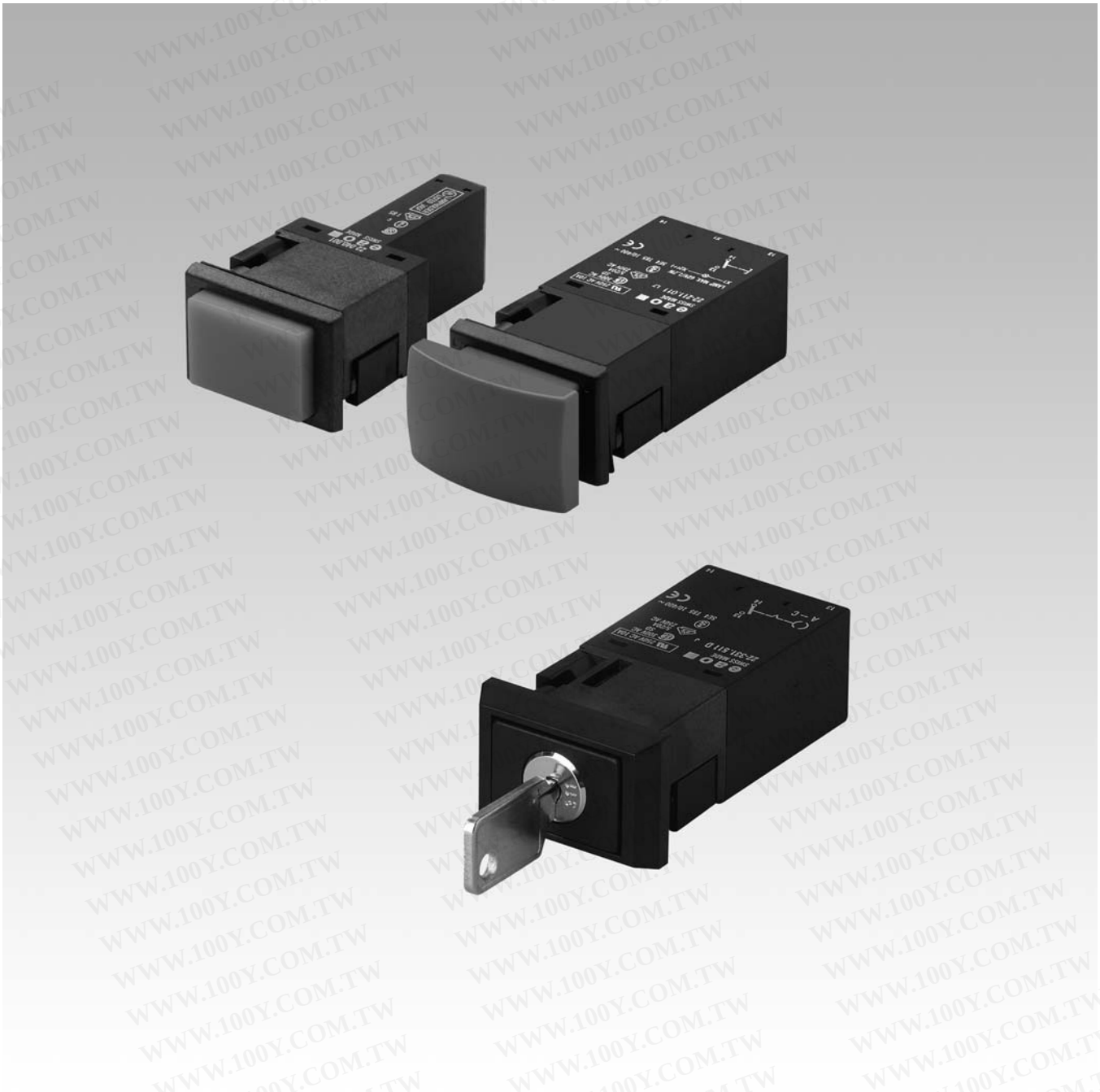
EAO – Your Expert Partner for
Human Machine Interfaces

EAO Product Information

Series 22

eao



Product Information

General notes
The illuminated pushbuttons, keylock switches, mushroom pushbuttons with momentary or maintained action and indicators are primarily noteworthy for their degree of protection IP 65 of the front (i.e. dust and splash-proof). Their robust, compact design, mounting by one man, their screw and plug-in terminals proof against inadvertent contact, and their large surface area for engraving and illumination are other quality features.
The switching element is a double-break snap-action system, the current being carried by a through-contact bar.
The dimensions of the front bezel are 24 x 36 mm. For indicators and illuminated pushbuttons you can choose the design of the front to suit your requirements from two front bezels which clip on in different ways.
The raised front bezel of keylock switches is fixed Typ-Nr. 02-967.0.

Mounting
Mounting by one man from the front. The switch, pushed into the square opening in the panel from the front, can be fixed with two clamping elements (tighten screws with max. 30 Ncm).

Lenses
The flat lenses, made of Polymethyl Methacrylate, are obtainable in various colours, as well as transparent or translucent.
The lens has to be fitted in the unactuated position.

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

Illumination
The T1 $^{3}/_{4}$ Midget Groove incandescent (filament) lamp (6 ... 48 V) ensures perfect illumination of the lenses, which are supplied in various colours.
T1 $^{3}/_{4}$ Midget Groove Single-LED (6, 12, 24, 28, 48 V) are also available in blue, green, red, white or yellow.
Luminosity and wave length scattering caused by the technology used in the LED manufacturing processes may lead to visual differences in our products.
For supply voltages above 48 V, it is necessary to use a voltage reduction element (external series resistor or transformer).

Position indication
The status of a maintained action switch can be determinded by the position of the lens.

Keylock switch
Standard lock (Index D). Standard lock number is 311. If the lock number is not specified, we will supply standard number 311.
An additional 134 special locks (Index X) are available on request.
Master keys for lock numbers 311 ... 445 may be ordered by quoting Typ-Nr. 31-989.300. Two keys are supplied with each keylock switch.
Spare keys (Index D) for standard locks may be ordered by quoting Typ-Nr. 31-989.xxx (please state the lock number).

Number structure
Nomenclature in accordance with ' IEC 61058 TEST REPORT '. The certification document we dispatch to them on demands.

Specimen order

Indicator :

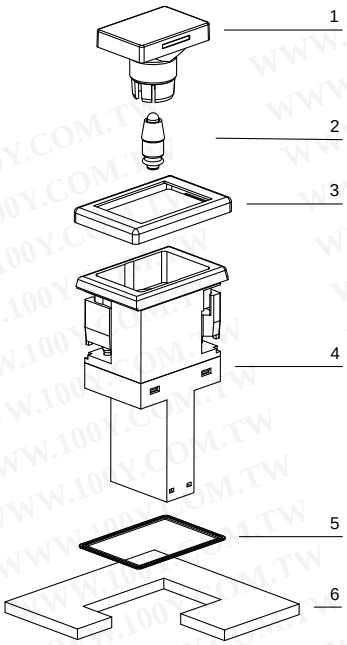
-	Indicator actuator, 24 x 36 mm, screw terminal	22-040.004

Essential accessories :

-	Lens plastic red, transparent	22-903.2
-	Front bezel flush, black	22-965.0
-	Single-LED, T1 $^{3}/_{4}$ MG, 24 VAC/DC, red	10-2J12.1062

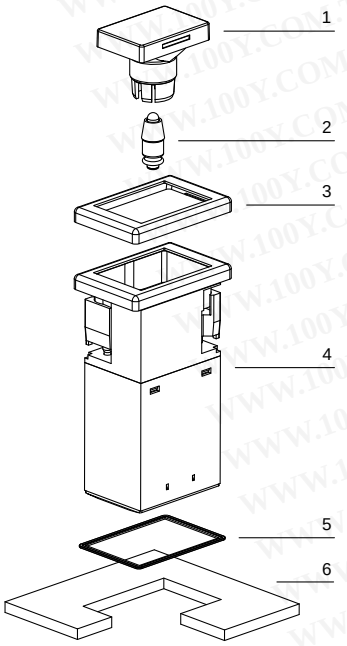
We reserve the right to modify technical data
All dimensions in mm

Indicator



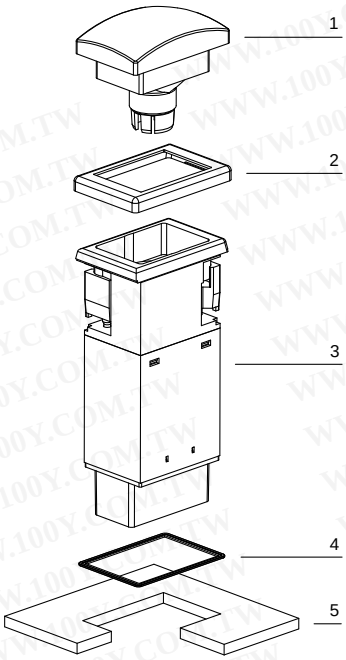
1 Lens
2 LED
3 Front bezel clip-on
4 Switch housing
5 Sealing
6 Front plate

Illuminated pushbutton



1 Lens
2 LED
3 Front bezel clip-on
4 Switch housing
5 Sealing
6 Front plate

Mushroom-head pushbutton



1 Mushroom-head cap
2 LED
3 Front bezel clip-on
4 Switch housing
5 Sealing
6 Front plate

Indicator actuator

Essential Accessories:

- Front bezel flush page 10
- Lens plastic page 10
- Single-LED page 12

	Front protection	Terminals	24 x 36 mm Typ-Nr.	Mounting dimensions	Technical drawing	Circuit drawing	kg
Indicator actuator	IP 65	PT 6.3	**22-040.004**	1	2	1	0.019
		ST	**22-040.001**	1	2	1	0.022

Terminals: PT 6.3 = Plug-in terminal 6.3 mm, ST = Screw terminal
Mounting dimensions from page 17, Technical drawing from page 17, Circuit drawing from page 19

Illuminated pushbutton actuator

Essential Accessories:

- Front bezel flush page 10
- Lens plastic page 10
- Single-LED page 12

	Front protection	Switching system	Contacts	Switching action	Terminals	24 x 36 mm Typ-Nr.	Mounting dimensions	Technical drawing	Circuit drawing	kg
Illuminated pushbutton actuator	IP 65	SA	1 NC	MA	PT 6.3	**22-222.014**	1	3	3	0.032
					ST	**22-222.011**	1	3	3	0.037
				M	PT 6.3	**22-212.014**	1	3	8	0.032
					ST	**22-212.011**	1	3	8	0.037
			1 NC + 1 NO	MA	PT 6.3	**22-225.014**	1	3	5	0.034
					ST	**22-225.011**	1	3	5	0.044
				M	PT 6.3	**22-215.014**	1	3	10	0.034
					ST	**22-215.011**	1	3	10	0.044
			1 NO	MA	PT 6.3	**22-221.014**	1	3	4	0.032
					ST	**22-221.011**	1	3	4	0.037
				M	PT 6.3	**22-211.014**	1	3	9	0.032
					ST	**22-211.011**	1	3	9	0.037
			2 NC	MA	PT 6.3	**22-224.014**	1	3	2	0.034
					ST	**22-224.011**	1	3	2	0.044
				M	PT 6.3	**22-214.014**	1	3	7	0.034
					ST	**22-214.011**	1	3	7	0.044
			2 NO	MA	PT 6.3	**22-223.014**	1	3	6	0.044
					ST	**22-223.011**	1	3	6	0.044
				M	PT 6.3	**22-213.014**	1	3	11	0.034
					ST	**22-213.011**	1	3	11	0.044

Switching system: SA = Snap-action switching element
Contacts: NC = Normally closed, NO = Normally open
Switching action: MA = Maintained action, M = Momentary action
Terminals: PT 6.3 = Plug-in terminal 6.3 mm, ST = Screw terminal
Mounting dimensions from page 17, Technical drawing from page 17, Circuit drawing from page 19

Mushroom-head pushbutton actuator

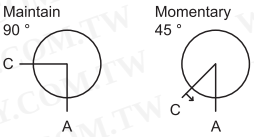
Essential Accessories:

- Front bezel flush page 10
- Mushroom-head cap page 10

	Switching system	Contacts	Switching action	Terminals	24 x 36 mm Typ-Nr.	Mounting dimensions	Technical drawing	Circuit drawing	kg
Mushroom-head pushbutton actuator	SA	1 NC	MA	PT 6.3	**22-222.014**	1	4	3	0.032
				ST	**22-222.011**	1	4	3	0.037
			M	PT 6.3	**22-212.014**	1	4	8	0.032
				ST	**22-212.011**	1	4	8	0.037
		1 NC + 1 NO	MA	PT 6.3	**22-225.014**	1	4	5	0.034
				ST	**22-225.011**	1	4	5	0.044
			M	PT 6.3	**22-215.014**	1	4	10	0.034
				ST	**22-215.011**	1	4	10	0.044
		1 NO	MA	PT 6.3	**22-221.014**	1	4	4	0.032
				ST	**22-221.011**	1	4	4	0.037
			M	PT 6.3	**22-211.014**	1	4	9	0.032
				ST	**22-211.011**	1	4	9	0.037
		2 NC	MA	PT 6.3	**22-224.014**	1	4	2	0.034
				ST	**22-224.011**	1	4	2	0.044
			M	PT 6.3	**22-214.014**	1	4	7	0.034
				ST	**22-214.011**	1	4	7	0.044
		2 NO	MA	PT 6.3	**22-223.014**	1	4	6	0.044
				ST	**22-223.011**	1	4	6	0.044
			M	PT 6.3	**22-213.014**	1	4	11	0.034
				ST	**22-213.011**	1	4	11	0.044

Switching system: SA = Snap-action switching element
Contacts: NC = Normally closed, NO = Normally open
Switching action: MA = Maintained action, M = Momentary action
Terminals: PT 6.3 = Plug-in terminal 6.3 mm, ST = Screw terminal
Mounting dimensions from page 17, Technical drawing from page 17, Circuit drawing from page 19

Keylock switch 2 positions



	Front protection	Switching system	Contacts	Switching action	Terminals	Key remove	24 x 36 mm Typ-Nr.	Mounting dimensions	Technical drawing	Circuit drawing	kg
Keylock switch 2 positions Position A : Basic position Position C : Maintained action Standard lock 311 Front : Plastic black	IP 65	SA	1 NC + 1 NO	MA	PT 6.3	A	**22-335.114D**	1	5	16	0.046
						C	**22-335.314D**	1	5	16	0.046
						C + A	**22-335.514D**	1	5	16	0.046
					ST	A	**22-335.111D**	1	5	16	0.051
						C	**22-335.311D**	1	5	16	0.051
						C + A	**22-335.511D**	1	5	16	0.051
			1 NO	MA	PT 6.3	A	**22-331.114D**	1	5	15	0.046
						C	**22-331.314D**	1	5	15	0.044
						C + A	**22-331.514D**	1	5	15	0.040
					ST	A	**22-331.111D**	1	5	15	0.051
						C	**22-331.311D**	1	5	15	0.044
						C + A	**22-331.511D**	1	5	15	0.044
			2 NO	MA	PT 6.3	A	**22-333.114D**	1	5	17	0.046
						C	**22-333.314D**	1	5	17	0.046
						C + A	**22-333.514D**	1	5	17	0.046
					ST	A	**22-333.111D**	1	5	17	0.051
						C	**22-333.311D**	1	5	17	0.051
						C + A	**22-333.511D**	1	5	17	0.051
Position A : Basic position Position C : Momentary action Standard lock 311 Front : Plastic black	IP 65	SA	1 NC + 1 NO	M	PT 6.3	A	**22-355.114D**	1	5	13	0.046
					ST	A	**22-355.111D**	1	5	13	0.051
			1 NO	M	PT 6.3	A	**22-351.114D**	1	5	12	0.046
					ST	A	**22-351.111D**	1	5	12	0.051
			2 NO	M	PT 6.3	A	**22-353.114D**	1	5	14	0.046
					ST	A	**22-353.111D**	1	5	14	0.051

Other lock numbers on request
Switching system: SA = Snap-action switching element
Contacts: NC = Normally closed, NO = Normally open
Switching action: MA = Maintained action, M = Momentary action
Terminals: PT 6.3 = Plug-in terminal 6.3 mm, ST = Screw terminal
Mounting dimensions from page 17, Technical drawing from page 17, Circuit drawing from page 19

Front

Lens plastic

	Lens	24 x 36 mm Typ-Nr.	kg
Lens plastic illuminative	blue transparent	**22-903.6**	0.003
	colourless transparent	**22-903.7**	0.003
	green transparent	**22-903.5**	0.003
	orange transparent	**22-903.3**	0.003
	red transparent	**22-903.2**	0.003
	smoked transparent	**22-903.1**	0.003
	yellow transparent	**22-903.4**	0.003
illuminative (not recommended for film insert)	colourless transparent	**22-905.7**	0.003
	green transparent	**22-905.5**	0.003
	red transparent	**22-905.2**	0.003
	yellow transparent	**22-905.4**	0.003
illuminative (not recommended for film insert, bright LED's are visible)	blue translucent	**22-901.6**	0.003
	green translucent	**22-901.5**	0.003
	orange translucent	**22-901.3**	0.003
	red translucent	**22-901.2**	0.003
	white translucent	**22-901.9**	0.003
	yellow translucent	**22-901.4**	0.003
non-illuminative	black opaque	**22-901.0**	0.003
	grey opaque	**22-901.8**	0.003

Mushroom-head cap

use Front bezel flush

	Mushroom had cap	24 x 36 mm Typ-Nr.	kg
Mushroom-head cap non-illuminative	Plastic black opaque	**22-930.0**	0.006
	Plastic green opaque	**22-930.5**	0.006
	Plastic red opaque	**22-930.2**	0.006
	Plastic yellow opaque	**22-930.4**	0.006

Front bezel flush

	Front bezel	24 x 36 mm Typ-Nr.	kg
Front bezel flush	Plastic black	**02-965.0**	0.001

Front bezel raised

Lens only removable with lens remover 98-969

	Front bezel	24 x 36 mm Typ-Nr.	kg
Front bezel raised	Plastic black	**02-967.0**	0.001

Protective cover

use Front bezel flush

	24 x 36 mm Typ-Nr.	Technical drawing	kg
Protective cover hinged, transparent, with means for sealing	**22-925**	1	0.004

Technical drawing from page 17

Blind plug

	Blind plug	24 x 36 mm Typ-Nr.	kg
Blind plug Mounting hole size 16 mm dia.	Plastic black	**22-949.0**	0.005

Master key

	Typ-Nr.	kg
Master key Lock numbers 311 ... 445 (DOM)	**31-989.300**	0.006

Spare key

	Typ-Nr.	kg
Spare key Key lock switch, standard lock 311 (DOM)	**31-989.311**	0.006

Other lock numbers on request

Illumination

Filament lamp

	Socket	Operating voltage/-current	Typ-Nr.	kg
Filament lamp	T1 3/4 MG	12 VAC/DC, 75 mA	**10-1309.1309**	0.001
		14 VAC/DC, 80 mA	**10-1310.1319**	0.001
		18 VAC/DC, 40 mA	**10-1311.1249**	0.001
		24 VAC/DC, 35 mA	**10-1312.1229**	0.001
		28 VAC/DC, 30 mA	**10-1313.1209**	0.001
		28 VAC/DC, 40 mA	**10-1313.1249**	0.001
		36 VAC/DC, 20 mA	**10-1316.1179**	0.001
		36 VAC/DC, 30 mA	**10-1316.1209**	0.001
		48 VAC/DC, 20 mA	**10-1319.1179**	0.001
		48 VAC/DC, 25 mA	**10-1319.1199**	0.001
		6 VAC/DC, 120 mA	**10-1306.1349**	0.001
		6.3 VAC/DC, 200 mA	**10-1307.1369**	0.001

Single-LED

	Socket	Light colour	Operating voltage/-current	Typ-Nr.	kg
Single-LED	T1 3/4 MG	blue	12 VAC/DC, 7/14 mA	**10-2J09.1066**	0.002
			24 VAC/DC, 7/14 mA	**10-2J12.1066**	0.002
			28 VAC/DC, 7/14 mA	**10-2J13.1066**	0.002
			48 VAC/DC, 4/8 mA	**10-2J19.1046**	0.002
			6 VDC, 15 mA	**10-2J06.3146**	0.002
		green	12 VAC/DC, 4/7 mA	**10-2J09.1065**	0.002
			24 VAC/DC, 4/7 mA	**10-2J12.1065**	0.002
			28 VAC/DC, 4/7 mA	**10-2J13.1065**	0.002
			48 VAC/DC, 2/4 mA	**10-2J19.1045**	0.002
			6 VDC, 7 mA	**10-2J06.3145**	0.002
		red	12 VAC/DC, 7/14 mA	**10-2J09.1062**	0.002
			24 VAC/DC, 7/14 mA	**10-2J12.1062**	0.002
			28 VAC/DC, 7/14 mA	**10-2J13.1062**	0.002
			48 VAC/DC, 4/8 mA	**10-2J19.1042**	0.002
			6 VDC, 15 mA	**10-2J06.3142**	0.002
		white diffuse	12 VAC/DC, 7/14 mA	**10-2J09.1069**	0.002
			24 VAC/DC, 7/14 mA	**10-2J12.1069**	0.002
			28 VAC/DC, 7/14 mA	**10-2J13.1069**	0.002
			48 VAC/DC, 4/8 mA	**10-2J19.1049**	0.002
			6 VDC, 15 mA	**10-2J06.3149**	0.002
		yellow	12 VAC/DC, 7/14 mA	**10-2J09.1064**	0.002
			24 VAC/DC, 7/14 mA	**10-2J12.1064**	0.002
			28 VAC/DC, 7/14 mA	**10-2J13.1064**	0.002
			48 VAC/DC, 4/8 mA	**10-2J19.1044**	0.002
			6 VDC, 15 mA	**10-2J06.3144**	0.002

Note:
AC operation through halve-wave rectifier possible, slight flickering can occure.

Series resistor

for lamp voltage reduction

	Operating voltage	Typ-Nr.	kg
Series resistor 10 kΩ, for filament lamp 48 VAC, 25 mA	230/240 V	**02-904.7**	0.003
2.7 kΩ, for filament lamp 48 VAC, 25 mA	110 V	**02-904.0**	0.003
3.3 kΩ, for filament lamp 48 VAC, 25 mA	125 V	**02-904.1**	0.003
4.7 kΩ, for filament lamp 48 VAC, 25 mA	145 V	**02-904.3**	0.003

Please keep to the country specific security rules.

Terminal plate empty

for fitting with series resistors

	Typ-Nr.	kg
Terminal plate empty 10 spaces 125 x 60 x 15 mm	**02-912.2**	0.045
15 spaces 187.5 x 60 x 15 mm	**02-912.3**	0.090
20 spaces 250 x 60 x 15 mm	**02-912.4**	0.095
5 spaces 62.5 x 60 x 15 mm	**02-912.1**	0.025

Assembling

Lens remover

	Typ-Nr.	kg
Lens remover for flush front bezel	**02-905**	0.011
for raised front bezel	**98-968**	0.004

Lamp remover

	Typ-Nr.	kg
Lamp remover	**61-9740.0**	0.003

CAUTION
A switching process might be released when replacing the lamp/LED !

Dismantling tool

for dismantling the lens from the holder

	Typ-Nr.	kg
Dismantling tool	**22-938**	0.030

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
Polymetylmethacrylate 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 mm²
Max. wire cross-section of stranded cable 2 x 1.5 mm²

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
≥100M Ω between all contacts at 100 VDC, as per IEC 60512-2-10

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

Switch rating AC (cosϕ 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
VDE

Declaration of conformity
CE

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.

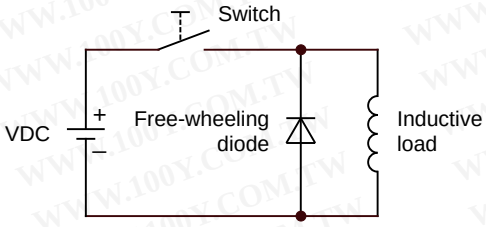
Fig. 1 shows an inductive load with a free-wheeling diode connected in parallel. This free-wheeling diode provides a path for the inductor current to flow when the current is interrupted by the switch. Without this free-wheeling diode, the voltage across the coil will be limited only by dielectric breakdown 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. 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!

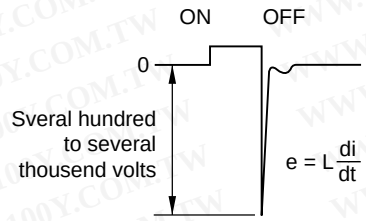
Switching with inductive load

Fig. 1



Counter emf
over load without free-wheeling diode

Fig. 2



General notes

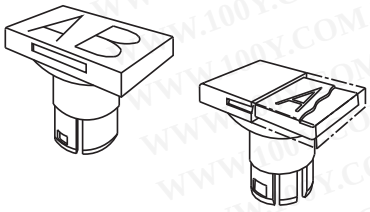
1. Engraving
In addition to the most commonly used world languages, in DIN 1451-3 close spacing, other typefaces are available as Scandinavian, Slavic, Greek, Russian and Polish.
Red, blue and black lenses are filled with white colour. Other colour lenses are filled in black.
Standard height of letters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

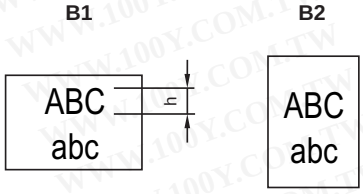
2. Hot stamping
For larger series it is worth considering markings by means of hot stamping We will pleased to advise you.
For letters and figures, typefaces with 2.5 mm, 3 mm and 4 mm are available.

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 advisible 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 pushbutton mounting orientation befor specifying engraving characters !

All dimensions in mm

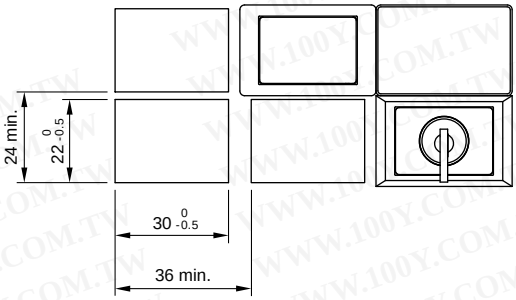
Film insert max. size	Height of letters h	Number of lines	Number of (target value) capital letters per line	Number of (target value) small letters per line	Image
14.3 x 22.4	3	4	11	13	B1
			7 - 8	8 - 9	B2
	4	2	7	9	B1
		4	5	5 - 6	B2
	5	2	5 - 6	6 - 7	B1
		3	3 - 4	4	B2
	6	1	5	6	B1
		2	3	4	B2
	8	1	3	4	B1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





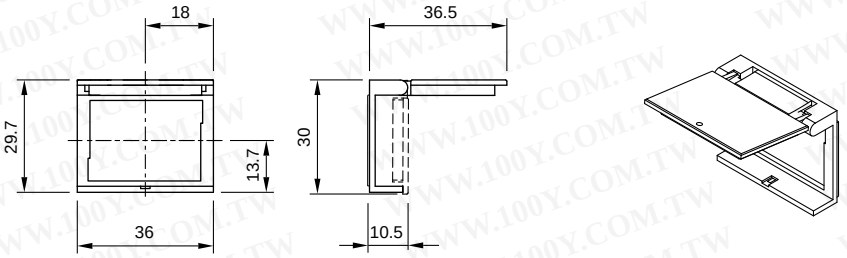
Mounting dimensions

1 Indicator actuator page 6 **| Illuminated pushbutton actuator** page 7 **| Mushroom-head pushbutton actuator** page 8 **| Keylock switch 2 positions** page 9

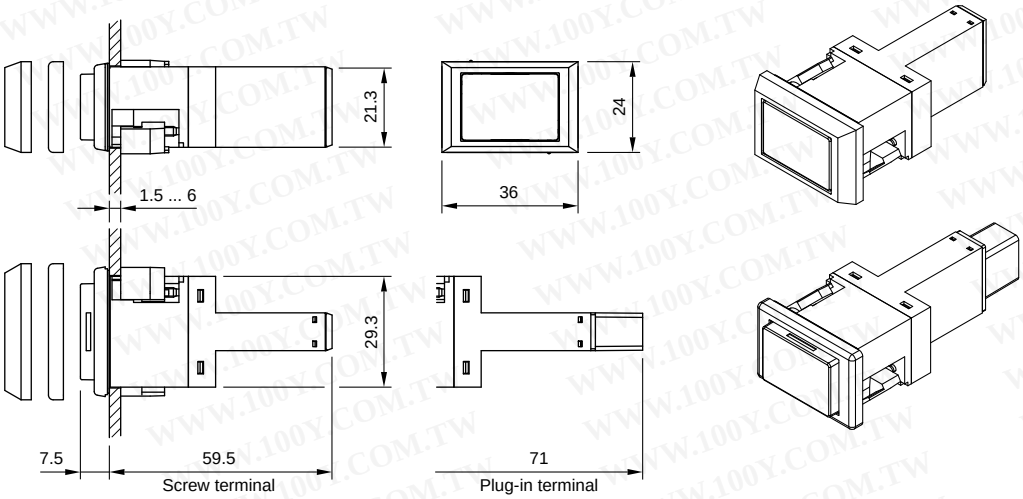


Technical drawing

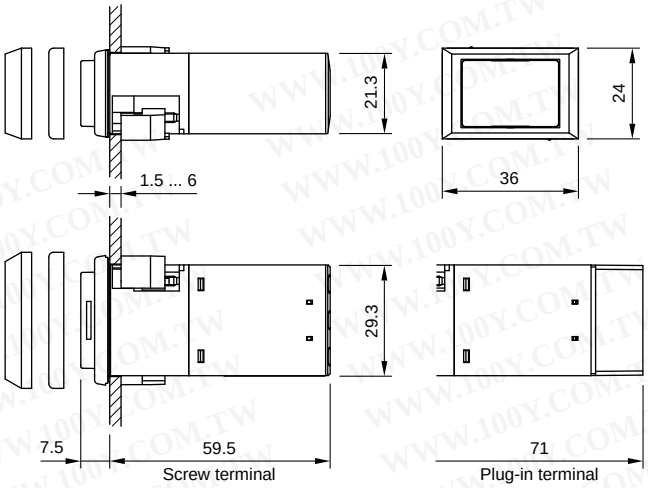
1 Protective cover page 11

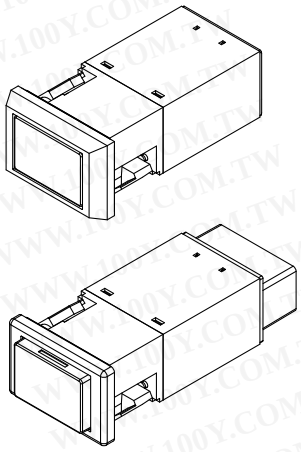


2 Indicator actuator page 6

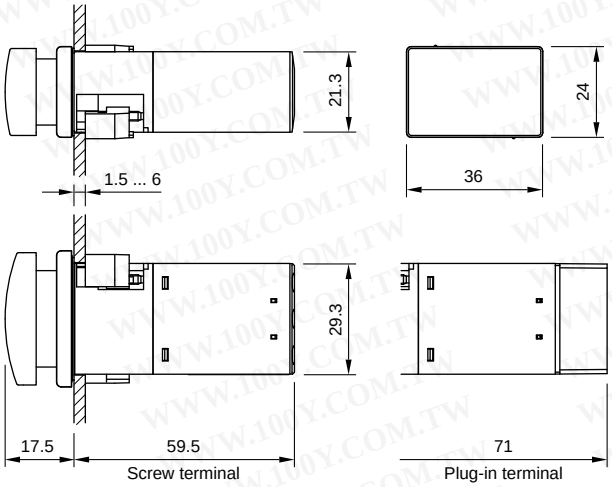


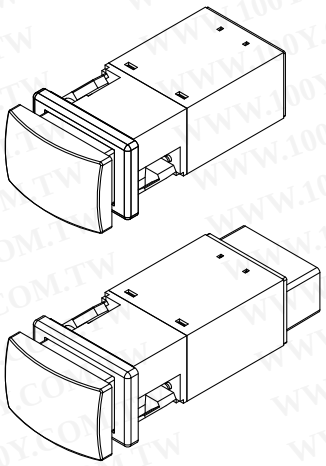
3 Illuminated pushbutton actuator page 7





4 Mushroom-head pushbutton actuator page 8





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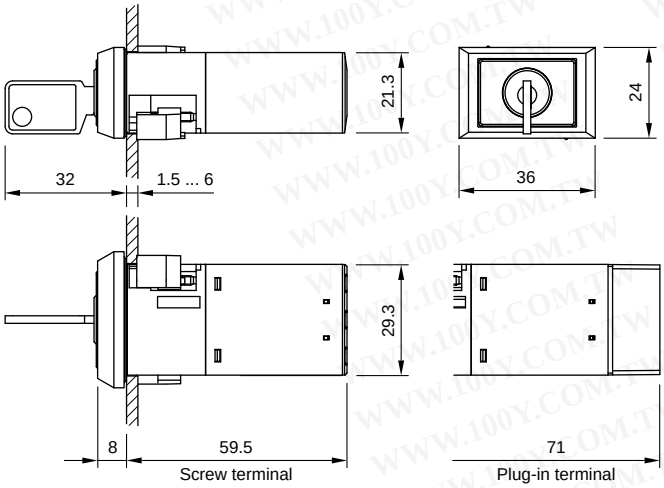
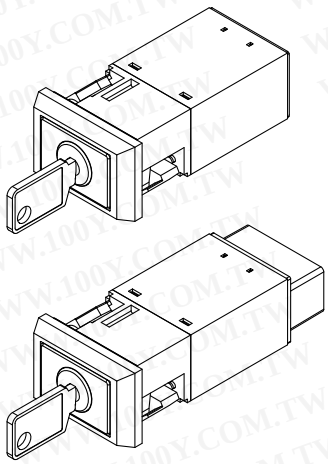
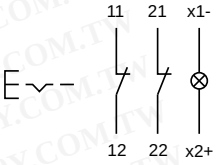




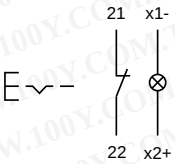
Circuit drawing

1 Indicator actuator page 6

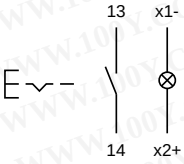
2 Illuminated pushbutton actuator page 7 **| Mushroom-head pushbutton actuator** page 8



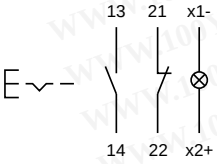
3 Illuminated pushbutton actuator page 7 **| Mushroom-head pushbutton actuator** page 8



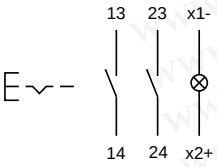
4 Illuminated pushbutton actuator page 7 **| Mushroom-head pushbutton actuator** page 8



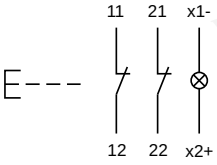
5 Illuminated pushbutton actuator page 7 **| Mushroom-head pushbutton actuator** page 8



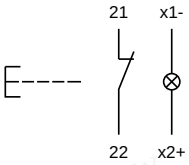
6 Illuminated pushbutton actuator page 7 **| Mushroom-head pushbutton actuator** page 8



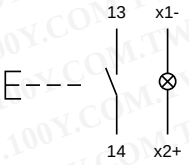
7 Illuminated pushbutton actuator page 7 **| Mushroom-head pushbutton actuator** page 8



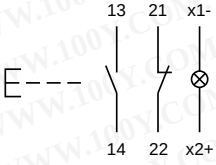
8 Illuminated pushbutton actuator page 7 **| Mushroom-head pushbutton actuator** page 8



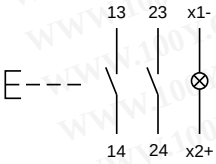
9 Illuminated pushbutton actuator page 7 **| Mushroom-head pushbutton actuator** page 8



10 Illuminated pushbutton actuator page 7 **| Mushroom-head pushbutton actuator** page 8



11 Illuminated pushbutton actuator page 7 **| Mushroom-head pushbutton actuator** page 8



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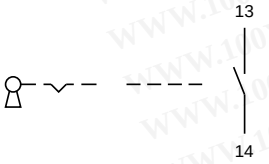
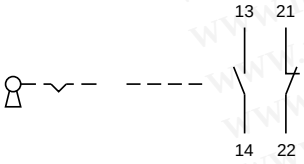
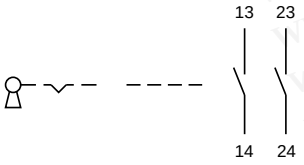


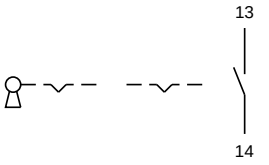
13 Keylock switch 2 positions page 9



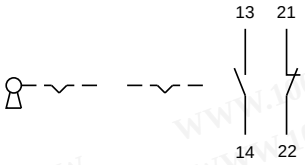
14 Keylock switch 2 positions page 9



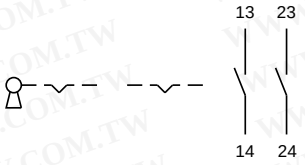
15 Keylock switch 2 positions page 9



16 Keylock switch 2 positions page 9



17 Keylock switch 2 positions page 9



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