

# Series 22

## Characteristics

The compact Series 22 is especially suited for:

- Flush design

The large rectangular design (24x36mm) features a large illuminated area.

## Functions

The Series 22 incorporates the following functions:

- Indicator
- Pushbutton
- Illuminated pushbutton
- Mushroom-head pushbutton
- Key lock switch

## Market segments

The EAO Series 22 is especially suited for applications in the segments:

- Public transportation
- Machinery and Automation
- Panel building

Please refer to the EAO website to obtain detailed information regarding this series [www.products.eao.com](http://www.products.eao.com)  
Configure a product to your exact needs and request a quotation.





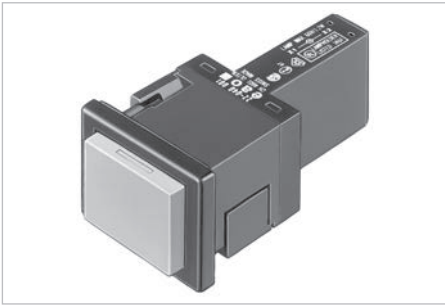
**Overview****Flush design**

Indicator	4
Illuminated pushbutton	5
Mushroom-head pushbutton	7
Keylock switch	9

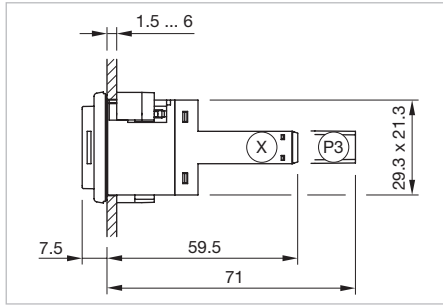
**Accessories****11****Technical data****18****Marking****19****Application guidelines****20****Index****21**

# 22 Flush design

## Indicator, IP 65



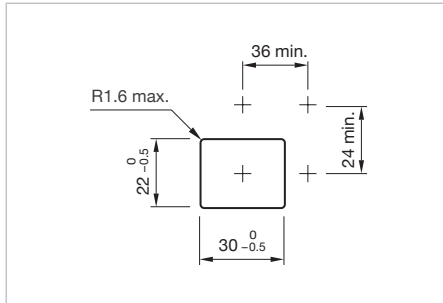
Product can differ from the current configuration.



Dimensions [mm]  
 P3 = Plug-in terminal 6.3 x 0.8 mm,  
 X = Screw terminal

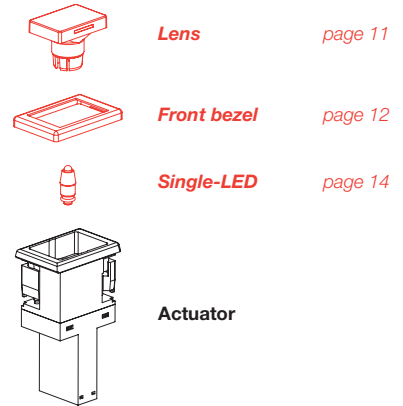
### Additional Information

- For front dimension 24 x 36 mm




Mounting cut-outs [mm]

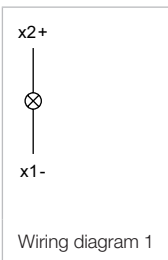
### Equipment consisting of (schematic overview)



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

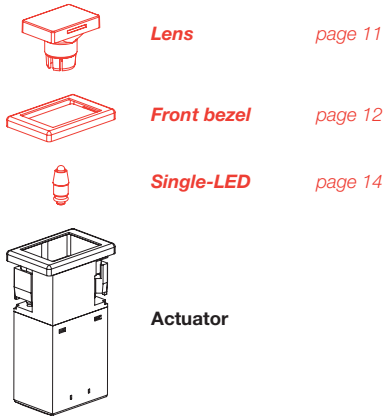
*To obtain a complete unit, please select the red components from the pages shown.*

Terminal	Part No.	Wiring diagram	Weight
 <p><b>Indicator actuator</b></p>			
	Screw	<b>22-040.001</b>	1
Plug 6.3 x 0.8 mm	<b>22-040.004</b>	1	0.019 kg



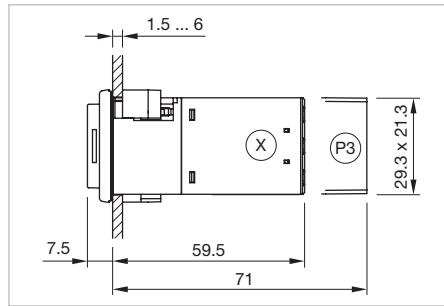
## Illuminated pushbutton, IP 65

### Equipment consisting of (schematic overview)

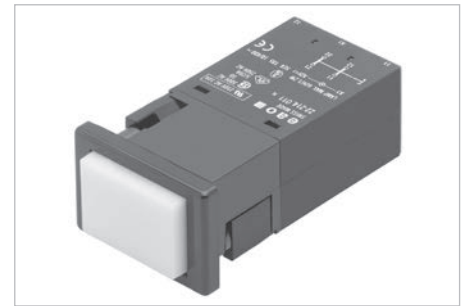


Each Part Number listed below includes all the black components shown in the 3D-drawing.

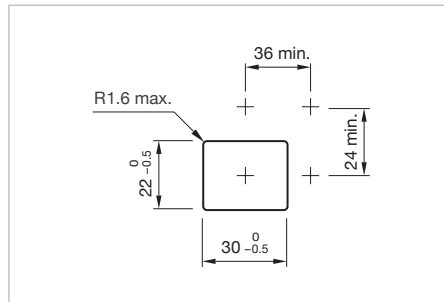
To obtain a complete unit, please select the red components from the pages shown.



Dimensions [mm]  
P3 = Plug-in terminal 6.3 x 0.8 mm,  
X = Screw terminal




Product can differ from the current configuration.



Mounting cut-outs [mm]

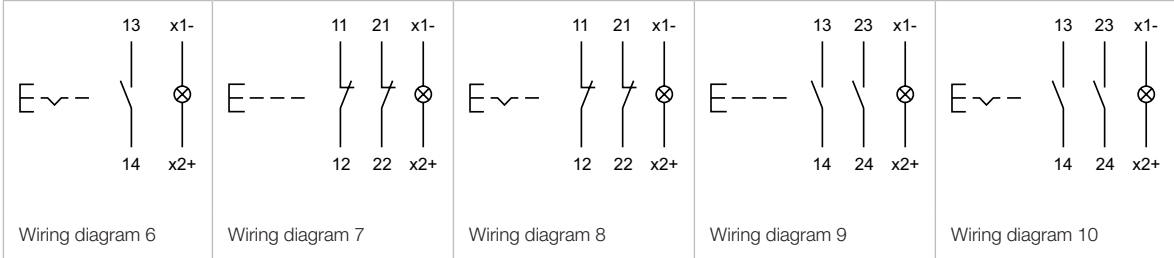
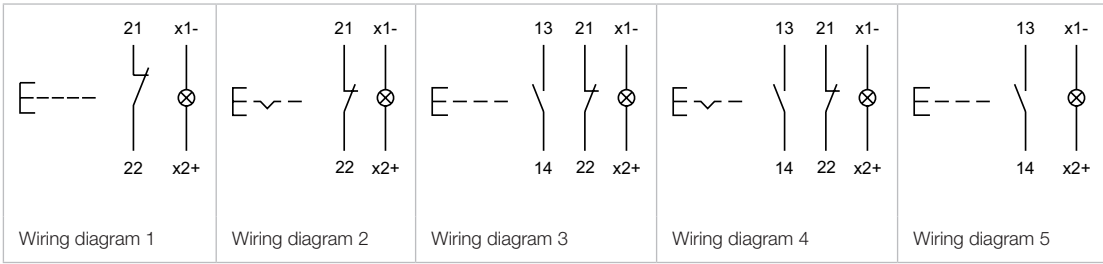
### Additional Information

- For front dimension 24 x 36 mm
- Switching system snap-action element

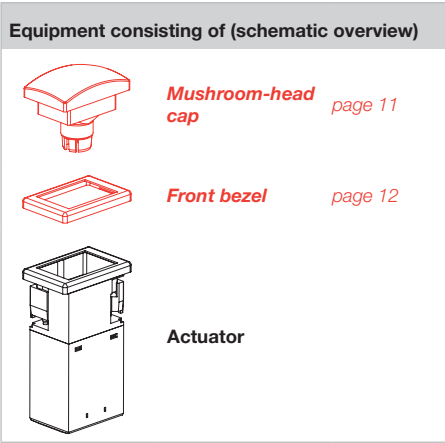
Contacts	Switching action	Terminal	Part No.	Wiring diagram	Weight
 <p><b>Illuminated pushbutton actuator</b></p>					
1 NC	B	Screw	<b>22-212.011</b>	1	0.037 kg
		Plug 6.3 x 0.8 mm	<b>22-212.014</b>	1	0.032 kg
	C	Screw	<b>22-222.011</b>	2	0.037 kg
		Plug 6.3 x 0.8 mm	<b>22-222.014</b>	2	0.032 kg
1 NC + 1 NO	B	Screw	<b>22-215.011</b>	3	0.044 kg
		Plug 6.3 x 0.8 mm	<b>22-215.014</b>	3	0.034 kg
	C	Screw	<b>22-225.011</b>	4	0.044 kg
		Plug 6.3 x 0.8 mm	<b>22-225.014</b>	4	0.034 kg
1 NO	B	Screw	<b>22-211.011</b>	5	0.037 kg
		Plug 6.3 x 0.8 mm	<b>22-211.014</b>	5	0.032 kg
	C	Screw	<b>22-221.011</b>	6	0.037 kg
		Plug 6.3 x 0.8 mm	<b>22-221.014</b>	6	0.032 kg
2 NC	B	Screw	<b>22-214.011</b>	7	0.044 kg
		Plug 6.3 x 0.8 mm	<b>22-214.014</b>	7	0.034 kg
	C	Screw	<b>22-224.011</b>	8	0.044 kg
		Plug 6.3 x 0.8 mm	<b>22-224.014</b>	8	0.034 kg
2 NO	B	Screw	<b>22-213.011</b>	9	0.044 kg
		Plug 6.3 x 0.8 mm	<b>22-213.014</b>	9	0.034 kg
	C	Screw	<b>22-223.011</b>	10	0.044 kg
		Plug 6.3 x 0.8 mm	<b>22-223.014</b>	10	0.044 kg

Contacts: NC = Normally closed, NO = Normally open  
Switching action: B = Momentary, C = Maintain

# 22 Flush design

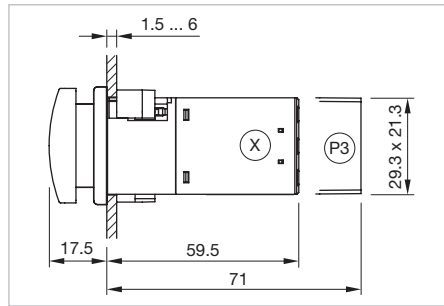


**Mushroom-head pushbutton, IP 65**



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

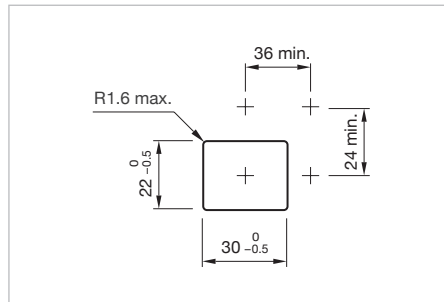
To obtain a complete unit, please select the red components from the pages shown.



Dimensions [mm]  
 P3 = Plug-in terminal 6.3 x 0.8 mm,  
 X = Screw terminal




Product can differ from the current configuration.



Mounting cut-outs [mm]

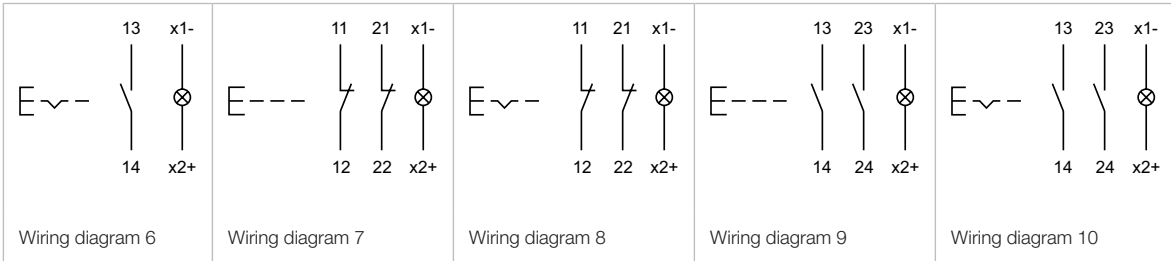
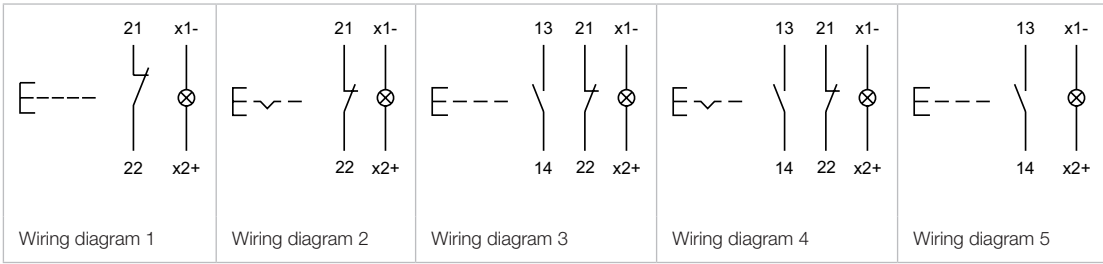
**Additional Information**

- For front dimension 24 x 36 mm
- Switching system snap-action element

Contacts	Switching action	Terminal	Part No.	Wiring diagram	Weight
 <p><b>Mushroom-head pushbutton actuator</b></p>					
1 NC	B	Screw	<b>22-212.011</b>	1	0.037 kg
		Plug 6.3 x 0.8 mm	<b>22-212.014</b>	1	0.032 kg
	C	Screw	<b>22-222.011</b>	2	0.037 kg
		Plug 6.3 x 0.8 mm	<b>22-222.014</b>	2	0.032 kg
1 NC + 1 NO	B	Screw	<b>22-215.011</b>	3	0.044 kg
		Plug 6.3 x 0.8 mm	<b>22-215.014</b>	3	0.034 kg
	C	Screw	<b>22-225.011</b>	4	0.044 kg
		Plug 6.3 x 0.8 mm	<b>22-225.014</b>	4	0.034 kg
1 NO	B	Screw	<b>22-211.011</b>	5	0.037 kg
		Plug 6.3 x 0.8 mm	<b>22-211.014</b>	5	0.032 kg
	C	Screw	<b>22-221.011</b>	6	0.037 kg
		Plug 6.3 x 0.8 mm	<b>22-221.014</b>	6	0.032 kg
2 NC	B	Screw	<b>22-214.011</b>	7	0.044 kg
		Plug 6.3 x 0.8 mm	<b>22-214.014</b>	7	0.034 kg
	C	Screw	<b>22-224.011</b>	8	0.044 kg
		Plug 6.3 x 0.8 mm	<b>22-224.014</b>	8	0.034 kg
2 NO	B	Screw	<b>22-213.011</b>	9	0.044 kg
		Plug 6.3 x 0.8 mm	<b>22-213.014</b>	9	0.034 kg
	C	Screw	<b>22-223.011</b>	10	0.044 kg
		Plug 6.3 x 0.8 mm	<b>22-223.014</b>	10	0.044 kg

Contacts: NC = Normally closed, NO = Normally open  
 Switching action: B = Momentary, C = Maintain

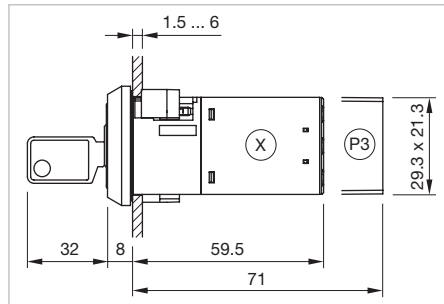
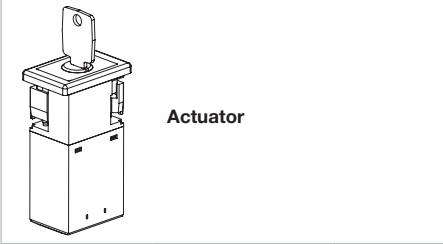
# 22 Flush design





**Keylock switch 2 positions, IP 65**

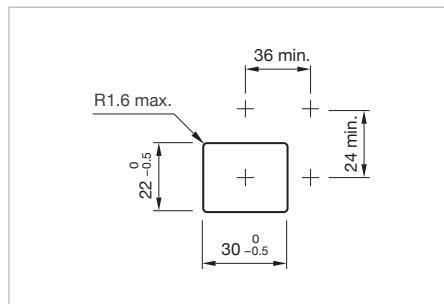
**Equipment consisting of (schematic overview)**



Product can differ from the current configuration.

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

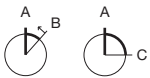
Dimensions [mm]  
 P3 = Plug-in terminal 6.3 x 0.8 mm,  
 X = Screw terminal



Mounting cut-outs [mm]

**Additional Information**

- Front plastic black
- Switching system snap-action element
- The standard lock: DOM 311
- Two keys are supplied with each key lock switch
- Optional lock numbers on request



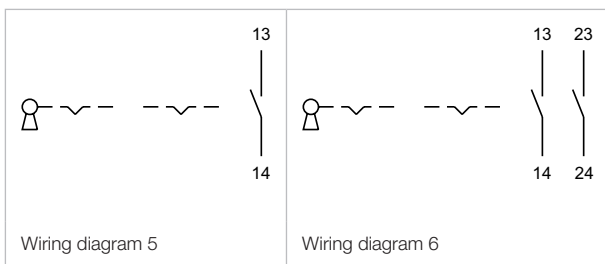
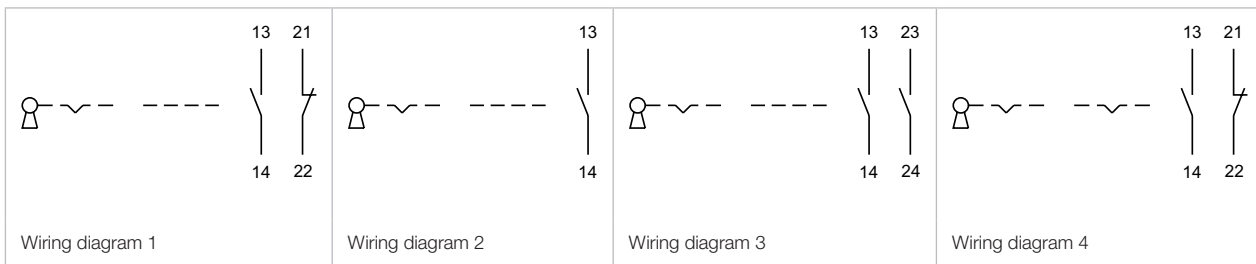
Switching positions (A = Rest, B = Momentary, C = Maintained)

Contacts	Switching action	Switching angle	Key remove	Terminal	Part No.	Wiring diagram	Weight
 <p><b>Keylock switch 2 positions, Front dimension 24 x 36 mm</b></p>							
1 NC + 1 NO	A - B	B = 45°	A	Screw	<b>22-355.111D</b>	1	0.051 kg
				Plug 6.3 x 0.8 mm	<b>22-355.114D</b>	1	0.046 kg
1 NO	A - B	B = 45°	A	Screw	<b>22-351.111D</b>	2	0.051 kg
				Plug 6.3 x 0.8 mm	<b>22-351.114D</b>	2	0.046 kg
2 NO	A - B	B = 45°	A	Screw	<b>22-353.111D</b>	3	0.051 kg
				Plug 6.3 x 0.8 mm	<b>22-353.114D</b>	3	0.046 kg
1 NC + 1 NO	A - C	C = 90°	A	Screw	<b>22-335.111D</b>	4	0.051 kg
				C	Screw	<b>22-335.311D</b>	4
			A + C	Screw	<b>22-335.511D</b>	4	0.051 kg
			A	Plug 6.3 x 0.8 mm	<b>22-335.114D</b>	4	0.046 kg
			C	Plug 6.3 x 0.8 mm	<b>22-335.314D</b>	4	0.046 kg
			A + C	Plug 6.3 x 0.8 mm	<b>22-335.514D</b>	4	0.046 kg
1 NO	A - C	C = 90°	A	Screw	<b>22-331.111D</b>	5	0.051 kg
				C	Screw	<b>22-331.311D</b>	5
			A + C	Screw	<b>22-331.511D</b>	5	0.044 kg
			A	Plug 6.3 x 0.8 mm	<b>22-331.114D</b>	5	0.046 kg
			C	Plug 6.3 x 0.8 mm	<b>22-331.314D</b>	5	0.044 kg
			A + C	Plug 6.3 x 0.8 mm	<b>22-331.514D</b>	5	0.040 kg

# 22 Flush design


Contacts	Switching action	Switching angle	Key remove	Terminal	Part No.	Wiring diagram	Weight
2 NO	A - C	C = 90°	A	Screw	<b>22-333.111D</b>	6	0.051 kg
			C	Screw	<b>22-333.311D</b>	6	0.051 kg
			A + C	Screw	<b>22-333.511D</b>	6	0.051 kg
			A	Plug 6.3 x 0.8 mm	<b>22-333.114D</b>	6	0.046 kg
			C	Plug 6.3 x 0.8 mm	<b>22-333.314D</b>	6	0.046 kg
			A + C	Plug 6.3 x 0.8 mm	<b>22-333.514D</b>	6	0.046 kg

Contacts: NC = Normally closed, NO = Normally open  
 Switching action: B = Momentary, C = Maintain



Front


Lens plastic

Product attribute	Dimension	Lens	Part No.	Weight	
 <p><b>Lens plastic</b></p>	17 x 25.5 mm	illuminative	smoked transparent	<b>22-903.1</b>	0.003 kg
			red transparent	<b>22-903.2</b>	0.003 kg
			orange transparent	<b>22-903.3</b>	0.003 kg
			yellow transparent	<b>22-903.4</b>	0.003 kg
			green transparent	<b>22-903.5</b>	0.003 kg
			blue transparent	<b>22-903.6</b>	0.003 kg
			colourless transparent	<b>22-903.7</b>	0.003 kg
illuminative, not suitable for film insert, bright LEDs are visible	17 x 25.5 mm		red translucent	<b>22-901.2</b>	0.003 kg
			orange translucent	<b>22-901.3</b>	0.003 kg
			yellow translucent	<b>22-901.4</b>	0.003 kg
			green translucent	<b>22-901.5</b>	0.003 kg
			blue translucent	<b>22-901.6</b>	0.003 kg
			white translucent	<b>22-901.9</b>	0.003 kg
illuminative, less suitable for film insert	17 x 25.5 mm		red transparent	<b>22-905.2</b>	0.003 kg
			yellow transparent	<b>22-905.4</b>	0.003 kg
			green transparent	<b>22-905.5</b>	0.003 kg
			colourless transparent	<b>22-905.7</b>	0.003 kg
non-illuminative	17 x 25.5 mm		black opaque	<b>22-901.0</b>	0.003 kg
			grey opaque	<b>22-901.8</b>	0.003 kg

Mushroom-head cap

Additional Information

- Non-illuminative
- Use only flush front bezel

Dimension	Mushroom-head cap	Part No.	Weight	
 <p><b>Mushroom-head cap</b></p>	23 x 35 mm	Plastic black	<b>22-930.0</b>	0.006 kg
		Plastic red	<b>22-930.2</b>	0.006 kg
		Plastic yellow	<b>22-930.4</b>	0.006 kg
		Plastic green	<b>22-930.5</b>	0.006 kg

# 22 Accessories

## Front bezel flush

### Additional Information

- Lens only removable with lens remover Part No. 02-905

Front bezel	Part No.	Weight
 <p><b>Front bezel flush, Front dimension 24 x 36 mm</b></p>		
Pastic black	<b>02-965.0</b>	0.001 kg

## Front bezel raised

### Additional Information

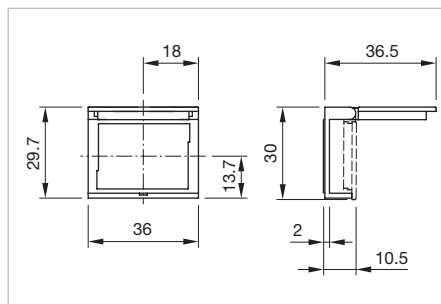
- Lens only removable with lens remover Part No. 98-969

Front bezel	Part No.	Weight
 <p><b>Front bezel raised, Front dimension 24 x 36 mm</b></p>		
Pastic black	<b>02-967.0</b>	0.001 kg


## Protective cover, IP 65

### Additional Information


- The dimensions of the mounting cut-outs are shown in the product details
- Use only flush front bezel
- Hinged, with means for sealing
- Front panel thickness reduces by 2 mm
- Please not that bigger minimum distances are necessary



Dimensions [mm]

Mounting cut-out	Material	Optics	Part No.	Weight
 <p><b>Protective cover</b></p>				
22 x 30 mm	Plastic	transparent	<b>22-925</b>	0.004 kg


**Blind plug**

Dimension	Mounting cut-out	Material	Colour	Part No.	Weight
 <p><b>Blind plug</b></p>					
24 x 36 mm	Ø 16 mm	Plastic	black	<b>22-949.0</b>	0.005 kg

**Master key**

**Additional Information**

- For standard lock: DOM 311 ... 445

Part No.	Weight
 <p><b>Master key</b></p>	
<b>31-989.300</b>	0.006 kg

**Spare key**

**Additional Information**

- For standard lock: DOM 311
- Optional lock numbers on request

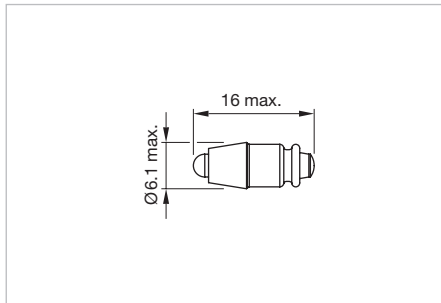
Part No.	Weight
 <p><b>Spare key</b></p>	
<b>31-989.311</b>	0.006 kg

## Illumination


### Single-LED, T1 3/4 MG


#### Additional Information

- When using AC/DC types with AC operation, slight flickering can occur
- Luminous intensity data of the LEDs on direct voltage
- Electrical and optical data are measured at 25 °C
- The specified versions are built with a protection diode (half wave rectifier) in series and the LED
- Luminosity and wave length scattering caused by LED manufacturing processes may cause slight variations in the illumination
- For supply voltages above 48V, a voltage reduction element (external series resistor or transformer) must be used
- Due to high surface temperatures, the series resistor must not be soldered directly to the terminals of the equipment (use a terminal plate)




Dimensions [mm]

LED colour	Operating voltage	Operation current	Lumi. intensity	Dom. wavelength	Part No.	Weight
 <p><b>Single-LED</b></p>						
red	6 VDC +10 %	15 mA ±15 %	350 mcd	630 nm	<b>10-2J06.3142</b>	0.002 kg
	12 VAC/DC +10 %	7/14 mA ±15 %	330 mcd	630 nm	<b>10-2J09.1062</b>	0.002 kg
	24 VAC/DC +10 %	7/14 mA ±15 %	330 mcd	630 nm	<b>10-2J12.1062</b>	0.002 kg
	28 VAC/DC +10 %	7/14 mA ±15 %	330 mcd	630 nm	<b>10-2J13.1062</b>	0.002 kg
	48 VAC/DC +10 %	4/8 mA ±15 %	200 mcd	630 nm	<b>10-2J19.1042</b>	0.002 kg
yellow	6 VDC +10 %	15 mA ±15 %	300 mcd	587 nm	<b>10-2J06.3144</b>	0.002 kg
	12 VAC/DC +10 %	7/14 mA ±15 %	280 mcd	587 nm	<b>10-2J09.1064</b>	0.002 kg
	24 VAC/DC +10 %	7/14 mA ±15 %	280 mcd	587 nm	<b>10-2J12.1064</b>	0.002 kg
	28 VAC/DC +10 %	7/14 mA ±15 %	280 mcd	587 nm	<b>10-2J13.1064</b>	0.002 kg
	48 VAC/DC +10 %	4/8 mA ±15 %	180 mcd	587 nm	<b>10-2J19.1044</b>	0.002 kg
green	6 VDC +10 %	7 mA ±15 %	1050 mcd	525 nm	<b>10-2J06.3145</b>	0.002 kg
	12 VAC/DC +10 %	4/7 mA ±15 %	1050 mcd	525 nm	<b>10-2J09.1065</b>	0.002 kg
	24 VAC/DC +10 %	4/7 mA ±15 %	1050 mcd	525 nm	<b>10-2J12.1065</b>	0.002 kg
	28 VAC/DC +10 %	4/7 mA ±15 %	1050 mcd	525 nm	<b>10-2J13.1065</b>	0.002 kg
	48 VAC/DC +10 %	2/4 mA ±15 %	600 mcd	525 nm	<b>10-2J19.1045</b>	0.002 kg
blue	6 VDC +10 %	15 mA ±15 %	680 mcd	470 nm	<b>10-2J06.3146</b>	0.002 kg
	12 VAC/DC +10 %	7/14 mA ±15 %	650 mcd	470 nm	<b>10-2J09.1066</b>	0.002 kg
	24 VAC/DC +10 %	7/14 mA ±15 %	650 mcd	470 nm	<b>10-2J12.1066</b>	0.002 kg
	28 VAC/DC +10 %	7/14 mA ±15 %	650 mcd	470 nm	<b>10-2J13.1066</b>	0.002 kg
	48 VAC/DC +10 %	4/8 mA ±15 %	400 mcd	470 nm	<b>10-2J19.1046</b>	0.002 kg
white	6 VDC +10 %	6 mA ±15 %	900 mcd	x0.31/y0.32 nm	<b>10-2J06.3149</b>	0.002 kg
	12 VAC/DC +10 %	3/6 mA ±15 %	900 mcd	x0.31/y0.32 nm	<b>10-2J09.1069</b>	0.002 kg
	24 VAC/DC +10 %	2.5/5 mA ±15 %	750 mcd	x0.31/y0.32 nm	<b>10-2J12.1069</b>	0.002 kg
	28 VAC/DC +10 %	2.5/5 mA ±15 %	750 mcd	x0.31/y0.32 nm	<b>10-2J13.1069</b>	0.002 kg
	48 VAC/DC +10 %	2/4 mA ±15 %	600 mcd	x0.31/y0.32 nm	<b>10-2J19.1049</b>	0.002 kg

LED colour	Operating voltage	Operation current	Lumi. intensity	Dom. wavelength	Part No.	Weight
 <p><b>Bi-colour LED</b></p>						
Bi-colour LED red/green	24 VDC +10 %	15/14 mA ±15 %	600/630 mcd	625/525 nm	<b>10-A312.314A</b>	0.002 kg


### Filament lamp, T1 3/4 MG

Operating voltage	Operation current	Part No.	Weight
 <p><b>Filament lamp</b></p>			
6 VAC/DC	120 mA ±10 %	<b>10-1306.1349</b>	0.001 kg
6.3 VAC/DC	200 mA ±10 %	<b>10-1307.1369</b>	0.001 kg
12 VAC/DC	75 mA ±10 %	<b>10-1309.1309</b>	0.001 kg
14 VAC/DC	80 mA ±10 %	<b>10-1310.1319</b>	0.001 kg
18 VAC/DC	40 mA ±10 %	<b>10-1311.1249</b>	0.001 kg
24 VAC/DC	35 mA ±10 %	<b>10-1312.1229</b>	0.001 kg
28 VAC/DC	30 mA ±10 %	<b>10-1313.1209</b>	0.001 kg
28 VAC/DC	40 mA ±10 %	<b>10-1313.1249</b>	0.001 kg
36 VAC/DC	20 mA ±10 %	<b>10-1316.1179</b>	0.001 kg
36 VAC/DC	30 mA ±10 %	<b>10-1316.1209</b>	0.001 kg
48 VAC/DC	20 mA ±10 %	<b>10-1319.1179</b>	0.001 kg
48 VAC/DC	25 mA ±10 %	<b>10-1319.1199</b>	0.001 kg

### Series resistor

#### Additional Information


- Only for filament lamp 48 VAC, 25 mA
- For lamp voltage reduction
- Keep to the country specific safety instructions
- Due to high surface temperatures, the series resistors must be soldered directly to the terminals of the equipment (use a terminal plate)

Operating voltage	Resistance	Part No.	Weight
 <p><b>Series resistor</b></p>			
110 VAC	2.7 kOhm	<b>02-904.0</b>	0.003 kg
125 VAC	3.3 kOhm	<b>02-904.1</b>	0.003 kg
145 VAC	4.7 kOhm	<b>02-904.3</b>	0.003 kg
240 VAC	10 kOhm	<b>02-904.7</b>	0.003 kg

## Terminal plate empty

### Additional Information



- For fitting with series resistors

Product attribute	Dimension	Part No.	Weight
 <p><b>Terminal plate empty</b></p>			
5 spaces	62.5 x 60 x 15 mm	<b>02-912.1</b>	0.025 kg
10 spaces	125 x 60 x 15 mm	<b>02-912.2</b>	0.045 kg
15 spaces	187.6 x 60 x 15 mm	<b>02-912.3</b>	0.090 kg
20 spaces	250 x 60 x 15 mm	<b>02-912.4</b>	0.095 kg



Mounting


Lens remover

Product attribute	Part No.	Weight
 <p><b>Lens remover</b></p>		
for flush front bezel	<b>02-905</b>	0.011 kg
 <p><b>Lens remover</b></p>		
for raised front bezel	<b>98-968</b>	0.004 kg

Lamp remover

Additional Information


▲ **Caution:** A switching process might be released when replacing the lamp

Part No.	Weight
 <p><b>Lamp remover</b></p>	
<b>61-9740.0</b>	0.003 kg

Dismantling tool

Additional Information

- For dismantling the lens from the holder

Part No.	Weight
 <p><b>Dismantling tool</b></p>	
<b>22-938</b>	0.030 kg

## Actuator with snap-action switching element

### Switching system

Self-cleaning, double-break, snap-action switching system (with contact gap 2 x 1.5 mm).  
Max. 2 normally closed or 2 normally open contacts, or one of each.

### Material

#### Lens

Polymethylmethacrylate PMMA, as per UL 94 HB, Polycarbonate (PC), as per UL 94 V0

#### Front bezel

Polyphenylenoxide (PPO)

#### Material of contact

Hard silver

#### Actuator housing

Polyamide (PA), Polytherimide (PEI)

### Mechanical characteristics

#### Terminals

Screw terminal (with self-lifting clip):  
Max. wire cross-section 2 x 2.5 mm<sup>2</sup>  
Max. wire cross-section of stranded cable 2 x 1.5 mm<sup>2</sup>

Plug-in terminal 6.3 x 0.8 mm

#### Actuating force

with 1 switching element 3.6 N ± 0.3 N  
with 2 switching elements 6.8 N ± 0.3 N

#### Actuating travel

5.5 mm ± 0.2 mm

#### Travel

3 mm

#### Rebound time

≤ 3 ms

#### Mechanical lifetime

Illuminated pushbutton 1 million operations  
Keylock switch 40 000 operations

### Electrical characteristics

#### Contact resistance

Starting value ≤ 50 mΩ, as per IEC 60512-2-4

#### Isolation resistance

≥ 100 MΩ between all contacts at 100 VDC, as per IEC 60512-3-1

### Switch rating

Power rating  
min. 12 VAC, 50 mA  
max. 400 VAC, 10 A

Switch rating AC (cos φ 0.7), service category AC-11  
Voltage 125 VAC 250 VAC 380 VAC  
Current 8 A 5 A 3 A  
Operations ≥ 100 000

Switch rating DC (inductive) L:R = 30 ms, service categorie DC-11  
Voltage 24 V 60 V 110 V 220 V  
Current 6 A 1.5 A 0.4 A 0.2 A  
Operations ≥ 100 000

### Electric strength

2500 VAC, 50 Hz, 1 min. between all terminals and earth, as per IEC 60512-2-11.

### Environmental conditions

#### Storage temperature

-40 °C ... +95 °C

#### Service temperature

-25 °C ... +85 °C

#### Protection degree

Terminal/case IP 20  
Front IP 65 as per IEC 60529

#### Shock resistance

50 g for 11 ms, as per IEC 60512-4-3

#### Vibration resistance

(sinusoidal)  
10 g at 10 Hz ... 2000 Hz, amplitude 0.75 mm, as per IEC 60512-4-4

### Approvals

#### Approbations

CB (IEC 61058)  
CSA  
ENEC (EN 61058)  
UL

#### Declaration of conformity

CE

## General notes

### 1. Engraving

In addition to the most commonly used world languages, in DIN1451-3 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 3 mm. If the height is not specified, we will supply 3 mm engraved letters.

### 2. Hot stamping

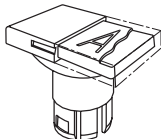
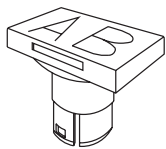
For larger series it is worth considering markings by means of hot stamping. We will be pleased to advise you. For letters and figures, typefaces with 2.5 mm, 3 mm and 4 mm are available.

### 3. Film inserts

Instead of using engraving the lenses can be fitted with transparent film inserts, as an alternative. For this purpose, though, it is advisable to use transparent lenses. In the case of use of a smoke-black lens the fitted film becomes readable only if the lamp is on. The film thickness is 0.2 mm. Important : Consider push-button mounting orientation before specifying engraving characters!

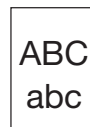
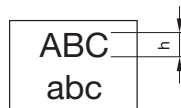
Alle Dimensionen in mm

Film insert max. size	Height of letters h	Number of lines	Number of capital letters per line (target value)	Number of small letters per line (target value)	Image
14.3 x 22.4	3	4	11	13	B1
			7-8	8-9	B2
	4	2	7	9	B1
			4	5-6	B2
	5	2	5-6	6-7	B1
			3	4	B2
	6	1	5	6	B1
			3	4	B2
	8	1	3	4	B1
			2	2	B2



B1

B2



# 22 Application guidelines

## Suppressor circuits

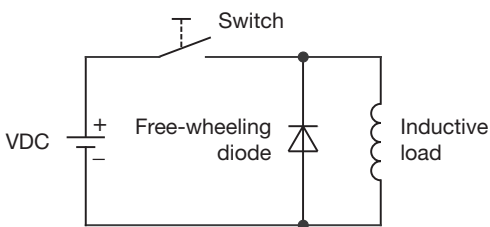
When switching inductive loads such as relays, DC motors, and DC solenoids, it is always important to absorb surges (e.g. with a diode) to protect the contacts. When these inductive loads are switched off, a counter emf can severely damage switch contacts and greatly shorten lifetime.

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.

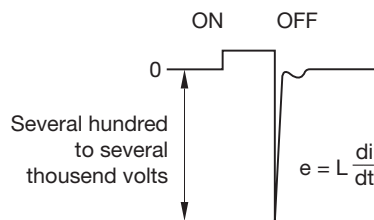
The free-wheeling diode should be chosen so that the reverse breakdown voltage is greater than the voltage driving the inductive load. The DC blocking voltage ( $V_R$ ) of the free-wheeling diode can be found in the datasheet of a diode. The forward current should be equal or greater than the maximum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



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