

# Safety detection solutions

## Safety interlock switches

Key-operated with solenoid, turret head

XCSE and XCSTE rectangular design

### XCSE metal

### Safety interlock switches operated by actuating key



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### XCSTE plastic

### Safety interlock switches operated by actuating key



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## Environmental characteristics

Safety interlock switch type		XCSE (metal)	XCSTE (plastic)
Conformity to standards	Products	EN/IEC 60947-5-1, UL 508, CSA C22-2 no. 14	EN/IEC 62061, EN/IEC 60947-1
	Machine assemblies	EN/IEC 60204-1, EN/ISO 14119	
Product certifications		UL, CSA, CCC, EAC	UL, CSA, CCC, EAC
Maximum safety level (1)		PL=e, category 4 conforming to EN/ISO 13849-1 and SIL 3 conforming to EN/IEC 61508	
Reliability data B <sub>100</sub>		5,000,000 (data value for a service life of 20 years can be limited by contact and mechanical wear)	
Ambient air temperature	For operation	-25...+40 °C	-25...+60 °C
	For storage	-40...+70 °C	
Vibration resistance		5 gn (10...500 Hz) conforming to EN/IEC 60068-2-6	
Shock resistance		10 gn (duration 11 ms) conforming to EN/IEC 60068-2-27	
Electric shock protection		Class I conforming to EN/IEC 61140	Class II conforming to EN/IEC 61140
Degree of protection		IP 67 conforming to EN/IEC 60529 and EN/IEC 60947-5-1 (2)	
Cable entry		2 entries tapped ISO M20 x 1.5 (clamping capacity 7 to 13 mm) or tapped for Pg 13.5 cable gland (clamping capacity 8 to 12 mm) or for 1/2" NPT conduit	1 entry tapped M16 x 1.5 (clamping capacity 4.5 to 10 mm) or tapped for Pg 11 cable gland (clamping capacity 7 to 10 mm) or for 1/2" NPT conduit using metal adapter DE9RA1012 with Pg 11 tapped entry
Connecting cable		–	4 x 0.5 mm <sup>2</sup>
Materials		Zamak case	Polyamide PA66 fibreglass impregnated case
		Actuating keys (all types): steel XC60, surface treated	

(1) Using an appropriate and correctly connected safety control unit.

(2) Live parts of these switches are protected to some extent against the penetration of dust and water. However, when installing take all necessary precautions to help prevent the penetration of solid bodies, or liquids with a high dust content, into the actuating key aperture. Use of XCSZ27 (with XCSE) or XCSZ28 (with XCSTE) blanking plugs for unused key slots can reduce the penetration of unwanted elements (one blanking plug is delivered with the product). Not recommended for use in saline atmospheres.

#### Contact block characteristics

<b>Rated operational characteristics</b>	2 and 3 contacts, slow break	<b>XCSE, XCSTE:</b> ~ AC-15, B300: $U_e = 240\text{ V}$ , $I_e = 1.5\text{ A}$ or $U_e = 120\text{ V}$ , $I_e = 3\text{ A}$ All models: --- DC-13, Q300: $U_e = 250\text{ V}$ , $I_e = 0.27\text{ A}$ or $U_e = 125\text{ V}$ , $I_e = 0.55\text{ A}$ conforming to EN/IEC 60947-5-1
<b>Conventional thermal current in enclosure</b>		<b>XCSE, XCSTE</b> 2 and 3 slow break contact versions: $I_{the} = 6\text{ A}$
<b>Rated insulation voltage</b>	2 and 3 contacts	3 contacts ( <b>XCSE</b> ), 2 contacts ( <b>XCSTE</b> ): $U_i = 500\text{ V}$ conforming to EN/IEC 60947-1; $U_i = 300\text{ V}$ conforming to UL 508, CSA C22-2 no. 14
<b>Rated impulse withstand voltage</b>	2 and 3 contacts	3 contacts ( <b>XCSE</b> ), 2 contacts ( <b>XCSTE</b> ): $U_{imp} = 6\text{ kV}$ conforming to EN/IEC 60947-5-1
<b>Positive operation</b>		NC contacts with positive opening operation conforming to EN/IEC 60947-5-1, Section 3
<b>Resistance across terminals</b>		$\leq 30\text{ m}\Omega$ conforming to EN/IEC 60947-5-4
<b>Short-circuit protection</b>	2 and 3 contacts	3 contacts ( <b>XCSE</b> ), 2 contacts ( <b>XCSTE</b> ): 10 A cartridge fuse type gG (gl)
<b>Connection</b>	Screw clamp terminals	2 and 3 contacts 3 contacts ( <b>XCSE</b> ), 2 contacts ( <b>XCSTE</b> ): Clamping capacity, min: $1 \times 0.5\text{ mm}^2$ , max: $2 \times 1.5\text{ mm}^2$ with or without cable end

#### Complementary characteristics

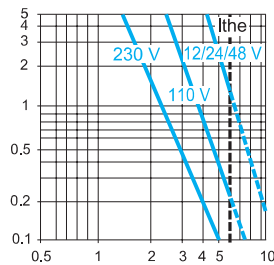
<b>Actuation speed</b>		Maximum: 0.5 m/s, minimum: 0.01 m/s
<b>Resistance to forcible withdrawal of actuating key (locked)</b>		<b>XCSE:</b> $F_{1max} = 2600\text{ N}$ ; $F_{Zh} = 2000\text{ N}$ ; <b>XCSTE:</b> $F_{1max} = 650\text{ N}$ ; $F_{Zh} = 500\text{ N}$
<b>Mechanical durability</b>		<b>XCSE:</b> > 1 million operating cycles <b>XCSTE:</b> 1 million operating cycles
<b>Maximum operating rate</b>		For maximum durability: 600 operating cycles per hour
<b>Minimum force for extraction of actuating key (not locked)</b>		$\geq 20\text{ N}$
<b>Materials</b>		Body and head: Zamak (XCSE) Body and head: polyamide PA66, fibreglass impregnated (XCSTE)

#### Electrical durability

- Conforming to EN/IEC 60947-5-1 Appendix C
- Utilization categories AC-15 and DC-13
- Maximum operating rate: 3600 operating cycles/hour
- Load factor: 0,5

#### XCSE 3-contact and XCSTE 2-contact version, slow break

AC supply  
50/60 Hz ~  
r.m. inductive circuit



DC supply ---  
Power broken in W for  
5 million operating cycles.

Voltage	V	24	48	120
r.m.	W	13	9	7

# Safety detection solutions

## Safety interlock switches

Key-operated with solenoid, turret head (1)

XCSE metal, 2 cable entries

Type of switch

Locking on de-energization and unlocking on energization of solenoid (2)



LED indication	Orange LED: "guard open" signaling (not available on 3NC main contact models). Green LED: "guard closed and locked" signaling.			
Solenoid supply voltage	24 V $\overline{\text{---}}$ or $\sim$ (50/60 Hz on $\sim$ )	48 V $\overline{\text{---}}$ or $\sim$ (50/60 Hz on $\sim$ )	110/120 V $\overline{\text{---}}$ or $\sim$ (3) (50/60 Hz on $\sim$ )	220/240 V $\overline{\text{---}}$ or $\sim$ (3) (50/60 Hz on $\sim$ )
Types of auxiliary contacts actuated by the solenoid (locking contacts). Contact states represented with actuating key inserted and solenoid not energized.	NC + NO 	2 NC 	NC + NO 	NC + NO 

References of switches without actuating key (5) (⊕ NC contact with positive opening operation)

Types of main contacts actuated by the key  
Contact states represented with actuating key inserted  
With 2 cable entries tapped ISO M20 x 1.5

3-pole NC + NO + NO (2 NO break before make) slow break 	XCSE5312 ⊕	-	XCSE5322 ⊕	XCSE5332 ⊕	XCSE5342 ⊕
3-pole NC + NC + NO (NO break before make) slow break 	XCSE7312 ⊕	XCSE73127 ⊕	-	XCSE7332 ⊕	XCSE7342 ⊕
3-pole NC + NC + NC slow break 	XCSE8312 ⊕ (4)	XCSE83127 ⊕ (4)	-	-	-
Weight (kg)	1.140	1.140	1.140	1.140	1.140

References of switches with locking on energization and unlocking on de-energization

To order a safety interlock switch with locking on energization and unlocking on de-energization of the solenoid, replace the second number (3) with 5 in the references shown above. Example: XCSE5312 becomes XCSE5512. For these models, the auxiliary contacts states are also represented with key inserted and solenoid not energized. 2 NC auxiliary contact models cannot be ordered with locking on energization. Some references with locking on energization may not be available.

References of switches with locking on de-energization and unlocking on energization with emergency release by mushroom head pushbutton

To order a switch with locking on de-energization and with emergency release pushbutton replace the second number (3) with 4 in the references shown above. Example: XCSE7312 becomes XCSE7412. Some references with trigger action mushroom head pushbutton may not be available.

References of switches with 2 cable entries tapped Pg 13.5 or 1/2" NPT

To order a switch with 2 cable entries for Pg 13.5 cable gland:  
- replace the last number (2) with 1 in the selected reference. Example: XCSE5312 becomes XCSE5311.  
- for switches with 7 at the end of the reference, replace the 2 before the 7 with 1 in the selected reference. Example: XCSE73127 becomes XCSE73117.  
To order a switch with 2 cable entries for 1/2" NPT conduit:  
- replace the last number (2) with 3 in the selected reference. Example: XCSE5312 becomes XCSE5313.  
- for switches with 7 at the end of the reference, replace the 2 before the 7 with 3 in the selected reference. Example: XCSE73127 becomes XCSE73137.  
Some Pg 13 and 1/2" NPT references may not be available.

References of actuating keys

See page 73

(1) Head adjustable in 90° steps through 360°. Blanking plug for operating head slot included with switch.  
(2) A key-operated lock (2 keys included with switch) enables forced opening of the interlocking mechanism, by authorized personnel, allowing withdrawal of the actuating key and subsequent opening of the NC safety contacts (auxiliary release).  
(3) For use on 110/120 V  $\overline{\text{---}}$  or 220/240 V  $\overline{\text{---}}$ , remove the LED indicator module.  
(4) Switches supplied with a single green LED.  
(5) Actuating keys to be ordered separately (see page 73).

Other versions: please consult our Customer Care Center.

## Safety detection solutions

Safety interlock switches  
Key-operated with solenoid, turret head  
XCSE metal, 2 cable entries

Solenoid characteristics					
Load factor	100%				
Rated operational voltage	~ or --- 24 V	~ or --- 24 V	~ or --- 48 V	~ or --- 110/120 V	~ or --- 220/240 V
Voltage limits	Conforming to EN/IEC 60947-1 - 15%, + 10% of the rated operational voltage (including ripple on ---)				
Service life	20,000 hours				
Consumption	Inrush: 10 VA. Sealed: 10 VA				

LED indicator characteristics		
Rated insulation voltage	50 V conforming to EN/IEC 60947-1	250 V conforming to EN/IEC 60947-1
Current consumption	7 mA	7 mA
Rated operational voltage	~ or 24/48 V ---	110/240 V ~
Voltage limits	~ or 20...52 V --- (including ripple)	95...264 V ~ (including ripple)
Service life	100,000 hours	100,000 hours
Protection against overvoltages	Yes	Yes

### Separate components



XCSZ90

Description	For use with	Key withdrawal positions from lock	Unit reference	Weight kg
Blanking plugs for operating head slot (Sold in lots of 10)	XCSE	–	XCSZ27	0.050
Keys for forced opening of interlocking device (Sold in lots of 10)	XCSE	–	XCSZ25	0.100
Padlocking device to help prevent insertion of actuating key, for up to 3 padlocks (padlocks not included)	XCSE	–	XCSZ90	0.055



DE9RA2012

Description	For use with	Unit reference	Weight kg
1/2" NPT conduit female, M20 male adapter (Sold in lots of 5)	XCSE	DE9RA2012	0.048
M20 x 1.5 female, Pg 13.5 male adapter (Sold in lots of 5)	XCSE	DE9RP13520	0.032

### References of actuating keys

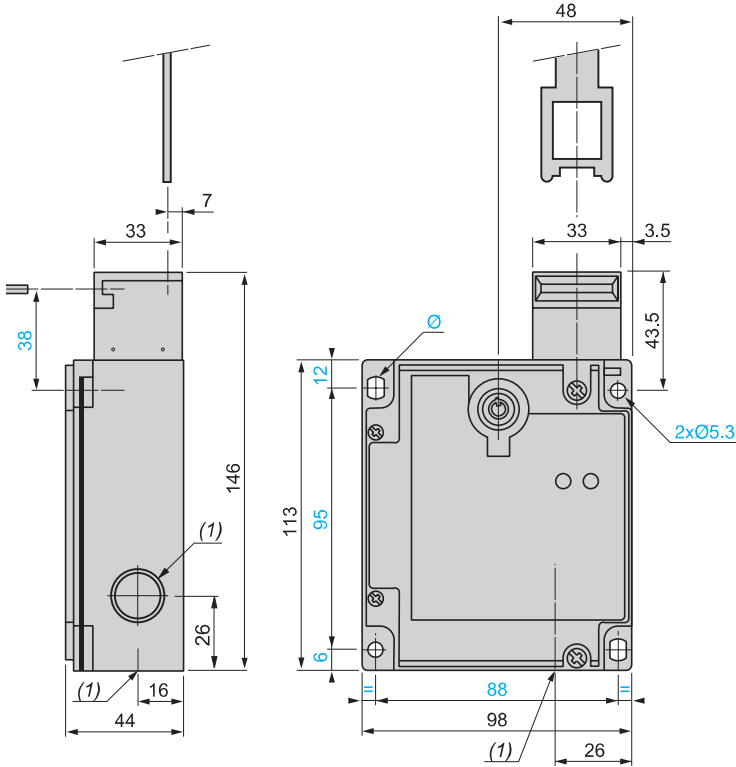


Description	Straight actuating key	Actuating key with wide fixing	Pivoting actuating key	Latch for sliding doors
For XCSE key-operated switches	XCSZ01	XCSZ02	XCSZ03	XCSZ05
Weight (kg)	0.020	0.020	0.095	0.600

#### Dimensions

#### Safety interlock switches

XCSE●●●●

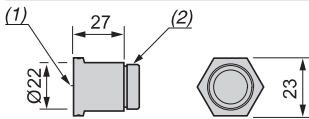


(1) 1 tapped entry for cable gland.

Ø: 2 elongated holes Ø 5.3 x 7.3

#### M20 x 1.5 adapter

DE9RP13520

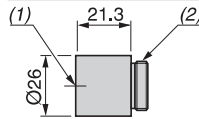


(1) M20 x 1.5 tapped entry

(2) Pg 13.5 threaded shank

#### 1/2" NPT conduit adapter

DE9RA2012

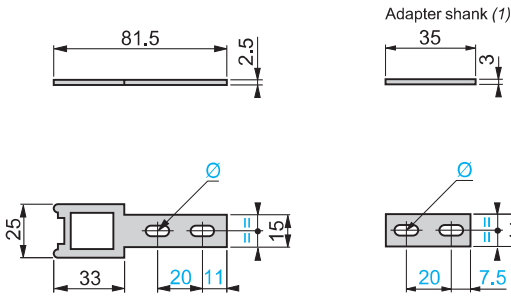


(1) Tapped entry for 1/2" NPT conduit

(2) M20 x 1.5 threaded shank

#### Actuating keys

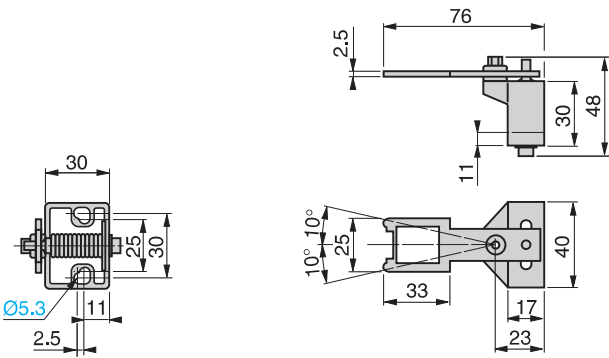
##### XCSZ01



(1) Adapter (included with XCSZ01 actuating key) for replacing, without drilling an additional fixing hole, an XCKJ guard switch with ZCKY07 actuating key by an XCSA, XCSB or XCSC guard switch with XCSZ01 actuating key.

Ø: 2 elongated holes Ø 5.3 x 10

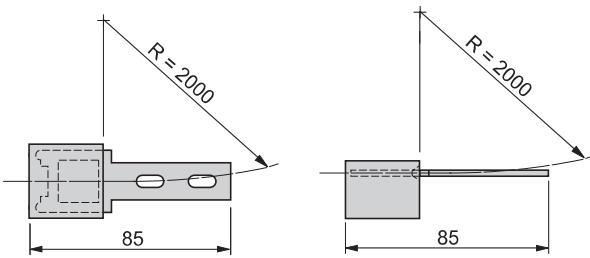
##### XCSZ03



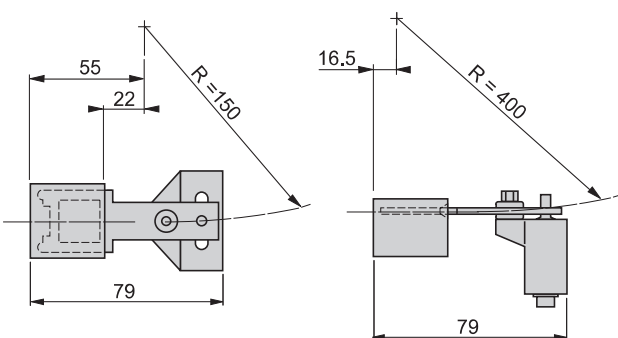
Fixing axis % related to actuating key.

#### Operating radius required for actuating key

##### XCSZ01

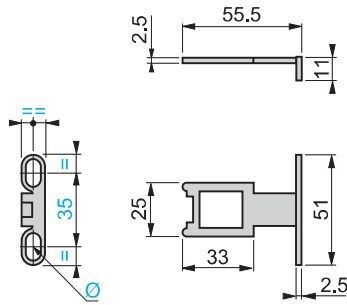


##### XCSZ03



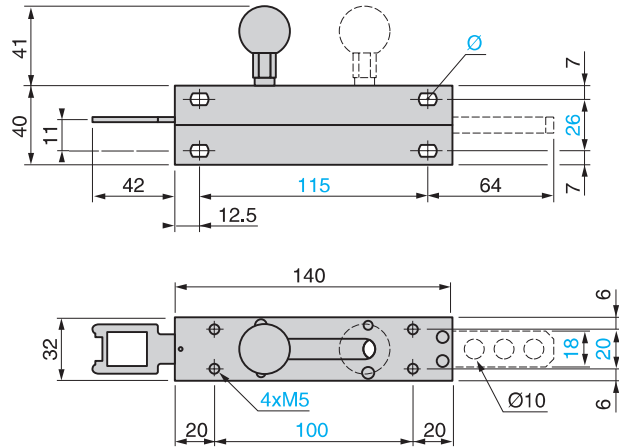
R = minimum radius

##### XCSZ02



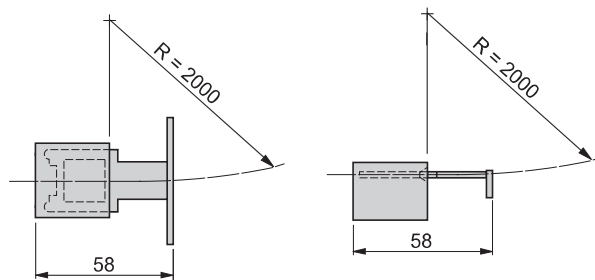
Ø: 2 elongated holes Ø 5.3 x 10

##### XCSZ05



Ø: 4 elongated holes Ø 5.3 x 7.3

##### XCSZ02

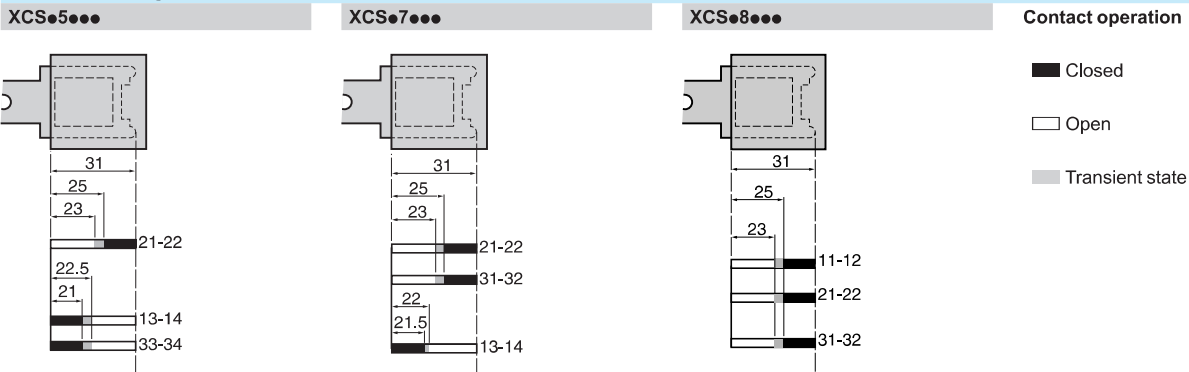


# Safety detection solutions

Safety interlock switches  
Key-operated with solenoid, turret head  
XCSE metal, 2 cable entries

## Setting-up

### Functional diagrams



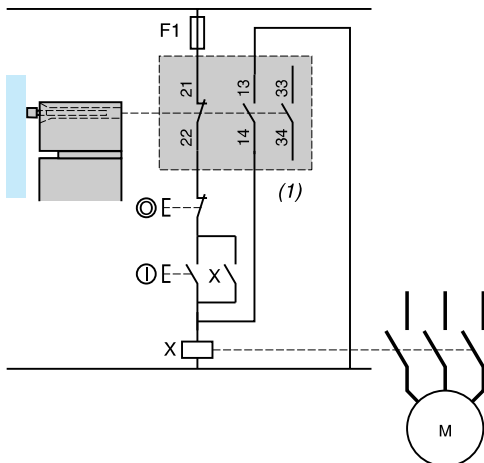
## Schemes

Contact states are represented with the actuating key inserted and the solenoid not energized.

**Note:** These schemes are given as examples only, the designer should refer to the relevant safety standards for guidance.

### Wiring to PL=b, category 1 conforming to EN/ISO 13849-1

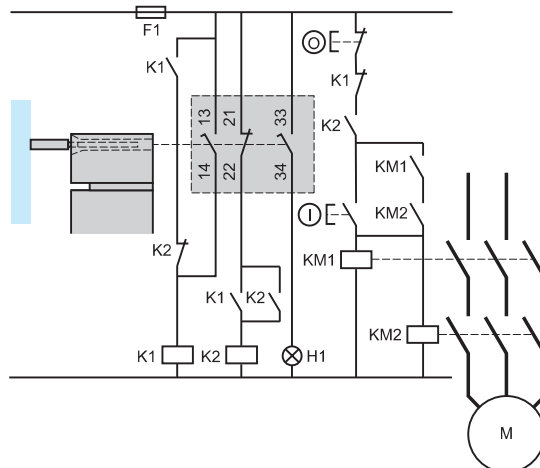
Example with 3-pole NC + NO + NO contact and protection fuse to help prevent shunting of the NC contact, due to either cable damage or tampering.



(1) Signaling contact

### Wiring to PL=d, category 3 conforming to EN/ISO 13849-1

Example with 3-pole NC + NO + NO contact with mixed redundancy of the contacts and the associated control relays. To activate K1, it is necessary to remove and re-insert the actuating key when the supply is switched on.



H1: "Actuating key not inserted" indicator

#### Schemes (continued)

Contact states are represented with the actuating key inserted and the solenoid not energized.

**Note:** These schemes are given as examples only, the designer should refer to the relevant safety standards for guidance.

#### Wiring to PL=b, category 1 conforming to EN/ISO 13849-1

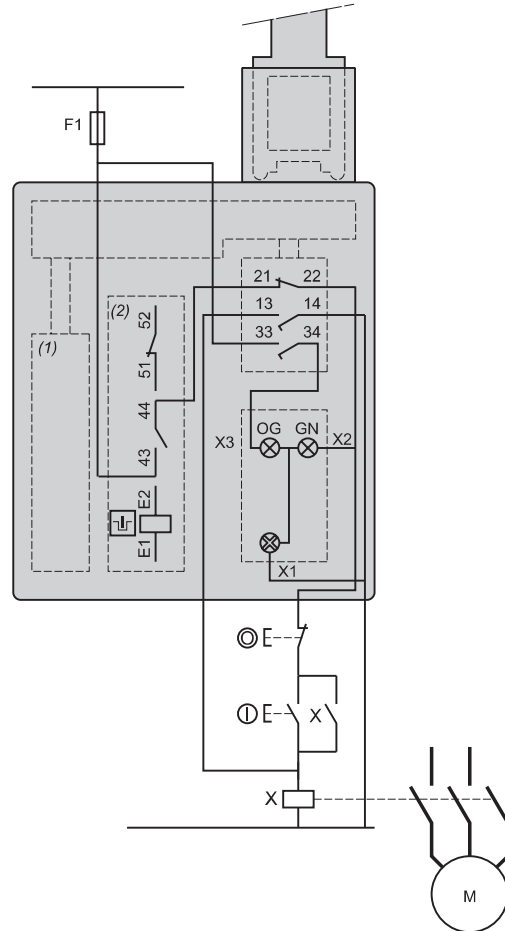
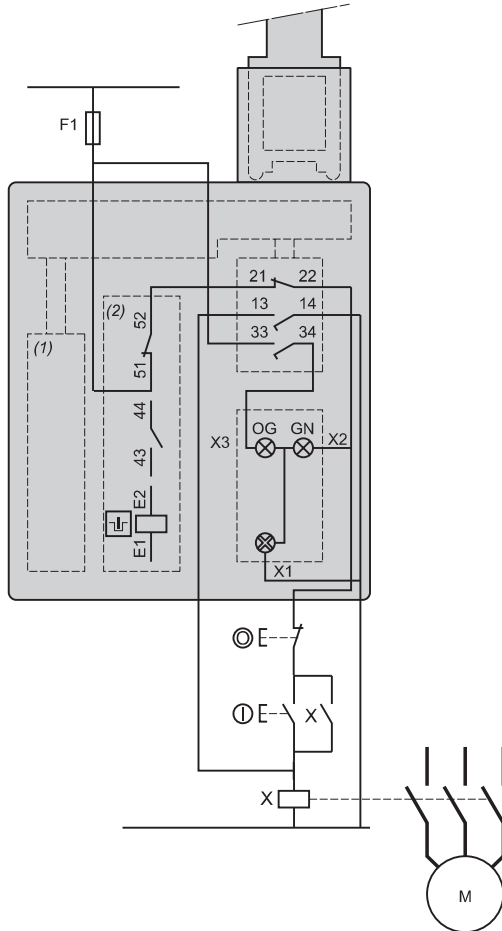
Wiring examples with protection fuse to help prevent shunting of the NC contact, due to either cable damage or tampering.

**Locking on de-energization, NC + NO + NO**

**Locking on energization, NC + NO + NO**

XCSE53●●

XCSE55●●



(1) Solenoid

(2) Auxiliary contact

E1-E2: Solenoid supply

43-44: Solenoid position signaling contact

51-52: Solenoid position monitoring contact

21-22: Safety contact: key position monitoring

33-34: Safety contact: key position signaling

13-14: Safety contact for detecting a possible shunt on 21-22 NC contact

33-X1: LED (orange): key withdrawn

51-X1: LED (green): key inserted and locked

21-52: Safety pre-wiring mandatory

(1) Solenoid

(2) Auxiliary contact

E1-E2: Solenoid supply

43-44: Solenoid position signaling contact

51-52: Solenoid position monitoring contact

21-22: Safety contact: key position monitoring

33-34: Safety contact: key position signaling

13-14: Safety contact for detecting a possible shunt on 21-22 NC contact

33-X1: LED (orange): key withdrawn

43-X1: LED (green): key inserted and locked

21-44: Safety pre-wiring mandatory



# Safety detection solutions

## Safety interlock switches

Key-operated with solenoid, turret head

XCSE metal, 2 cable entries

### Schemes (continued)

Contact states are represented with the actuating key inserted and the solenoid not energized.

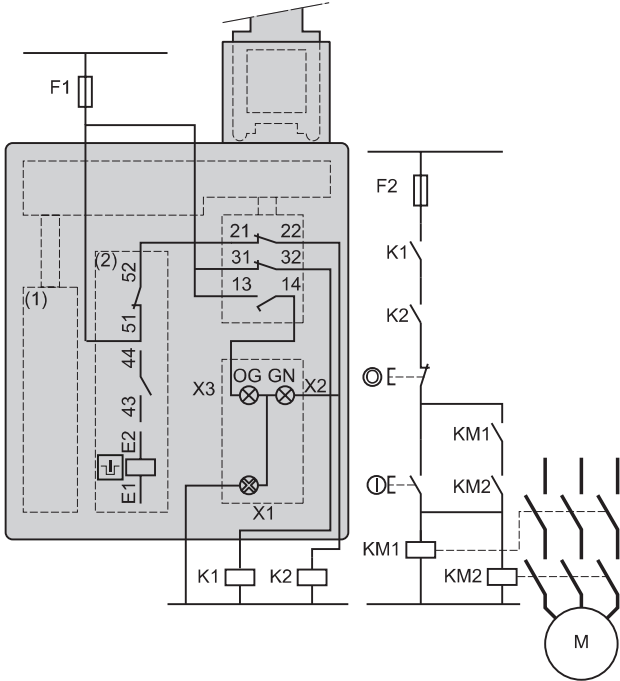
**Note:** These schemes are given as examples only, the designer should refer to the relevant safety standards for guidance.

#### Wiring to PL=d, category 3 conforming to EN/ISO 13849-1

Wiring examples with redundancy for the safety interlock switch contacts, without monitoring or redundancy in the power circuit

Locking on de-energization, NC + NC + NO

XCSE73●●



(1) Solenoid

(2) Auxiliary contact

E1-E2: Solenoid supply

21-22 and 31-32: Redundant safety contacts, key position monitoring

13-14: Safety contact, key position signaling

51-52: Solenoid position monitoring contact

43-44: Solenoid position signaling contact

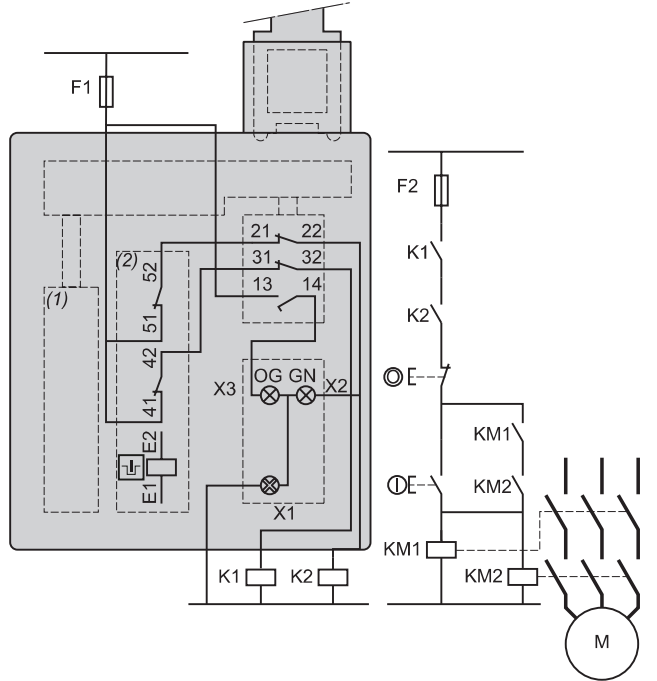
13-X1: LED (orange): key withdrawn

51-X1: LED (green): key inserted and locked

21-52: Safety pre-wiring mandatory dimensions: page 72

Locking on de-energization, NC + NC + NO

XCSE73●●7



(1) Solenoid

(2) Auxiliary contact

E1-E2: Solenoid supply

21-22 and 31-32: Redundant safety contacts, key position monitoring

13-14: Safety contact, key position signaling

41-42 and 51-52: Redundant contacts, Solenoid position monitoring

13-X1: LED (orange): key withdrawn

51-X1: LED (green): key inserted and locked

21-52 and 42-31: Safety pre-wiring mandatory

#### Schemes (continued)

Contact states are represented with the actuating key inserted and the solenoid not energized.

**Note:** These schemes are given as examples only, the designer should refer to the relevant safety standards for guidance.

#### Wiring to PL=d, category 3 conforming to EN/ISO 13849-1

Wiring examples with redundancy for the safety interlock switch contacts, without monitoring or redundancy in the power circuit

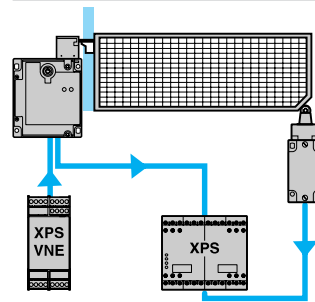
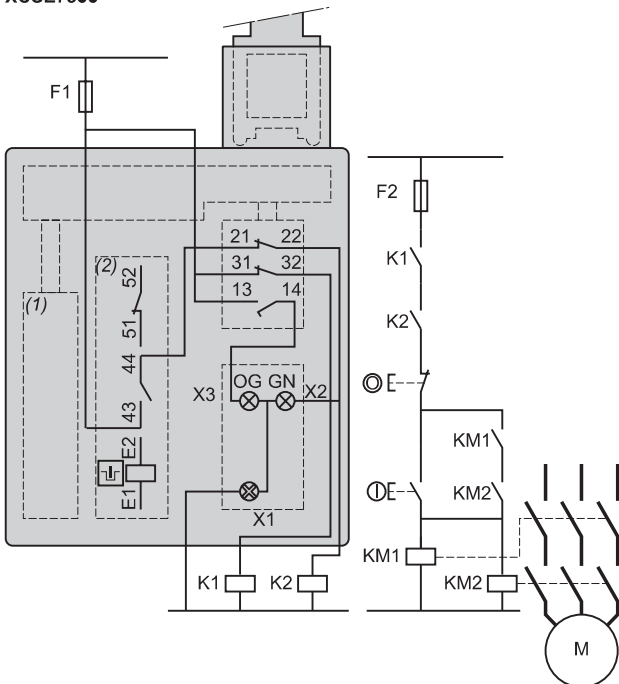
#### Wiring to PL=e, category 4 conforming to EN/ISO 13849-1 and SIL 3 conforming to EN/IEC 61508. Wiring method used in conjunction with a control unit

(The safety interlock switch should be used in conjunction with a safety limit switch to give electrical/mechanical redundancy).

#### Locking on energization, NC + NC + NO

XCSE75●●

#### Method for machines with long rundown time (high inertia)



Interlocking device for actuating key fitted on guard and zero speed detection.

(1) Solenoid

(2) Auxiliary contact

E1-E2: Solenoid supply

21-22 and 31-32: Redundant safety contacts, key position monitoring

13-14: Safety contact, key position signaling

43-44: Solenoid position monitoring contact

51-52: Solenoid position signaling contact

13-X1: LED (orange): key withdrawn

43-X1: LED (green): key inserted and locked

21-44: Safety pre-wiring mandatory