## Series

## Characteristics

The Series 70 consists of special short stroke pushbuttons for use with membrane keyboards. It is particularly suited for:

- PCBs

The use of single LEDs ensures that the entire control panel is very well illuminated. The module is offered in six colours and in a round or square design.

## Functions

The Series 70 incorporates the following functions:

- Indicator
- Pushbutton
- Illuminated pushbutton


## Market segments

The EAO Series 70 is especially suited for applications in the segments:

- Machinery and Automation
- Medicinal technology
- Laboratory and measuring equipment

Please refer to the EAO website to obtain detailed information regarding this series www.products.eao.com Configure a product to your exact needs and request a quotation.

PCB pushbuttons
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## 70 PCB pushbuttons

Illumination element



Dimensions

Equipment consisting of (schematic overview)
Lens page 684

Each Part Number listed below includes all the black components shown in the 3D-drawing.

To obtain a complete unit, please select the red components from the pages shown.

| LED colour | Forward voltage typ. | Lumi. intensity | Dom. wavelength | Terminal | Part No. |  | Weight |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |

## Illumination element

| Single-LED red | 2.1 VDC @ 20 mA | 200 mcd | 625 nm | PCB | 70-820.2 | 3 | 2 | 0.001 kg |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Single-LED orange | 2.1 VDC @ 20 mA | 220 mcd | 590 nm | PCB | 70-820.3 | 3 | 2 | 0.001 kg |
| Single-LED yellow | 3.3 VDC @ 30 mA | 500 mcd | 570 nm | PCB | 70-820.4 | 3 | 2 | 0.001 kg |
| Single-LED green | 3.5 VDC @ 20 mA | 250 mcd | 525 nm | PCB | 70-820.5 | 3 | 2 | 0.001 kg |
| Single-LED blue | 3.5 VDC @ 20 mA | 450 mcd | 470 nm | PCB | 70-820.6 | 3 | 2 | 0.001 kg |
| Single-LED white | 3.3 VDC @ 20 mA | 600 mcd | $x=0.29 / y=0.31 \mathrm{~nm}$ | PCB | 70-820.9 | 3 | 2 | 0.001 kg |



Illumination element

| Bi-colour red/green | 2.0/3.2 VDC @ 20 mA | 310/800 mcd | 625/528 nm | PCB | 70-820.25 | 3 | 1 | 0.001 kg |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Bi-colour yellow/green | 2.0/3.2 VDC @ 20 mA | 350/750 mcd | 591/528 nm | PCB | 70-820.45 | 3 | 1 | 0.001 kg |



The component layouts you will find from page 687


Switching element without illumination
Equipment consisting of (schematic overview)

Each Part Number listed below includes all the black components shown in the 3D-drawing.

To obtain a complete unit, please select the red components from the pages shown.



The component layouts you will find from page 687



## 70 PCB pushbuttons

Switching element with illumination


Product can differ from the current configuration.

## Additional Information

- Contact normally open
- Switching action momentary
- The customer has to decide what series resistor shall be used to the LED
- Luminosity and wave length variations caused by LED manufacturing processes may cause slight differences regarding the illumination
- Dimensions with fitted lens see details «Lens»



## Dimensions

Equipment consisting of (schematic overview)


Lens
page 684


LED


Switching element

Each Part Number listed below includes all the black components shown in the 3D-drawing.

To obtain a complete unit, please select the red components from the pages shown.

| LED colour | Forward voltage typ. |  | Lumi. intensity | Dom. wavelength | Terminal | Part No. |  |  | Weight |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | Forward voltage typ. Dom. wavelength Part No. Weight

## Switching element with illumination

| Single-LED red | 2.1 VDC @ 20 mA | Gold | 200 mcd | 625 nm | PCB | 70-220.2 | 4 | 3 | 0.001 kg |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Single-LED orange | 2.1 VDC @ 20 mA | Gold | 220 mcd | 590 nm | PCB | 70-220.3 | 4 | 3 | 0.001 kg |
| Single-LED yellow | 3.3 VDC @ 20 mA | Gold | 500 mcd | 570 nm | PCB | 70-220.4 | 4 | 3 | 0.001 kg |
| Single-LED green | 3.5 VDC @ 20 mA | Gold | 250 mcd | 525 nm | PCB | 70-220.5 | 4 | 3 | 0.001 kg |
| Single-LED blue | 3.5 VDC @ 20 mA | Gold | 450 mcd | 470 nm | PCB | 70-220.6 | 4 | 3 | 0.001 kg |
| Single-LED white | 3.3 VDC @ 20 mA | Gold | 600 mcd | $x=0.29 / y=0.31 \mathrm{~nm}$ | PCB | 70-220.9 | 4 | 3 | 0.001 kg |



## Switching element with illumination

| Bi-colour LED red/green | 2.0/3.2 VDC @ 20 mA | Gold | $310 / 800 \mathrm{mcd}$ | 625/528 nm | PCB | 70-220.25 | 4 | 2 | 0.001 kg |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Bi-colour LED yellow/green | 2.0/3.2 VDC @ 20 mA | Gold | 350/750 mcd | 591/528 nm | PCB | 70-220.45 | 4 | 2 | 0.001 kg |



Switching element with illumination


The component layouts you will find from page 687


## Front

## Lens



Dimensions


## Lens, Front dimension $19.05 \times 19.05 \mathrm{~mm}$

| Plastic white translucent | $\mathbf{7 0 - 9 2 0 . 9}$ | 0.001 kg |
| :--- | :--- | :--- |

## Lens, Front dimension $15.4 \times 15.4$ mm

| Plastic red translucent | $\mathbf{7 0 - 9 2 1 . 2}$ | 0.001 kg |
| :--- | :--- | :--- |
| Plastic orange translucent | $\mathbf{7 0 - 9 2 1 . 3}$ | 0.001 kg |
| Plastic yellow translucent | $\mathbf{7 0 - 9 2 1 . 4}$ |  |
| Plastic green translucent | $\mathbf{0 . 0 0 1} \mathrm{kg}$ |  |
| Plastic blue translucent | $\mathbf{7 0 - 9 2 1 . 5}$ | 0.001 kg |
| Plastic white translucent | $\mathbf{7 0 - 9 2 1 . 6}$ | 0.001 kg |
|  | $\mathbf{7 0 - 9 2 1 . 9}$ | 0.001 kg |

## Lens, Front dimension $12.4 \times 12.4 \mathrm{~mm}$

| Plastic red translucent | $\mathbf{7 0 - 9 2 2 . 2}$ | 0.001 kg |
| :--- | :--- | :--- |
| Plastic orange translucent | $\mathbf{7 0 - 9 2 2 . 3}$ | 0.001 kg |
| Plastic yellow translucent | $\mathbf{7 0 - 9 2 2 . 4}$ |  |
| Plastic green translucent | $\mathbf{0 . 0 0 1} \mathrm{kg}$ |  |
| Plastic blue translucent | $\mathbf{7 0 - 9 2 2 . 5}$ |  |
| Plastic white translucent | $\mathbf{7 0 - 9 2 2 . 6}$ | 0.001 kg |
|  | $\mathbf{0 . 0 0 1} \mathrm{~kg}$ |  |

## Lens, Front dimension Ø $\mathbf{1 5 . 4 \text { mm }}$

| Plastic red translucent | $\mathbf{7 0 - 9 1 1 . 2}$ | 0.001 kg |
| :--- | :--- | :--- | :--- |
| Plastic orange translucent | $\mathbf{7 0 - 9 1 1 . 3}$ |  |
| Plastic yellow translucent | $\mathbf{0 . 0 0 1} \mathrm{kg}$ |  |
| Plastic green translucent | $\mathbf{7 0 - 9 1 1 . 4}$ |  |
| Kunststoff weiss transluzent | $\mathbf{0 . 0 0 1} \mathrm{kg}$ |  |


| Lens | Part No. | Weight |
| :---: | :---: | :---: |
| Lens, Front dimension $\varnothing 12.4$ mm |  |  |
| Plastic red translucent | 70-912.2 | 0.001 kg |
| Plastic orange translucent | 70-912.3 | 0.001 kg |
| Plastic yellow translucent | 70-912.4 | 0.001 kg |
| Plastic green translucent | 70-912.5 | 0.001 kg |
| Plastic white translucent | 70-912.9 | 0.001 kg |

## Spacing cap



Dimensions

|  |  |  |  |
| :--- | :--- | :--- | :--- |
| Product attribute |  |  |  |
|  | Part No. |  |  |
|  | Weight |  |  |
|  |  |  |  |
| without recesses for LED, H = 18.9 mm |  |  |  |
| 2 recesses for LED, $\mathrm{H}=9 \mathrm{~mm}$ | $\mathbf{7 0 - 9 0 1 . 0}$ |  |  |
| 2 recesses for LED, $\mathrm{H}=13 \mathrm{~mm}$ | $\mathbf{7 0 - 9 1 0 . 0}$ |  |  |
| 2 recesses for LED, $\mathrm{H}=22.5 \mathrm{~mm}$ | $\mathbf{0 . 0 0 1} \mathrm{~kg}$ |  |  |

## 70 <br> Accessories

## Illumination

## Single-LED, T1 Bi-Pin

## Additional Information

- The customer has to decide what series resistor shall be used to the LED
- Luminosity and wave length variations caused by LED manufacturing processes may cause slight differences regarding the illumination

| LED colour | Forward voltage typ. | Lumi. intensity | Dom. wavelength | Part No. | Weight |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Single-LED |  |  |  |  |  |
| Single-LED red | 2.1 VDC @ 20 mA | 200 mcd | 625 nm | 10-2602.3202L | 0.001 kg |
| Single-LED orange | 2.1 VDC @ 20 mA | 220 mcd | 590 nm | 10-2602.3203L | 0.001 kg |
| Single-LED yellow | 3.3 VDC @ 20 mA | 500 mcd | 570 nm | 10-2602.3204L | 0.001 kg |
| Single-LED green | 3.5 VDC @ 20 mA | 250 mcd | 525 nm | 10-2602.3205L | 0.001 kg |
| Single-LED blue | 3.5 VDC @ 20 mA | 450 mcd | 470 nm | 10-2602.3206L | 0.001 kg |
| Single-LED white | 3.3 VDC @ 20 mA | 600 mcd | $x=0.29 / y=0.31 \mathrm{~nm}$ | 10-2602.3209L | 0.001 kg |

## Bi-colour-LED, T1 Bi-Pin

## Additional Information

- The customer has to decide what series resistor shall be used to the LED
- Luminosity and wave length variations caused by LED manufacturing processes may cause slight differences regarding the illumination



## Bi-colour-LED

| Bi-colour LED red/green | $2.0 / 3.2$ VDC @ 20 mA | $310 / 800 \mathrm{mcd}$ | $625 / 528 \mathrm{~nm}$ | $\mathbf{1 0 - 2 6 0 3 . 3 0 8 A L}$ | 0.001 kg |
| :--- | :--- | :--- | :--- | :--- | :--- |
| Bi-colour LED yellow/green | $2.0 / 3.2 \mathrm{VDC} @ 20 \mathrm{~mA}$ | $350 / 750 \mathrm{mcd}$ | $591 / 528 \mathrm{~nm}$ | $\mathbf{1 0 - 2 6 0 3 . 3 0 8 C L}$ | 0.001 kg |

Drawings
Component layout 1 Component layout 2

## Single-LED

Drilling plan (element side)
B Holes for LED
C Holes for centering pins


Bi-colour-LED

Drilling plan (element side)
B Holes for Bi-colour LED
BA1 (green) + BA2 (yellow or red) $=$ Anodes, BC = Cathode C Holes for centering pins


## Bi-colour-LED

Drilling plan (element side)
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


Component layout 4


## 70 <br> Technical data

## Switching element illuminated

## Switching system

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

## Material

## Material of contact

Gold (Au)

## Switching element

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

## Mechanical characteristics

## Actuating force

with overlay foil $4 \mathrm{~N} \pm 1,5 \mathrm{~N}$
Max. actuating force $>50 \mathrm{~N}$, as per DIN 42115

## Actuating travel

0.4 mm

## Rebound time

$\leq 1 \mathrm{~ms}$

## Resistance to heat of soldering

$260^{\circ} \mathrm{C}, 5 \mathrm{~s}$, as per IEC 60068-2-20
Mechanical lifetime
> 5 million operations

## Electrical characteristics

## Contact resistance

Starting value (initial) $\leq 100 \mathrm{~m} \Omega$, as per IEC 60512-2-2b
Isolation resistance
$\geq 1000 \mathrm{M} \Omega$

## Contact resistance

$\leq 100 \mathrm{~m} \Omega$
as per 500000 cycles of operation at $12 \mathrm{VDC}, 5 \mathrm{~mA}$ resistive
load $\leq 200 \mathrm{~m} \Omega$

## Electrical life

$\geq 500000$ operations at $42 \mathrm{VDC}, 50 \mathrm{~mA}$, 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.

## Switch rating

max. 2 VA (resistive load)

## Switch rating

Switching voltage VDC/NAC min. 50 mV max. 42 V
Switching current VDC/VAC min. $10 \mu \mathrm{~A} \quad \max .100 \mathrm{~mA}$
Power rating

## Electric strength

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

Environmental conditions
Storage temperature
$-40^{\circ} \mathrm{C} \ldots+85^{\circ} \mathrm{C}$

## Operating temperature

$-25^{\circ} \mathrm{C} \ldots+70^{\circ} \mathrm{C}$

## Switching element non-illuminated Part No. 70-100.0 and 70-101.0

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

## Material

## Material of contact

Silver (Ag)

Mechanical characteristics

## Actuating force

with overlay foil $5 \mathrm{~N} \pm 2 \mathrm{~N}$
Max. actuating force $>50 \mathrm{~N}$, as per DIN 42115
Actuating travel
0.3 mm

Rebound time
$\leq 5 \mathrm{~ms}$
Mechanical lifetime
> 1 million operations

## Electrical characteristics

## Isolation resistance

$\geq 50 \mathrm{M} \Omega$

## Contact resistance

$\leq 100 \mathrm{~m} \Omega$
as per 500000 cycles of operation at $12 \mathrm{VDC}, 5 \mathrm{~mA}$ resistive load $\leq 200 \mathrm{~m} \Omega$

## Electrical life

at $5 \mathrm{VDC}, 1 \mathrm{~mA}>1$ million operations
at $24 \mathrm{VDC}, 1 \mathrm{~mA}>100000$ operations

## Switch rating

$\leq 1 \mathrm{VA}$ (resistive load)

## Switch rating

$\leq 24 \mathrm{VDC}, \leq 50 \mathrm{~mA}$
Electric strength
250 VAC for 1 min.

Environmental conditions

## Storage temperature

$-30^{\circ} \mathrm{C} \ldots+85^{\circ} \mathrm{C}$

## Operating temperature

$-20^{\circ} \mathrm{C} \ldots+70^{\circ} \mathrm{C}$

## Switching element non-illuminated Part No. 70-201.0

## Switching system

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

## Material

## Material of contact

Gold (Au)

## Switching element

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

Mechanical characteristics

## Actuating force

with overlay foil $2.1 \mathrm{~N} \pm 0.2 \mathrm{~N}$
Max. actuating force $>50 \mathrm{~N}$, as per DIN 42115

## Actuating travel

max. 0.5 mm

## Rebound time

$\leq 1 \mathrm{~ms}$

## Resistance to heat of soldering

$260^{\circ} \mathrm{C}$, 5 s, as per IEC 60068-2-20

## Mechanical lifetime

$>5$ million operations

## Front protection

front with overlay foil IP 65

## Electrical characteristics

## Contact resistance

Starting value (initial) $\leq 100 \mathrm{~m} \Omega$, as per IEC 60512-2-2b

## Isolation resistance

$\geq 1000 \mathrm{M} \Omega$

## Contact resistance

$\leq 100 \mathrm{~m} \Omega$
as per 500000 cycles of operation at $12 \mathrm{VDC}, 5 \mathrm{~mA}$ resistive load $\leq 200 \mathrm{~m} \Omega$

## Electrical life

$\geq 500000$ operations at $42 \mathrm{VDC}, 50 \mathrm{~mA}$, 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.

## Switch rating

max. $42 \mathrm{~V}, 50 \mathrm{~mA}$
min. $50 \mathrm{mV}, 10 \mu \mathrm{~A}$

## Switch rating

Switching voltage VDC/NAC min. 50 mV max. 42 V
Switching current VDCNAC min. 10 mA max. 100 mA
Switch rating
max. 2 W
Electric strength
500 VAC, 50 Hz , 1 min, as per IEC 60512-2-4a

Environmental conditions
Storage temperature
$-40^{\circ} \mathrm{C} \ldots+85^{\circ} \mathrm{C}$
Operating temperature
$-25^{\circ} \mathrm{C} \ldots+70^{\circ} \mathrm{C}$

EAO reserves the right to alter specifications without further notice.

## 70 <br> Application guidelines

## 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 breakdown 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. 12VDC) 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


