	-	50	mA
Rated insulation voltage U _i	-	-	300	V
Rated impulse withstand voltage U _{imp}	-	-	1.5	kV
Conditional short-circuit current	100			A
Shock and vibration resistance	Acc. to EN IEC 60947-5-3			
EMC protection requirements	Acc. to EN IEC 60947-5-3			
Ready delay	-	CKS2-BP: 2 CKS2-BR: 5	-	s
Risk time for single device	-	-	125	ms
Risk time extension per device in series connection	-	-	10	ms
Reaction time ²⁾	27.4			ms
Reaction time extension per device in series connection	6.7			ms
Turn-on time	-	-	400	ms
Discrepancy time	-	-	10	ms
Test pulse duration	0.3			ms
Test pulse interval	Approx. 100			ms
Reliability values acc. to EN ISO 13849-1 ³⁾				
Category	4			
Performance Level	PL e			
PFD _D	6 x 10 ⁻¹⁰ / h			
Mission time	20			years
Reliability values acc. to EN 62061:2005/A2:2015	SILCL3			

1) Values at a switching current of 50 mA without taking into account the cable lengths.

2) The reaction time is the time until the moment when at least one of the outputs (FO1A or FO1B) switches off when the key is removed from the actuating range, given compliance with all manufacturer's specifications.

3) Refer to the declaration of conformity in chapter 18 for the issue date.

15.1.1. Radio frequency approvals

FCC ID: 2AJ58-17

IC: 22052-17

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:

CKS2-K-BP SERIES

CKS2-K-BR SERIES

Responsible Party – U.S. Contact Information

EUCHNER USA Inc.

6723 Lyons Street
East Syracuse, NY 13057

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<http://www.euchner-usa.com>

15.1.2. 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 key is in the actuating range to the moment when the safety outputs switch on.

Simultaneity monitoring of safety inputs F11A/F11B: If the safety inputs have different switching states over a certain time, the safety outputs F01A and F01B will be switched off. The device enters the fault state.

Risk time according to EN 60947-5-3: The risk time is the maximum time until at least one of the safety outputs F01A or F01B switches off safely when the key is removed from the actuating range. This also applies if an internal or external fault occurs at this moment.

If several devices are operated in a series connection, the risk time of the overall device chain will increase with each device added. Use the following calculation formula:

$$t_r = t_{r,e} + (n \times t_i)$$

t_r = Total risk time

$t_{r,e}$ = Risk time, single device (see technical data)

t_i = Risk time extension per device

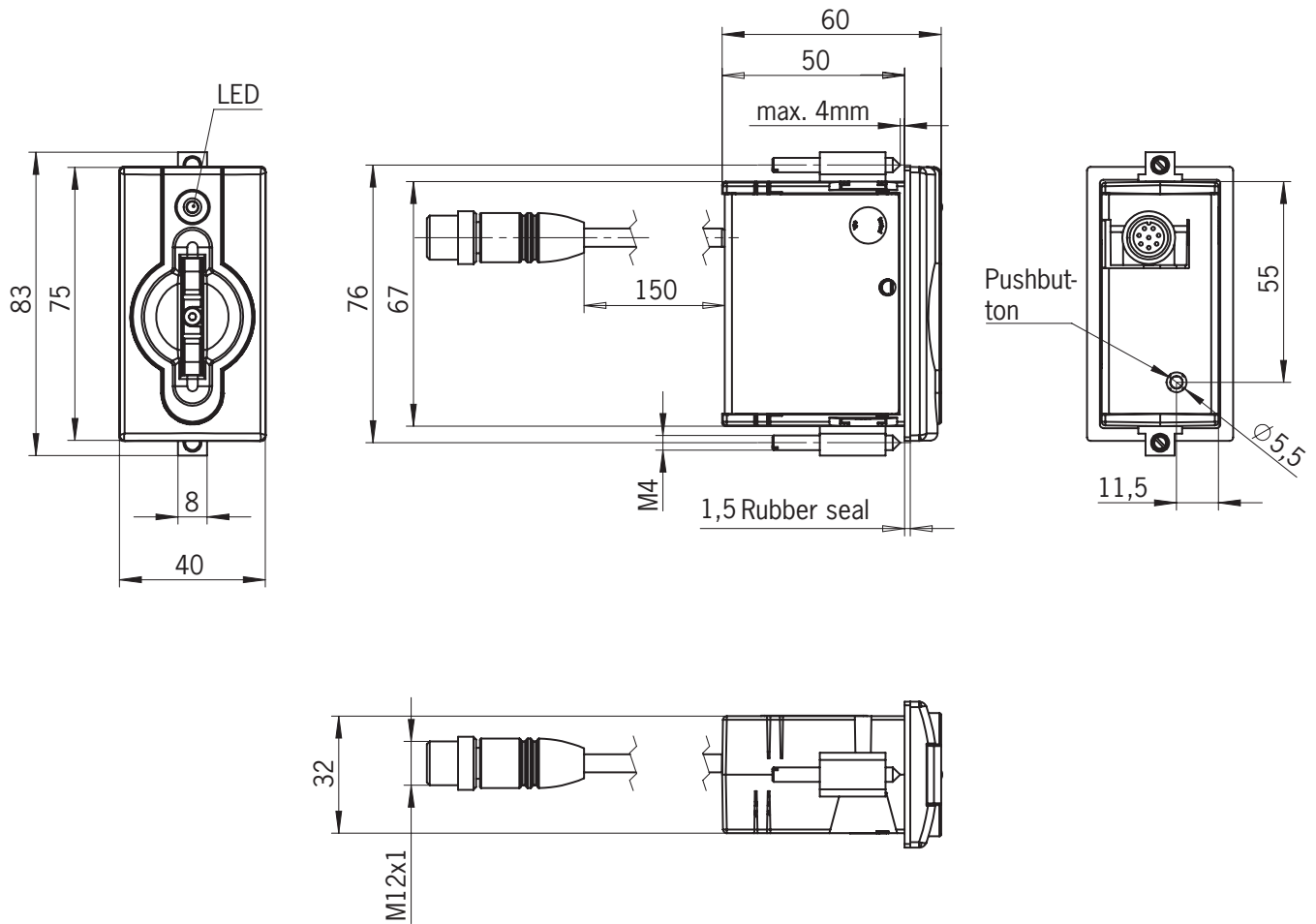
n = Number of additional devices (total number -1)

Discrepancy time: The safety outputs F01A and F01B 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 F01A and F01B. 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.

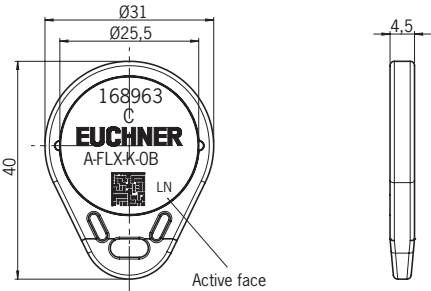
15.1.3. Dimension drawing for key adapter



15.2. Technical data for key A-FLX-K-...

Parameter	Value			Unit
	min.	typ.	max.	
Housing material	ABS plastic			
Dimensions	40 x 31 x 5			mm
Weight	0.004			kg
Ambient temperature	-25	-	+85	°C
Degree of protection	IP65/IP67			
Power supply	Inductive via key adapter			

15.2.1. Dimension drawing for key



15.2.2. 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*.

16. Inspection and service



WARNING

Loss of the safety function because of damage to the device.

- › In case of damage, the entire device must be replaced.
- › Only accessories or spare parts that can be ordered from EUCHNER may be replaced.

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

- › Check the switching function (see chapter 12.3. *Electrical function test on page 28*)
- › Check the secure mounting of the devices and the connections
- › Check for contamination

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 bottom right corner. The current version number in the format (VX.X.X) can also be found on the device.

17. 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

18. Declaration of conformity

The declaration of conformity is part of the operating instructions.

The complete EU declaration of conformity can also 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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Edition:
MAN20001512-01-03/22
Title:
Operating Instructions Key Adapter CKS2-K-BP/BR-CC-FLX
(translation of the original operating instructions)
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