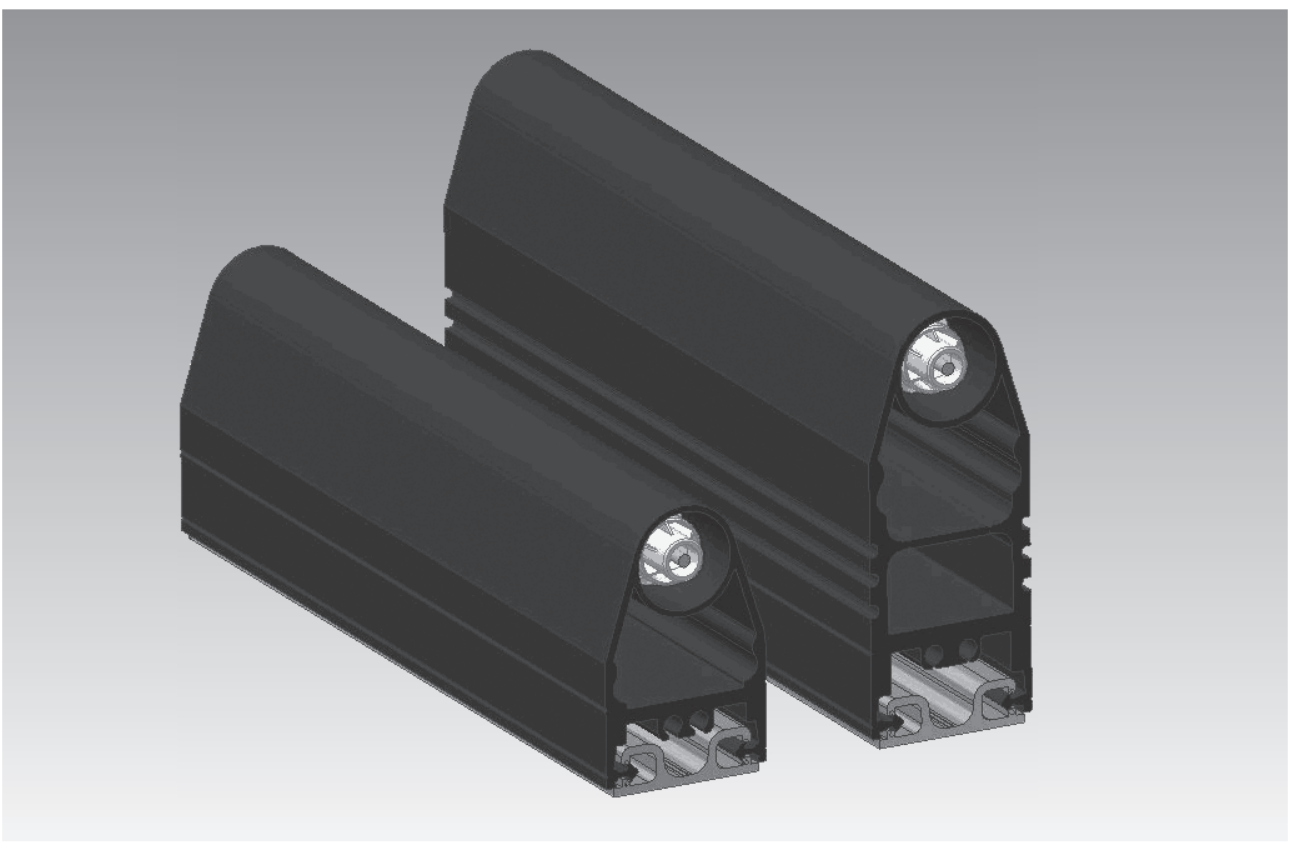


MAYSER®

Polymer Electric



Product information



Normally closed Safety Edges SL/NC II

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Important information

Read through the product information carefully. It contains important information on operation, safety and maintenance of the normally closed Safety Edge. Retain the product information for later reference.

Always observe the safety instructions on the following pages under **ATTENTION**. Only use the normally open Safety Edge for the purpose described in the product information.

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Definitions

See Definitions and Operation Principles in chapter 1 of the catalogue.

Intended use

A Safety Edge detects a person or part of the body when pressure is applied to the actuation area. It is a linear tripping device. Its task is to avoid possible hazardous situations for a person within a danger zone, such as shearing and pinching edges. Typical areas of application are door and gate systems, moving parts on machines, platforms and lifting devices.

Safe operation of a Safety Edge depends entirely on

- the surface condition of the mounting surface,
- the correct selection of the size and resistance as well as
- correct installation.

Limits

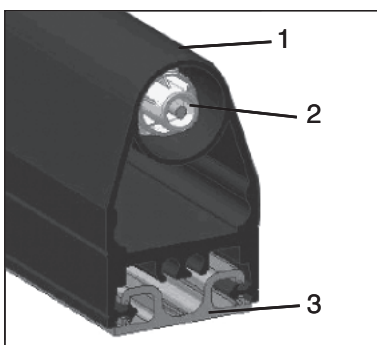
A maximum of 10 SL/NC (normally closed) Safety Edges may be connected to one signal processing.

Exclusion

The normally closed Safety Edge is not suitable:

- for detecting fingers
- for areas of application with high levels of vibration

Design



The normally closed Safety Edge SL/NC II consists of
(1) Rubber profile GP 65 EPDM or GP 100 EPDM,
(2) Contact chain made of connected positive break normally closed contacts and
(3) Aluminium profile C 36M; C 36L, C 36S or C 36.

The positive break contact chain simultaneously carries out the functions of the sensor, signal processing and output signal switching device. Therefore, a special control unit is not necessary. The downstream control must comply with at least EN 954 category 3 and have inputs for the reliable evaluation of the status of the normally closed Safety Edge.

Tip

**See EN 1760 2 Appendix E
or ISO 13856 2 Appendix E.**

ATTENTION

If automatic start-up or restart represents a danger, a corresponding reset function (e.g. start button) must be integrated in the downstream control

Tip

For the risk and safety assessment of your machine, we recommend ISO 12100

“Safety of machinery – Basic concepts, general principles for design”.

Effective actuation area

The parameters X, Y, Z, L_{NE} and the angle α describe the effective actuation area.

For the effective actuation area, the following applies:

$$L_{WB} = L_{SL} - 2 \times L_{NE}$$

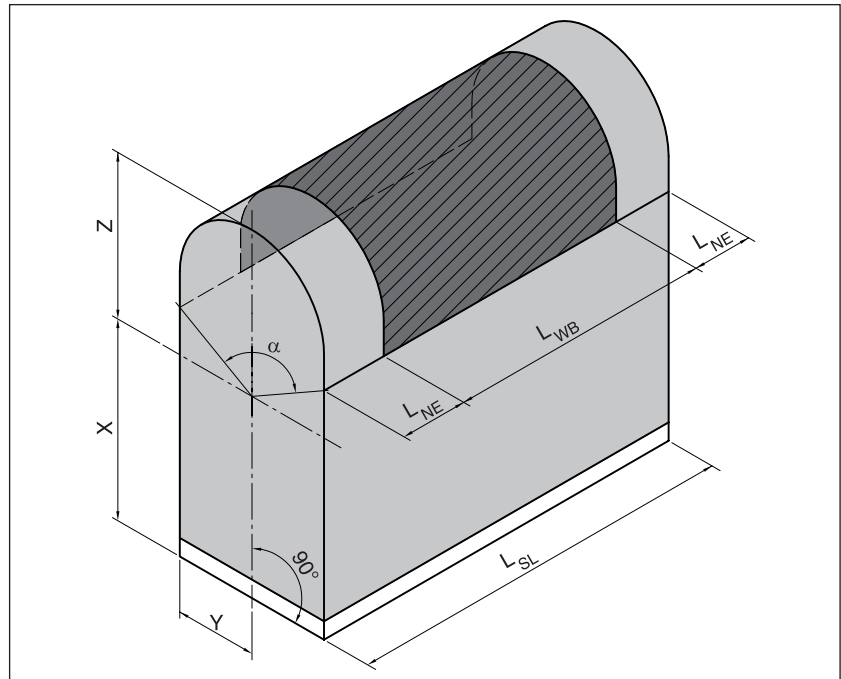
Parameters:

L_{WB} = Effective actuation length

L_{SL} = Overall length of the Safety Edge

L_{NE} = Non-sensitive length at the end of the Safety Edge

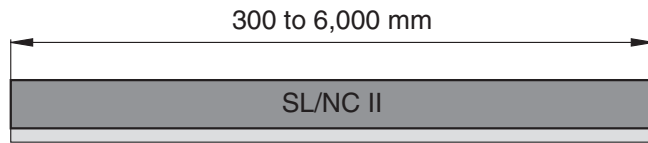
α = Effective actuation angle



SL/NC II	GP 65	GP 100
α	120°	120°
L_{NE}	40 mm	50 mm
X	52 mm	85 mm
Y	18 mm	18 mm
Z	13 mm	14 mm

Subject to technical modifications

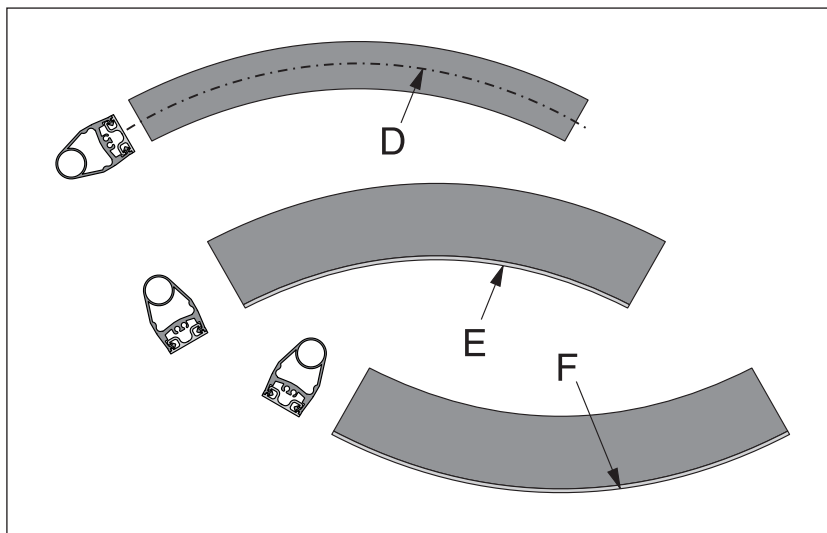
Available lengths



Bend angles and bend radii

Bend angles

Bend angles are not possible on the normally closed Safety Edge SL/NC II.



Note:

Bend angles and bend radii are not part of the EC design tests

Bend radii

Normally closed Safety Edges with a bend radius are only possible with the aluminium profiles C 36 and C 36S. The aluminium profile must be prepared for this at our plant.

Bend radius min.	GP 65	GP 100
D	–	–
E	750 mm	750 mm
F	750 mm	750 mm

Installation position

The installation position can be selected as required, i.e. all installation positions A to E as per EN 1760-2 are possible.

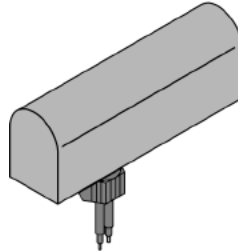
Subject to technical modifications

Connection

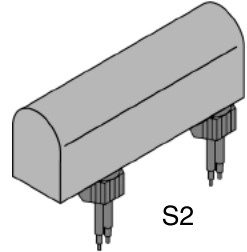
Cable exits

90° exit

Distance to front end each 60 mm



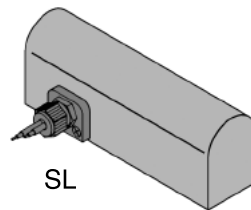
Standard (S1)



S2: 2 cables

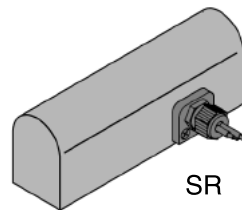
Lateral exit

Distance to front end each 60 mm



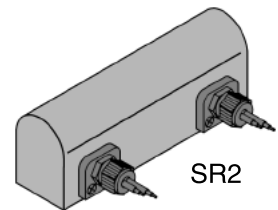
SL

SL: lateral exit left



SR

SR: lateral exit right



SR2

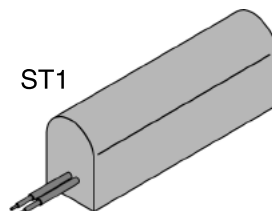
SR2: 2 cables

ATTENTION

Axial cable exits (ST1/ST2) must be laid free of tension. A tensile load of max. 50 N apply to cables through cable screw connection.

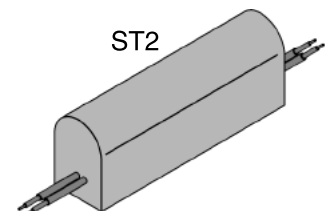
Axial exit

without PG-screw connection



ST1

ST1



ST2

ST2: 2 cables

In the case of several sensors connected in sequence, we recommend version S2, SR2 or ST2. These versions provide an additional line in the rubber profile for feedback to the control.

Cable connection

- Cable: Ø 3.3 mm PVC, 1 × 0.5 mm²; double insulated, short-circuit-proof, highly flexible
- Cable length: 1.5 m
Option: up to max. 200 m
- Cable ends: wires stripped
Option: Cable ends available with plug and coupling

ATTENTION

It must be ensured that the lines to the downstream control are double insulated

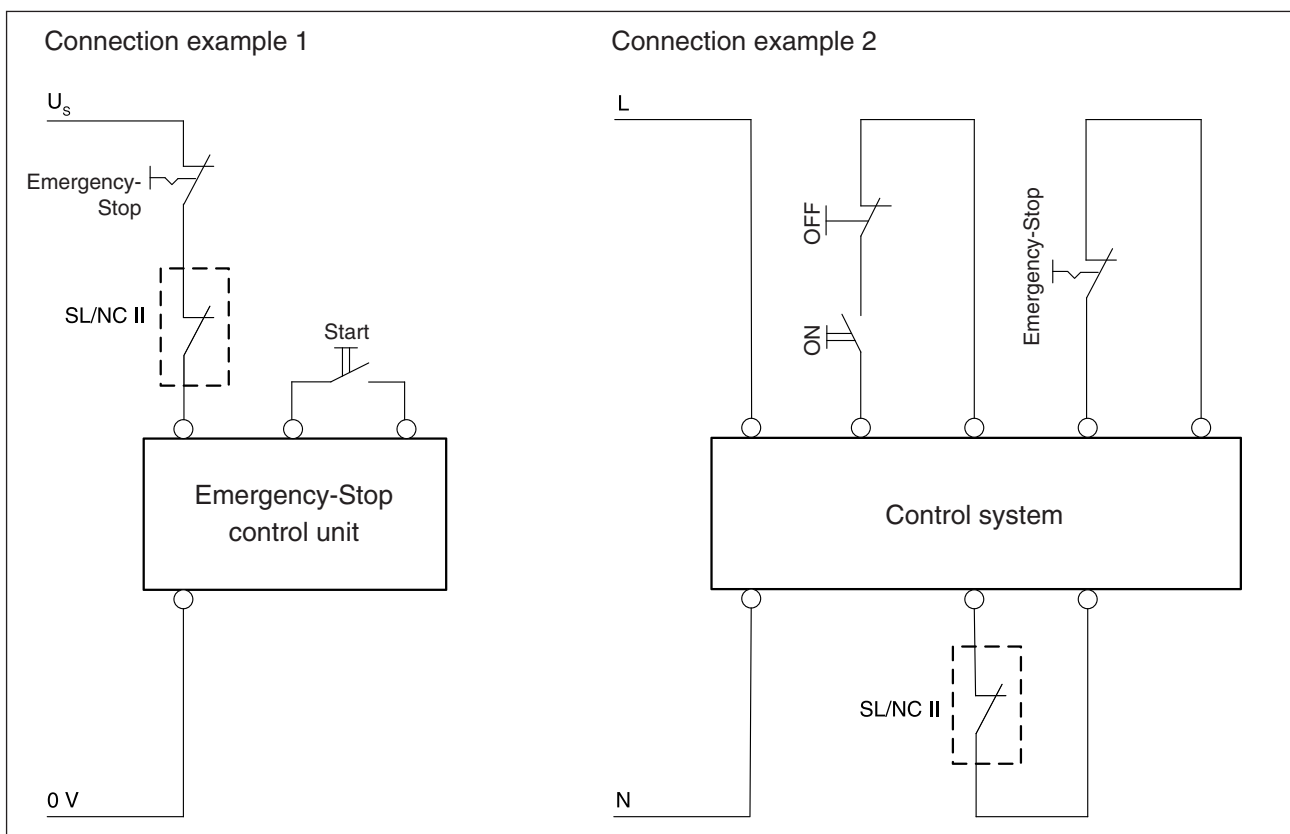
Connection examples

Connection example 1

Normally closed Safety Edge in series with Emergency-Stop button on Emergency-Stop control unit. Connecting voltage: DC.

Connection example 2

Normally closed Safety Edge directly connected to control up to PL e as per ISO 13849-1. Connecting voltage: AC.



Rubber profiles

Dimensions and operating distances

Note:

Dimensional tolerances as per ISO 3302 E2/L2.

Note:

Test piece (cylinder): Ø 80 mm.
Values apply at temperature +20 °C.

GP 65 EPDM	GP 100 EPDM
Actuation force: < 150 N Actuation distance (A) at 10 mm/s 9 mm at 100 mm/s 8 mm Overtravel distance up to 250 N (B1) at 10 mm/s 12 mm at 100 mm/s 12 mm	Actuation force: < 150 N Actuation distance (A) at 10 mm/s 13 mm at 100 mm/s 12 mm Overtravel distance up to 250 N (B1) at 10 mm/s 33 mm at 100 mm/s 31 mm

Physical resistance

ATTENTION

IP65 means: Normally closed Safety Edge must not be cleaned with high-pressure cleaners etc..

Rubber profile GP	EPDM
Degree of protection (IEC 60529)	IP65
Hardness as per Shore A	65 ±5

Chemical resistance

The Safety Edge is resistant against normal chemical influences such as diluted acids and alkalis as well as alcohol over an exposure period of 24 hrs.

The values in the table are results of tests carried out in our laboratory to the best of our knowledge and belief. The suitability of our products for your special area of application must always be verified with your own practical tests.

Rubber profile GP	EPDM
Acetone	+
Formic acid	+
Ammonia	+
Petrol	-
Brake fluid	±
Chloride solutions	+
Diesel oils	-
Greases	-
Household-/sanitary cleaners	+
Isopropyl alcohol	+
Cooling lubricant	-
Metal working oil	-
Methyl alcohol	+
Oils	-
Ozone and weather conditions	+
Hydrochloric acid 10 %	+
Spirit (ethyl alcohol)	+
Carbon tetrachloride	-
Hydrogen peroxide 10 %	+
Water and frost	+

Explanation of symbols:

+ = resistant

± = resistant to a certain extent

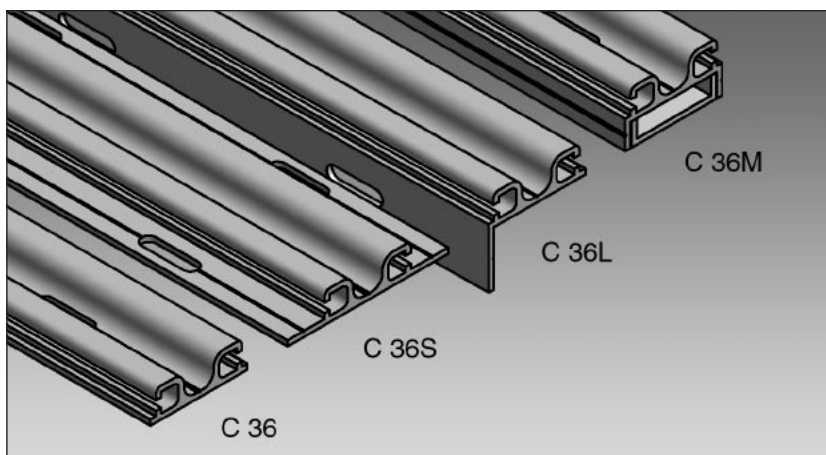
- = not resistant

Note:

Tests are carried out at room temperature (+23 °C).

Fixing rails

Normally closed Safety Edges SL/NC II are mounted directly to the dangerous main and secondary closing edges. The aluminium profile range C 36 is used for mounting. The aluminium profiles are mounted with M5 screws or rivets.

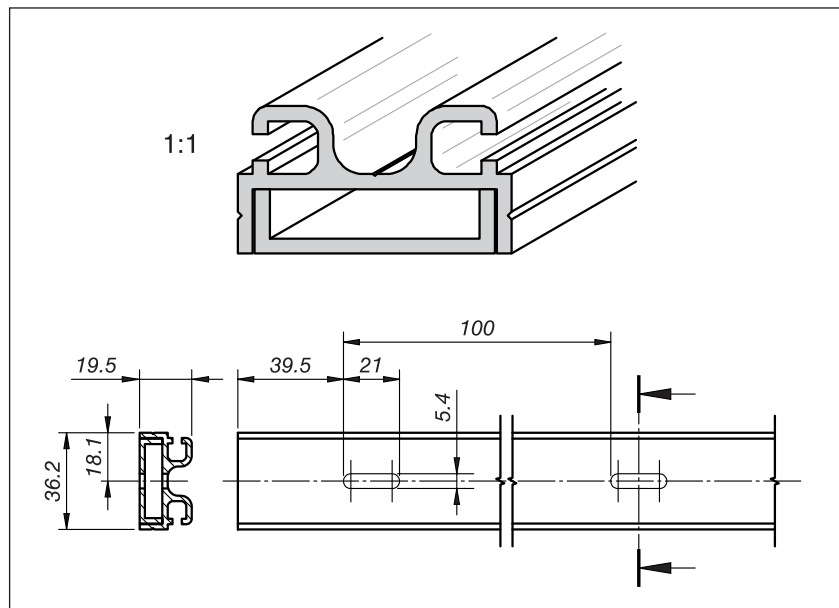


Material properties

- AlMgSi0.5 F22
- Wall thickness 2 mm
- Tolerances as per EN 755-9
- extruded
- hot hardened

Subject to technical modifications

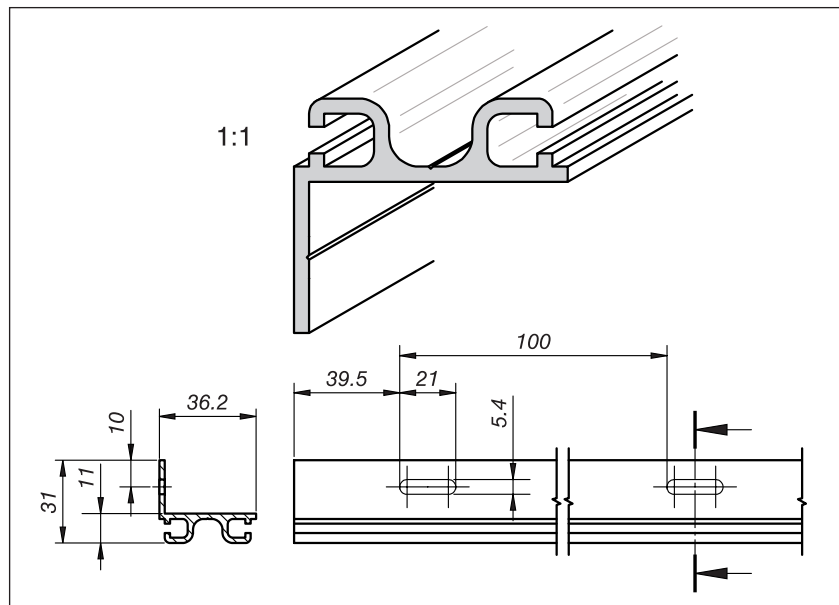
Aluminium profile C 36M



Two-part profile:

For convenient assembly and disassembly. The rubber profile is clipped into the upper section and the upper section inserted in the installed lower section and fastened.

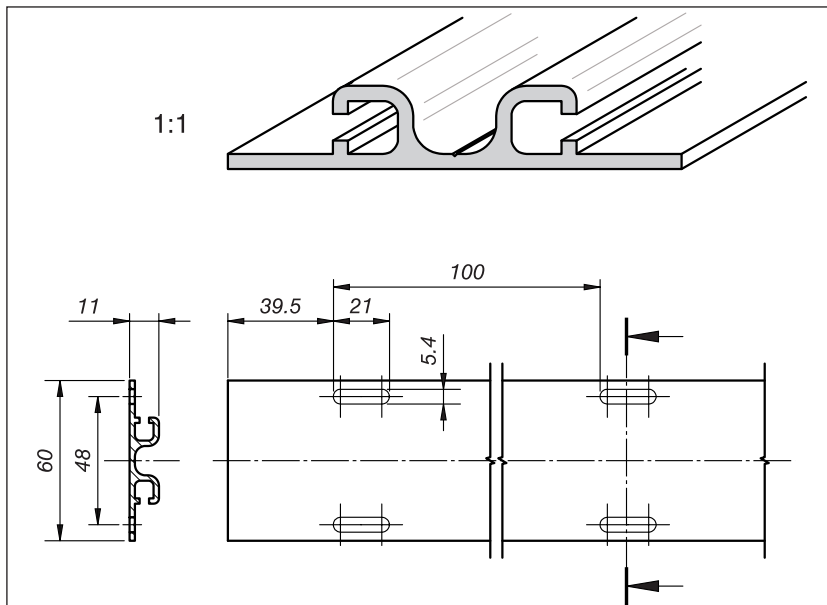
Aluminium profile C 36L



Angle profile:

If the closing edge should or must not have assembly holes, this angle solution is suitable. Final assembly is also possible when the rubber profile is already clipped into the aluminium profile.

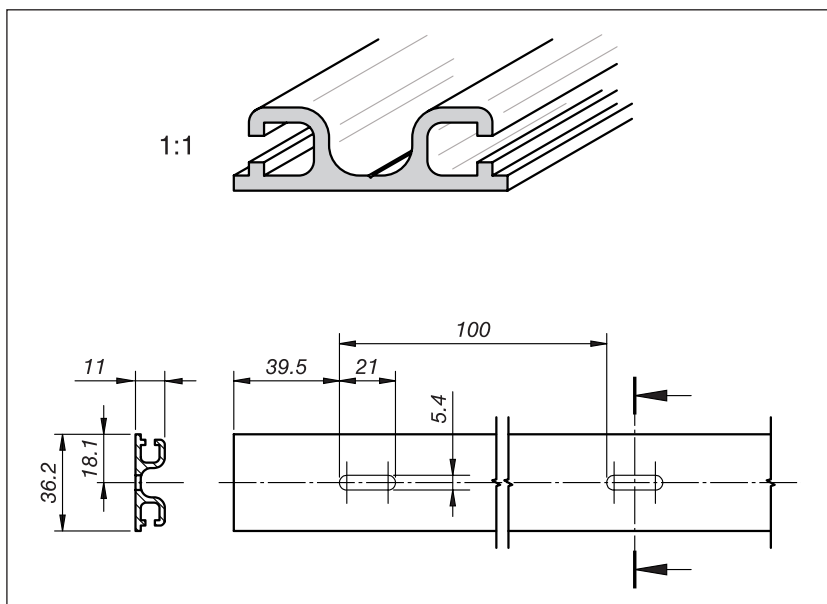
Aluminium profile C 36S



Flange profile:

Final assembly is also possible when the rubber profile is already clipped into the aluminium profile.

Aluminium profile C 36



Standard profile:

The aluminium profile must first be installed on the closing edge and the rubber profile can then be clipped into the aluminium profile.

SL/NC II: The right selection

Calculation for selection of the Safety Edge height

s_1 = Stopping distance of the dangerous movement
[mm]

v = Velocity of the dangerous movement [mm/s]

T = Follow-through time of the complete system [s]

t_1 = Response time Safety Edge

t_2 = Stopping time of the machine

s = Minimum overtravel distance of the Safety Edge so that the pinching force does not exceed a limit value [mm]

C = Safety factor; if components susceptible to failures (braking system) exist in the system, a higher factor must be selected.

The stopping distance of the dangerous movement is calculated using the following formula:

$$s_1 = 1/2 \times v \times T \quad \text{where: } T = t_1 + t_2$$

In accordance with EN 1760-2, the minimum overtravel distance of the Safety Edge is calculated using the following formula:

$$s = s_1 \times C \quad \text{where: } C = 1.2$$

A suitable Safety Edge profile can now be selected based on the result. Overtravel distances of normally closed Safety Edges: see "Rubber profiles", chapter "Dimensions and operating distances".

Calculation examples

Calculation example 1

The dangerous movement on your machine has a velocity of $v = 40$ mm/s and can be brought to a standstill within $t_2 = 320$ ms. The relatively low velocity suggests that a short overtravel distance is to be expected. Therefore the Safety Edge SL/NC II GP 65 EPDM could be sufficient. The response time of the Safety Edge is $t_1 = 80$ ms.

$$s_1 = 1/2 \times v \times T \quad \text{where: } T = t_1 + t_2$$

$$s_1 = 1/2 \times 40 \text{ mm/s} \times (80 \text{ ms} + 320 \text{ ms})$$

$$s_1 = 1/2 \times 40 \text{ mm/s} \times 0.4 \text{ s} = \mathbf{8 \text{ mm}}$$

$$s = s_1 \times C \quad \text{where: } C = 1.2$$

$$s = 8 \text{ mm} \times 1.2 = \mathbf{9.6 \text{ mm}}$$

The Safety Edge must have a minimum overtravel distance of $s = 9.6$ mm. The selected SL/NC II GP 65 EPDM has an overtravel distance of at least 12 mm. This is more than the required 9.6 mm.

Result: The SL/NC II GP 65 EPDM is **suitable** for this case.

Calculation example 2

The same conditions as in calculation example 1 with the exception of the velocity of the dangerous movement. This is now $v = 80$ mm/s.

$$s_1 = 1/2 \times v \times T \quad \text{where: } T = t_1 + t_2$$

$$s_1 = 1/2 \times 80 \text{ mm/s} \times (80 \text{ ms} + 320 \text{ ms})$$

$$s_1 = 1/2 \times 80 \text{ mm/s} \times 0.4 \text{ s} = \mathbf{16 \text{ mm}}$$

$$s = s_1 \times C \quad \text{where: } C = 1.2$$

$$s = 16 \text{ mm} \times 1.2 = \mathbf{19.2 \text{ mm}}$$

The Safety Edge must have a minimum overtravel distance of $s = 19,2$ mm. The selected SL/NC II GP 65 EPDM has an overtravel

distance of at least 12 mm. This is less than the required 19,2 mm.

Result: The SL/NC II GP 65 EPDM is **not suitable** for this case.

Calculation example 3

The same conditions as in calculation example 2. Instead of SL/NC II GP 65 EPDM the SL/NC II GP 100 EPDM is selected. The response time of the Safety Edge is $t_1 = 130$ ms.

$$s_1 = 1/2 \times v \times T \quad \text{where: } T = t_1 + t_2$$

$$s_1 = 1/2 \times 80 \text{ mm/s} \times (130 \text{ ms} + 320 \text{ ms})$$

$$s_1 = 1/2 \times 80 \text{ mm/s} \times 0.45 \text{ s} = \mathbf{18 \text{ mm}}$$

$$s = s_1 \times C \quad \text{where: } C = 1.2$$

$$s = 18 \text{ mm} \times 1.2 = \mathbf{21.6 \text{ mm}}$$

The Safety Edge must have a minimum overtravel distance of $s = 21.6$ mm. The selected SL/NC II GP 100 EPDM has an overtravel distance of at least 31 mm at 100 mm/s. This is more than the required 21.6 mm

Result: The SL/NC II GP 100 EPDM is **suitable** for this case.

Tip:

See appendix C and E of EN 1760-2 or ISO 13856-2 for further selection criteria.

Customised designs

In addition to the standard range, special solutions are also possible, such as.

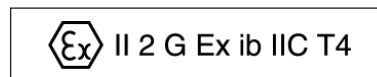
- higher degree of protection: IP67

SL/NC II in ATEX version

The normally closed Safety Edge ATEX SL/NC II safety system consists of a sensor SL/NC II, aluminium profile, safety barrier and Control Unit. Safety Edges of the type ATEX SL/ NC II are only designed for the equipment group II, i.e. for all potentially explosive environments except for mining. The potentially explosive medium divides the area of application into atmospheres G and D:

Atmosphere G

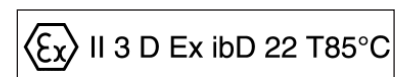
Gases, vapours, mist
Zones 1 and 2
Equipment categories 2 and 3
Ignition protection class "ib"
Explosion group IIC
Temperature class T4
Marking:



Corresponds to IEC 60079-11

Atmosphere D

Dusts
Zone 22
Equipment categories 3
Ignition protection class "ibD 22"
Temperature class T85°C
Marking:



Corresponds to IEC 61241-11

Accessories

Extension kit

For extension of connection cable by customer (contents: double insulated wire, crimp connector and heat-shrinkable sleeves)

Extension kit 5 m	1003870
Extension kit 10 m	1003871

Wiring aids

Diode	1003872
Special resistor 1k2	1003873
Special resistor 8k2	1003874

Technical data

Normally closed Safety Edge SL/NC II consisting of sensor and aluminium profile from the profile range C 36.

	GP 65 EPDM	GP 100 EPDM
Testing basis	EN 1760-2, ISO 13856-2	EN 1760-2, ISO 13856-2
Switching characteristics at $v_{\text{test}} = 100 \text{ mm/s}$		
Switching operations at 0.1 A	> 5×10^4	> 5×10^4
Actuation force	< 150 N	< 150 N
Actuation distance	8 mm	13 mm
Response time	80 ms	130 ms
effective actuation angle	120°	120°
Safety classifications		
EN 1760: Reset	without	without
ISO 13849-1:2006	Category 3	Category 3
B_{10d}	2×10^6	2×10^6
Mechanical operating conditions		
Sensor length (min./max.)	300 mm / 6000 mm	300 mm / 6000 mm
Cable length (min./max.)	1.5 m / 200 m	1.5 m / 200 m
Operating velocity (min./max.)	10 mm/s / 100 mm/s	10 mm/s / 100 mm/s
max. load capacity	600 N	600 N
Degree of protection as per IEC 60529	IP65	IP65
max. humidity (23 °C)	95% (non-condensing)	95% (non-condensing)
Operating temperature	-15 °C to +60 °C	-15 °C to +60 °C
Storage temperature	-20 °C to +80 °C	-20 °C to +80 °C
Weight	1.9 kg/m	2.1 kg/m
Electrical operating conditions		
Switching voltage (PELV)	max. 48 V DC max. 48 V AC 50/60 Hz	max. 48 V DC max. 48 V AC 50/60 Hz
Switching current	max. 0.2 A	max. 0.2 A
Contact fuse protection, external	250 mA inert	250 mA inert
Connection cable	Ø 3.3 mm PVC 1× 0.5 mm ²	Ø 3.3 mm PVC 1× 0.5 mm ²
Chemical resistance (see page 4.8)		
	The sensor is resistant against normal chemical resistances over an exposure period of 24 hours. (see page 4.8).	
Maintenance, service		
Maintenance Monitoring Inspection	<p>The Safety Edge is maintenance-free. Possible via external control.</p> <ul style="list-style-type: none"> Depending on the amount of use, the Safety Edges are to be checked regularly for correct operation and visible signs of damage by manual operation or by applying the relevant test piece (cylinder). The correct position of the rubber profile in the aluminium profile is to be checked. 	
Dimensional tolerances		
Rubber profile	ISO 3302 E2/L2	ISO 3302 E2/L2
Aluminium profile	EN 12020-2	EN 12020-2

Subject to technical modifications

Force-distance ratios

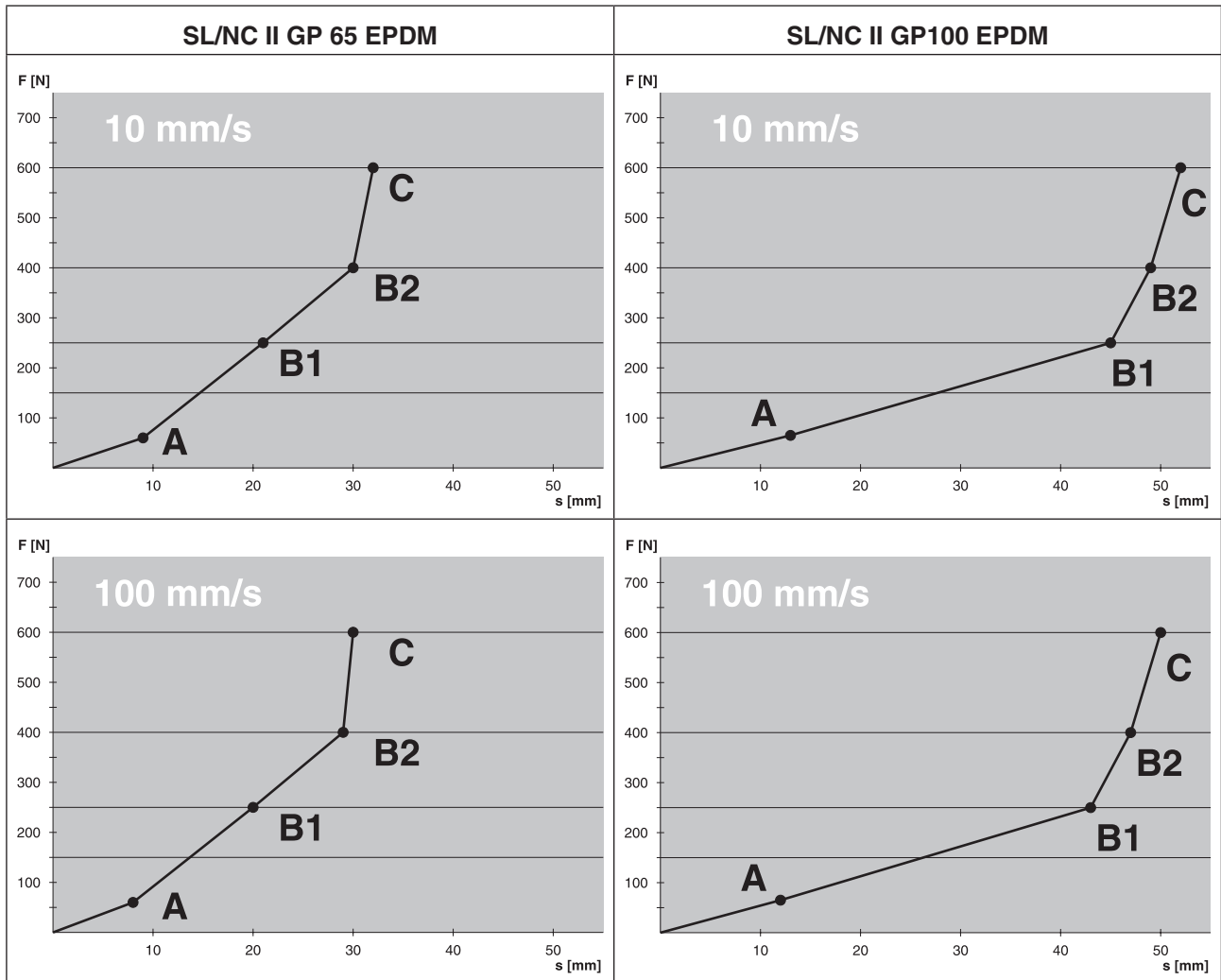
Measurement point c3, test piece (cylinder) Ø 80 mm, temperature 20 °C

A: Actuation distance

B1: Total deformation at 250 N

B2: Total deformation at 400 N

C: Total deformation at 600 N



Conformity



The CE symbol indicates that this Mayser product complies with the relevant EC directives and that the stipulated conformity assessments have been carried out. The design type of this Mayser product complies with the EC Machinery Directive 2006/42/EC and EMC Directive 2004/108/EC.

Certificates

Subject to technical modifications

UL certification

U8V 10 31146 006

Request for quotation

Fax:

+49 731 2061-222

From		
Company		
Department		
Name, first name		
P. O. Box	Post code	City
Street	Post code	City
Phone	Fax	E-mail

Area of application

(e.g. door and gate systems, machine closing edges, textile machines, local public transport, ...)

Environmental conditions

dry water oil

aggressive substances: Coolant, type: _____

Solvent, type: _____

other: _____

room temperature other: from _____ °C to _____ °C

Mechanical conditions

The stopping distance of the system is max. _____ mm

cable exit version _____

number of monitoring circuits: _____ SG- _____

Pinching and shearing edges to be protected:

(Diagram incl. mounting possibility and cable routing)

↓ Please keep free ↓
For internal use only

201010 v1.1