INDUSTRY
4.0

IO-Link

Ongoing dialog

Communication at Industry 4.0 level

EUCHNER

More than safety.

Safety switch CES-C07

There is more than meets the eye to EUCHNER's smallest safety switch.
Its actual innovation is on the inside.

The **CES-C07** supplements the familiar and frequently used option of connecting sensors in series by adding much more comprehensive diagnostics. Even better: the devices provide process-relevant parameters in real time, thereby guaranteeing information for preventive maintenance. The sensors measure relevant parameters in the surroundings to indicate problems before machine failure can occur. This system can even detect tampering attempts.

When safety module **ESM-CB** is used, this information is polled automatically from each switch in the chain and provided to your control system via IO-Link. It goes without saying that the switch features functions such as weak-range indication and highly visible display LEDs, as well as a safety classification in category 4 / PL e. This switch can also be approached from three installation positions, allowing it to be mounted in different positions. The standard M12 plug integrated directly into the switch permits connection using standard M12 cables. Another benefit is the option of incorporating mechanical safety switches in the series connection of CES devices.
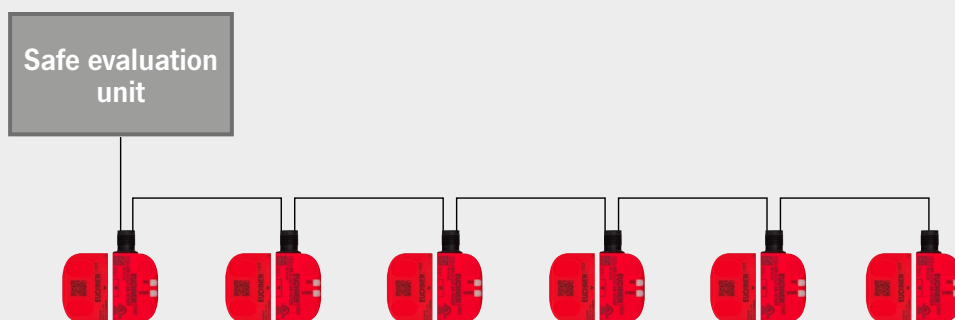
Approach directions

Three active faces/
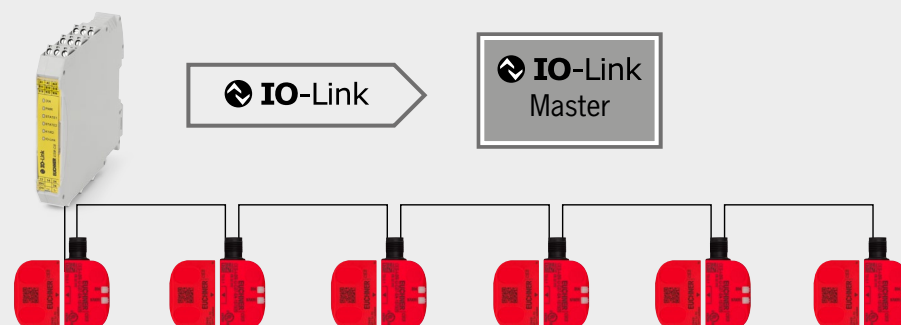eight mounting
options
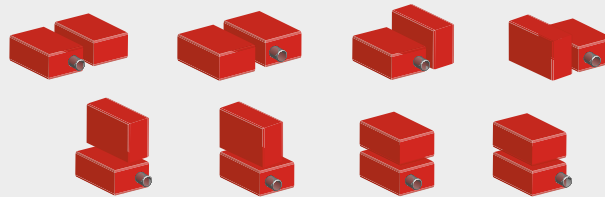
Examples for series connection in the field

Connection to safe
PLCs or safety relays

Safe evaluation unit

Connection to safety
module ESM-CB

IO-Link

IO-Link Master

Safety switch CES-C07

Technical data

Parameter	Value			Unit
	min.	typ.	max.	
Housing material		PBT plastic		
Dimensions		40 x 26.5 x 18		mm
Weight		0.08		kg
Ambient temperature at U_B = DC 24 V	-25	-	+55	°C
Degree of protection		IP65/IP67/IP69/IP69K		
Operating voltage U_B (reverse polarity protected, regulated, residual ripple < 5%)		24 ± 15% (PELV)		V DC
External fuse (operating voltage)	0.25	-	8	A
Safety outputs FO1A/FO1B		Semiconductor output p-switching, short circuit-proof		
- Output voltage U(FO1A)/U(FO1B) [1]				
HIGH U(FO1A)	U_B-1.5	-	U_B	
HIGH U(FO1B)	0	-	1	V DC
LOW U(FO1A)/U(FO1B)				
Switching current per safety output	1	-	150	mA
Utilization category acc. to EN IEC 60947-5-2		DC-13 24 V 150 mA		
Monitoring output OD/C [1]		Semiconductor output p-switching, short circuit-proof		
- Output voltage	U_B-1.5	-	U_B	V DC
- Switching current	1	-	50	mA
Resilience to vibration		In acc. with EN IEC 60947-5-2		
EMC protection requirements		In acc. with EN IEC 60947-5-3/EN IEC 61326-3-1		
Reliability values acc. to EN ISO 13849-1				
Category		4		
Performance Level		PL e		
PFH_d		6×10^{-10}/h		
Mission time		20 years		

[1] Values at a switching current of 50 mA without taking into account the cable length.

Dimension drawing for safety switch CES-I-BR-.-C07...
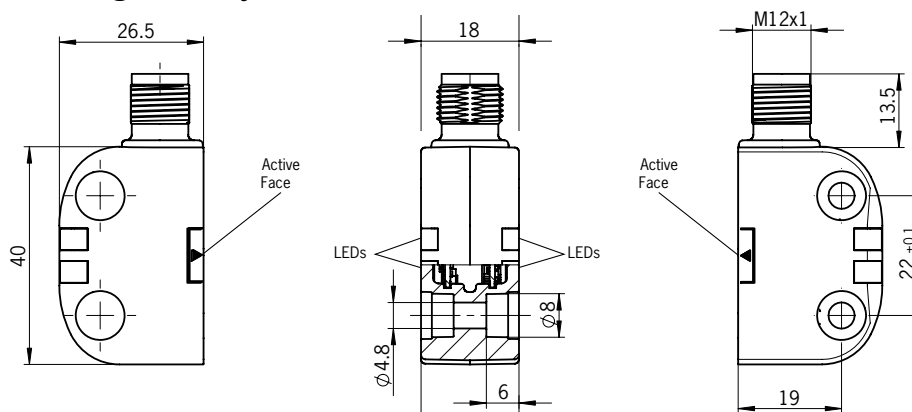
Dimension drawing for actuator CES-A-BTN-C07
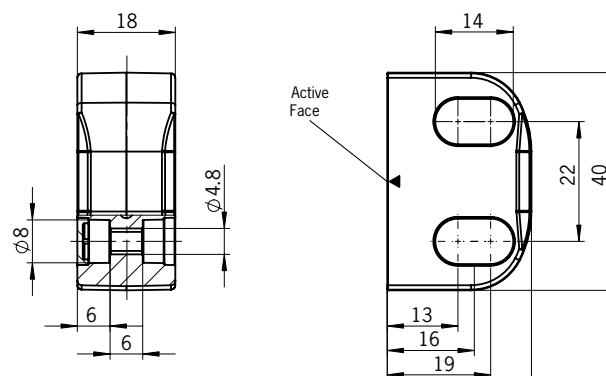
IO-Link communication data CES-C07

The devices transmit both process data, which the system continuously provides to the IO-Link master, and acyclical data.

Process data

Data		Meaning
Guard position	O_D	This signal indicates whether the guard is open or closed.
Weak-range indication	O_W	This signal provides timely information about whether an actuator is in the limit range of the transponder field. This usually occurs when safety doors settle over time, causing the actuator to drift out of the operating distance. The weak-range indication signals this state early enough for you to readjust the safety door.
Safety outputs switched	O_M	This signal indicates whether or not the safety outputs are switched on. The guard must be closed for this purpose, but all other conditions must be met as well: for example, the safety outputs of all previous devices in the series connection must be on.
Message pending	O_I	This signal indicates a pending message. You can retrieve it via the acyclical data.

Acyclical data

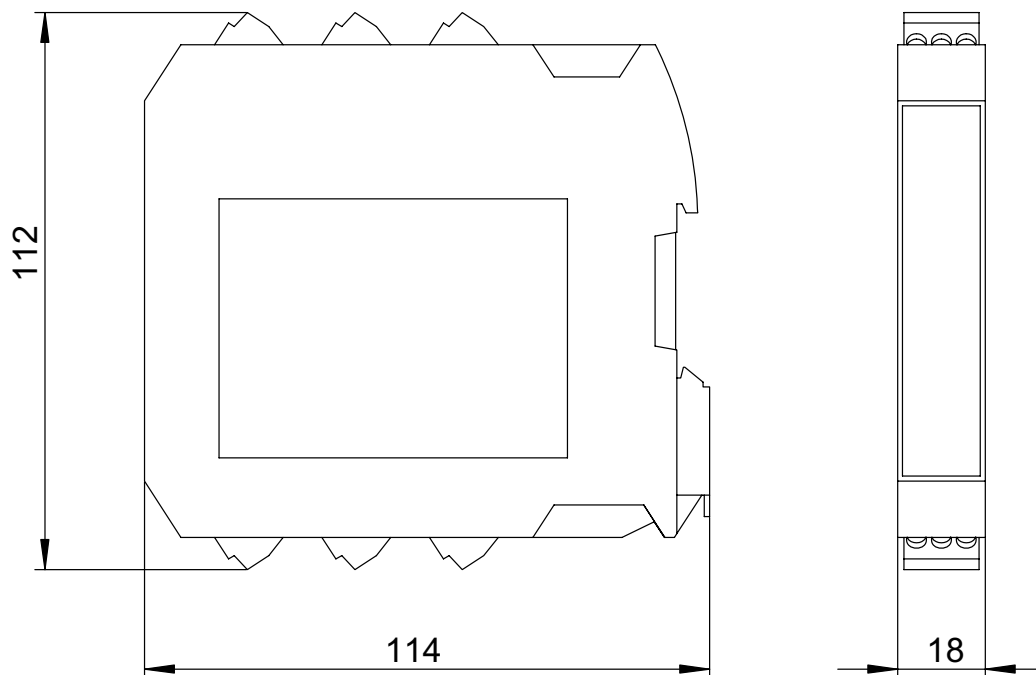| Data	Meaning
Series connection version	This value indicates whether all devices in the series connection are mutually compatible.
Sensor order number Sensor version	This function reads the order number and the switch version. The safety switch provides all the data you need to order a replacement.
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, for example shortening the chain.
Current diagnostic code	When O_I indicates a pending message, the specific error can be read in detail via this code. This lets you know what to do to remedy 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. 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 "enable signal" function (see below), the control system can switch off the safety equipment if the comparison results are implausible.
Code of blocked actuator	Function for polling the actuator code in the "blocked" memory. On unicode switches: this code can be displayed to the machine setter to aid in teaching in a new actuator during service and setup.
Code of taught-in actuator	This function polls the currently taught-in actuator code. 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 CES-C07. Preventive service can be requested if the voltage falls below a certain value, for example.
Temperature	This indicates the temperature currently measured in the CES-C07. Preventive service can be requested if the values are too high.
Number of switching cycles	Information about the cumulative switching cycles. The CES-C07 is free from wear, so this value is hardly relevant for the switch itself. However, this value can be used to monitor the mechanical components of the guard, for example.
Log-data readout	The sensor internally logs relevant events. The log-data can be read out.

Safety module ESM-CB

Technical data

Parameter	Value			Unit
	min.	typ.	max.	
Housing material		Polyamide PA6.6		
Dimensions		112 x 18 x 114.5		mm³
Ambient temperature	-25	-	+60	°C
Storage temperature	-40	-	+85	°C
Degree of protection		IP 20		
Installation method		Mounting rail 35 mm acc. to DIN EN 60715 TH35		
Connection		Plug-in spring terminals		
Input circuit 1		For floating contacts and semiconductor outputs without communication		
Input circuit 2		For semiconductor outputs from EUCHNER product family BR		
Number of safety contacts		2		
Operating voltage		24 -15% ... +10%		V DC
LED displays		DIA LED red		
		PWR LED green		
		STATE1 and STATE2 LEDs green		
		K1/K2 LED green		
		IO-Link LED green		
Normally open output contacts		Relay contacts floating and positively driven (redundant)		
Switching voltage		Max. 250		V AC/DC
Switching current		Max. 6		A
IO-Link		According to IO-Link specification V1.1 Device with IO-Link communication		
Safety classification		Category 4 / PL e according to EN ISO 13849-1*		

* = Taking into account a maximum current to be observed and a maximum number of operating cycles per year.

Dimension drawing for safety module

112

114

18

IO-Link communication data ESM-CB

Process data

| Data		Meaning
State of safe input circuit 1	S0	This indicates whether or not input circuit 1 is closed.
State of safe input circuit 2	S1	This indicates whether or not input circuit 2 is closed.
State of outputs K1 and K2	O_M	This indicates whether or not the safety relays are switched on. Both input circuits must be closed and the start signal must be present for this purpose.
Start requested	O_Q	This signal indicates whether or not any start button used has already been pressed.
Current diagnostic code		The most important messages are transmitted directly into process data.

Acyclical data

Data	Meaning
Order number of the ESM-CB Version of the ESM-CB	The safety module provides all the data needed to order a replacement.
Expanded diagnostic code	When the current diagnostic code indicates a pending message, the specific error can be read in detail via this code. This lets you know what to do to remedy faults promptly.

Acyclical output data

| Data	Meaning
Enabling signal	The control system can influence whether or not the safe relay contacts have to be switched on. The safe relay contacts will not be switched on without the enabling signal, even if all other safe conditions have been met.
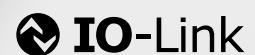
Safety module ESM-CB with IO-Link

Measuring only 18 mm in width, the slimline safety module ESM-CB is multifunctional: it is an **evaluation unit**, **safety relay** and **IO-Link device** in one. Everything you need to secure a small machine. A special advantage is the option of transmitting all relevant sensor and device data via IO-Link.

You can connect two safety circuits to the inputs: one with which the device can monitor an emergency-stop chain or the switching contacts of mechanical safety switches. Another one is used for evaluating a switch chain comprising the new safety switches CES-C07. Two redundant, safe relay contacts enable the direct switching of loads up to 6 A mps.

The safety module is in a constant dialog with the connected devices, polling each sensor for information including the system state, the ambient conditions, and the sensor's data such as the sensor type and version number. This allows you to communicate at Industry 4.0 level.
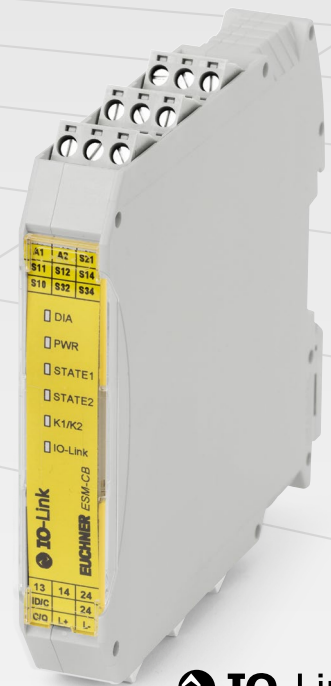
Block diagram
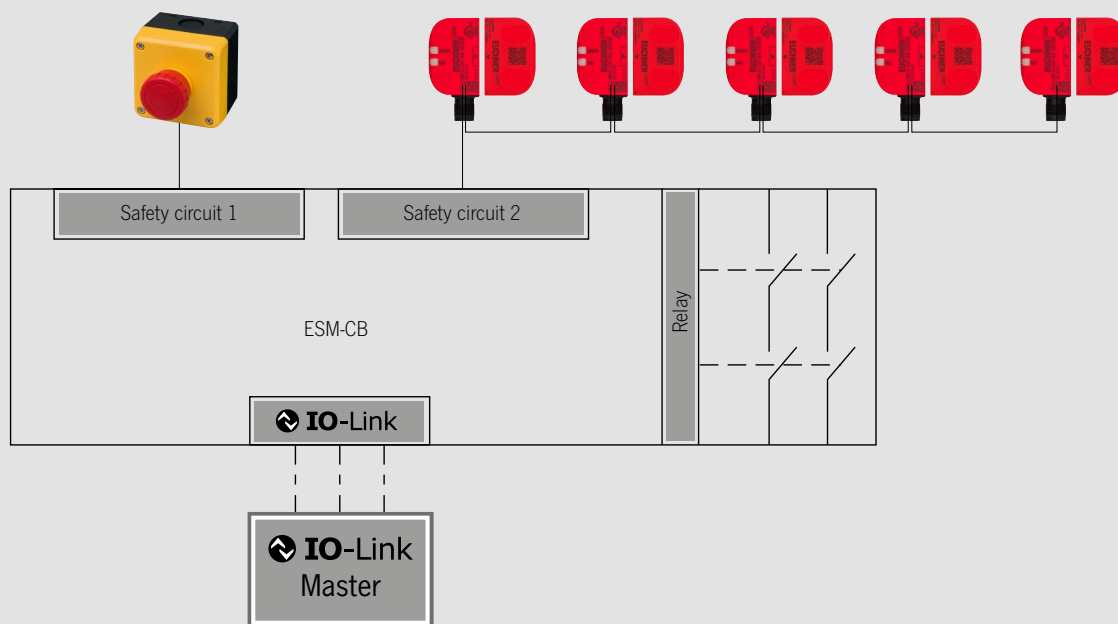
Advantages at a glance

CES-C07

▸ Minimum space requirement thanks to compact design
▸ Variable approach and mounting options
▸ Unicode and multicode versions to suit the application
▸ Two safe semiconductor outputs
▸ Switch chains up to 200 m long possible
▸ Series connection with full diagnostics (only in combination with ESM-CB)

ESM-CB

▸ Two safety inputs for up to 20 safety switches
▸ Two safety outputs
▸ Diagnostic function via IO-Link
▸ Category 4 / PL e according to EN ISO 13849-1
▸ Compact version measuring only 18 mm in width
▸ Data for Industry 4.0 applications

Ordering table for safety switch CES-I-BR-.-C07 (available from autumn 2018)

Description	Order number/item designation	
	Unicode	**Multicode**
Safety switch CES-I-BR-C07 Cube-shaped; plug connector M 12	**157920** CES-I-BR-U-C07-SA-157920	**156233** CES-I-BR-M-C07-SA-156233
Actuator CES-A-BTN-C07 Cube-shaped	**156230** CES-A-BTN-C07-156230	
Actuator CES-A-BDN0-06 Ø 6 mm	**158210** CES-A-BDN-06-158210	
Strapping plug	**097645**	
Y-distributor	**157913**	
Y-distributor with connecting cable	**158192** with 0.2 m cable and **158193** with 1.0 m cable	

Ordering table for safety module ESM-CB (available from autumn 2018)

Description	Order number/item designation
Safety module ESM-CB	**158875** ESM-CB-AZ-FI2-BR-IO-158875

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