

Hygiene control devices and indicator lights

Catalogue N



Hygiene control devices and indicator lights

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Subject to technical modifications and error. The data specified in this catalogue are carefully checked typical standard values.

Or as the ancient Greeks already knew:

The Gods do not reveal everything to mortals from the beginning. But during the course of time our search will show us what is better.

Xenophanes (Greek philosopher, 580/577 B.C.)

Hygiene control devices and indicator lights

Type series N



If the basic principles of hygienic design are also to be applied to control devices and indicator lights used in food processing machines, then it must be said that commercially available devices of this type either fail to satisfy the requirements in full or in part or require additional adaptation to do so.

It is against this background and under extensive consideration of the above described design principles that this new range of hygiene-conform control devices and indicator lights for mounting holes of 22.3 mm diameter has been developed (type series N).

An adapter ring enables the devices of type series N products to also be installed in mounting holes of 30.5 mm diameter.

Special design features

The advantageous features are described below:

- Special sealing to extensively prevent the ingress of dirt and bacteria in the gaps between the fixed and moving device parts.
- Specially shaped devices which are easy to clean and which avoid corners and edges or which create smooth surfaces so that dirt and bacteria cannot accumulate.
- Plus a special selection of materials and colour design.

Product range

The range consists of the following:

- Pushbuttons
- Illuminated pushbuttons with LEDs
- Selector switches with 2 and 3 positions and knob and lever
- Mushroom buttons
- High and flat indicator lights with LEDs
- Emergency-stop control devices
- Blanking plugs
- Lockable selector switch covers
- Adapters D-30/D-22

The contact and light element system used is the tried and tested EF/EL system using screw terminals, flat-pin plugs and WAGO cage clamps.



Illuminated devices

Illuminated pushbuttons and indicator lights of the N range have been designed under consideration of the features specified above in the same way as the other devices. "Super bright" LEDs with a virtually unlimited life are used instead of traditional bulbs in order to avoid the need to replace them – not least for reasons of device hygiene. If the LED is defective the device head should be replaced.

Lockable covers for selector switches/selector pushbuttons

Since key-operated selector switches and selector pushbuttons cannot be included in the N range for reasons of hygiene, a lockable frame has been created, i.e. a type of cover which can be locked in the desired position by means of one or two padlocks. The frame is designed in such a way that the requirements placed on a hygienic design are satisfied. Any padlocks used are to be viewed separately.

Blanking plugs

Unused bore holes in an operating or control panel can be sealed using this accessory. Here too, the requirements of hygienic design are satisfied.

Adapter ring

An adapter ring for the N range permits the new devices to also be installed in mounting holes of 30.5 mm diameter.

BG prototype testing

The N range is based on the special requirements of standards EN 1672-1 and EN 1672-2 with the safety and hygiene requirements for food-processing machines in general as well as EN 13570 (ditto for mixing machines) and EN 12266 (ditto for end-less saw machines).

A BG prototype test with respect to the introduction of the relevant requirements has been completed (BG test certificate dated 6.9.2002: refer to page 39).

Special remarks

Organisational measures must ensure that devices whose seals are damaged or have been destroyed are replaced immediately.

Background¹

Irrespective of a number of standards, statutory and other provisions, "hygiene" finally became a subject of the EC Machinery Directive in 1995 and thus of relevance to machine safety. This is something that affects food-processing machinery in particular.

The incorporation of this subject in the "Basic health and safety requirements in the design and building of machines and safety components"² permits the conclusion that the rules on hygiene serve two purposes:

1. They are intended to protect employees for infection and disease (employee health protection).
2. They are also intended to prevent the product becoming contaminated by the machine (consumer protection).

¹ Partly quoted from: Special imprint of the Employers' Liability Insurance Association for Food and Restaurants (*Berufsgenossenschaft Nahrungsmittel und Gaststätten*), Test and Certification Centre in Mannheim, from *Handbuch Maschinensicherheit*, Issue 01/96, Chapter 5.30, Wickert: *Hygienegerechte Konstruktion von Nahrungsmittelmaschinen*

² Cf. EC Machinery Directive, Annex 1, Section 2.1: Basic Safety and Health Requirements for Specific Machine Equipment – Food processing machines



Hygiene

Basic requirements placed on a hygienic design¹

Two aspects need to be taken into consideration for the hygiene requirements placed on machines (and also on other technical equipment). Firstly, the suitability of materials and secondly a hygienic design, the principles of which can be summarised as follows:

- Surfaces and their transitions must be sufficiently smooth.
- Connections must be designed in such a way that protruding parts, strips and concealed corners are kept to a minimum.
- Connections of inner surfaces must be rounded with sufficient diameters.
- Operating materials (e.g. lubricants) may not come into contact with food if these materials are not compatible with food.
- Liquids (food and cleaning agents) must be able to flow off the machines unhindered at least in cleaning position.
- Any surfaces coming into contact with food must be easy to clean.
- Areas not accessible for cleaning must be sealed against ingress of organic substances.

¹ Quoted from: Special imprint of the Employers' Liability Insurance Association for Food and Restaurants (*Berufsgenossenschaft Nahrungsmittel und Gaststätten*), Test and Certification Centre in Mannheim, from *Handbuch Maschinensicherheit*, Issue 01/96, Chapter 5.30, Wickert: *Hygienegerechte Konstruktion von Nahrungsmittelmaschinen*

Hygiene-conform control devices and indicator lights

Special design features in detail



The special sealing measures (1), the specially shaped devices (2) and the selected materials (3) are based on the following design features:

(1): Device sealing

Special seals protect the gaps between fixed and moving parts from the ingress of dirt and bacteria.

A: In the case of pushbuttons, mushroom buttons and emergency-stop control devices, i.e. axially operated actuators, this seal is permanently attached by means of recesses on the bezel and on the actuators, outwardly sealing the gap.

B: In the case of rotatable actuators, e.g. selector switches, the device sealing is designed in such a way that it is only attached on one side to the actuators but extends over the bezel, i.e. an unhygienic gap is not produced when the actuator is turned. Another seal in the inside of the device also protects against the ingress of pressurised water.

C: The front plate is also sealed on all devices.

(2): Device shape

Special thought has been given to making the devices easier to clean as follows:

- Bezel design
- Design of the outer surfaces of the device seals
- Design or shape of the actuators.

D: The bezel is designed in such a way that the front plate and the outside surface of the bezel are positioned at an angle of approx. 135° to each other, thus producing a surface without “sharp” edges and corners. Owing to the fact that the bezel with front plate sealing lies flush on the front plate there is only little room for dirt and bacteria to accumulate (another advantage).

The outer surfaces of the device seals pass over flush (in the case of pushbuttons and illuminated pushbuttons) and continuously (in the case of other device types) from the bezel to the free outer surface of the actuator, i.e. a smooth transition is ensured here too. The same applies to selector switches and selector pushbuttons, the only difference being that the seal is attached in the actuator and extends over the bezel in a bell-shaped manner.

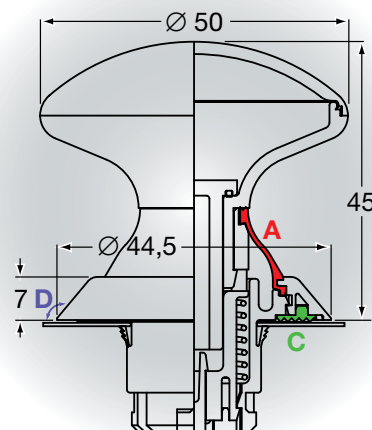
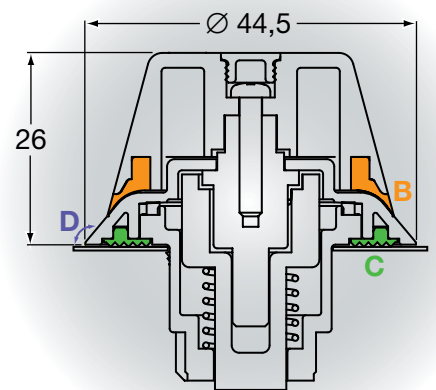
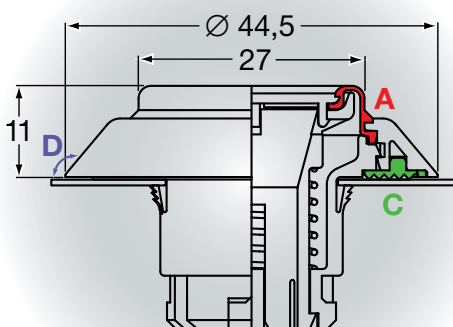
Also from the point of view of being able to clean the devices easily, the actuators of all devices with knob or mushroom shape have radii of curvature ≥ 3.2 mm at all corners and edges.

Furthermore, a distance is always kept to the fixing surfaces which is larger than one finger-width in order to make it easy to clean by hand.

(3): Selected materials

All external parts of the control devices and indicator lights in this range are made of thermoplastics. These materials are approved to European directive standard for use in food and beverages areas. The materials are commercially available ones such as PA, PC, POM, TPE and ABS.

The bezels are electrochrome-plated (ABS) so that their surface is smooth and easy to clean. The other parts are highly close-pored and thus also make the devices easy to clean.





Degree of protection on front side

The special design features of the N range as described on the previous page facilitate the following degrees of protection:

- IP 67 with reference to EN 60529 (including protection against the penetration of water in cases of permanent submersion, tested with 1 m water column/30 min.)

and

- Conformity with IP 69 K with reference to DIN 40050 Part 9 (including protection against the penetration of water in cases of high pressure/steam jet cleaners, 100 bars/



0.1 m distance, tested with water at room temperature, standard test with water at 80° C in preparation).

Suitability for cleaning agents

The device heads of the N range were subjected to different tests with commercially available cleaning agents. These included a resistance test against resin remover (= submersion in a test liquid composed of 10% resin remover, 90% water, 7 days) without any impairment to appearance or function (refer also to resistance tables on page 28).

Test conditions

All tests mentioned above were successfully performed under standard or laboratory conditions. However, different results cannot be ruled out due to different practical conditions.

Symbols

Tampon print on the top side of the buttons with 2-component paints which are finally stove baked to increase resistance to abrasive wear.

Hot embossing:
upon request

Symbols: refer to page 29 et seq.



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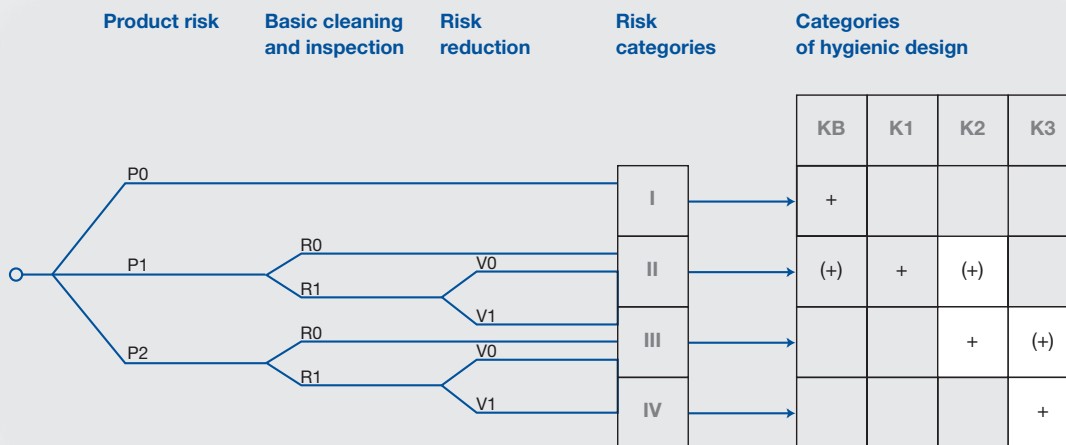
Hygiene-conform control devices and indicator lights

Application of preference



Control devices and indicator lights of the N range have been developed for food-processing machines with control input and command panels, the operation of which is associated with the risk of cross-contamination or which are installed in machine areas^{1, 2} which require the extensive or systematic application of basic hygiene principles (= hygiene categories K2 and K3 in accordance with "Hygiene risk chart for food-processing machines").

- 1 Refer to "Handbuch Maschinensicherheit", Issue 1/96, Berufsgenossenschaft Nahrungsmittel und Gaststätten, Test and Certification Centre in Mannheim, ISBN-Nr. 3-920506-51-0
- 2 Refer also to Annex starting on page 31.



Hygiene risk chart for food-processing machines

+ = expedient category
 (+) = possible expedient category

P Product risk

- P0 Products with little hygienic sensitivity
- P1 Products with moderate hygienic sensitivity
- P2 Products with high hygienic sensitivity

R Basic cleaning and inspection

- R0 Critical areas easy to see and reach
- R1 Critical areas difficult to see and reach

V Risk reduction

- V0 Risk-reducing factors present
- V1 No effective risk reduction

K Categories of hygienic design

- KB Basic measures
- K1 Basic measures and application of basic principles of hygiene if practicable
- K2 Basic measures and extensive application of principles of hygiene if technically possible
- K3 Basic measures and systematic application of principles of hygiene if technically possible

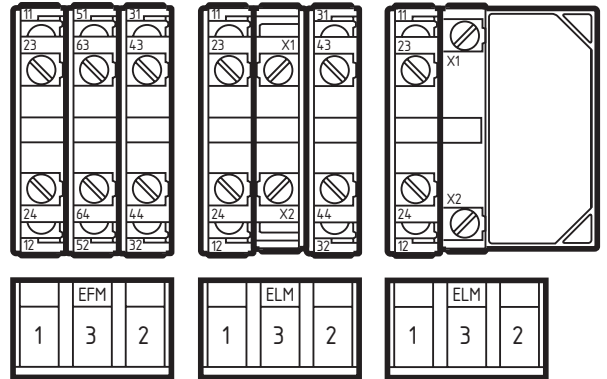
Hygiene-conform control devices and indicator lights

Components

Special design features

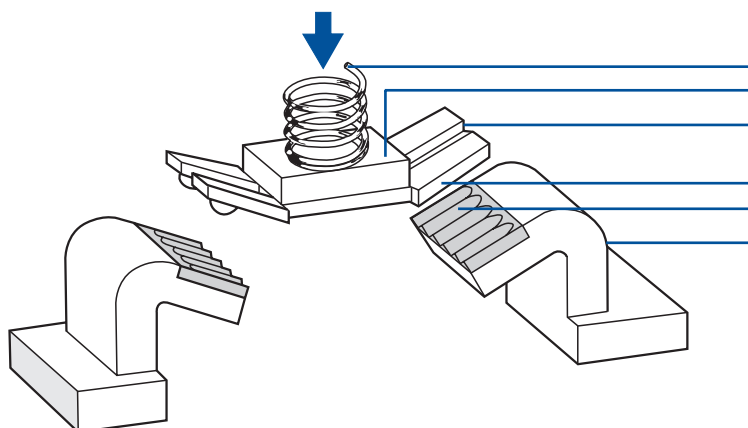
All elements of the EF/EL systems have the following special design features:

- A self-cleaning contact bridge system suitable for very small voltages – the bi-furcated contacts or so-called Elan four-way system – with a lower switching capacity of 5 VDC/3.2 mA (max. 400 VAC/8 A) in the shape of a bent twin contact bridge with parallel and crosswise operation.
- A robust element mount by means of snap-on stainless steel springs.
- Complete terminal designations visible at a glance in accordance with EN 50005 and EN 50013 with a complete function and sequence number (refer also to product tables). The function number identifies NC and NO contact. The sequence number specifies the number and the order of the contacts on the complete switch device. We therefore recommend that when selecting type, the position at which the element is to be snapped on to the assembly flange be specified.
- Positively opening NC contacts in accordance with EN 60947-1-5.
- Separated contact circuits in the case of the 2-pole elements.
- High shock and vibration resistance.



Example of complete assembly with 2-pole contact and light elements in the EF/EL system.

N



- Contact spring
- Insulating elements for the separation of the contacts
- Four-way contact bridge with parallel and cross-operating twin contacts
- Contact points made of fine silver
- Ditto
- Fixed contacts with embossed fine silver plating

The statistical maloperation probability of the Elan four-way contact system is 0.5 ppm. A variety of special design features (namely the selected material and the multi-embossed and anular surface areas of the contacts) ensure a high specific contact pressure which, together with a micromovement, ensures the continuous self-cleaning of the contacts and reliably eliminates disturbing oxide and dirt particles even with the smallest of currents and voltages.

Connection systems

The following connection systems are available in the EF/EL system:

- Screw terminals (1-/2-pole elements)
- Flat-pin plugs (1-/2-pole elements)
- WAGO cage clamp terminals (1-pole elements).

Connection system: WAGO cage clamp terminals

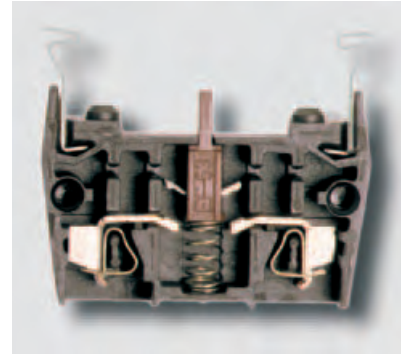
Contact and light elements with cage clamp terminals are not part of the standard range of commercially available control devices and indicator lights. This connection system is to be found in the Elan N range due to the possibility to save on wiring time and the advantage that WAGO cage clamp terminals are protected from becoming loose even under strong vibration.

Protection against electric shock in accordance with DIN VDE 0106100

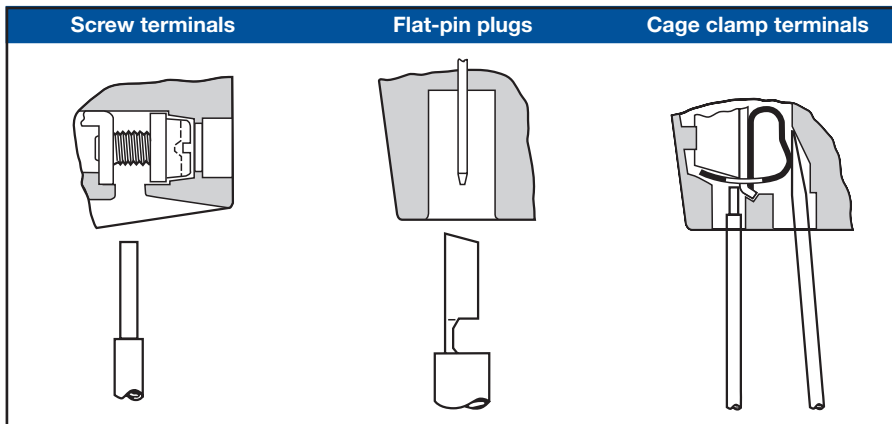
Screw terminals and cage clamps satisfy the shock hazard requirements in the event of the elements being operated with dangerous contact voltages without the need for additional measures.

Insulated plugs are to be used if flat-pin plugs are used.

Attention! In the case of indicator lights and illuminated pushbuttons the positions on the assembly flange which are not assigned are to be secured by means of snap-on covers of the type EL-15. These are available as an accessory (refer to page 25).



WAGO cage clamps



Recessed head screws:

Conductor cross-section $2 \times 0.5 \dots 2.5 \text{ mm}^2$, with wire end ferrule max. 1.5 mm^2 (automatic screwing down possible).
The connection screws (recessed head) are sealed when delivered.

Flat-pin plugs:

Commercially available flat-pin plugs $6.3 \times 0.8 \text{ mm}$ or $2 \times 2.8 \text{ mm} + 0.8 \text{ mm}$.

WAGO cage clamp terminals:

Conductor cross-section $2 \times 0.08 \text{ mm}^2 \dots 1.5 \text{ mm}^2$, splice protection not necessary, but possible.

N

Hygiene-conform control devices and indicator lights

Overview of elements

Assembly flange
with spring element



The EFR spring element automatically moves the actuator to the OFF position after a pressure point has been reached. It is unlocked by pulling in order to retension the EFR spring element.

Contact elements



EFK series, 1 pole, with WAGO cage clamp terminals



EF series, 2 pole, either with WAGO cage clamp terminals

Light elements
with integrated multi LED
for illuminated
pushbuttons NDL...



ELDEK.N series with WAGO cage clamp terminals,
24 V versions



ELDE.N/ELDEF.N series, either with screw terminals
or flat-pin plugs, 24 V versions

Light elements
(voltage sensor)
with holder Ba9S
for indicator lights
NMEF¹



ELEK series with WAGO cage clamp terminals



ELE/ELEF series either with screw terminals or flat-pin plugs

48/110/230 VAC
versions



ELV/ELVF series for 48 VAC/DC, 115 VAC, 230 VAC,
either for screw terminals or flat-pin plugs

Hygiene-conform control devices and indicator lights

Practical assembly instructions

Mounting hole 22.5 mm

The devices are designed for installation bore holes of 22.3 mm in diameter + 0.4 mm in accordance with DIN EN 50 007. An additional lug cutout as anti-rotation element is not necessary. It is possible to install several devices with a minimum contact spacing of 50 x 50 (selector switch/selector pushbutton with long knob: 50 x 60 mm).

The device head is positioned exactly and tightly in the DIN installation bore hole.

One-hand assembly: retention lugs on the device sleeve enable the assembly flange to be placed on the bayonet from the rear side of the front panel, positioned and then screwed on tightly.

Assembly flange fixing

Please remember: you will achieve optimum fixing of the assembly flange if both screws are tightened evenly until the tip of the screws has reached the front panel, i.e. avoid tightening the screws until they cannot be turned any more (recommended torque: max. 0.3 Nm).

Fixing of the elements

It is recommended that the contact and light elements be snapped on to the respective position on the assembly flange in accordance with their terminal designations. In order to make assignment easier the elements are marked with .1, .2 and .3 (refer to figure). If only one switching element is used we recommend that this be snapped on to the middle rack position.

The light elements ELE... and ELDE..N... are exclusively intended for the middle position on the assembly flange (No. 3). They must be snapped on first before any other EF... contact elements. When dismantling the EF elements are then to be removed first.

Points to be remembered during use

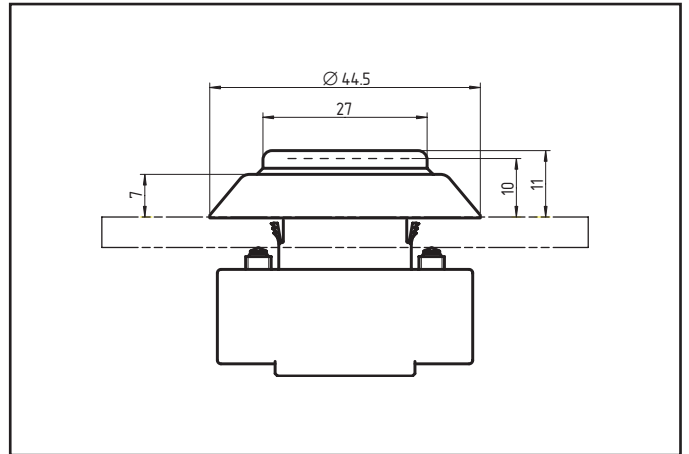
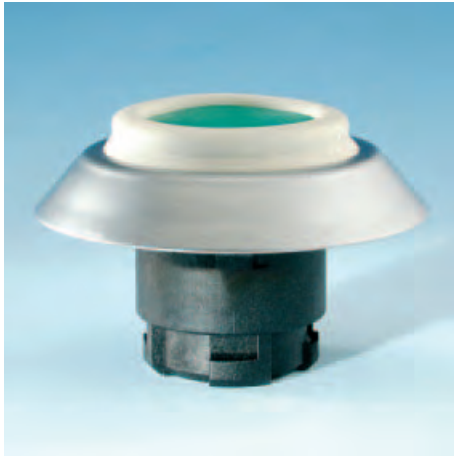
For reasons of hygiene it is not planned to replace bulbs in the N range. If the multi LEDs become defective in the indicator lights and illuminated pushbuttons or if they have reached the end of their serviceable life, the entire device head or the light element must be replaced.

Damaged device heads, in particular devices with damaged seals, must be replaced immediately because otherwise reliable hygiene protection is no longer guaranteed.



Product range

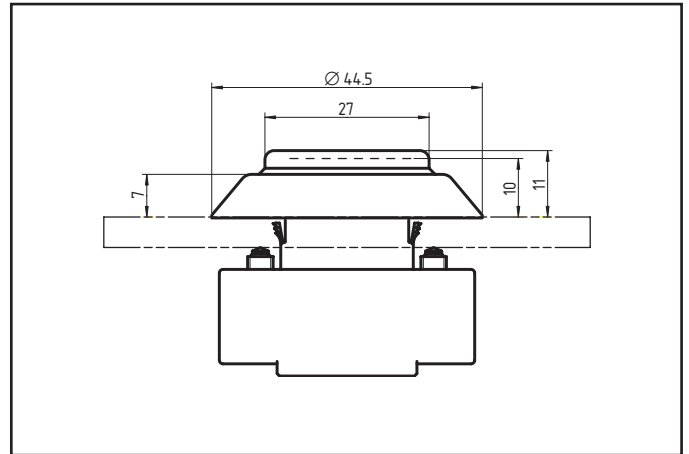
Pushbuttons



Product overview

Devices	Colour	Type	Order No.
Pushbutton	black	NDT SW	0800010
	yellow	NDT GB	0800015
	red	NDT RT	0800020
	green	NDT GN	0800025
	white	NDT WS	0800030
	blue	NDT BL	0800035
	grey	NDT GR	0800040

Illuminated pushbuttons



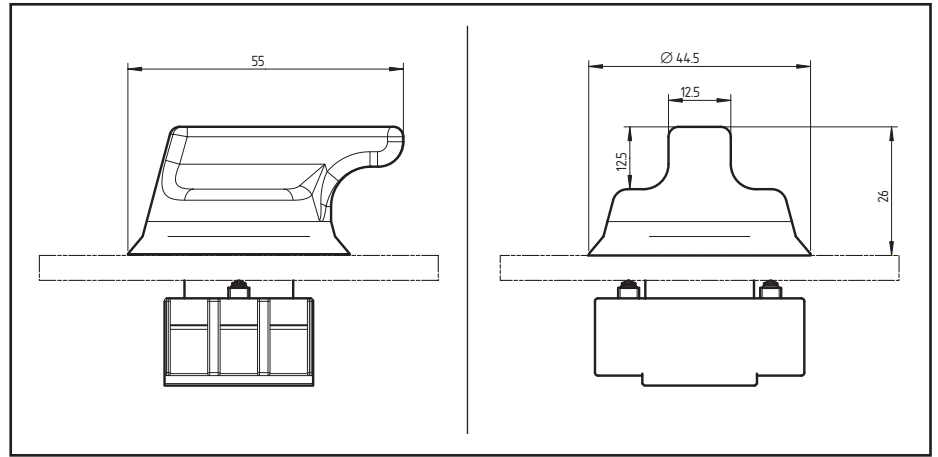
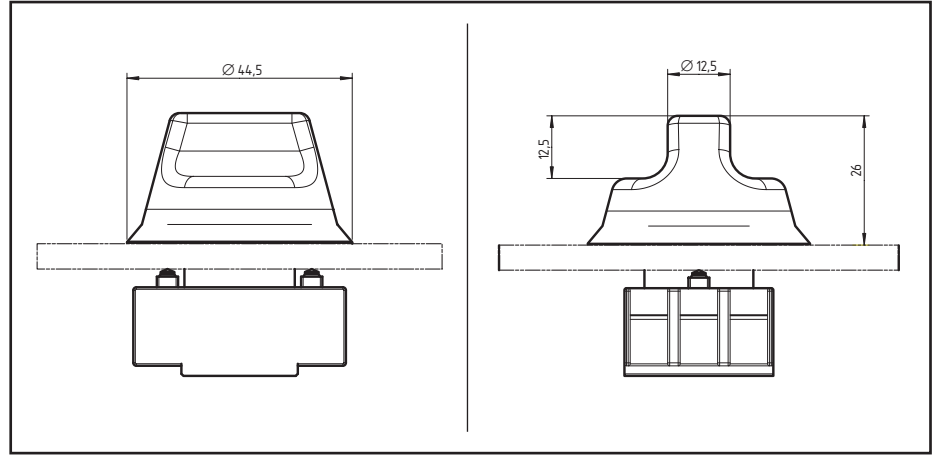
● For ELDE... light elements (with integrated "super-bright" multi-LED)

● For ELE... light elements (with Ba9S holder for commercially available LEDs, refer to accessories on page 25)

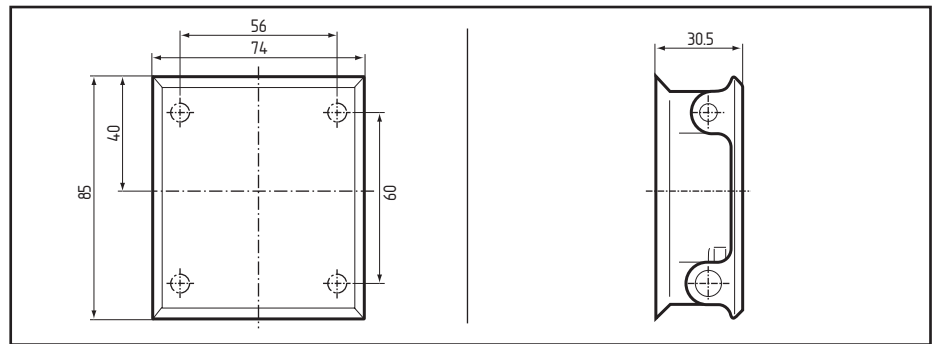
Product overview

Devices	Colour	Type	Order No.
Illuminated pushbutton (LED)	yellow	NDL GB	080 5015
	rot	NDL RT	080 5020
	green	NDL GN	080 5025
	white	NDL WS	080 5030
	blue	NDL BL	080 5035

Selector switches/selector pushbuttons with knob or lever



Selector switch lock



Product overview

Devices	Colour of knob	Type ¹	Order No.
Selector pushbutton, 2 positions	anthracite	NWT 21 NWT 21.1	080 2000 080 2010
	white	NWT 21 WS NWT 21.1 WS	080 2003 080 2013
Selector switch, 3 positions	anthracite	NWT 32 NWT 32.1	080 2020 080 2030
	white	NWT 32 WS NWT 32.1 WS	080 2023 080 2033
Selector switch, 3 positions, right – momentary contact, left – switching	anthracite	NWTS 32 NWTS 32.1	080 2035 080 2040
	white	NWTS 32 WS NWTS 32.1 WS	080 2038 080 2043
Selector switch, 3 positions, right – momentary contact, left – switching	anthracite	NWTS 321 NWTS 321.1	080 2045 080 2050
	white	NWTS 321 WS NWTS 321.1 WS	080 2048 080 2053
Selector switch, 2 positions	anthracite	NWS 21 NWS 21.1	080 2060 080 2070
	white	NWS 21 WS NWS 21.1 WS	080 2063 080 2073
Selector switch, 3 positions	anthracite	NWS 32 NWS 32.1	080 2080 080 2090
	white	NWS 32 WS NWS 32.1 WS	080 2083 080 2093

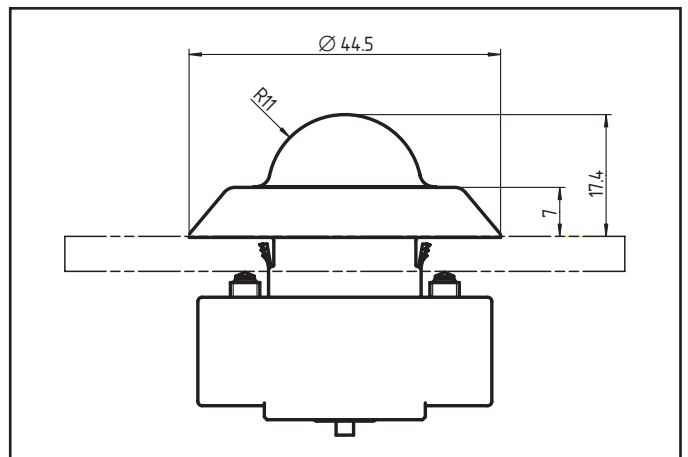
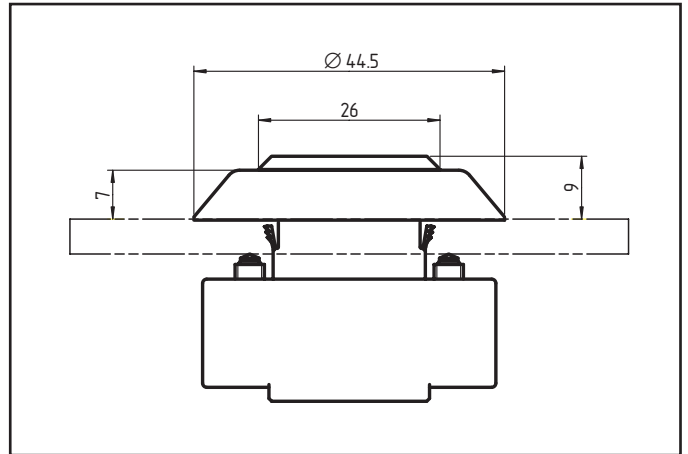
¹ .1 version: long knob (46 mm), selector switch/selector pushbutton with long knob require contact spacing of 50 x 60 mm

Product overview

Devices	Colour of cover/bottom part	Type	Order No.
Selector switch lock for 2-position selector switch	transparent/grey	NWSP-21 GR	080 3000
	transparent/white	NWSP-21 WS	080 3010
Selector switch lock für 3-position selector switch	transparent/grey	NWSP-32 GR	080 3020
	transparent/white	NWSP-32 WS	080 3030

Fixed on the rear side for which 4 blind holes 3.5 mm in diameter, 12 mm deep for self-tapping screws are provided. Contact spacing: 60 x 56 mm.

Indicator lights



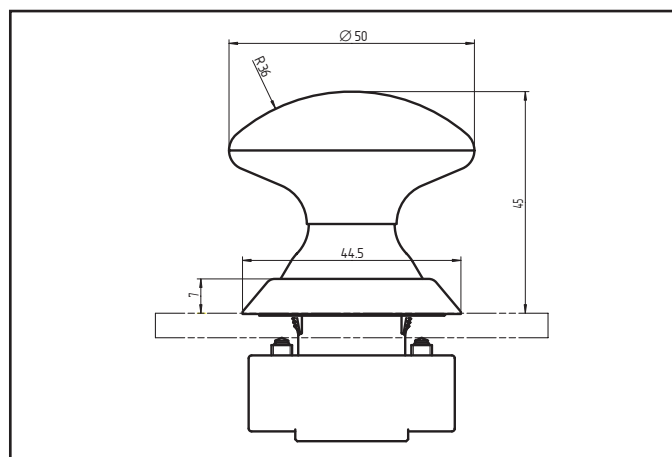
- Multi-LED "superbright" versions integrated into device head
- For ELE light elements (as voltage sensor only)

Product overview

Devices	Colour	Type	Order No.
Indicator light with flat cap	yellow	NMEF GB	080 7088
	red	NMEF RT	080 7079
	green	NMEF GN	080 7086
	white	NMEF WS	080 7080
	blue	NMEF BL	080 7082
	Indicator light with high spherical cap ¹	yellow	NME GB
red		NME RT	080 7036
green		NME GN	080 7038
white		NME WS	080 7045
blue		NME BL	080 7050

¹ Symbol print not possible

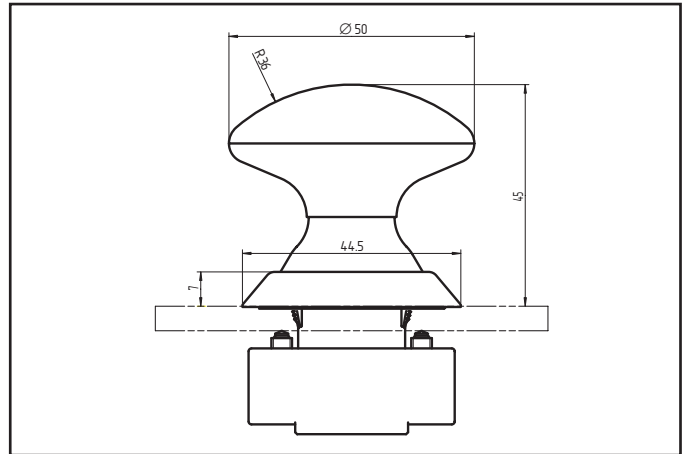
Mushroom buttons



Product overview

Devices	Colour	Type	Order No.
Mushroom button	black	NDP 50 SW	0800710
	yellow	NDP 50 GB	0800715
	green	NDP 50 GN	0800725
	white	NDP 50 WS	0800730
	blue	NDP 50 BL	0800735

Emergency-stop "slam" button



- The emergency-stop control devices in connection with the EFR spring element comply with EN 418 und EN 60947-5-5.
- The spring element automatically moves the actuator into the off position after reaching a pressure point.
- Only for a maximum of 2 contact elements EF/EFK
- An actuated device is reset by pulling the device head into order to re-tension the EFR spring element.
- Yellow washer (can be stuck on): refer to accessories page 25 (enlarged contact spacing 70 x 70 mm!).

Product overview

Devices	Colour	Type	Order No.
Emergency-stop slam button	red	NDRR50 RT ¹	080 1270
Spring element ²		EFR	028 0187

¹ Only in connection with NC contact of the contact elements EF 220..., EF 303... and EFK30...

² Installed depth as for EF/EL elements (refer to page 22)

Assembly and dismantling instructions

Assembly

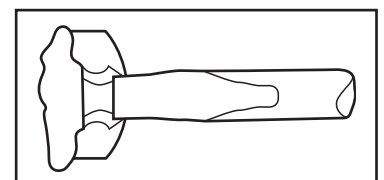
1. Assembly, align and tighten emergency-stop actuator NDRR50... and ELM assembly flange (max. 0.3 Nm).
2. Actuate/latch in emergency-stop actuator NDRR50...
3. Snap spring element EFR on the middle position of the ELM assembly flange (position 3). The plunger of the actuator NDRR50... automatically engages with the EFR spring element. The EFR spring element is delivered in a non-tension state.

4. The emergency-stop device is now to be set/released to the basic position by pulling the actuator NDRR50...
5. Snap contact elements EF... to position(s) 1 (and 2) of the ELM assembly flange.
6. The emergency-stop device is ready for operation.

Dismantling

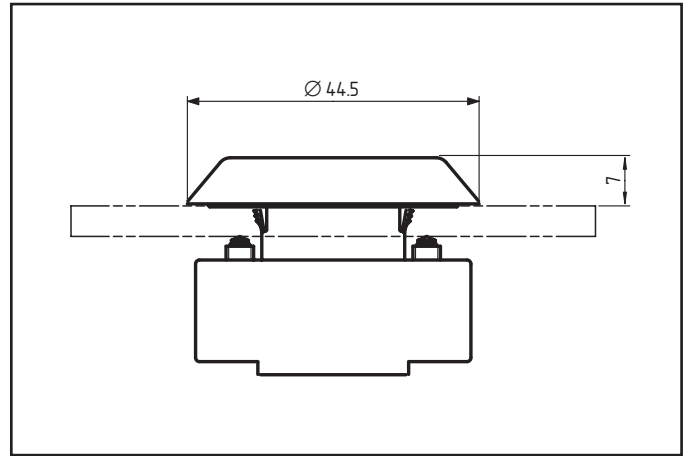
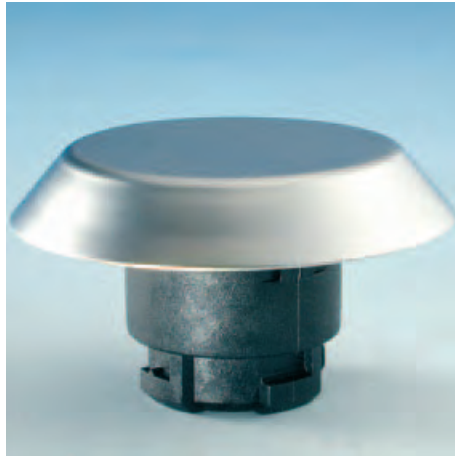
1. Snap off contact element(s) EF...
2. Actuate/latch in emergency-stop actuator NDRR50...

3. Spread drive spring between actuator plunger NDRR50... and spring element EFR using a screwdriver (see drawing). The actuator returns to the basic position.
4. Snap off spring element EFR and dismantle operating head where applicable.



Contact elements: refer to page 20 et seq.

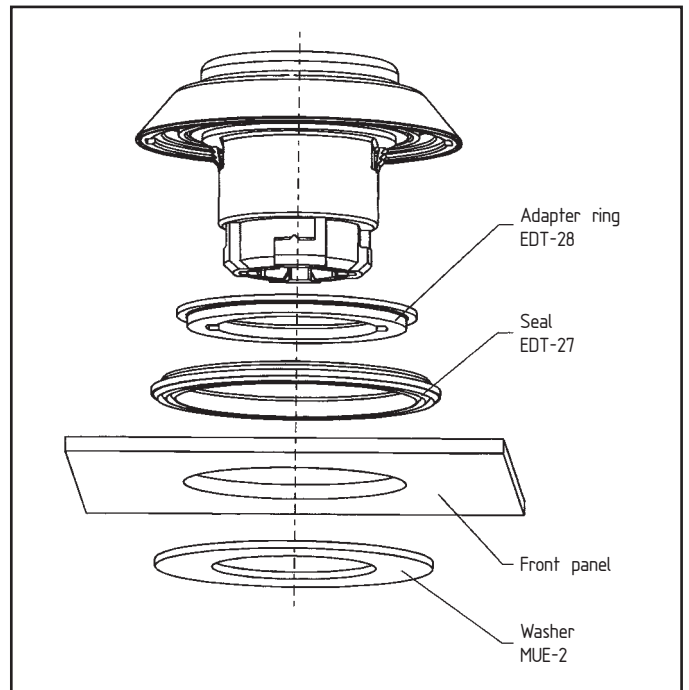
Blanking plugs



Product overview

Devices	Colour	Type	Order No.
Blind plug	metallic	NB	0800300

Adapters



Product overview










Devices	Type	Order No.
Adapter 22/30 mm ¹	NUE	0809000

¹ consisting of: adapter ring EDT-28, seal EDT-27, washer MUE-2

Contact and light elements

EF/EL system with screw terminals or flat-pin plugs

2-pole contact elements

Function/ switching diagram (mm)	Assembly flange position	with screw terminal		with flat-pin plug	
		Form	Order No.	Form	Order No.
1 NC contact ¹ 0 2 4 6 mm 	Pos. 1	EF10.1	0280010	EF10F.1	0281010
	Pos. 2	EF10.2	0280020	EF10F.2	0281020
	Pos. 3	EF10.3	0280030	EF10F.3	0281030
1 NO contact 0 2 4 6 mm 	Pos. 1	EF03.1	0280040	EF03F.1	0281040
	Pos. 2	EF03.2	0280050	EF03F.2	0281050
	Pos. 3	EF03.3	0280060	EF03F.3	0281060
2 NC contacts ^{1,2} 0 2 4 6 mm 	Pos. 1	EF110.1	0280070	EF110F.1	0281070
	Pos. 2	EF110.2	0280080	EF110F.2	0281080
	Pos. 3	EF110.3	0280090	EF110F.3	0281090
2 NC contacts ² 0 2 4 6 mm 	Pos. 1	EF220.1	0281382	EF220F.1	0281388
	Pos. 2	EF220.2	0281384	EF220F.2	0281390
	Pos. 3	EF220.3	0281386	EF220F.3	0281394
2 NC contact 0 2 4 6 mm 	Pos. 1	EF033.1	0280100	EF033F.1	0281100
	Pos. 2	EF033.2	0280110	EF033F.2	0281110
	Pos. 3	EF033.3	0280120	EF033F.3	0281120
1 NC/1 NO contact ¹ 0 2 4 6 mm 	Pos. 1	EF103.1	0280130	EF103F.1	0281130
	Pos. 2	EF103.2	0280140	EF103F.2	0281140
	Pos. 3	EF103.3	0280150	EF103F.3	0281150
1 NC/1 NO contact overlapping ^{1,2} 0 2 4 6 mm 	Pos. 1	EF301.1	0280160	EF301F.1	0281160
	Pos. 2	EF301.2	0280170	EF301F.2	0281170
	Pos. 3	EF301.3	0280180	EF301F.3	0281180
1 NC/1 NO contact synchronised ² 0 2 4 6 mm 	Pos. 1	EF303.1	0281360	EF303F.1	0281375
	Pos. 2	EF303.2	0281365	EF303F.2	0281380
	Pos. 3	EF303.3	0281370	EF303F.3	0281381
1 NC/1 NO contact with safety spring, synchronised ^{2,3} 0 2 4 6 mm 	Pos. 1	EF303.S.1	0281300	EF303.SF.1	0281330
	Pos. 2	EF303.S.2	0281310	EF303.SF.2	0281340
	Pos. 3	EF303.S.3	0281320	EF303.SF.3	0281350





¹ not suitable for emergency-stop devices NDRR50...

² not for selector switch/selector pushbutton NWS/NWT





³ The reset spring of these elements is a safety spring, i.e. even if the spring breaks, the special guide and coiling of the spring ensures continued perfect functioning of the device or contact elements. We recommend that contact elements with safety springs be used if the NO contact function needs to be particularly reliable. NC and NO contacts operate virtually simultaneously in this version, but without overlapping.

N.B.: The terminal designation of the contacts to DIN 50005 contains a complete function and sequence number. The function number identifies the NC and NO contact. The sequence number specifies the number and order of the contacts for the complete switching device. We therefore recommend that the position on the assembly flange to which the contacts are to be attached be stipulated in the designation. Terminal designations: see page 22.

Light elements with integrated multi-LED for NDL indicator lights

Circuit diagram/ operating voltage	Colour	with screw terminal		with flat-pin plug	
		Form	Order No.	Form	Order No.
 24 VDC/AC	red	ELDE.N RT 24	027 6610	ELDEF.N RT 24	027 6630
	yellow	ELDE.N GB 24	027 6611	ELDEF.N GB 24	027 6631
	green	ELDE.N GN 24	027 6612	ELDEF.N GN 24	027 6632
	blue	ELDE.N BL 24	027 6613	ELDEF.N BL 24	027 6633
	white	ELDE.N WS 24	027 6614	ELDEF.N WS 24	027 6634
 48 VDC/AC	red	ELDE.N RT 48	027 6615	ELDEF.N 48 RT	027 6635
	yellow	ELDE.N GB 48	027 6616	ELDEF.N 48 GB	027 6636
	green	ELDE.N GN 48	027 6617	ELDEF.N 48 GN	027 6637
	blue	ELDE.N BL 48	027 6618	ELDEF.N 48 BL	027 6638
	white	ELDE.N WS 48	027 6619	ELDEF.N 48 WS	027 6639
 115 VAC	red	ELDE.N RT 115	027 6620	ELDEF.N RT 115	027 6640
	yellow	ELDE.N GB 115	027 6621	ELDEF.N GB 115	027 6641
	green	ELDE.N GN 115	027 6622	ELDEF.N GN 115	027 6642
	blue	ELDE.N BL 115	027 6623	ELDEF.N BL 115	027 6643
	white	ELDE.N WS 115	027 6624	ELDEF.N WS 115	027 6644
 230 VAC	red	ELDE.N RT 230	027 6625	ELDEF.N RT 230	027 6645
	yellow	ELDE.N GB 230	027 6626	ELDEF.N GB 230	027 6646
	green	ELDE.N GN 230	027 6627	ELDEF.N GN 230	027 6647
	blue	ELDE.N BL 230	027 6628	ELDEF.N BL 230	027 6648
	white	ELDE.N WS 230	027 6629	ELDEF.N WS 230	027 6649

Light elements (voltage sensor) with Ba9S holder for indicator lights NME/NMEF^{1, 2}

Circuit diagram/ operating voltage	with screw terminal		with flat-pin plug	
	Form	Order No.	Form	Order No.
 24 VDC/AC	ELE	027 7090	ELEF	027 7093
 48 VDC/AC	ELE 48	027 7095	ELEF 48	027 7089
 115 VAC	ELE 115	027 7097	ELEF 115	027 7098
 230 VAC	ELE 230	027 7100	ELEF 230	027 7102

¹ or for illuminated pushbuttons NDLE if capped LEDs are to be used (max. LED length 27 mm). Refer also to accessories on page 25.

² LED integrated in the indicator light NME/NMEF

Contact and light elements EF/EL system with WAGO cage clamp terminals

1 pole contact elements

Function/ switching path diagram (mm)	Assembly flange position	Form	Order No.
1 NC contact ¹ 0 2 4 6 mm 	Pos. 1	EFK10.1	028 1001
	Pos. 2	EFK10.2	028 1002
	Pos. 3	EFK10.3	028 1003
1 NC contact ² 0 2 4 6 mm 	Pos. 1	EFK30.1	028 1005
	Pos. 2	EFK30.2	028 1006
	Pos. 3	EFK30.3	028 1007
1 NO contact 0 2 4 6 mm 	Pos. 1	EFK03.1	028 1066
	Pos. 2	EFK03.2	028 1067
	Pos. 3	EFK03.3	028 1068

¹ not suitable for emergency-stop devices NDRR50...

² Terminal designation: refer to page 22

N.B.: The terminal designation of the contacts to DIN 50005 contains a complete function and sequence number. The function number identifies the NC and NO contact. The sequence number specifies the number and order of the contacts for the complete switching device. We therefore recommend that the position on the assembly flange to which the contacts are to be attached be stipulated in the designation.

Light elements with integrated multi-LED for illuminated push-buttons NDL

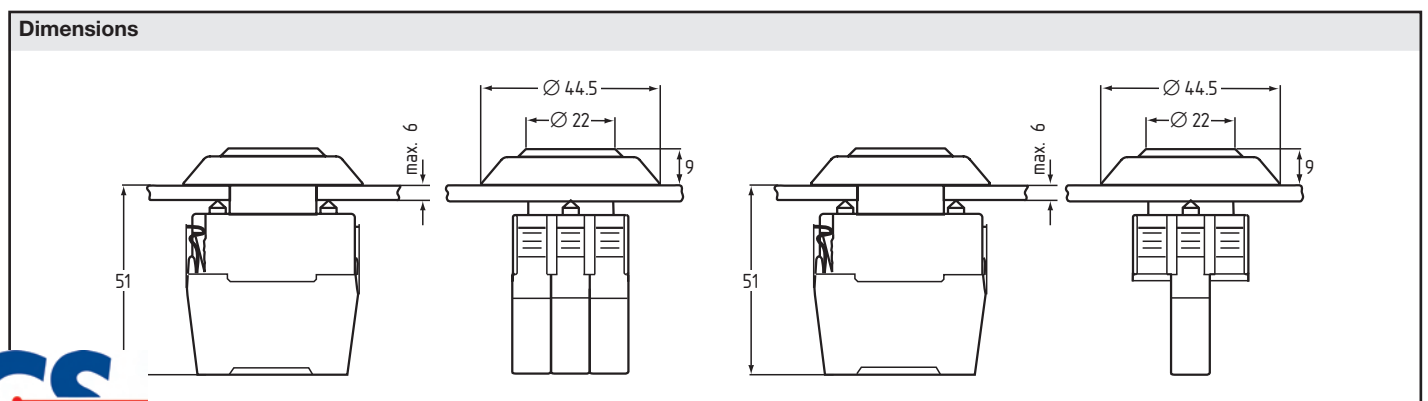
Circuit diagram	Colour	Form	Order No.
 24 VDC/AC	red	ELDEK RT	027 6650
	yellow	ELDEK GB	027 6651
	green	ELDEK GN	027 6652
	blue	ELDEK BL	027 6653
	white	ELDEK WS	027 6654

Light elements (voltage sensor) with Ba9S holder for indicator lights NME/NMEF^{1,2}

Circuit diagram	Form	Order No.
 24 VDC/AC	ELEK	027 7096

¹ LED integrated in the indicator light NME/NMEF

² for illuminated pushbuttons NDLI if capped LEDs are to be used (max. LED length 27 mm). Refer also to accessories on page 25.



Assembly instructions

The spring clamp terminals are characterised by ease and simplicity of handling:

- The contact and light elements EFK and ELK are suitable for stripped copper wire of 0.08 mm² to 1.5 mm² (splice protection is not necessary, but possible).
- 1 conductor per terminal clamping point is provided (in many standards and provisions "1 conductor per clamping point" is recommended). However, the contact and light elements EFK and ELK have double clamps so that it is not

possible for the conductors to loop through.

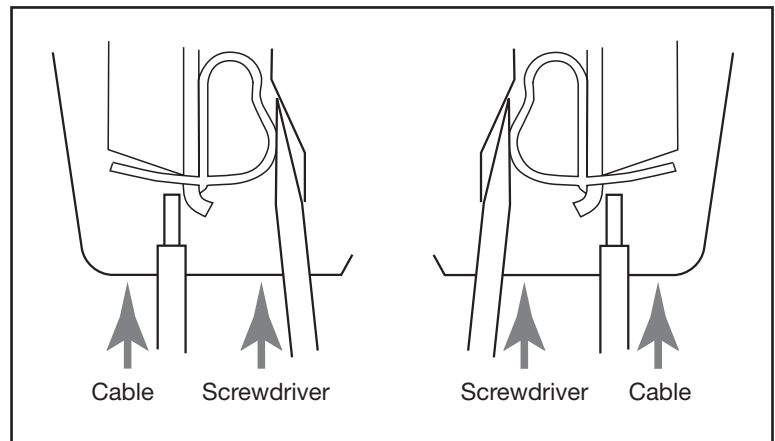
- The wiring of the WAGO cage clamps is performed from the front in the following steps:

1. Open the clamp by means of a screwdriver.

2. Insert the conductor.

3. Close the clamp by pulling out the screwdriver.

- (Any dismantling is performed in reverse order. Step 2: Pull out the conductor).



Accessories

Product overview

Version	Type	Order No.
LED white, Ba9S, 24 VDC	LE24/9	069 0030
Emergency-stop plate, outer diameter 65 mm, self-adhesing	NDP-65	080 1300
Snap-on cover	EL-15	071 3005
Stainless steel housing upon request		

Technical data

Operating elements and indicator lights

Device type	D-22-N product range
Regulations	IEC 947-1 et seq., EN 60947-1 et seq., DIN VDE 0660 Part 100 et seq. (insofar as applicable)
Installed diameter to DIN EN 50007	D 22
Front panel thickness	1 ... 6 mm
Fixing	Assembly flange
Max. torque for fixing screws	approx. 0.3 Nm
Installation position	any
Temperature range	-25° C ... +80° C (in the case of illuminated pushbuttons max. ambient temperature +40° C)
Resistance to climatic changes to DIN EN 60068	Part 2-30
Type of protection	Operating elements to EN 60529: IP 67 High pressure cleaners to DIN 40050 Part 9: IP 69K (in preparation)
Type of sealing	Diaphragms, lip seals, contour seals
Full insulation	yes
Materials	PA GV, ABS, TPE, PA
Bezel version	ABS electroplated, matt chrome

Contact elements EF

Regulations	IEC 947, EN 60947, DIN VDE 0660 (where applicable)
Rated operating voltage U° max.	400 V
Rated insulation voltage U_i	440 V, test voltage 2,500 V
Rated operating current I_o depending on utilization category and test voltage	8 A, AC 15, 250 VAC 5 A, DC 13, 24 VDC
Thermal rated current I_{th} (in air)	10 A
Short-circuit protection	gG 10 A slow-blowing
Creepage distances and clearances to DIN VDE 0110-1 (04/97)	4 kV/3
Contact bridge separation	yes
Proof of positive opening	2.5 kV surge voltage
Positive opening path	approx. 2 mm after reaching opening point
Switching of small loads	≥ 5 V, 3.2 A
Operating frequency to DIN VDE 0660 Part 200	1,200 s/h
Temperature range	-25° C ... +80° C
Resistance to climatic changes to DIN EN 60068	Part 2-30
Installation position	any

Mechanical life to DIN VDE 0660 Part 200	10 x 10 ⁶ operating cycles
Shock resistance	110 g/4 ms – 30 g/18 ms, no bouncing (appropriately smaller in the case of operating heads with larger mass)
Vibration resistance	> 20 g/10 ... 200 Hz (appropriately smaller in the case of operating heads with larger mass)
Bouncing duration (100 mm/s)	< 5 ms
Housing material	PA GV self-extinguishing, hardly flammable
Terminal designations	to DIN EN 50005 and DIN EN 50013
Type of protection	IP 40
Contact points, terminal points	Fine silver, spring bronze or Ms carrier
Contact force	0.5 N per contact point \triangleq 2 N per contact bridge
Actuating force at	
– 2 mm lift	4 N
– 4 mm lift	7 N
– 6 mm lift	9 N
Shock protection	refer to page 9
Connections	refer to page 9

Light elements and voltage sensors

Regulations	IEC 947, EN 60947, DIN VDE 0660 (where applicable)
Rated operating voltage U _e max.	250 V
Rated insulation voltage U _i	440 V, test voltage 2,500 V
Short-circuit protection	gG 10 A
Creepage distance and clearances to DIN VDE 0110/01.89	Pollution degree 3 Overvoltage category III
Resistance to climatic changes to DIN EN 60068	Part 2-30
Temperature range	–25° C ... +40° C
Installation position	any
Shock resistance	refer to EF (observe LED values)
Vibration resistance	refer to EF (observe LED values)
Housing material	PA GV self-extinguishing, hardly flammable
Terminal designation	X1/X2 to DIN EN 50005 or DIN EN 50013
Type of protection	IP 40
Rated power max.	2 W
Special features	Series resistance version for 48/115/230 V
Other data	Refer to EF

Provisional resistance table¹

+ = resistant; 0 = conditionally resistant; - = not resistant










Part	Material	Petrol	Ben- zene	Diesel oil	Lubri- cating oils and greases	Mineral oils	Animal and vegetable fats	Weak lyes	Strong lyes	Weak acids	Stong acids	Spirit	Sea water
Adapter ring 22/30 mm	PA GV self-ex- tinguishing	+	+	+	+	+	+	+	-	0	-	+	+
Sealing bellows	TPE	0	-	0	0	0	0	+	0	+	0	0	+
Front panel seal	buna N self-ex- tinguishing	+	+	+	+	+	+	+	0	0	-	+	+
Bezels	ABS elec- trochrome- plated	+	0	+	+	+	+	+	+	+	0	0	+
Caps/symbol bases	PA 12	+	+	+	+	+	+	+	-	0	±	+	+
Contact elements	PA GV self-ex- tinguishing	+	+	+	+	+	+	+	-	0	-	+	+
Assembly flange	PA GV	+	+	+	+	+	+	+	-	0	-	+	+
Plunger	PBT	+	0	+	+	+	+	+	0	+	-	+	+
Lenses	PC foil	+	-	+	+	+	+	-	-	+	0	-	+
Border	PA GV	+	+	+	+	+	+	+	-	0	-	+	+
Selector switch knobs	ABS	+	0	+	+	+	+	+	+	+	0	0	+
Selector switch lock	ABS	+	0	+	+	+	+	+	+	+	0	0	+

¹ The resistance usually depends on the duration of exposure to the chemicals.













Symbols*

- Tampon print on the top side of the buttons with 2-component paints which is finally stove baked to increase resistance to abrasive wear.
- Device markings/symbols to DIN 30600: the form designation consists of the letters Z-SY to which the series number is added to DIN 30600, e.g. Z-SY 201.
- Hot embossing: upon request.


Straight-line motions

	101 ¹ Working motion feed		102 Rapid motion or idling		103 ² Rapid motion		104 Feed
	105 Interrupted motion inching		106 Motion swinging				
	107 Restricted motion		108 Indexing		109 Travel in 2 directions		

Rotation













	201 Continuous rotation to the right		202 Rotation to the left		203 Stop from rotation to the right		
	204 Stop from rotation to the left						
	205 1 revolution to the right		206 to the left		207 Circular indexing		
	208 Interrupted rotation						
	209 Restricted motion turning to the right		210 Restricted motion turning to the left		211 Motion turning to the right from a restriction		
	212 Motion turning to the left from a restriction						

Additional devices













	301 Clamping tensioning		302 Releasing		303 Braking		
	304 Releasing brake						
	305 Unlocking		306 Locking				

¹ to VDE 3260 applies also to travel diagram













Drives

 401 Electric motor	 402 Pump in general	 403 Geared pump	 404 Coolant
 406 Oil lubrication	 407 Round table	 408 Long table forward	 409 Long table back
 410 Centrifugal brake operator	 411 Caution voltage	 412 Rectangular clamping table	 413 Electrical machine







Signals

 501 On	 502 Inching	 503 Automatic	 504 Off
 505 Everything off	 506 On - off	 507 Increase in a variable	 508 Decrease in a variable
 509 Break (time sequence)	 510 Manual operation	 511 Visual	 512 Hydraulics

Words

 513 Start	 514 Stop	 515 On	 516 Off
 517 Left	 518 Right	 519 Up	 520 Down
 521 Closed	 522 Halt	 523 Full	 524 Empty

Arabic numbers¹

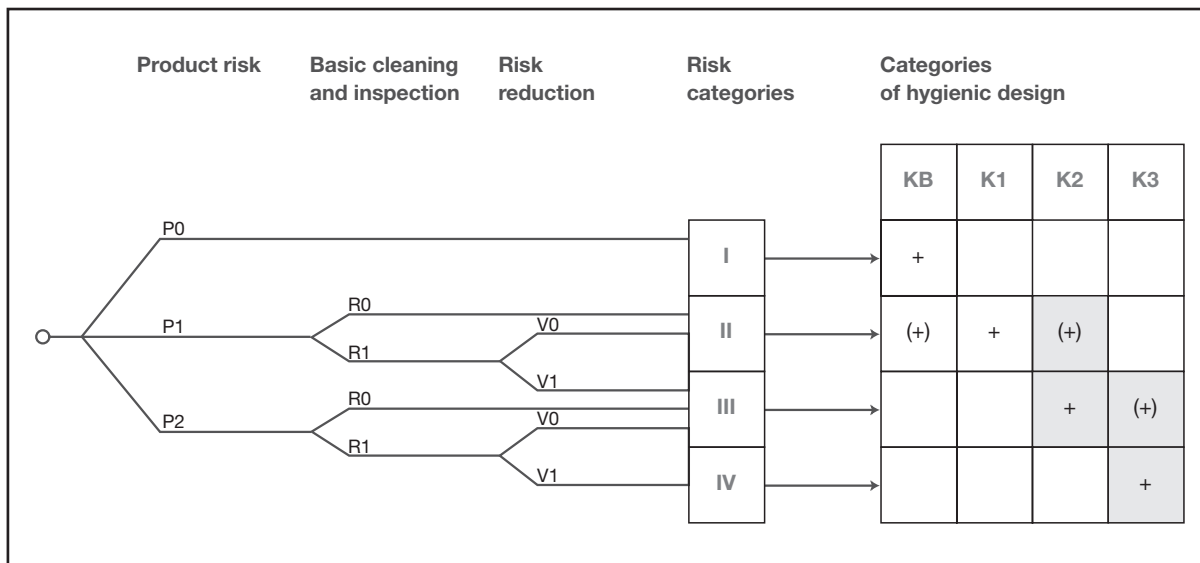
 700	 701	 702
 801	 802	 803

¹ Additional numbers available, e.g.

Annex 1

Hygiene-conform design of food-processing machines*

Hygiene risk chart for food-processing machines



+ = expedient category
 (+) = possible expedient category

- P Product risk**
 P0 Products with little hygiene sensitivity
 P1 Products with moderate hygiene sensitivity
 P2 Products with high hygiene sensitivity
- R Basic cleaning and inspection**
 R0 Critical areas easy to see and reach
 R1 Critical areas difficult to see and reach
- V Risk reduction**
 V0 Risk-reducing factors present
 V1 No effective risk reduction

- K Categories of hygienic design**
 KB Basic measures
 K1 Basic measures and application of basic principles of hygiene if practicable
 K2 Basic measures and extensive application of principles of hygiene if technically possible
 K3 Basic measures and systematic application of principles of hygiene if technically possible

Product risk

A machine primarily presents no hygiene risk. Only a specific product in connection with the machine can lead to a hygiene risk. Machine types of the same construction, e.g. mixing machines, can be used for the processing of food or other substances, e.g. plastics. A hygiene risk can arise only if food is processed.

Food products differ in terms of their sensitivity. It would therefore seem to be expedient to specify the product as a parameter for the basic risk. The level of hygiene sensitivity will determine the amount of risk on this decision-making level. Hygiene sensitivity is higher the higher the perishability of the product and / or the capacity to promote pathogenic germs.

The following table provides examples of and information on assignment of products to the categories P0, P1 and P2.

In view of the fact that a broad range of food-processing machines needs to be considered, the categorisation of a food may alter depending on its processed state.

An example will explain this. An undamaged egg could be assigned to category P0. Once it has been cracked there will be a transition to P2. After adding flour the dough could be categorised in P1. If the dough is made into pasta and then dried, the finished state will be assigned to P0 once again.

The viewing of products in this way therefore leads to different results, depending on the stage of processing in the different machines.

* Source: Handbuch Maschinensicherheit, Issue 1/96, edited by: Berufsgenossenschaft Nahrungsmittel und Gaststätten, Test and Certification Centre in Mannheim, ISBN No. 3-920506-51-0

Assignment of products to the product risk categories (examples)

Possible criteria for product risk assignment:

P0 (products with little hygiene sensitivity)

Products with high content of salt, sugar, acids, alcohol, e.g.

- Spirits
- Honey
- Jam
- Chocolate
- Sweets
- Vinegar
- Sauerkraut

Products with low water content, e.g.

- Cereals
- Spices
- Tobacco
- Flour
- Coffee
- Snack

Other non-critical products, e.g.

- Water
- Oils

P1 (products with moderate hygiene sensitivity)

Products which cannot be clearly assigned to P0 or P2, possibly depending on the state of processing

P2 (products with high hygiene sensitivity)

Highly sensitive products, e.g.

- Milk
- Mayonnaise
- Fresh egg
- Meat
- Delicatessen salads
- Fish
- Poultry
- Ice cream
- Cream

Basic cleaning and inspection

The cleaning of an object that comes into contact with food is a basic hygiene requirement. This is why it is seen to be a basic measure in relationship to the product. Cleaning is a basic measure using which the product risk is to be eliminated. However, this only applies to a restricted extent if the areas soiled by the product only are accessible to basic cleaning. Basic cleaning is understood to mean the complete cleaning from outside with direct access. This is primarily cleaning by hand or with hand-substituting aids such as water jet, steam jet or cleaning machines. It must be possible to visually check the result of cleaning. This requires that the areas coming into contact with the product are easy to reach and access. Basic cleaning can therefore only be performed on simple objects such as tubs, funnels, pots, plates, cutlery, tools.

Complex structures such as machines or machine parts are only accessible to basic cleaning if they can be completely dismantled into simple objects with no concealed areas.

Risk reduction

In compliance with EN 1050, risk-reducing circumstances can also be taken into consideration when assessing the hygiene risk.

Risk-reducing circumstances are said to exist if favourable conditions can be derived from the treatment or processing of the product or from the properties of the product or from the ambient conditions (see above).

Favourable circumstances exist, for example, if the product in the machine is exposed to a process that destroys micro-organisms or a process that prevents or restricts the growth of micro-organisms.

Risk reduction can also be effective in an object if the process is applied at a later stage of processing, possibly in other machines or plants. This means that an accumulation of micro-organisms can be accepted if these micro-organisms are destroyed or their growth prevented later on as long as the formation of toxins can be ruled out.

This assessment primarily applies to the product (consumer protection). If employees working with machines or plant are at risk, the risk-reducing factors are to be viewed more narrowly. Protection of employees should only be put to the fore, however, in those cases in which a risk exists that clearly exceeds the general risk to life (e.g. in households).

It will be necessary to examine the individual case as in all cases of the risk chart.

Risk reducing factors

Examples of risk reduction

1. Product processing	2. Measures to preserve a product	3. Product characteristics	4. Ambient conditions
<ul style="list-style-type: none"> -Baking -Boiling -Drying -Acidifying -Pickling -Smoking 	<ul style="list-style-type: none"> -Pasteurisation -Microwaving -Radiation -Deep-freezing -Addition of Velcorin -A-septic packaging -Fermentation 	<ul style="list-style-type: none"> -Low storage qualities -Highly water soluble (cleaning) 	<ul style="list-style-type: none"> -Cooled machine room -Clean air conditions

Risk categories

Working through risk charts ultimately produces one of several risk categories that describes the extent of the existing risk. Risk category I means a small risk whilst risk category IV is a high risk.

If several risk categories may apply due to changing products or applicable risk reduction factors in different time frames the highest of all categories determined must be selected.

Even if the hygiene risk chart is applied to machines and tools of the food-processing industry in this article, there is nothing to stop it being used for devices and machines in other areas (e.g. health service, bio-laboratory, pharmaceuticals industry etc.). It is also conceivable to extend the risk chart to include higher risk categories so that handling medical instruments, body implants or organs are incorporated.

Incorporation into an HACCP concept (7) is also conceivable.

Categories of hygienic design

The identified risk category must now be brought into relationship with appropriate measures of hygienic design. A similar approach is to be found in EN 954-1 for the control of machines. 4 categories (KB, K1, K2, K3) of hygienic design are suggested and applied to the risk categories.

The number of categories of hygienic design corresponds to the number of risk categories only coincidentally.

These categories can be defined as follows:

KB Implementation of basic measures

K1 Implementation of basic measures and application of basic principles of hygiene if practicable

K2 Implementation of basic measures and extensive application of basic principles of hygiene if this is technically possible.

K3 Implementation of basic measures and systematic application of basic principles of hygiene if this is technically possible.

The principles described at the beginning for the design of machinery are to be understood as basic principles of hygiene.

How can the individual categories now be used in practice?

Possible measures of design implementation are outlined in the table "Measures for the hygiene-conform design of parts coming into contact with food" (refer to page 34).

The basic measures provide a foundation for every additional category. This includes suitability of the materials for the food coming into contact with it. As explained in (2) and (6), the selection of a suitable material can be very complicated particularly if no empirical data are available. In the case of the high risk categories, the requirements placed on the selection of the material will increase so that the basis measure becomes more critical. The same applies to the contact with operating materials, such as lubricants. It will not usually be necessary to

describe special cleaning procedures in category KB because cleaning will usually be limited to basic cleaning.

There are no special demands placed on the surface treatment. It is assumed that the material has been produced using state of the art methods in general machine construction.

Increasingly higher requirements are expected in categories K1 to K3. These may be supplemented or even replaced by proven materials from practical experience if this complies better with the risk category identified.

The bundle of measures is always to be determined for each individual case. Therefore, a situation may well arise in which the risk category is better catered to by a higher or lower design category. In this case the chosen category must be used.

Measures for the hygiene-conform design of parts coming into contact with food

Suggestion for the description of hygiene categories

KB (basic measures)	<ul style="list-style-type: none"> – Use of materials suitable for food – No damaging contact between operating materials and food – Surface roughness in compliance with material processing as usual in general machine construction
K1	<ul style="list-style-type: none"> – Basic measures – Cleaning procedures described – Reduce damaging grooves and pores – Make dead spaces and blind lines accessible to inspection where at all possible – Run-off of product and/or cleaning fluid is possible if necessary (where applicable in cleaning position) – Surface roughness: $R_z > 30$ (depending on material) – Radius of corners and edges: $r > 1.5$ mm
K2	<ul style="list-style-type: none"> – Basic measures – Where applicable, CIP cleaning – Avoid damaging grooves and pores where at all possible – Avoid dead spaces and blind lines where at all possible, otherwise make easily accessible for inspection – Run-off of product and/or cleaning fluid is guaranteed (where applicable, in cleaning position) – Surface roughness: $R_z > 25$ (depending on material) – Radius of corners and edges: $r > 1.5$ mm
K3	<ul style="list-style-type: none"> – Basic measures – Contact surfaces made of suitable stainless steel if technically possible and compatible with basic measures – Where applicable, CIP cleaning – Where applicable, sterilisation of the machine – Where applicable, single use (batch) of tools or machine parts – Where applicable, intermediate cleaning at suitable intervals – No damaging grooves and pores – No avoidable dead spaces and blind lines – Run-off of product and/or cleaning fluid is guaranteed (where applicable, in cleaning position) – Surface roughness: $R_z > 16$ to 25 (depending on application) – Radius of corners and edges: $r > 3.2$ to 2.5 mm

The 'Hygiene risk chart for food-processing machines' (refer to page 31) therefore specifies categories which may be consulted along with the expedient categories.

It may be necessary to select a higher category due to the intended use of the food and/or the expectations of the consumer. Higher standards are placed on baby and infant food, for example, as expected by the population and in accordance with the requirements of the Federal Contagious Diseases Act.

Similar expectations could be placed on other areas of use.

The use of technologies, processes or materials which in the past have not led to an acceptable hygiene risk may not be excluded from a risk analysis particularly if they are technically expedient or necessary.

The advantage of the methods presented is the systematic approach using which existing or still to be constructed equipment can be assigned to a hygienic risk category.

Suitable measures can be found using the assigned categories of hygienic design.

It is conceivable to assign further category matrixes to the risk categories in addition to the categories for hygienic design, such as categories for hygiene-conform behaviour of the employees or categories of works hygiene.

In the same way a distinction can be made between the food area, the splash area and other areas through different category matrixes.

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Annex 2

Excerpt from EN 60204-1 – Electrical Equipment of Machines: Section 10: Operator interface and machine mounted control devices

10.1 General remarks

This section contains the requirements for equipment mounted outside or partly outside control housing.

Insofar as practicable, this equipment must be selected, installed and labelled or coded in compliance with IEC 73, IEC 447. (A European standard for the principles for indicators, actuators and labelling is currently being prepared by CENELEC/TK 44X.

10.1.1 Layout and assembly

Insofar as practicable the control equipment on the machine must

- be easily accessible for operation and maintenance and
- be installed in such a way that the possibility of damage through handling equipment or through other moving equipment is minimised.

The actuating organs of hand-operated control equipment must be selected and installed in such a way that

- they are no less than 0.6 m above the operating level and are easily accessible from the normal working position of the operator;
- the operator does not move into a dangerous situation when he operates the equipment, and
- the possibility of unintended operation is minimised.

10.1.2 Protection from external influences

The operator interfaces and the control devices attached to the machine must be able to withstand the burdens of intended use and must have a type of protection of IP 54, and preferably IP 55 (refer to EN 60529). Together with other suitable measures, the type of protection must provide protection from:

- the influence of aggressive fluids, vapours or gases in the physical environment or used by the machine, and
- the ingress of dirt (e.g. chips, dust, foreign bodies).

10.1.3 Position sensors

Position sensors (e.g. position switches, proximity switches) must be arranged in such a way that they are not damaged when run over. Mechanically actuated position sensors in current circuits serving safety purposes must be equipped with positively opening contacts (refer to EN 60947-5-1).

10.2 Pushbuttons

10.2.1 Colours

Pushbutton actuators must be marked according to Table 2.

The colours of preference for START/ON actuators should be WHITE, GREY or BLACK, and preferably WHITE. GREEN and RED may not be used.

The colour RED must be used for emergency-stop actuators. The colours for the STOP/OFF actuators should be BLACK, GREY or WHITE, and preferably BLACK. RED is similarly permitted. GREEN may not be used.

Table 2: Colour marking of pushbutton actuators and their meaning

Colour	Meaning	Explanation	Examples of use
RED	Emergency	Actuate in hazardous situation or in an emergency	Initiation of emergency-stop functions, refer also to 10.2.1
YELLOW	A-normal	Actuate in a-normal states	Intervention in order to suppress an a-normal state in order to restart an interrupted automatic sequence
GREEN	Safe	Actuate under safe conditions or in order to prepare for normal state	Refer to 10.2.1
BLUE	Mandatory	Actuate in state requiring mandatory action	Reset function
WHITE			START/ON STOP/OFF
GREY			START/ON STOP/OFF
BLACK			START/ON STOP/OFF (preferred)

N.B.: If an additional measure is used to mark (e.g. structure, shape, position) the pushbutton actuator, the same colours WHITE, GREY or BLACK may be used for different functions, e.g. WHITE for START/ON and STOP/OFF actuators.

WHITE, GREY and BLACK are the colours of preference for pushbutton actuators which alternate as START/ON and STOP/OFF pushbuttons. The colours RED, YELLOW or GREEN may not be used (refer also to 9.2.6).

WHITE, GREY and BLACK are the colours of preference for pushbutton actuators which bring about a work sequence when actuated and end the sequence when released (e.g. inching). The colours RED, YELLOW and GREEN may not be used.

The colour GREEN is reserved for functions indicating a safe or normal state.


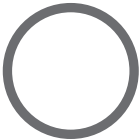


The colour YELLOW is reserved for functions indicating a warning or an a-normal state.

The colour BLUE is reserved for mandatory functions.

Reset pushbuttons must be BLUE, WHITE, GREY or BLACK. If they act as STOP/OFF pushbuttons the colours WHITE, GREY or BLACK are preferred, and preferably BLACK. GREEN may not be used.

10.2.2 Labelling

In addition to the functional labelling described in 18.3, it is recommended to provide pushbuttons with symbols next to or preferably on the actuator. For example:

START or ON	STOP or OFF	Pushbuttons which are either used for START and STOP or ON and OFF functions	Pushbuttons which bring about a movement when actuated and which stop the movement when released
417-IEC-5007	417-IEC-5008	417-IEC-5010	417-IEC-5011
			

10.3 Display lights and displays

10.3.1 Types of use

Display lights and displays serve the purpose of providing the following information:

- Display: the operator's attention is to be drawn to the fact that a specific action is to be performed. The colours RED, YELLOW, GREEN and BLUE are usually used for this type of operation.
- Confirmation: a command, a state or a condition or the end of a change or of a transitional period is confirmed. The colours BLUE and WHITE are usually used for this type of operation. GREEN may be used in some cases.

10.3.2 Colours

If nothing to the contrary has been agreed between supplier and operator, the front surfaces of the display lights must be marked in the colours shown in Table 3 under consideration of the state of the machine. In compliance with IEC 73, deviating meanings may be assigned in accordance with the following criteria:

- the safety of individuals and the surrounding areas, or
- the state of the electrical equipment.

(Display principles are processed by CENELEC/TC 44X.)

10.3.3 Flashing signals

Flashing lights may be used for further distinction or as additional information and to emphasise something. This includes the following purposes:

- in order to draw attention
- in order to bring about immediate action
- in order to display a difference between actual and target state, and
- in order to show a change in state (flashing during a transitional period).

It is recommended to assign higher flashing frequencies to more important information (refer to IEC 73 for recommended flashing frequencies and pulse/pause ratios). (Display principles are processed by CENELEC/TC 44X.)

10.4 Illuminated push-buttons

Actuators for illuminated pushbuttons must correspond to the meaning of the colours as shown in Tables 2 and 3. If there are difficulties in assigning a suitable colour WHITE must be used. The colour effect of RED for the emergency-stop actuator may not depend on lighting.

10.5 Rotary switches

Devices with a rotary part, e.g. rotary potentiometers and selector switches, must be fixed in such a way that the fixed parts cannot be turned. Friction alone may not suffice..