

Functional Description

The **Coded Magnetic Safety** systems CMS comprise three components:

- Actuator
- Read head
- Evaluation unit

Several permanent magnets are accommodated in the actuator housing. The number of magnets, their position (polarization) in the housing and the magnetic field strength characterize the actuator type. For this reason they are also called coded actuators.

Within a series, the individual actuator coding is identical. Using one actuator type on a machine or complete system allows for quick and easy replacement.

Reed contacts are installed in the read head of the safety system CMS. The operating principle for the reed contacts (NC contacts or NO contacts), the number of reed contacts fitted and their physical arrangement determine the type of read head. The contact blades on the reed contacts will close when under the influence of the magnetic field from the actuator.

The actuators and read heads are matched in pairs and are available in 4 different housings. Depending on the application, the system operator can select a rectangular or cylindrical design. The read head only responds to the specific mating component, that is a specific actuator which is allocated to the read head type. The same applies to the allocation of the read head to the evaluation unit.

The evaluation unit is the system unit which is downstream from the read head. Using internal relays, it switches the safety circuit as a function of the position of the reed contacts. The evaluation unit in degree of protection IP 20 is mounted in the control cabinet.

EUCHNER offers various evaluation units. The unit is selected as a function of the number of read heads to be connected and the overall system category to be achieved according to EN 954-1. The related evaluation units are described in detail in the following sections.

In order to achieve a particular safety level, fault analyses must be carried out where safety-related components are used.

A fault could be caused by a short circuit in the connecting lead or by welding of a reed contact in the closed position. If a reed contact is welded, the magnetic force might not be strong enough to open the contact. For reasons of safety, several reed contacts (2 or 3, depending on the switch type) are fitted to each read head.

The NC contact/NO contact combination is used as an example. If the actuator is moved into the read head's operating distance, the reed contacts are switched by the magnets (in the actuator). Magnets with different polarization are assigned to the NC and NO contacts. The downstream evaluation unit monitors the read head: the NC/NO contacts in the read head must always have opposite states.

If this is not the case, the safety contacts on the evaluation unit are not switched and the unit switches to the blocked state.

The read head is fastened to the fixed part of the safety guard and is connected to the evaluation unit using a two-core or four-core cable. When the safety guard is closed, the actuator is moved towards the read head. As soon as there is an actuator in the operating distance (i.e. the switch-on distance s_{ao} is reached) the reed contacts in the read head switch, i.e. they change their contact position.

If the evaluation unit detects that the reed contacts are in a specific position on all read heads connected, i.e. all actuators are in the operating distance, the safety contact is switched on.

If the actuator is moved away from the read head, the magnetic field around the reed contacts reduces with increasing distance. When the switch-off distance s_{ar} is reached, the reed contacts return to their pre-loaded position (home position).

The sensitivity of the reed contacts and the field strength of the magnets determine the switching distance between the actuator and the read head. Diagrams of the typical operating distances of the individual sensor units are shown in the technical data for the actuators and read heads. The illustration of the operating distance in x, y and z directions provides the user with information on how the actuator and read head must be positioned. When ideally positioned, the read head is in the middle of the operating distance.

The actuator and read head sensor units have a large operating distance. The advantage of this fact is that the door clearance setting may vary within the limits of the operating distance.

The safety systems CMS have switching characteristics with hysteresis ($s_{ar} > s_{ao}$).

If the read head is adjusted just inside the actuator's s_{ao} operating distance, the plant will not be switched off immediately if the door vibrates slightly.

The switch-on and switch-off distances shown in the ordering tables refer to the approach of the sensor unit in the x direction (frontal approach direction). If the actuator approaches the read head from the side, the switching distances are likely to be reduced.

The switch-on and switch-off distances in the x, y and z directions are given by the operating diagrams.

An excessively low approach speed in the z direction (side approach direction) can result in an error in the evaluation unit. For further information on the approach speed, refer to the individual product descriptions.

The magnetic systems are notable for their high degree of protection and compact design. They are therefore particularly suitable for areas where dirt and cleaning are major factors.

A major advantage of EUCHNER's CMS safety switch is that the actuator and read head can be fitted behind stainless steel. This property makes it possible to use the system in the food industry in particular.

The switching distances are, however, reduced in line with the material and wall thickness.

Installation using the corrosion-resistant safety screws (supplied) provides tamper-proof mounting of the actuator and read head on the safety guard.

General Information

According to EN 1088, interlocking devices are mechanical or electrical devices which are designed to prevent the operation of a machine element for as long as the movable safety guard is left open.

Safety switches without guard locking are used if the control concept is structured in such a way as to ensure that:

- ▶ the machine shuts down immediately upon opening the safety guard or
- ▶ the stop time (the time between the stop order being triggered by the interlocking device and the point of no further risk from hazardous machine function) is shorter than the access time.

In the case of these safety switches, there are a number of different operating principles:

- ▶ Mechanical safety switches, e.g. EUCHNER safety switches series NZ, NP and NM
- ▶ Non-contact safety switches based on transponder technology, e.g. EUCHNER safety systems series CES
- ▶ Non-contact safety switches based on a magnetically coded principle, e.g. EUCHNER safety systems series CMS

Magnetically coded safety switches are interlocking devices which are designed to protect people and machines.

Compared with electromechanical safety switches, they are used if:

- ▶ a high level of protection against tampering must be achieved
- ▶ strict hygiene requirements are to be met (e.g. in the food industry)
- ▶ a precise door guide is not possible
- ▶ machine doors are subjected to heavy vibration.

The EUCHNER safety system CMS is based on the magnetic principle. The tamper-proof coded system was specifically developed to monitor moving machine components and movable safety guards.

The EUCHNER safety system CMS... offers important advantages

- ▶ Non-contact safety guard monitoring
 - ▶ No mechanical wear of the sensor units
- ▶ Long mechanical life (100 million operating cycles) of reed contacts
- ▶ The coding for all the actuators in a series is identical
 - ▶ Quick easy replacement if required
- ▶ Evaluation units permit connection of various versions of actuators and read heads (whether rectangular or cylindrical)
- ▶ Actuator and read head have high degree of protection IP 67
- ▶ The actuator and read head can be fitted behind stainless steel
- ▶ Operates perfectly under extreme environmental conditions, e.g. dirt and moisture
- ▶ Large operating distance with hysteresis
- ▶ The sensor units can be approached from different directions
- ▶ Low costs with maximum benefits
- ▶ The rail in accordance with EN 50022 ensures ease of assembly in the control cabinet.
- ▶ For connection to a safe control system with or without pulse signals
- ▶ LED displays
 - ▶ Simplified diagnostics in case of service work
- ▶ Approval: TÜV and UL



Evaluation unit CMS-E-ER



- ▶ Up to 30 read heads can be connected
- ▶ Up to category 4 according to EN 954-1
- ▶ 2 safety contacts
- ▶ 1 auxiliary contact
- ▶ 1 feedback loop can be connected
- ▶ Start automatic/monitored/not monitored



Functional description

The evaluation unit CMS-E-ER is used to monitor numerous safety guards in category 3 or 4 according to EN 954-1.

Read heads

The evaluation unit CMS-E-ER is suitable for the direct connection of up to 30 read heads.

Category according to EN 954-1

- ▶ Category 3 with more than one read head connected
- ▶ Category 4 with only one read head connected

LED displays

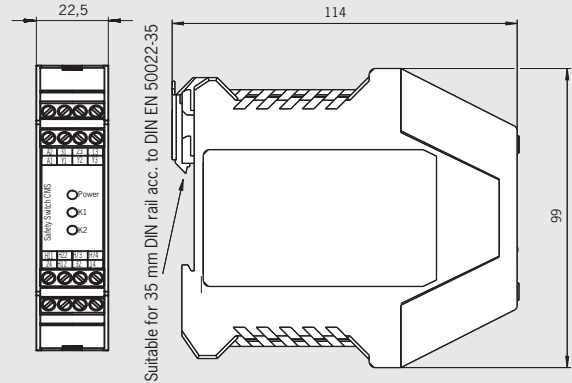
LED	U _B Operating voltage green	K1 Chan- nel 1 green	K2 Chan- nel 2 green
Actuator			
in the operating distance	●	●	●
not in the operating distance	●		
not completely in the operating distance	●	● or ●	

Evaluation unit CMS-E-ER

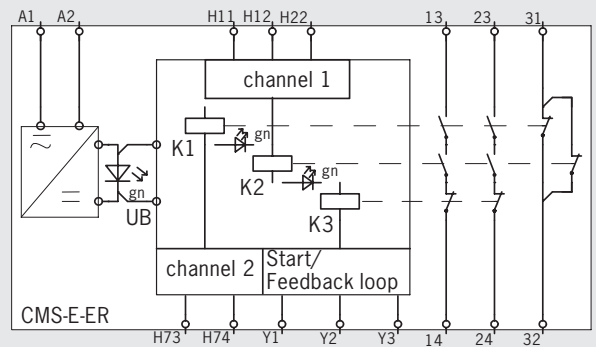
Cat.
3

Cat.
4

Dimension drawing



Block diagram



Note:

At low approach speeds in the z direction, the time between the switching the reed contacts must not be more than 0.6 ms.

Ordering table

Designation	Scope of delivery	Order No. / Item
Evaluation unit CMS-E-ER	Evaluation unit One 2-pole jumper	099 182 CMS-E-ER

Technical data evaluation unit CMS-E-ER

Parameter	min.	Value typ.	max.	Unit
Housing material		Polyamide PA6.6		
Dimensions		114 x 99 x 22.5		mm
Weight		0.3		kg
Ambient temperature	0	-	+55	°C
Storage temperature	-25	-	+70	°C
Degree of protection according to EN 60529		Terminals IP 20 / housing IP 40		
Degree of contamination		2		
Installation		DIN rail 35 mm according to EN 50022-35		
Number of read heads		1 ... 30		
Connection type		Connection terminals		
Operating voltage U_g		24 ±10% ¹⁾		V AC/DC
Internal fuse (operating voltage) (automatically resetting fuse PTC)		750		mA
Safety contacts		2 NO contacts		
Switching voltage U	-	-	240	V AC
Current consumption at DC 24 V	10	-	120	mA
Switching current I at 24 V	-	-	3	A
Switching current I at 24 V	10	-	-	mA
Breaking capacity P	-	-	720	VA
External contact fuse (safety circuit according to EN IEC 60269-1)		4 A gG		
Auxiliary contact		1 NC contact		
Switching current I at 24 V	-	-	1.5	A
Utilization category to EN 60947-5-1		I_e ²⁾	U_e ²⁾	
	AC-1	3 A	230 V	
	AC-1	3 A	24 V	
	AC-15	0.9 A	240 V	
	AC-15	0.9 A	24 V	
	DC-13	1.5 A	24 V	
Switching load acc. to UL Class 2		Input: 24 V AC/DC Output: 30 V AC / 24 V DC		
Category according to EN 954-1	3 ³⁾		4 ⁴⁾	
Classification according to EN 60947-5-3	PDF-S		PDF-M	
Rated insulation voltage U_i		250		V
Vibration resistance		According to EN 60947-5-2		
Mechanical operating cycles relays		10 ⁷		
EMC compliance		According to EN 60947-5-3		

1) All the electrical connections must either be isolated from the mains supply by a safety transformer according to EN 61558-2-6 with limited output voltage in the event of a fault, or by other equivalent isolation measures.

2) I_e = max. switching current max. per contact, U_e = switching voltage

3) Safety category 3 with more than one connected read head

4) Safety category with only one read head connected