

## S20 Safety Switches



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1	About this document .....	5
1.1	Other applicable documents .....	5
1.2	Used symbols and signal words .....	6
2	Safety .....	7
2.1	Approved purpose and foreseeable improper operation .....	8
2.1.1	Proper use .....	8
2.1.2	Foreseeable misuse .....	9
2.2	Competent personnel .....	10
2.3	Responsibility for safety .....	10
2.4	Exemption of liability .....	10
3	Device description .....	11
4	Functions .....	14
5	Applications .....	15
6	Mounting .....	16
6.1	Adjusting the deflection head .....	16
6.2	Mounting the Safety Switch .....	17
6.3	Mounting the actuator .....	18
7	Electrical connection .....	20
7.1	Connecting the contact block .....	20
8	Setting the device into service .....	24
9	Testing .....	25
9.1	To be performed prior to the initial start-up by competent personnel .....	25
9.2	To be performed periodically by competent personnel .....	25
9.3	To be performed daily by the operating personnel .....	26
10	Cleaning .....	27
11	Disposing .....	28
12	Service and support .....	29
13	Accessories .....	30
13.1	Accessory dimensional drawings .....	31
14	Technical data .....	35

15    EC Declaration of Conformity ..... 38

## 1 About this document

### 1.1 Other applicable documents

The information on the S20 Safety Switch is divided into two documents. Document "S20 Application information" contains only the most important safety notices.

- ✎ For the safe implementation, testing and operation, download document S20 Safe implementation and operation from <http://www.leuze.com/s20/> or request it from [service.schuetzen@leuze.de](mailto:service.schuetzen@leuze.de) or tel. +49 8141 5350-111.

Table 1.1: Documents on the S20 Safety Switch

Purpose and target group	Title	Source
Detailed information for all users	S20 Safe implementation and operation (this document)	On the Internet, download from: <a href="http://www.leuze.com/s20/">http://www.leuze.com/s20/</a>
Basic information for technicians and operating company	S20 Application information	Print document part no. 607234 included in the delivery contents of the product

## 1.2 Used symbols and signal words

Table 1.2: Warning symbols and signal words

	Symbol for dangers
NOTICE	Signal word for property damage Indicates dangers that may result in property damage if the measures for danger avoidance are not followed.
CAUTION	Signal word for minor injury Indicates dangers that may result in minor injury if the measures for danger avoidance are not followed.
WARNING	Signal word for severe injury Indicates dangers that may result in severe or fatal injury if the measures for danger avoidance are not followed.
DANGER	Signal word for life-threatening danger Indicates dangers that will result in severe or fatal injury if the measures for danger avoidance are not followed.

Table 1.3: Other symbols

	Symbol for tips Text passages with this symbol provide you with further information.
	Symbols for action steps Text passages with this symbol instruct you to perform actions.
xxx	Placeholder in the product description for all variants

## 2 Safety

Before using the Safety Switch, a risk evaluation must be performed according to valid standards (e.g. EN ISO 12100-1, EN ISO 13849-1, EN ISO 14121). For mounting, operating and testing, document S20 Safe implementation and operation, application information as well as all applicable national and international standards, regulations, rules and directives must be observed. Observe and print out relevant and supplied documents and distribute to the affected personnel.

The following standards apply for the risk evaluation at the protective device prior to using the Safety Switch:

- EN ISO 14121, Safety of machinery, risk evaluation
- EN ISO 12100-1, Safety of machinery
- EN ISO 13849-1, Safety-related parts of control systems

The realizable category of integration in control circuits acc. to EN ISO 13849-1 is dependent on the used contact block, wiring and mechanical conditions.

In particular, the following national and international legal regulations apply for the start-up, technical inspections and work with Safety Switch:

- Machinery directive 2006/42/EC
- Low voltage directive 2006/95/EC
- Use of work equipment directive 89/655 EEC
- Safety regulations
- Accident-prevention regulations and safety rules
- Ordinance on Industrial Safety and Health and Labor Protection Act
- Device Safety Act



For safety-related information you may also contact the local authorities (e.g., industrial inspectorate, employer's liability insurance association, labor inspectorate, labor protection and health authority).

## 2.1 Approved purpose and foreseeable improper operation

### 2.1.1 Proper use

- The Safety Switch must only be used after it has been selected in accordance with the respectively applicable instructions and relevant standards, rules and regulations regarding labor protection and safety at work, and after it has been installed on the machine, connected, commissioned, and checked by a **competent person**.
- When selecting the Safety Switch it must be ensured that its safety-related capability meets or exceeds the required performance level PL, ascertained in the risk assessment.
- It must be in perfect condition and inspected regularly.
- The switching process must only be triggered by an actuator approved for this Safety Switch that is connected to the moveable guard in a non-detachable and tamperproof manner.



#### **WARNING**

##### **A running machine can cause severe injuries!**

↳ Make certain that, during all conversions, maintenance work and inspections, the system is securely shut down and protected against being restarted again.

S20 Safety Switches must be connected in such a way that a dangerous state can only be activated while the protective device is closed and so that the dangerous state stops upon opening of the protective device. It must not be used if the point of operation can be accessed during the lag time before the dangerous state has ended.

Connection conditions:

- the dangerous state can only be activated while the protective device is closed
- opening the protective device while the machine is running triggers a stop command and ends the dangerous state

Furthermore, the S20 Safety Switch must **not** be used under the following conditions:

- high concentration of dust particles in the surrounding area
- rapidly changing ambient temperature (leads to condensation)
- in the event of strong physical shocks
- in explosive or easily flammable atmospheres
- the mounting locations are not sufficiently stable
- the safety of multiple persons is dependent on the function of this Safety Switch (e.g. nuclear power plants, trains, aircraft, motor vehicles, incinerators, medical devices)



For machines with longer slowdowns, a Safety Locking Device must be used.

Handling the Safety Switch:

- ↯ Observe the permissible environmental conditions for storage and operation (see chapter 14).
- ↯ Immediately replace damaged Safety Switch according to these instructions (see chapter 6).
- ↯ Use cable gland, insulation materials and connecting wires of the appropriate protection rating.
- ↯ Protect the Safety Switch from penetrating foreign bodies (e.g. shavings, sand and blasting agent).
- ↯ Before performing painting work, cover the actuation slot, actuator and name plate.
- ↯ Immediately clean any contamination from the Safety Switch that impacts function according to these instructions.
- ↯ Make no structural changes to the Safety Switch.
- ↯ The Safety Switch must be exchanged after a maximum of 20 years.

### 2.1.2 Foreseeable misuse

Any use other than that defined under the "approved purpose" or which goes beyond that use of the Safety Switch is considered improper use!

E.g. - using without non-detachably mounted actuator

- looping into the safety circuit parts that are not relevant to safety
- using the switch as a limit stop

## 2.2 Competent personnel

Prerequisites for competent personnel:

- suitable technical training
- knows the rules and regulations for labor protection, safety at work and safety technology and can assess the safety of the machine
- knows the instructions for the Safety Switch and the machine
- was instructed by the responsible individuals on the mounting and operation of the machine and of the Safety Switch

## 2.3 Responsibility for safety

Manufacturer and operating company must ensure that the machine and implemented Safety Switch function properly and that all affected persons are adequately informed and trained.

The type and content of all imparted information must not lead to unsafe actions by users.

The manufacturer of the machine is responsible for:

- safe machine construction
- safe implementation of the Safety Switch
- imparting all relevant information to the operating company
- adhering to all regulations and directives for the safe starting-up of the machine

The operating company is responsible for:

- instructing the operating personnel
- maintaining the safe operation of the machine
- adhering to all regulations and directives for labor protection and safety at work
- regular testing by competent personnel

## 2.4 Exemption of liability

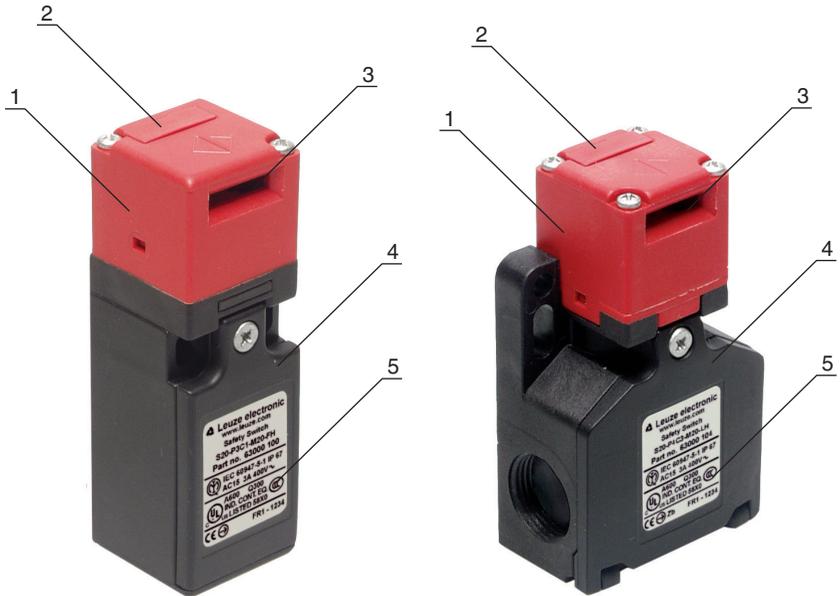
Leuze electronic GmbH + Co. KG is not liable in the following cases:

- Safety Switch is not used as intended
- safety notices are not adhered to
- mounting and electrical connection are not properly performed
- reasonably foreseeable misuse is not taken into account

**3 Device description**

The Safety Switch of the S20 series is an electro-mechanical switching device in a housing made of glass-fibre-reinforced and non-combustible plastic; the device satisfies protection rating IP 67. The standard design facilitates easy replacement. By means of the funnel-shaped insertion opening, the actuator self-centers, even if the door is slightly misadjusted.

Models with different contact sets with screw terminals or M12 plug connection as well as 10 N or 30 N extraction force are available.



- 1 Deflection head
- 2 Dust cover
- 3 Insertion opening for actuator
- 4 Housing cover
- 5 Name plate (connection data, production code and year of manufacture)

Table 3.1: S20 Safety Switch

Article	Part No.	Description
S20-P3C1-M20-FH	63000100	2NC, 1 cable entry
S20-P1C1-M20-FH	63000101	1NC + 1NO, 1 cable entry
S20-P4C1-M20-FH	63000103	2NC + 1NO, 1 cable entry
S20-P1C3-M20-LH	63000102	1NC + 1NO, 3 cable entries
S20-P4C3-M20-LH	63000104	2NC + 1NO, 3 cable entries
S20-P4C1-M20-FH30	63000105	2NC + 1NO, 1 cable entry, 30 N extraction force
S20-P4C1-M12-FH	63000106	2NC + 1NO, 1 cable entry / M12 plug

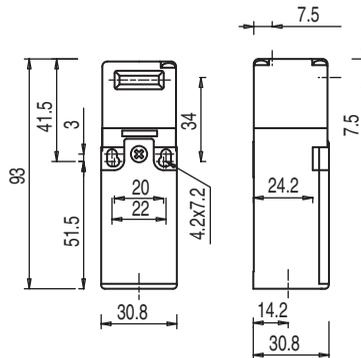


Figure 3.1: Dimensions of S20-P3C1-M20-FH, S20-P1C1-M20-FH30 and S20-P4C1-M20-FH in mm

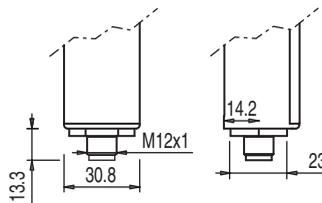


Figure 3.2: Dimensions of S20-P4C1-M12-FH in mm (M12 plug dimensions)

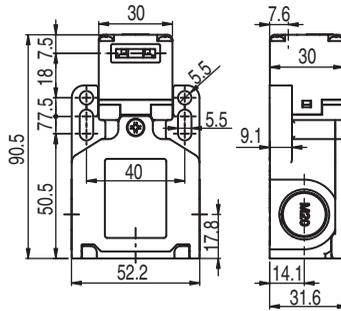


Figure 3.3: Dimensions of S20-P1C3-M20-LH and S20-P4C3-M20-LH in mm

The deflection head can be turned in 90° increments and set to 5 approach directions. A selection of different actuators ensures that the Safety Switch can be mounted in any position.

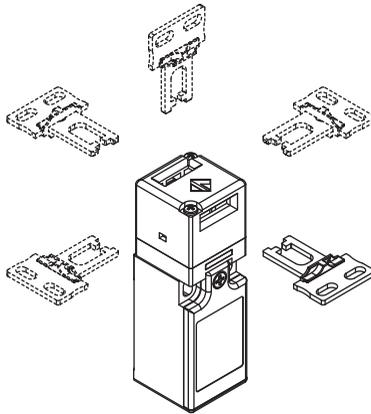


Figure 3.4: Approach directions

## **4 Functions**

The Safety Switch signals to the safety switching device whether the protective device is closed. Moving the actuator in closes the safety contacts; moving the actuator out forces the safety contacts to open (e.g. upon opening of the protective device). As a result, the machine can only be switched on if the protective device is closed.

## **5 Applications**

The Safety Switch can be used for e.g. the following protective devices:

- turning or swiveling moveable guards
- laterally moveable protective gratings or sliding gates
- protective flaps

## 6 Mounting



### WARNING

**Severe accidents may result if the Safety Switch is not mounted properly!**

The protective function of the Safety Switch is only ensured if appropriately and professionally mounted for the respective, intended area of application.

- ↪ Mounting may only be performed by competent personnel.
- ↪ Observe standards, regulations and these instructions.
- ↪ Protect the housing and deflection head from materials penetrating the enclosure (environmental conditions (see chapter 14)).
- ↪ Test to ensure proper function.

### 6.1 Adjusting the deflection head

- ↪ Loosen the 2 screws on the deflection head.



- ↪ Lift the deflection head and turn in the desired approach direction.



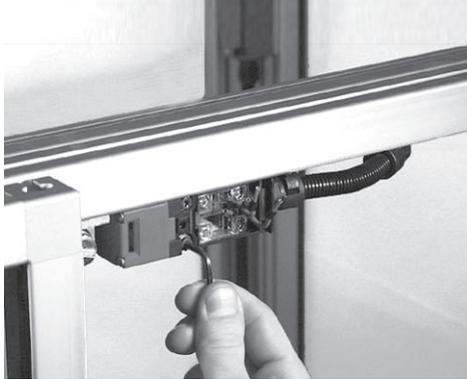
- ↪ Tighten the 2 screws on the deflection head with 0.7–0.9Nm.
- ↪ Close unused opening with the dust cover.

## 6.2 Mounting the Safety Switch

Prerequisites for mounting:

- deflection head has been set
  - fully assembled
- ↪ Select the mounting location so that the following conditions are satisfied:
- Safety Switch and actuator can be well matched to one another mechanically and can be permanently mounted
  - accessible to qualified personnel for testing and replacement
  - difficult to access by operating personnel while the protective device is open

- ↪ Position washers and screw down Safety Switch with 2–3Nm.



### 6.3 Mounting the actuator

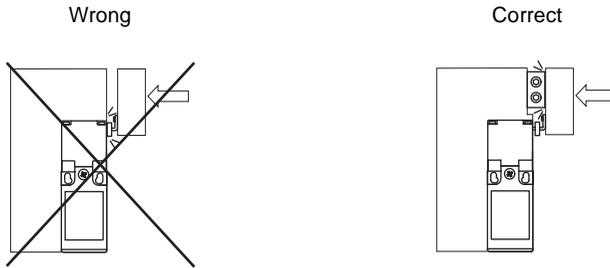
**NOTICE**

**The Safety Switch may be damaged if mounted improperly!**

- ↪ Use separate mechanical limit stop for the moving part of the protective device.
- ↪ Align actuator so that it does not hit or rub against the edges of the insertion opening.

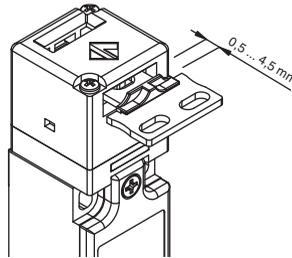
Prerequisites for proper function:

- actuator is not deformed or damaged
  - actuator is suitable for the Safety Switch
- Proper function is ensured only with original accessories (see chapter 13).



↪ Align actuator.

Play for the actuator in the closed state: 0.5–4.5 mm.



↪ Secure actuator with rivets or tamperproof screws so that it cannot be detached.



## 7 Electrical connection

 **WARNING**

**Serious accidents may result if the electrical connection is faulty!**

↘ Electrical connection may only be performed by competent personnel.

### 7.1 Connecting the contact block

 **DANGER**

**Risk of death by electric shock!**

↘ Interrupt the voltage supply to the Safety Switch.

Prerequisites for the electrical connection:

- temperature stability of the cable insulation material must be greater than the maximum temperature of the housing (see chapter 14)
- cable gland with appropriate protection rating
- maximum current load is observed (see chapter 14)

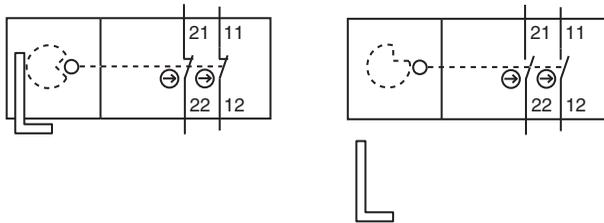


Figure 7.1: Contact block 2NC (S20-P3xxx)

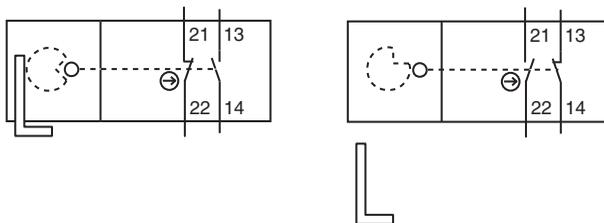


Figure 7.2: Contact block 1NC + 1NO (S20-P1xxx)

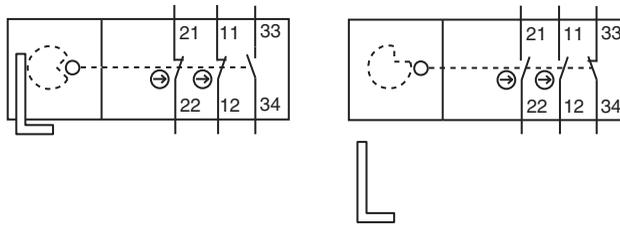


Figure 7.3: Contact block 2NC + 1NO (S20-P4xxx)

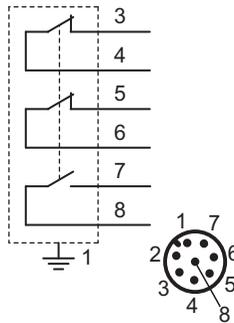
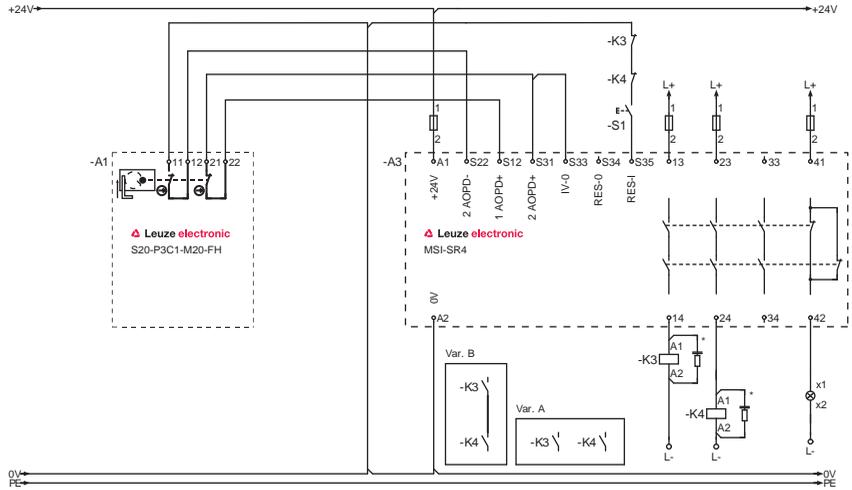


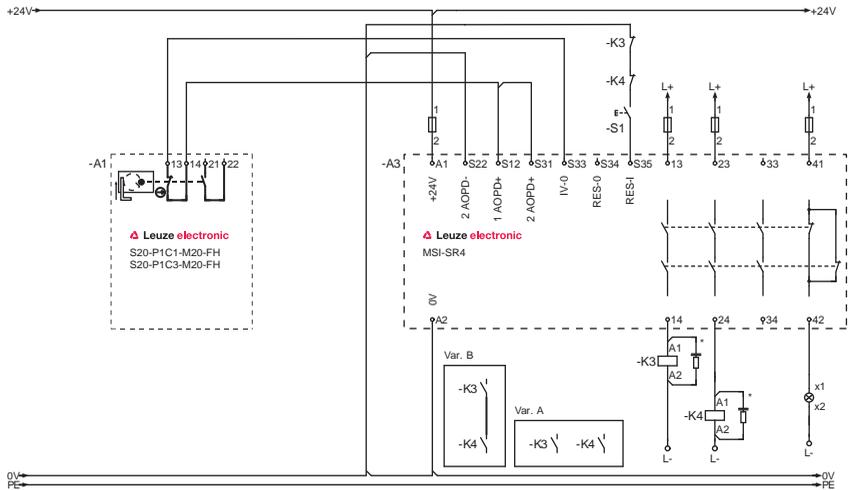
Figure 7.4: Pin assignment of the 8-pin M12 plug (S20-xxx-M12-xxx)

- ✦ Unscrew the housing cover.
- ✦ Connect the contact block according to the circuit diagram.



\* Spark extinction circuit, suitable spark extinction provided

Figure 7.5: Connection example S20-P3C1-M20-FH



\* Spark extinction circuit, suitable spark extinction provided

Figure 7.6: Connection example S20-P1C1-M20-FH

- ↪ Tighten cable terminal screws with 0.6–0.8Nm.



- ↪ Tighten the housing cover with 0.7–0.9Nm.



## **8 Setting the device into service**

Prerequisites:

- Safety Switch is mounted and connected according to these instructions
- operating personnel have been trained in the correct use

↳ Test the function of the Safety Switch (see chapter 9).

The Safety Switch is then ready for use.

**9 Testing**

S20 Safety Switches are maintenance free. Nevertheless, they must be replaced after maximum 1,000,000 switching cycles.

- ↖ Always replace the entire Safety Switch including actuator.
- ↖ For the testing intervals, observe nationally applicable regulations.
- ↖ Document all tests in a comprehensible manner.

**9.1 To be performed prior to the initial start-up by competent personnel**

- ↖ Check whether the Safety Switch is operated according to its specified environmental conditions (see chapter 14).
- ↖ Test to ensure proper mechanical and electrical function (see chapter 9.2).

**9.2 To be performed periodically by competent personnel**

**Mechanical function**

- ↖ Stop the dangerous state and open the protective device.
- ↖ Check that the components are securely fastened.
- ↖ Test the cable entry for leaks.
- ↖ Check Safety Switch and actuator for damage, deposits, deformation and wear.
- ↖ Test several times whether the actuator can be easily moved into the Safety Switch.

**Electrical function**

	<b>WARNING</b>
<b>Severe accidents may result if tests are not performed properly!</b>	
↖ Make certain that there are no persons in the danger zone.	

- ↖ Stop the dangerous state and open the protective device.
- ↖ Make certain that the machine cannot be started while the protective device is open.
- ↖ Close the protective device and start the machine.
- ↖ Test several times whether the machine stops upon opening of the protective device.

- ↵ Test whether the dangerous state ends before the point of operation can be reached.

### 9.3 To be performed daily by the operating personnel



#### **WARNING**

**Severe accidents may result if tests are not performed properly!**

- ↵ Make certain that there are no persons in the danger zone.
- ↵ Stop the dangerous state and open the protective device.
- ↵ Check the Safety Switch and actuator for damage or tampering.
- ↵ Make certain that the machine cannot be started while the protective device is open.
- ↵ Close the protective device and start the machine.
- ↵ Test whether the machine stops upon opening of the protective device.

## 10 Cleaning

There must be no soiling (e.g. shavings and dust) present, especially in the deflection head of the Safety Switch.

Prerequisites for cleaning:

- protective device is opened and machine is switched off
  - voltage supply to the Safety Switch is interrupted
- ↪ Periodically clean the Safety Switch while the protective device is opened (e.g. with vacuum cleaner).

## 11 Disposing

- ↪ The nationally valid regulations for electro-mechanical components are to be observed when disposing.

## 12 Service and support

Telephone number for 24-hour standby service:  
+49 (0) 7021/ 573-0

Service hotline:  
+49 (0) 8141/ 5350-111  
Monday to Thursday, 8.00 a.m. to 5.00 p.m. (UTC+1)  
Friday, 8.00 a.m. to 16.00 p.m. (UTC +1)

E-mail:  
service.protect@leuze.de Return address for repairs: Service Center  
Leuze electronic GmbH + Co. KG  
In der Braike 1  
D-73277 Owen - Teck / Germany



Leuze electronic offers a regular safety inspection by a competent person.

## 13 Accessories

Table 13.1: Actuators of the AC-AN series for the S20 Safety Switch

Article	Part No.	Description
AC-AN-S	63000700	Straight
AC-AN-A	63000701	Angled
AC-AN-F4	63000702	Straight, flexible in 4 directions
AC-AN-F2J2	63000703	Straight, flexible in 2 directions, alignable in 2 directions
AC-AN-SL	63000704	Straight, long
AC-AN-AL	63000705	Angled, long
AC-AN-F1J2	63000706	Straight, flexible in 1 direction, alignable in 2 directions
AC-AN-ASH	63000707	Angled, short

Table 13.2: Accessories for the S20 Safety Switch

Article	Part No.	Description
AC-A-M20-12NPT	63000843	Adapter, M20 x 1.5 on 1/2 NPT
AC-PLP-8	63000844	Built-in plug, M12, plastic, with internal 8-pin connection cable
CB-M12-5000E-5GF	678055	PUR, 5-pin, 5 m, shielded, M12 coupling, straight, prefabricated on one end
CB-M12-10000E-5GF	678056	PUR, 5-pin, 10 m, shielded, M12 coupling, straight, prefabricated on one end
CB-M12-15000E-5GF	678057	PUR, 5-pin, 15 m, shielded, M12 coupling, straight, prefabricated on one end
CB-M12-25000E-5GF	678058	PUR, 5-pin, 25 m, shielded, M12 coupling, straight, prefabricated on one end
CB-M12-5000E-8GF	678060	PUR, 8-pin, 5 m, shielded, M12 coupling, straight, prefabricated on one end

Article	Part No.	Description
CB-M12-10000E-8GF	678061	PUR, 8-pin, 10 m, shielded, M12 coupling, straight, prefabricated on one end
CB-M12-15000E-8GF	678062	PUR, 8-pin, 15 m, shielded, M12 coupling, straight, prefabricated on one end
CB-M12-25000E-8GF	678063	PUR, 8-pin, 25 m, shielded, M12 coupling, straight, prefabricated on one end

**13.1 Accessory dimensional drawings**

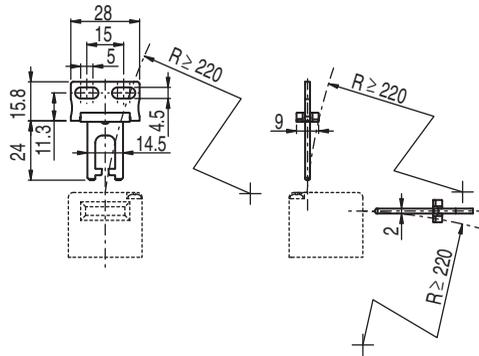


Figure 13.1: AC-AN-S actuator

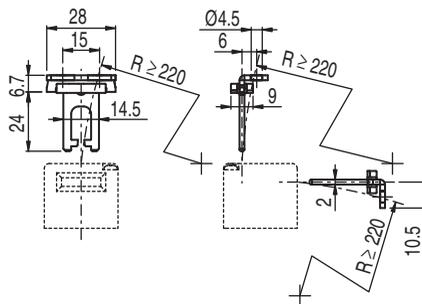


Figure 13.2: AC-AN-A actuator

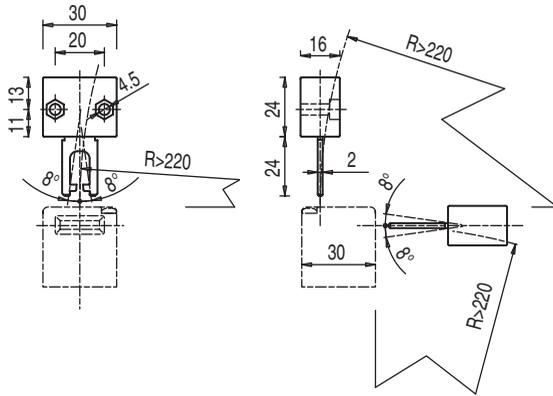


Figure 13.3: AC-AN-F4 actuator

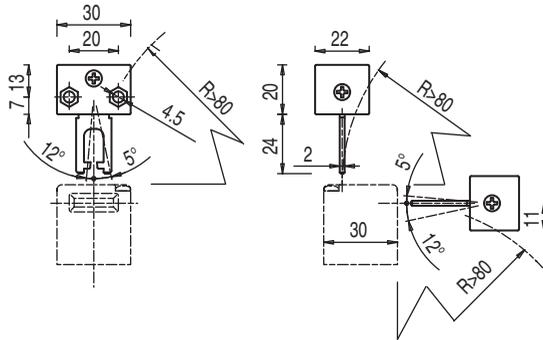


Figure 13.4: AC-AN-F2J2 actuator

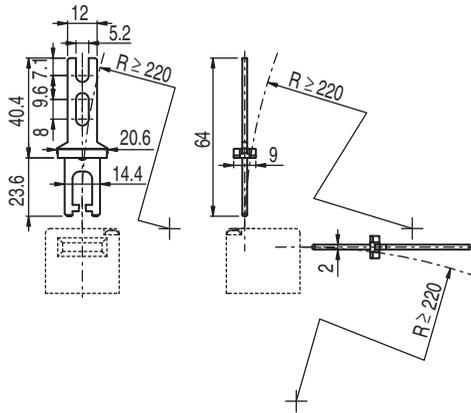


Figure 13.5: AC-AN-SL actuator

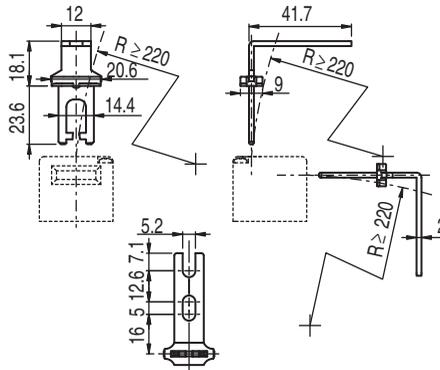


Figure 13.6: AC-AN-AL actuator

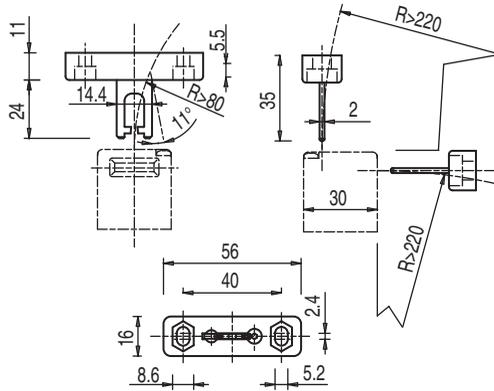


Figure 13.7: AC-AN-F1J2 actuator

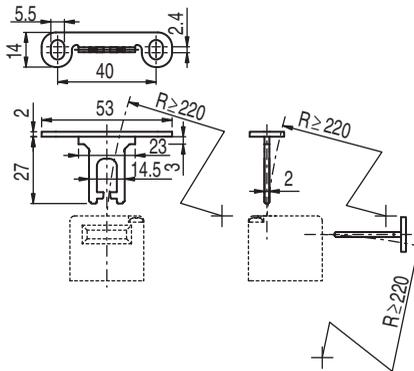


Figure 13.8: AC-AN-ASH actuator

**14 Technical data**

Table 14.1: General

Switch type	Interlock device without guard interlocking in accordance with EN 1088
Actuator, external	AC-AN series: straight, angled, resilient, alignable
Approach actuation directions	1 x above, 4 x side (90°)
Approach speed	min. 1 mm/s, max. 0.5m/s
Actuation force (pull-out)	S20-P3xxx: 10N S20-P1xxx: 10N S20-P4xxx: 10N S20-P4C1-M20-FH30: 30N
Actuating path with forced separation	S20-P3xxx: S20- min. 9.0mm P1xxx: min. 7.2mm S20-P4xxx: min. 7.8mm
Mechanical life time according to IEC 60947-5-1	1,000,000 switching cycles
Actuation frequency in accordance with IEC 60947-5-1	max. 3600 per hour
Service life ( $T_M$ ) in accordance with EN ISO 13849-1	20 years
Number of cycles until the dangerous failure (B10d) in accordance with EN 61810-2	2,000,000

Usage category in accordance with EN 60947-5-1 with screw terminal connection	AC 15: (U <sub>e</sub> / I <sub>e</sub> ) 250 V / 6 A 400 V / 4 A 500 V / 1 A  DC 13: (U <sub>e</sub> / I <sub>e</sub> ) 24 V / 6 A 125 V / 1.1 A 250 V / 0.4 A
Maximum load when using 5-pin cables: Maximum load when using 8-pin cables:	24 V / 4 A (see chapter 13) 24 V / 2 A (see chapter 13)
Usage category in accordance with EN 60947-5-1 with M12 plug connection	AC 15: (U <sub>e</sub> / I <sub>e</sub> ) 24 V / 2 A  DC 13: (U <sub>e</sub> / I <sub>e</sub> ) 24 V / 2 A
Dimensions (dimensional drawings)	see chapter 3

Table 14.2: Safety

Protection rating	IP 67
Contact protection	protective insulation O
Recoil tolerance	4.5 mm
Contact allocation	S20-P3xxx: 2NC S20-P1xxx: 1NC + 1NO S20-P4xxx: 2NC + 1NO
Contact material	silver alloy
Switching principle	slow-action contact
Opening of contact	positive-forced
Rated insulation voltage with screw terminal connection	400 VAC, 600 VDC
Rated insulation voltage with M12 plug connection	30 VAC, 36 VDC
Conventional thermal current with screw terminal connection	max. 10 A

Conventional thermal current with M12 plug connection	max. 2 A
Short circuit protection in accordance with IEC 60269-1 with screw terminal connection	10A, 500V, type aM
Short circuit protection in accordance with IEC 60269-1 with M12 plug connection	2A, 500V, type gG

Table 14.3: Housing

Housing material	fiberglass-reinforced, thermo-plastic plastic, self-extinguishing
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Table 14.4: Connection

Number of cable entries	S20-P3C1-xxx: 1 S20-P1C1-xxx: 1 S20-P4C1-xxx: 1 S20-P1C3-xxx: 3 S20-P4C3-xxx: 3
Type of cable entry	M20 x 1.5
Conductor cross-section (stranded) with screw terminal connection	1 x 0.5mm <sup>2</sup> to 2 x 2.5mm <sup>2</sup>

Table 14.5: Environment

Temperature range, operation	-25 ... +80°C
Degree of contamination, external, according to EN 60947-1	3



These tables do not apply in combination with additional M12 plug or connecting cable except where these components are explicitly mentioned.

15 EC Declaration of Conformity

the sensor people

EG-KONFORMITÄTS-ERKLÄRUNG	EC DECLARATION OF CONFORMITY	DECLARATION CE DE CONFORMITE
Der Hersteller	The Manufacturer	Le constructeur
<p><b>Leuze electronic GmbH + Co. KG</b>                      In der Braike 1, PO Box 1111                      73277 Owen, Germany</p> <p>erklärt, dass die nachfolgend aufgeführten Produkte den einschlägigen Anforderungen der genannten EG-Richtlinien und Normen entsprechen.</p>	<p><b>Leuze electronic GmbH + Co. KG</b>                      In der Braike 1, PO Box 1111                      73277 Owen, Germany</p> <p>declares that the following listed products fulfil the relevant provisions of the mentioned EC Directives and standards.</p>	<p>déclare que les produits identifiés suivants sont conformes aux directives CE et normes mentionnées.</p>
<p><b>Produktbeschreibung:</b>                      Sicherheits-Schalter                      S20, S200, S300, S400                      Sicherheits-Zuhaltung                      L10, L100, L200                      NOT-HALT-Befehlsgerät                      ERS200                      Seriennummer siehe Typschild</p>	<p><b>Description of product:</b>                      Safety Switch                      S20, S200, S300, S400                      Safety Locking Device                      L10, L100, L200                      E-STOP command device                      ERS200                      Part No. see name plates</p>	<p><b>Description de produit:</b>                      Interrupteur de sécurité                      S20, S200, S300, S400                      Interverrouillage de sécurité                      L10, L100, L200                      Appareil de commande d'ARRÊT D'URGENCE                      ERS200                      Art. n° voir plaques signalétiques</p>
<p><b>Angewandte EG-Richtlinie(n):</b>                      2006/42/EG                      2004/108/EG                      2006/95/EG</p>	<p><b>Applied EC Directive(s):</b>                      2006/42/EC                      2004/108/EC                      2006/95/EC</p>	<p><b>Directive(s) CE appliquées:</b>                      2006/42/CE                      2004/108/CE                      2006/95/CE</p>
<p><b>Angewandte Normen:</b></p>	<p><b>Applied standards:</b>                      EN 60947-5-1; IEC 60947-5-1</p>	<p><b>Normes appliquées:</b></p>
<p><b>Benannte Stelle / Baumusterprüfbescheinigung:</b></p>	<p><b>Notified Body / Certificate of Type Examination:</b></p>	<p><b>Organisme notifié / Attestation d'examen CE de type:</b></p>
<p><b>IMQ S.p.A.</b>                      Istituto Italiano Del Marchio Di Qualità                      Via Quintiliano 43                      I-20138 Milano</p>	<p>CAO2.03747 (S20);                      CAO2.04212 (L200);                      CAO2.03756 (S400);                      CAO2.03750 (L10-P)</p>	<p>CAO2.03748 (L100);                      CAO2.03749 (S200, S300);                      CAO2.03749 (ERS200, L10-M);</p>
<p><b>Bevollmächtigter für die Zusammenstellung der technischen Unterlagen:</b></p>	<p><b>Authorized person to compile the technical file:</b></p>	<p><b>Personne autorisée à constituer le dossier technique:</b></p>
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Owen, *06.05.10* Datum / Date / Date  Dr. Harald Grübel, Geschäftsführer / Director / Directeur

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