EAO – Your Expert Partner for
Human Machine Interfaces
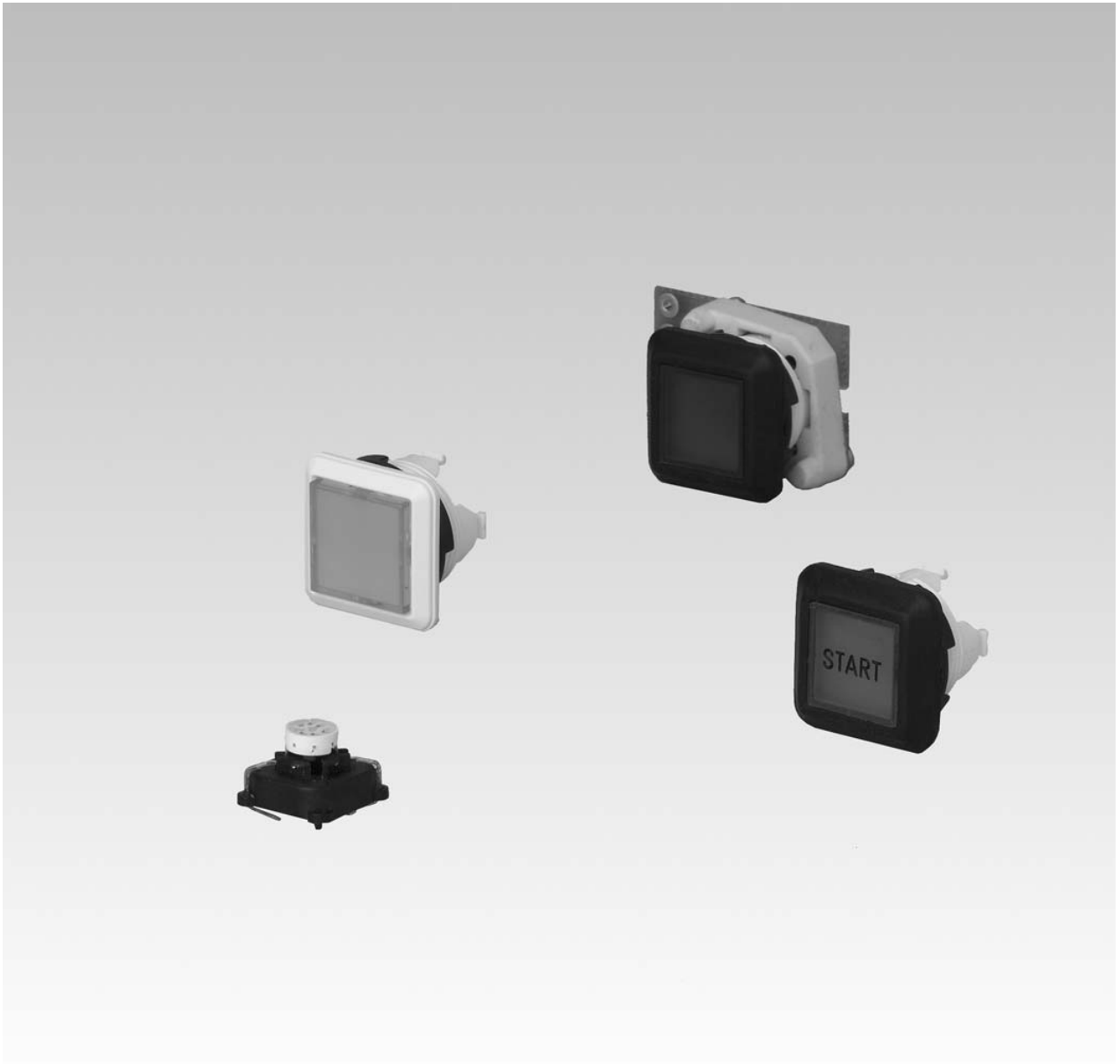
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EAO Product Information

Series 92

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Product Information

General notes

With the series 92, users have a comprehensive range of applications at their disposal in the PCB key range. In particular, this series is an interesting alternative to the membrane switching system, because it offers convincing advantages, such as: Saving on initial costs, short manufacturing times, all-over illumination and a reliable and nevertheless removable PCB fastening technology.

With the series 92, many different applications are possible even as a discrete switch.

Thanks to front sealing IP 67, and the use of chemical-resistant materials, the elements of this series are suited for industrial use.

The actuator, measuring 18.8 x 18.8 mm at the front (18.8 x 18.4 mm IP 40), is available as an indicator, pushbutton or illuminated pushbutton in marked or unmarked versions.

In order to have matching colours, the actuator element can be supplied with different colours. The switching element complies with international protection level IP 40 and is solder-proof on the connection side. The specially formed connection legs prevent it from falling out when using flow soldering.

Mounting

The actuators of the series 92 are made for the standard 16 mm dia. mounting hole and fastened tightly to the front panel by means of a fixing nut. Mounting torque max. 50 Ncm.

The switching element is mounted on the printed board independently of the actuator. The arrangement of contacts is based on the matrix dimension 2.54 mm (1/10"). By means of the mounting flange, the PCB can be snapped on the pre-assembed actuator. Later adjustment is no longer necessary. The mounting flange is fastened to the PCB with two 1.8 mm dia. screws, also independent of the actuator. The positioning and the number of flanges is determined by the size of the front panel or PCB.

The actuators are protected against distortion.

Lenses

The flat front bezel with integrated pressure plate, made of UV resistant TPE has a black finish (standard). Colour variations enable the manufacture of transparent pressure plates of different colours.

Marking

For further information about hot stamping, laser marking and film inserts see part Marking.

Illumination

Perfect illumination of the touch surfaces available in various colours is assured by the LEDs Bi-Pin T1 in the colours blue, yellow, green, orange, red and white.

Luminosity and wave length scattering caused by the technology used in the LED manufacturing processes may lead to visual differences in our products.

Cleaning of soldered PCB

PCBs are often cleaned after machine soldering. When doing this, care must be taken to prevent the "cleaning fluid" polluted with dirt, grease and flux from penetrating the switch.

Specimen order

Illuminated pushbutton :

-	Illuminated pushbutton actuator, IP 40, front-ring black, lens yellow	92-458.400

Essential accessories :

|		
-	Switching element illuminative	92-851.342
-	Single-LED T1 Bi-Pin, yellow	10-2602.3174D
-	Mounting flange	92-960.0

We reserve the right to modify technical data
All dimensions in mm

Indicator IP 40
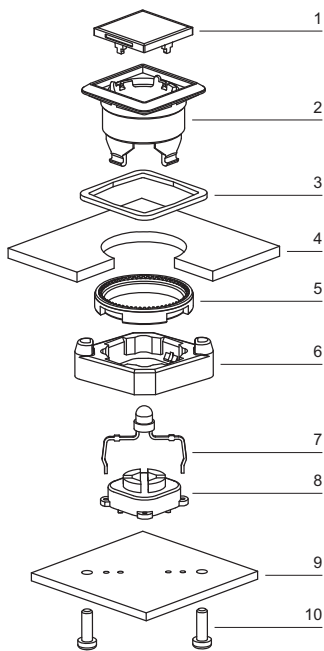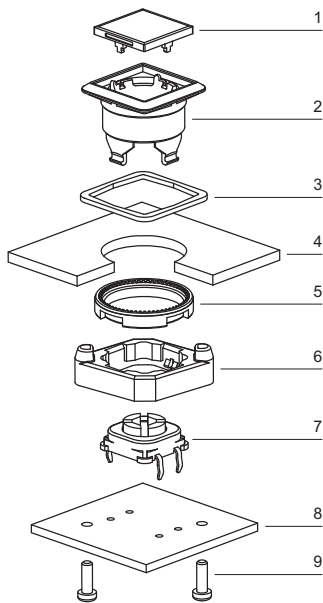
1 Lens
2 Actuator housing
3 Switch housing
4 Front plate
5 Fixing nut
6 Mounting flange
7 LED
8 Switching element
9 Printed circuit board
10 Fixing screws

Illuminated pushbutton IP 67
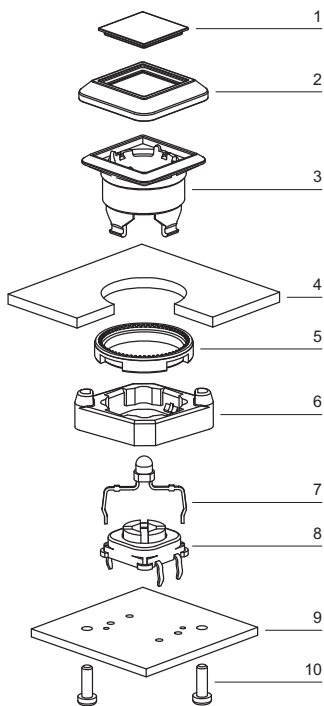
1 Lens
2 Front bezel
3 Actuator housing
4 Front plate
5 Fixing nut
6 Mounting flange
7 LED
8 Switching element
9 Printed circuit board
10 Fixing screws

Pushbutton IP 40

1 Lens
2 Actuator housing
3 Bezel
4 Front plate
5 Fixing nut
6 Mounting flange
7 Switching element
8 Printed circuit board
9 Fixing screws

Arrangement mounting flange
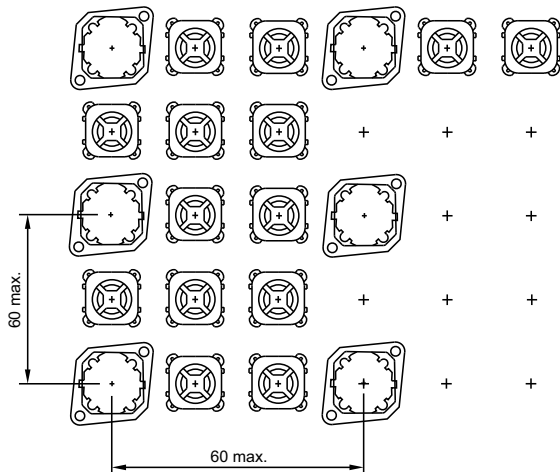
The arrangement of the mounting flanges and their number is determined by the size of the front panel or PCB. To ensure uniform, tactile switching, we recommend a layout of the flanges as per adjacent sketch.

For large PCBs with several switching elements we recommend the following procedure :

1. Fit the actuator to the front panel.
2. Clip the mounting flange to the rear of the intended actuator.
3. Screw the PCB with the components soldered to it to the assembled mounting flange.

This arrangement applies to PCBs 1.6 mm thick.

Dismantling mounting flange
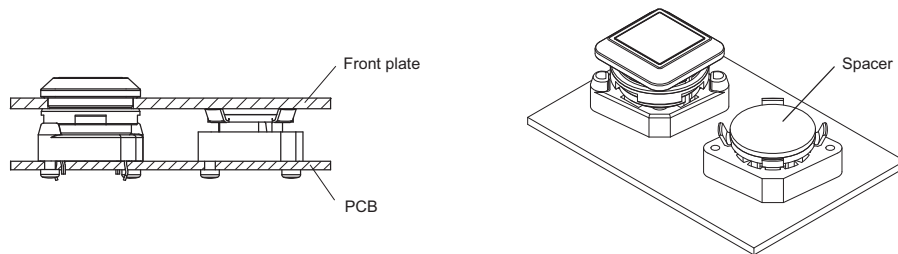
The tool 92-971.0 must be used for removing the mounting flange from the actuator. Before removing the flange, the PCB fixing screws must be loosened.
If the number of actuators is insufficient, use the spacer 92-965.0 which can be attached to the front panel.
The spacer can be adjusted to the following front panel thicknesses: 1.5/2/2.2/3/3.5/4 mm and can be stuck to the back of the panel free of dirt and grease.

Indicator actuator

Essential Accessories:

🛒 Illumination element PCB mounting page 10

🛒 Mounting flange page 12

🛒 Single-LED page 11

	Front protection	Front bezel	Lens	⌷ 18.8 x 18.8 mm Typ-Nr.	⌷ 18.4 x 18.4 mm Typ-Nr.	Mounting dimensions	Technical drawing	🔩
Indicator actuator	IP 67	Plastic black	Plastic blue transparent	**92-143.600**		1	7	0.003
			Plastic colourless transparent	**92-143.700**		1	7	0.003
			Plastic green transparent	**92-143.500**		1	7	0.003
			Plastic orange transparent	**92-143.300**		1	7	0.003
			Plastic red transparent	**92-143.200**		1	7	0.003
			Plastic yellow transparent	**92-143.400**		1	7	0.003
		Plastic white	Plastic blue transparent	**92-043.600**		1	7	0.003
			Plastic colourless transparent	**92-043.700**		1	7	0.003
			Plastic green transparent	**92-043.500**		1	7	0.003
			Plastic orange transparent	**92-043.300**		1	7	0.003
			Plastic red transparent	**92-043.200**		1	7	0.003
			Plastic yellow transparent	**92-043.400**		1	7	0.003
	IP 40	Plastic black	Plastic blue transparent		**92-158.600**	1	4	0.003
			Plastic colourless transparent		**92-158.700**	1	4	0.003
			Plastic green transparent		**92-158.500**	1	4	0.003
			Plastic orange transparent		**92-158.300**	1	4	0.003
			Plastic red transparent		**92-158.200**	1	4	0.003
			Plastic smoked transparent		**92-158.100**	1	4	0.003
			Plastic yellow transparent		**92-158.400**	1	4	0.003
		Plastic white	Plastic blue transparent		**92-058.600**	1	4	0.003
			Plastic colourless transparent		**92-058.700**	1	4	0.003
			Plastic green transparent		**92-058.500**	1	4	0.003
			Plastic orange transparent		**92-058.300**	1	4	0.003
			Plastic red transparent		**92-058.200**	1	4	0.003
			Plastic smoked transparent		**92-058.100**	1	4	0.003
			Plastic yellow transparent		**92-058.400**	1	4	0.003

Mounting dimensions from page 18, Technical drawing from page 19

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Pushbutton actuator

Essential Accessories:

🛒 Mounting flange page 12

🛒 Switching element PCB mounting illuminative page 10

	Front protection	Front bezel	Lens	⌗ 18.8 x 18.8 mm Typ-Nr.	⌗ 18.4 x 18.4 mm Typ-Nr.	Mounting dimensions	Technical drawing	Circuit drawing	[kg]
Pushbutton actuator	IP 67	Plastic black	Plastic black opaque	**92-441.000**		1	8	1	0.002
			Plastic grey opaque	**92-441.800**		1	8	1	0.002
		Plastic white	Plastic black opaque	**92-341.000**		1	8	1	0.002
			Plastic grey opaque	**92-341.800**		1	8	1	0.002
	IP 40	Plastic black	Plastic black opaque		**92-456.000**	1	5	1	0.002
			Plastic grey opaque		**92-456.800**	1	5	1	0.002
			Plastic white opaque		**92-456.900**	1	5	1	0.002
		Plastic white	Plastic black opaque		**92-356.000**	1	5	1	0.002
			Plastic grey opaque		**92-356.800**	1	5	1	0.002
			Plastic white opaque		**92-356.900**	1	5	1	0.002

Mounting dimensions from page 18, Technical drawing from page 19, Circuit drawing from page 21

Illuminated pushbutton actuator

Essential Accessories:

🛒 Mounting flange page 12

🛒 Single-LED page 11

🛒 Switching element PCB mounting illuminative page 10

	Front protection	Front bezel	Lens	⌥ 18.8 x 18.8 mm Typ-Nr.	⌥ 18.4 x 18.4 mm Typ-Nr.	Mounting dimensions	Technical drawing	Circuit drawing	[kg]
Illuminated pushbutton actuator	IP 67	Plastic black	Plastic blue transparent	92-443.600		1	3	1	0.003
			Plastic colourless transparent	92-443.700		1	3	1	0.003
			Plastic green transparent	92-443.500		1	3	1	0.003
			Plastic orange transparent	92-443.300		1	3	1	0.003
			Plastic red transparent	92-443.200		1	3	1	0.003
			Plastic yellow transparent	92-443.400		1	3	1	0.003
		Plastic white	Plastic blue transparent	92-343.600		1	3	1	0.003
			Plastic colourless transparent	92-343.700		1	3	1	0.003
			Plastic green transparent	92-343.500		1	3	1	0.003
			Plastic orange transparent	92-343.300		1	3	1	0.003
			Plastic red transparent	92-343.200		1	3	1	0.003
			Plastic yellow transparent	92-343.400		1	3	1	0.003
	IP 40	Plastic black	Plastic blue transparent		92-458.600	1	6	1	0.003
			Plastic colourless transparent		92-458.700	1	6	1	0.003
			Plastic green transparent		92-458.500	1	6	1	0.003
			Plastic orange transparent		92-458.300	1	6	1	0.003
			Plastic red transparent		92-458.200	1	6	1	0.003
			Plastic smoked transparent		92-458.100	1	6	1	0.003
			Plastic yellow transparent		92-458.400	1	6	1	0.003
		Plastic white	Plastic blue transparent		92-358.600	1	6	1	0.003
			Plastic colourless transparent		92-358.700	1	6	1	0.003
			Plastic green transparent		92-358.500	1	6	1	0.003
			Plastic orange transparent		92-358.300	1	6	1	0.003
			Plastic red transparent		92-358.200	1	6	1	0.003
			Plastic smoked transparent		92-358.100	1	6	1	0.003
			Plastic yellow transparent		92-358.400	1	6	1	0.003

Mounting dimensions from page 18, Technical drawing from page 19, Circuit drawing from page 21

Front

Blind plug

		⌗ 18 x 18 mm Typ-Nr.	Mounting dimensions	(kg)
	Blind plug			
Blind plug	Plastic black	**51-948.0**	1	0.003

Mounting dimensions from page 18

Backside

Illumination element PCB mounting

The customer has to decide what series resistor shall be used to the LED

	Terminals	Typ-Nr.	Component layout	Technical drawing	(kg)
Illumination element PCB mounting	P	**92-800.042**	1	1	0.001

Illumination and mounting flange to be ordered separately.
Terminals: P = PCB terminal
Component layout from page 18, Technical drawing from page 19

Switching element PCB mounting illuminative

The customer has to decide what series resistor shall be used to the LED

	Terminals	Typ-Nr.	Component layout	Technical drawing	Circuit drawing	(kg)
Switching element PCB mounting illuminative	P	**92-851.342**	2	9	2	0.001

Illumination and mounting flange to be ordered separately.
Terminals: P = PCB terminal
Component layout from page 18, Technical drawing from page 19, Circuit drawing from page 21

Spacer

	Typ-Nr.	(kg)
Spacer	**92-965.0**	0.003

When fitting, ensure that back of panel is free of grease and dirt

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Accessories

PCB assembled

	Typ-Nr.	⚖ kg	
PCB assembled for discrete switching applications including switching element and mounting flange, soldering terminal (assembled PCB incl. series resistor and LED on request)	**92-981.0**	0.003	

Illumination

Single-LED

The customer has to decide what series resistor shall be used to the LED

	Socket	Operating voltage/-current	Light colour	Typ-Nr.	⚖ kg
Single-LED	T1 Bi-Pin	2.1 VDC, 20 mA	orange	**10-2602.3203L**	0.001
			red	**10-2602.3202L**	0.001
		2.2 VDC, 20 mA	yellow	**10-2602.3174D**	0.001
		3.5 VDC, 20 mA	blue	**10-2602.3206L**	0.001
			green	**10-2602.3205L**	0.001
			white	**10-2602.3209L**	0.001

Bi-colour LED

The customer has to decide what series resistor shall be used to the LED

	Socket	Light colour	Operating voltage/-current	Typ-Nr.	⚖ kg
Bi-colour LED	T1 Bi-Pin	red/green	1.9/3.5 VDC, 20 mA	**10-2603.320AL**	0.001
		yellow/green	2.0/3.2 VDC, 20 mA	**10-2603.320CL**	0.001

Multi-LED

The customer has to decide what series resistor shall be used to the LED

	Socket	Operating voltage/-current	Light colour	Typ-Nr.	⚖ kg
Multi-LED	T1 Bi-Pin	12 VDC, 40 mA	yellow	**10-5609.3174D**	0.001

Assembling

Anti-twist ring

for front panel thickness max. 2 mm

	Typ-Nr.	⚖ kg	
Anti-twist ring Mounting hole size 16 mm dia.	**51-910**	0.001	

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Mounting flange

	Typ-Nr.	Technical drawing	[kg]
Mounting flange	**92-960.0**	2	0.001

Technical drawing from page 19

Lens remover

	Typ-Nr.	[kg]
Lens remover for lens plate IP 40 only	**18-910**	0.002

Mounting tool

	Typ-Nr.	[kg]
Mounting tool for Indicator 16 mm dia.	**01-907**	0.020

Dismantling tool

	Typ-Nr.	[kg]
Dismantling tool for actuator dismantling of switching- and illumination element and mounting flange	**92-971.0**	0.002

Pushbutton- and Illuminated pushbutton actuator IP 40

Pushbutton- and Illuminated pushbutton actuator IP 40

Lens and Front bezel order separately

	Front ring	⌗ 18.4 x 18.4 mm Typ-Nr.	⚖ kg
Pushbutton- and Illuminated pushbutton actuator IP 40	Plastic black	**92-450.000**	0.003
	Plastic white	**92-350.000**	0.003

Lens for pushbuttons and indicators IP 40

	Lens	⌗ 18.4 x 18.4 mm Typ-Nr.	⚖ kg
Lens for pushbuttons and indicators IP 40 13.2 x 13.2 mm with white Marking plate	Plastic black opaque	**92-956.000**	0.001
	Plastic blue translucent	**92-956.600**	0.001
	Plastic blue transparent	**92-958.600**	0.001
	Plastic colourless transparent	**92-958.700**	0.001
	Plastic green translucent	**92-956.500**	0.001
	Plastic green transparent	**92-958.500**	0.001
	Plastic grey opaque	**92-956.800**	0.001
	Plastic orange translucent	**92-956.300**	0.001
	Plastic orange transparent	**92-958.300**	0.001
	Plastic red translucent	**92-956.200**	0.001
	Plastic red transparent	**92-958.200**	0.001
	Plastic smoked transparent	**92-958.100**	0.001
	Plastic white opaque	**92-956.900**	0.001
	Plastic yellow translucent	**92-956.400**	0.001
	Plastic yellow transparent	**92-958.400**	0.001

Front bezel for pushbuttons and indicators IP 40

	Front ring	⌗ 18.4 x 18.4 mm Typ-Nr.	⚖ kg
Front bezel for pushbuttons and indicators IP 40	Plastic black	**92-912.0**	0.001
	Plastic white	**92-912.9**	0.001

Pushbutton- and Illuminated pushbutton actuator IP 67

Pushbutton- and Illuminated pushbutton actuator IP 67

Lens order separately

	Front ring	⌗ 18.8 x 18.8 mm Typ-Nr.	⚖ kg
Pushbutton- and Illuminated pushbutton actuator IP 67	Plastic black	**92-440.000**	0.003
		92-340.000	0.003

Indicator actuator IP 67

Lens plate order separately

	Front ring	⊡ 18.8 x 18.8 mm Typ-Nr.	kg
Indicator actuator IP 67	Plastic black	**92-140.000**	0.003

Lens for pushbuttons and indicators IP 67

	Lens plate	⊡ 18.8 x 18.8 mm Typ-Nr.	kg
Lens for pushbuttons and indicators IP 67 12 x 12 mm	Plastic black flush opaque	**92-941.000**	0.001
	Plastic blue flush transparent	**92-941.600**	0.001
	Plastic colourless flush transparent	**92-941.700**	0.001
	Plastic green flush transparent	**92-941.500**	0.001
	Plastic grey flush opaque	**92-941.800**	0.001
	Plastic orange flush transparent	**92-941.300**	0.001
	Plastic red flush transparent	**92-941.200**	0.001
	Plastic yellow flush transparent	**92-941.400**	0.001

Pushbutton- and Illuminated pushbutton

Switching system
Short-travel switching system with 2 independent contact points and tactile operation.
Guarantees reliable switching even of very light loads.
Fitted with 1 normally open contact.

Material

Lens
Polycarbonate (PC)

Front bezel
Thermoplastic Elastomer (TPE)

Frame
Thermoplastic Polyester (PBT)

Material of contact
Gold (Au)

Switching element
Thermoplastic Polyester (PET, PBT) and Polyacetale (POM)

Actuator housing
Thermoplastic Polyester (PBT)

Mechanical characteristics

Tightening torque
Fixing screw 40 Ncm recommended
Fixing nut max. 50 Ncm

Actuating force
2.7 N ±1 N measured at the switching element
5 N measured at the lens

Actuating travel
Switching element 0.4 mm

Rebound time
≤1 ms

Resistance to heat of soldering
260 °C, 5 s, as per IEC 60068-2-20

Mechanical lifetime
≥1 Million operations as per IEC 60512-5-9a

Electrical characteristics

Contact resistance
Starting value (initial) ≤100 mΩ as per IEC 60512-2-2b

Isolation resistance
$\geq 10^9$ Ω between all terminals at 100 VDC, as per IEC 60512-2-3a

Electrical life
≥500 000 operations at 42 VDC, 50 mA as per IEC 60512-5-9c.
When attention is paid to the direction of current flow from terminal 3/4 to 1/2 the electrical life can be prolonged.

Electrostatic discharge (ESD)
15 kV

Switch rating

Switching voltage   min. 50 mV AC/DC
                          max. 42 V AC/DC
Switching current   min. 10 μA AC/DC
                          max. 100 mA AC/DC
Power rating   max. 2 W

Electric strength
500 VAC, 50 Hz, 1 min, as per IEC 60512-2-4a

Environmental conditions

Storage temperature
-40 °C ... +80 °C

Operating temperature
-25 °C ... +70 °C

Front protection
Switching element IP 40 (fluxproof to DIN 41640 Part 84)
front IP 67 or IP 40

Shock resistance
≤50 g for 11 ms as per IEC 60512-4-6c

Vibration resistance
(sinusoidal)
10 g at 10-2000 Hz, amplitude 0.75 mm as per IEC 60512-4-6d

Suppressor circuits

When switching inductive loads such as relays, DC motors, and DC solenoids, it is always important to absorb surges (e.g. with a diode) to protect the contacts. When these inductive loads are switched off, a counter emf can severely damage switch contacts and greatly shorten lifetime.

Fig. 1 shows an inductive load with a free-wheeling diode connected in parallel. This free-wheeling diode provides a path for the inductor current to flow when the current is interrupted by the switch. Without this free-wheeling diode, the voltage across the coil will be limited only by dielectric break-down voltages of the circuit or parasitic elements of the coil. This voltage can be kilovolts in amplitude even when nominal circuit voltages are low (e.g. 12 VDC) see Fig. 2.

The free-wheeling diode should be chosen so that the reverse breakdown voltage is greater than the voltage driving the inductive load. The DC blocking voltage (VR) of the free-wheeling diode can be found in the datasheet of a diode. The forward current should be equal or greater than the maximum current flowing through the load.

To get an efficient protection, the free-wheeling diode must be connected as close as possible to the inductive load!

Switching with inductive load
Fig. 1
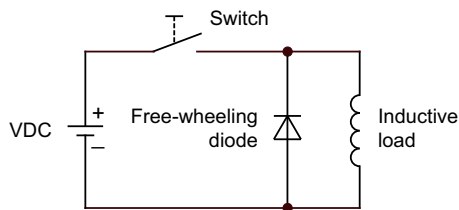
Counter emf
over load without free-wheeling diode
Fig. 2

Switch

VDC

Free-wheeling diode

Inductive load

ON   OFF

0

Sveral hundred to several thousend volts

$$e = L\frac{di}{dt}$$
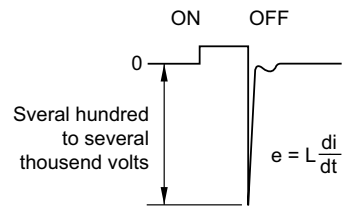
General notes

If desired, the actuators of the series 92 can be supplied ready marked. With your order please enclose a list of the desired markings or a drawing, showing the type or size of script or the symbols desired.

1. Laser engraving (Fig. 1)
In addition to the most commonly used world languages, in DIN 1451-3 close spacing, other typefaces are available as Scandinavian, Slavic, Greek, Russian and Polish.
Red, blue and black lenses are filled with white colour. Other colour lenses are filled in black. Standard height of letters is 2 mm. If the height is not specified, we will supply 2 mm engraved letters.

2. Hot stamping (Fig. 1)
For larger series it is worth considering markings by means of hot stamping. We will pleased to advise you.
For letters and figures, typefaces with 2.5 mm, 3 mm and 4 mm are available.

3. Film inserts (Fig. 2)
Instead of using engraving, the actuator can be fitted with transparent film inserts. However, for this purpose the use of transparent lens caps is recommended. If smoked lens caps are used the lettering does not become visible until the LED is alight.
Max. size of film insert
11.4 x 11.4 mm for IP 40
10.4 x 10.4 mm for IP 67
Film thickness 0.2 mm.

All dimensions in mm

Height of letters h	Number of lines	Number of (target value) capital letters per line	Number of (target value) small letters per line
3	2	5 - 6	6
4	2	4	4
5	1	3	3 - 4
6	1	2 - 3	3
8	1	2	2

Fig. 1   **Fig. 2**
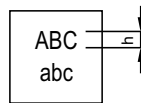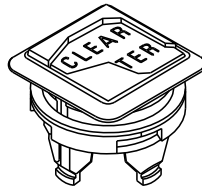
Component layout

1 Illumination element PCB mounting page 10

Single-LED

Bi-colour-LED

Drilling plan (Elementside)

A Fixing holes for mounting flange (92-960.0)
B Holes for LED
C Holes for centering pins
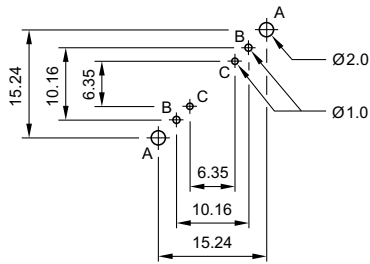
Drilling plan (Elementside)

A Fixing holes for mounting flange (92-960.0)
B Holes for Bi-colour LED:
   BA1 (green) + BA2 (yellow or red) = Anodes, BC = Cathode
C Holes for centering pins
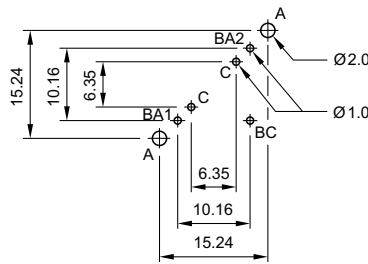
2 Switching element PCB mounting illuminative page 10

Single-LED

Bi-colour-LED

Drilling plan (Elementside)

A Fixing holes for mounting flange (92-960.0)
B Holes for LED
C Holes for contact pins
   Pad max. Ø 2.5 mm
   Through-connection recommended
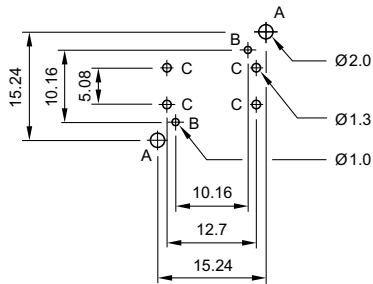
Drilling plan (Elementside)

A Fixing holes for mounting flange (92-960.0)
B Holes for Bi-colour LED:
   BA1 (green) + BA2 (yellow or red) = Anodes, BK = Cathode
C Holes for contact pins
   Pad max. Ø 2.5 mm
   Through-connection recommended
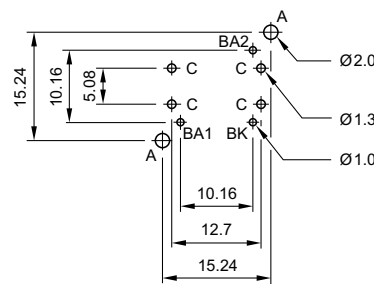
Mounting dimensions

1 Indicator actuator page 7 **| Pushbutton actuator** page 8 **| Illuminated pushbutton actuator** page 9 **| Blind plug** page 10
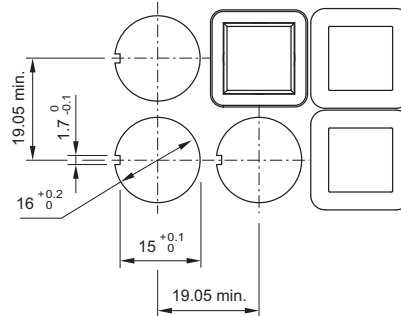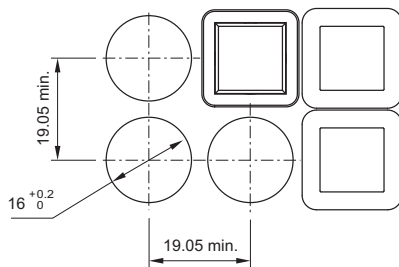
Technical drawing

1 Illumination element PCB mounting page 10
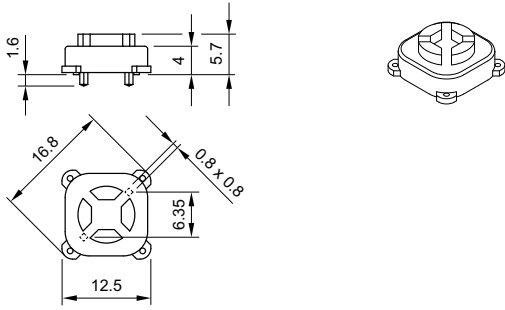
1.6
4
5.7
16.8
0.8 x 0.8
6.35
12.5

2 Mounting flange page 12
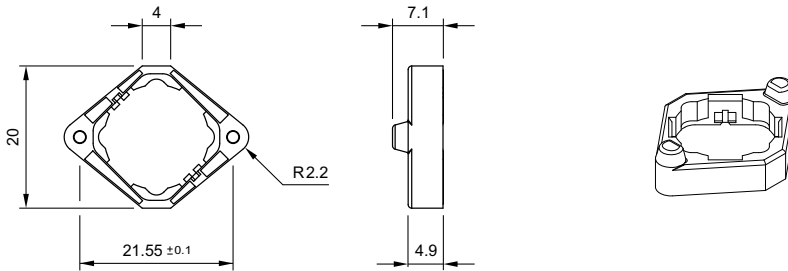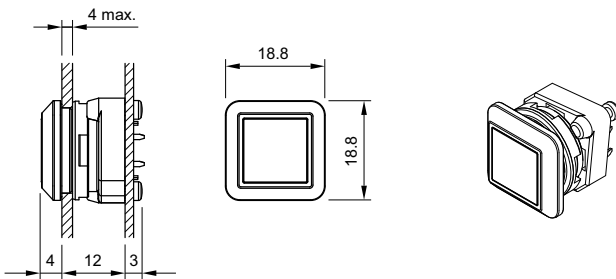
4
7.1
20
R2.2
21.55 ±0.1
4.9

3 Illuminated pushbutton actuator page 9

4 max.
18.8
18.8
4 12 3

4 Indicator actuator page 7

4 max.
18.4
18.4
3.4 12 3

5 Pushbutton actuator page 8

4 max.

18.4

18.4

3.4 12 3

6 Illuminated pushbutton actuator page 9

4 max.

18.4

18.4

3.4 12 3

7 Indicator actuator page 7

4 max.

18.8

18.8

4 12 3
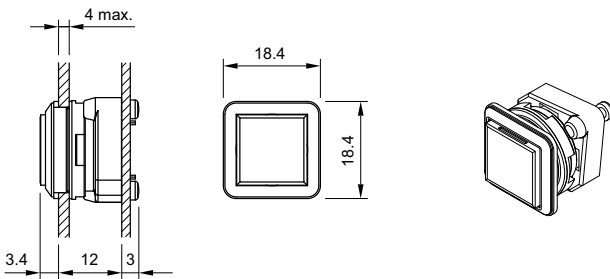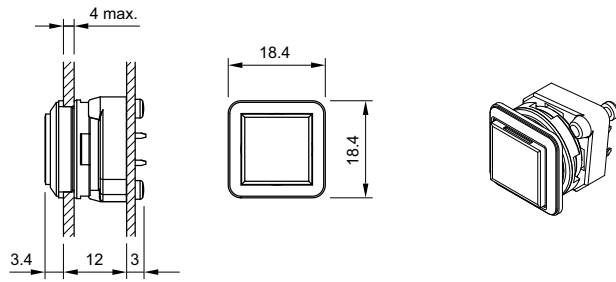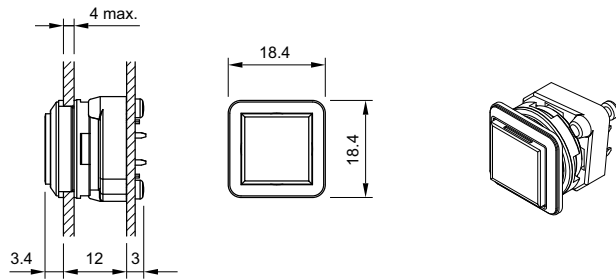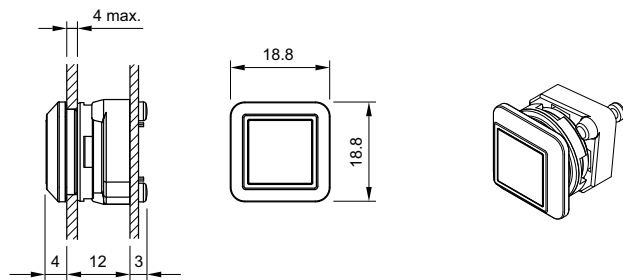
8 Pushbutton actuator page 8

4 max.

18.8

18.8

4 12 3
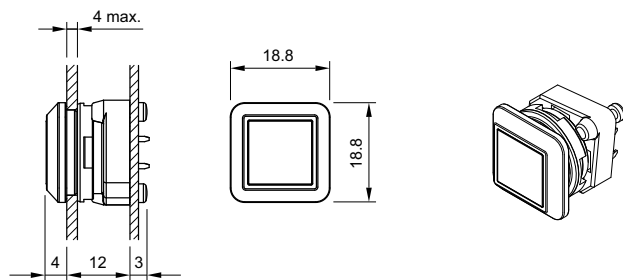
9 Switching element PCB mounting illuminative page 10
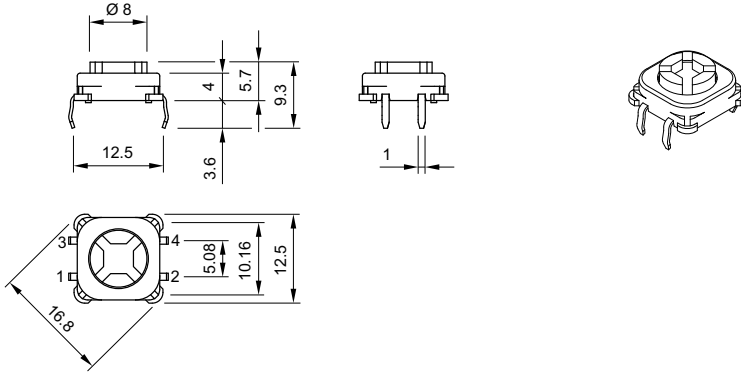
Circuit drawing

1 Pushbutton actuator page 8 **| Illuminated pushbutton actuator** page 9

2 Switching element PCB mounting illuminative page 10

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