

**Control Devices and Indicator Lights
for Food Processing Machines and Heavy-Duty Applications,
22.3 mm Diameter Installation
Catalogue N/08**





Warning!

The devices in this range are not intended for private consumers, i.e. they are not consumer products within the meaning of the European Directives (in Germany within the meaning of § 5 GPSG) or other national laws. Assembly and commissioning of the devices require personnel with appropriate electrical know-how or who have been suitably instructed.

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,
born 580/577 BC)

Descriptions of technical correlations, details on external control units, installation and operating instructions or similar have been provided to the best of our knowledge. However, this does not mean that any warranted characteristics or other properties under liability law may be assumed which extend beyond the "General Terms of Delivery of Products and Services of the Electrical Industry".

We trust you will understand that the user must check our information and recommendations before using our equipment.

Control Devices and Indicator Lights for Food Processing Machines and Heavy-Duty Applications, 22.3 mm Diameter Installation

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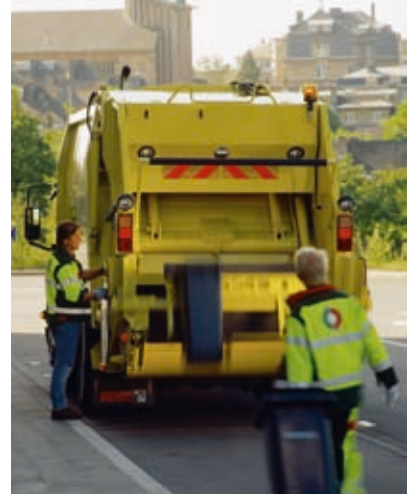
Control Devices and Indicator Lights for Food Processing Machines and Heavy-Duty Applications Type Series N

Application

A number of special design features and properties make this range of control devices and indicator lights (installation diameter: 22.3 mm) suitable for the following applications:

- food processing machines to comply with the special cleaning requirements of this industry and to prevent the hygiene risk of cross-contamination, particularly with respect to machines processing raw goods, such as fish, meat, poultry, milk or eggs;
- applications, for example, in clean room machines which are similarly required to satisfy hygiene requirements (in whole or in part) as set out in EN 1672-2 and ISO 14 159.

Furthermore the devices are suitable for applications with high requirements as to the sealing capacity of the device heads, for example, for control input panels and command panels in the outdoor area on ships, commercial vehicles, in traffic systems etc. or in extremely dusty and dirty environments, as in the case of tunnel drilling machinery.



The range* has been designed under analogous consideration of EN 1672-2 "Food Machinery – General Design Principles – Part 2: Hygiene Requirements", as documented by a prototype test with the "hygiene" test certificate of the Prüfstelle der Fleischerei-Berufsgenossenschaft im

BG-Prüfzert (Testing Agency of the Employers' Liability Association for the Butcher's Trade).

In addition to the advantages of the IP 69K type of protection (refer to page 3) and the cleaning friendly shapes of the device heads the following features deserve additional mention in terms of hygienic conformance design:

- Special seals extensively prevent the penetration of product residue in the gaps between the fixed and moving device parts, thereby effectively preventing the formation of bacteria nests in places which cannot be accessed for cleaning.
- Easy to clean due to
 - smooth surfaces and the extensive avoidance of areas on which residue could collect
 - selection of materials resistant to cleaning agents typical in the food processing industry such as smoke resin removers.
- Use of food-compatible materials only as a matter of course.
- UV- or ozone-resistant materials.



Hygiene



* Refer also to:

- Page 7: Special design features in detail/
- Page 8/9: Background information on the subject of "hygienic conformance design"

Design features and properties

- **Type of protection IP 67/ IP 69K**

All device heads satisfy the protection type tests

- IP 67 to EN 60529 (including protection from the penetration of water when constantly submersed, tested at 1 m water column/30 min.), and

- IP 69K to DIN 40050, Part 9 (1983)

- **Type of protection IP 69K**

In addition to the test for dust-tightness the test for IP 69K (originally conceived

as a protection type test for road vehicles) simulates the resistance of devices to high-pressure water cleaners by subjecting the test subjects to a hot (approx. 80 °C) water jet at very high pressure (approx. 100 bars) at 5 revolutions per minute without any damage occurring.

- **Easy to clean**

The special shape of the devices, in which corners and edges are largely avoided and smooth surfaces have been created, make cleaning of the device heads simple and effective.

- **Industrial compliance**

The devices – both of the type series N and of the type series E...O, in connection with the long-time well tried contact and light terminal blocks EF/EL, satisfy the requirements placed on industrial control devices and indicator lights to IEC EN 60947-5-1 (VDE 0660 Part 200) as well as IEC EN 60947-5-5 (VDE Part 210) and ISO EN 13850 in the case of EMERGENCY STOP control devices.

- **Design**

The range was given the "IF award winner 2003".



design award
winner
2003

Product range/accessories

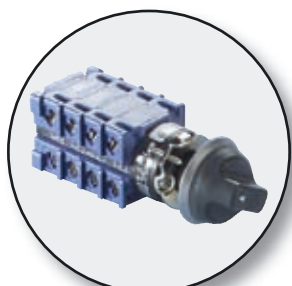
The range consists of the following commercially available types of devices:

- pushbuttons
- illuminated pushbuttons with LEDs
- maintained selector switches with 2 and 3 positions and short and long knobs
- ditto, spring return selector switches
- mushroom pushbuttons
- EMERGENCY STOP control devices
- high and flat indicator lights with LEDs

The range also includes the following (refer also to page 4 et seq.):

- short-lift pushbuttons
- potentiometer drives
- 2- to 12-step maintained selector switches
- blanking plugs
- a so-called maintained selector switch inhibit

- adapters with position switches (for type of protection IP 65/IP 67 behind the front plate)
- accessories, e.g. labels and protective collars
- adapter rings (installation diameter 30.5 → 22.3 mm)
- V4A mounting boxes (command boxes).



Design features of individual devices



Illuminated devices (for product range refer to pages 19 (illuminated pushbuttons)/33 et seq. (indicator lights))

For reasons of hygiene and sealing illuminated pushbuttons and indicator lights are designed in such a way that it is not possible to replace a bulb from the front (from the front side of the front panel). For this reason LED-based versions are available (LEDs with an expected service-life > 10.000 hours compared with bulbs < 1,000 hours).

Special light terminal blocks (ELDE) with integrated "superbright" multi-LEDs are offered for both types of devices. Alternatively, LEDs with Ba9S holder (refer to accessories, page 59) can also be used in connection with light terminal blocks of the ELE type, which in this case only act as voltage supply.

Furthermore, indicator lights with "superbright" LEDs are available which are integrated into the device head to provide illumination over the entire surface.



Lockable maintained selector switch mounting frame as substitute for the key-operated maintained selector switch (refer to page 22 for product range)

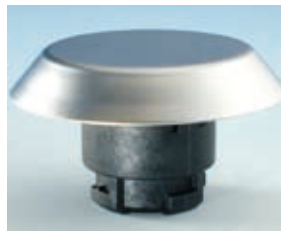
This mounting frame, consisting of a type of lid with an inner-lying cam and a fixed hole, provides a functionality similar to a key-operated maintained selector switch when combined with a maintained selector switch. The cam inside the lid fixes the desired switched state. It is locked by means of one or two padlocks.

The mounting frame is designed such that it complies with hygiene requirements. The padlocks used are to be viewed separately.

Key-operated maintained selector switches and key-operated selector spring return selector switches are not featured in the product range.

Lockable maintained selector switch mounting frame as main switch substitute

On request.



Blanking plug (refer to page 54 for product range)

Unused holes in an operating or control panel can be closed using this accessory. The design of the blanking plug also satisfies the sealing requirements of IP 67/IP 69K and the demands placed on a hygienic conformance design.

Adapter ring (refer to page 55 for product range)

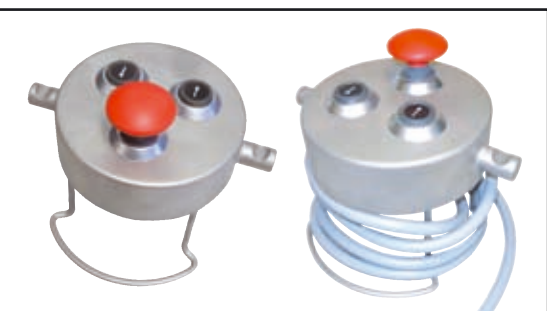
The adapter ring (transition ring) permits devices of the N type series to be used in installation bore holes with a diameter of 30.5 mm without affecting the design features and properties.

Symbols (refer to pages 60/61 for product range)

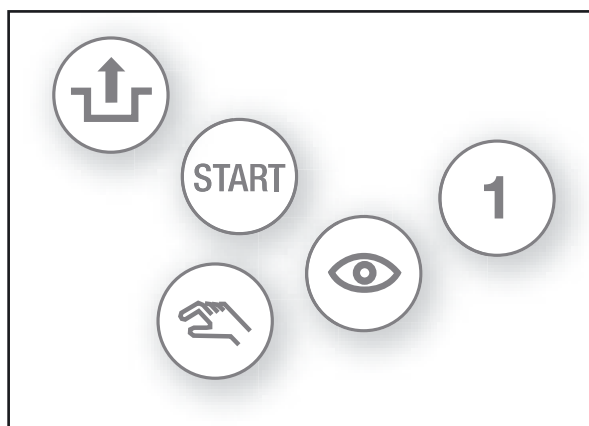
Symbols can be attached to the devices by means of tampon printing on the button surface with a single component paint. The print is then stoved to increase wear resistance. From the point of view of hygiene the colours used are safe if used correctly.

Symbols to ISO 7000/DIN 40101 Part 2 respectively to EN 60417-1/-2: possible on request.

Hot embossing: on request.



Customers special solution
"mobile button" with
emergency stop slam button





Step switches with 2 to 12 switching positions

(refer to page 23 et seq. for product range)

Step switches with 2 to 12 switching positions consist of a maintained selector switch device head and contact block in cam-operated design with locating mechanism.



Potentiometer drives

(refer to page 25 for product range)

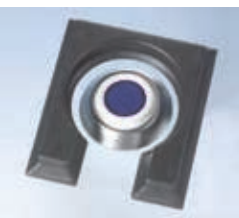
This device consists of a fluted knob and potentiometer receptacle with integrated mounting flange. The potentiometers themselves are not part of the product range.



Control devices for position switches

(refer to page 43 et seq. for product range)

For applications in which a high class of protection is also required behind the front plate, an adapter is available for the connection of position switches with type of protection IP 65 and IP 67 from the Elan SEK type series (position switches to EN 50047, shape B, vertical plunger).

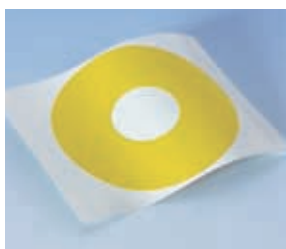


Protective collar

(refer to page 58 for product range)

Labels

(refer to page 56 for product range)



Short-lift pushbuttons

(refer to page 50 et seq. for product range)

In order to facilitate fatigue-free work with frequent actuation of pushbuttons, so-called short-lift pushbuttons supplement the product range. The actuation of the devices is limited to an ergonomic-friendly 2 mm switching lift with an actuating force of approx. 15 N.

The short-lift pushbuttons operate on the basis of an electromechanical principle of action and are available as NC/NO contact combination (3 ... 50 V, max. 100 mA, NC contacts not positively opening).

Actuating heads for the adapter solution include pushbuttons, mushroom buttons, single-plunger maintained and spring return selector switches as well as EMERGENCY STOP control devices (without EFR spring element).

SEK position switches are offered as 2-pole version with snap-action contacts (1 NC/1 NO contact, 2 NC contacts, 2 NO contacts). Three-pole versions on request.



Design features of individual devices (continued)



Mounting boxes (control boxes)

(refer to page 63 et seq. for product range)

Control boxes made of a special V4A material are available, particularly to supplement the N type series. In the same way as the control devices and indicator lights of this product range, these control boxes satisfy the basic requirements placed on a hygienic conformance design, i.e.

- they are extensively designed without corners and edges with radiuses >6 mm
- they satisfy the type of protection IP 67 and IP 69K, and

- they have been manufactured using NIROSTA 1.4571 (AiSi316Ti), a deep-drawn material specially for use in food processing machines.

The boxes are also suitable for other applications outside the hygiene-critical area with high environmental stress and sealing requirements.

The control boxes are offered in three versions for 1, 3 and 5 control points.

EF/EL terminal block system

(refer to page 35 et seq. for product range)

In the N type series the EF/EL system is offered as standard for contact and light terminal blocks (for exceptions refer to device descriptions). This is a modular system consisting of individual blocks snapped on to an mounting flange. The contacts are characterised by their suitability for very small voltages (switching currents ≥ 5 V/3.2 mA).

On request: contacts with 5 μ m hard gold plating in aggressive ambient conditions, e.g. in sewage treatment plants (ammonia).

The following connections are available:

- screw terminals (1-pole/2-pole elements)
- flat-pin plugs (1-pole/2-pole elements)
- WAGO Cage Clamp terminals (1-pole/2-pole elements)



Application information



Warning!

- The preferred installation positions for the devices are diagonal and vertical surfaces. It is also possible to use sealed position switches instead of the EF... contact elements – see page 43 et seq.
- It must be ensured by organisational measures that devices with damaged or destroyed seals are replaced immediately.
- However, if the above measures cannot be complied with or implemented, the voltage limitation is 50 VAC and 120 VDC (VDE 0110 part 410).



Warning! The devices are not suitable for so-called “vandal-proof” applications.

Mounting instructions

Refer to page 12 et seq. and the respective device types.

Cleaning agent suitability

The device heads of the N type series have been subjected to different tests with commercially available cleaning agents. This includes a resistance test on the N type series to smoke resin remover (= submersion

in a test liquid consisting of 10% smoke resin remover, 90% water for 7 days) without any impairment to appearance or function (refer here to resistance table on page 52).

Test conditions

All tests were successfully performed under standard or laboratory conditions. However, due to differences in practical application deviating results cannot be ruled out.

Special design features in detail



The special sealing measures (1), the special device shapes (2) and the choice of material (3) are based on the following design features:

(1) Device sealing

Specially designed seals serve to protect against the penetration of dirt and bacteria in the gaps between fixed and moving parts of the device.

A: In the case of pushbuttons, mushroom buttons and EMERGENCY STOP control devices, i.e. in the case of axially operated actuators, this seal is permanently fixed to the bezel and actuators via corresponding receptacles, thereby closing open gaps to the outside.

B: In the case of rotating actuators, e.g. in the case of maintained and spring return selector switches, the device seal is designed in such a way that whilst it is only attached to the actuators on one side, it reaches over the bezel, assisted by the bell shape, i.e. when the actuator is turned a hygiene-critical gap does not form. An additional seal inside the device also protects against the penetration of pressurised water.

C: All devices feature an additional front plate seal.

(2) Device shape

The special thought given to making the devices easy to clean are reflected

- in the bezel design
- the design of the outer surfaces of the device seals, and
- in the design of the actuators.

D: The bezel on the device sleeve is designed in such a way that the front plate and the outer surface of the bezel are at an angle of approx. 135° to each other, thereby creating a surface without "sharp" transitions. Owing to the fact that the bezel with the front plate seal lies flush on the front plate there is little surface area for dirt and bacteria to collect (another advantage).

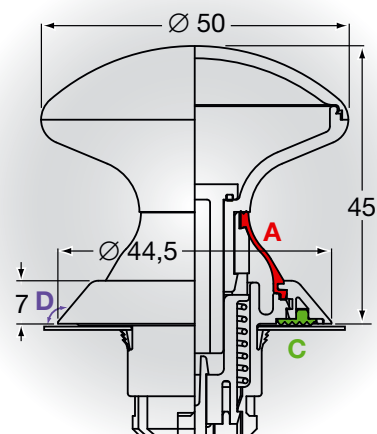
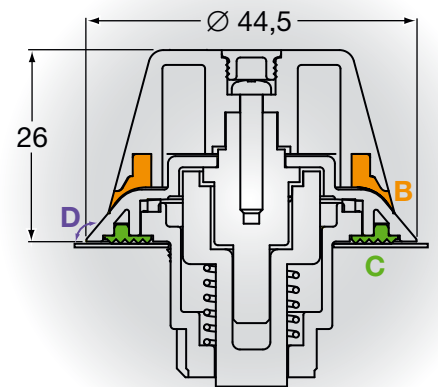
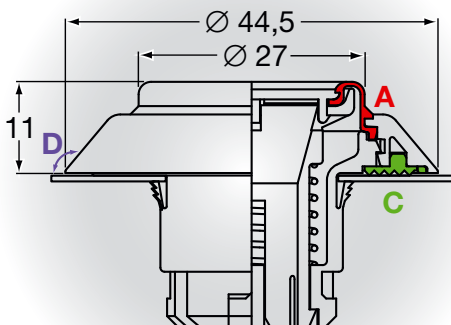
The outer surfaces of the device seals make a flush (in the case of pushbuttons and indicator lights) or continuous (in the case of other device versions) transition from the bezel to the free outer surface of the actuator, i.e. a smooth transition is formed here too. The same applies to maintained and spring return selector switches, the only difference being that the seal is tensioned in the actuator here and reaches over the bezel.

The actuators of all devices with grip or mushroom shape have curvature radiuses ≥ 3.2 mm at all corners and edges similarly for reasons of ease of cleaning. Furthermore, a distance which is always larger than a finger width is maintained to the fixing surface in order to guarantee ease of cleaning by hand.

(3) Choice of material

All external parts of the control devices and indicator lights of this programme are made of thermoplastics. These materials are approved in accordance with the European directives for use in food processing. These are commercially available materials such as PA, PC, POM, Silicone and ABS.

The bezels are galvanically matt chromed (ABS), making their surfaces smooth and easy to clean. The other parts are highly closed-pore, thus making them also easy to clean.



Background information on the subject of “hygienic conformance design”

Background¹

Irrespective of the large number of statutory, standard and other provisions the subject of hygiene has been important at least since 1995 as a subject for the EC Machine Directive and thus a subject of machine safety which affects the food processing industry in particular.

This subject has been incorporated in the “Basic Safety and Health Requirements in the Design and Construction of Machines and Safety Components”² and permits the conclusion to be drawn that the hygiene regulations serve two purposes:

- They are intended to protect employees from infection and disease (health protection of the employees).
- They are also intended to prevent the product becoming contaminated by the machine (consumer protection).

- ¹ Partly quoted from: Special publication of the Berufsgenossenschaft Nahrungsmittel und Gaststätten, Prüf- und Zertifizierungsstelle Mannheim, from Handbuch Machinensicherheit, Edition 01/96, Section 5.30, Wockert: Hygienegerechte Konstruktion von Nahrungsmittelmachines
- ² Refer to EC Machine Directive, Annex 1, Section 2.1: Basic Safety and Health Requirements for Specific Machine Equipment – Food Processing Machines



Harmonised standards within the meaning of the EC Machine Directive on the subject of “hygiene”:

- EN 1672-2: Food-processing machines – General Principles of Design – Part 2: Hygiene Requirements
- ISO 14159: Hygiene Requirements on the Design of Machines



Basic requirements of hygienic conformance design

Two areas must be considered with respect to the hygiene requirements placed on machines (and also on other technical aids). Firstly, the suitability of materials and secondly the hygienic conformance design, the principles of which can be summarised as follows:

- Surfaces and their transitions must be sufficiently smooth.
- Connections must be conceived in such a way that protruding parts, strips and concealed corners are restricted to a minimum.
- The connections of inside surfaces must be made with curves of sufficient diameter.
- Operating materials (e.g. lubricants) may not come into contact with food if these substances are not food-compatible.
- Fluids (food and cleaning agents) must be able to flow from the machine at least in cleaning position.
- Any surfaces coming into contact with food must be easy to clean.
- Areas which are inaccessible to cleaning must be sealed against the penetration of organic substances.

Control devices and indicator lights of the N type series have been developed for food processing machines with command entries and command panels the operation of which is associated with the risk of cross-contamination or which are integrated into parts of machines which required extensive or systematic application of the basic hygiene principles (= hygiene categories K2 and K3 in accordance with the "Risk chart showing the hygiene risk in food processing machines").



Product risk **Basic cleaning and inspection** **Risk reduction** **Risk classes** **Categories of hygiene design**

	KB	K1	K2	K3
I	+			
II	(+)	+	(+)	
III			+	(+)
IV				+

- K Categories of hygiene design**
 - KB Basic measures**
 - K1 Basic measures and application of basic hygiene principles insofar as practicable**
 - K2 Basic measures and further application of basic hygiene principles insofar as technologically possible**
 - K3 Basic measures and systematic application of basic hygiene principles insofar as technologically possible**



EF/EL terminal block system

Pushbuttons _____	18
Illuminated pushbuttons _____	19
Selector switches (maintained/spring return versions) with short and long knobs _____	20
Maintained selector switch inhibit _____	22
Step switch with 2 to 12 switching positions _____	23
Potentiometer drives _____	25
Mushroom pushbuttons _____	26
EMERGENCY STOP control devices _____	27
Main switches for food processing machines _____	30
Indicator light with flat cap _____	33
Indicator light with domed cap _____	34
EF/EL contact and light terminal block system with screw terminals or flat-pin plugs _____	35
EF/EL contact and light terminal block system with WAGO Cage Clamp _____	38
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Adapter with position switch _____	45
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Control devices and indicator lights – N type series

Range with contact and light terminal blocks of the EF/EL system

Structure

A control and indicator device consists of the assemblies “device head with mounting flange” and “contact or light terminal block” (in the case of EMERGENCY STOP devices possibly plus spring element). The type designation of a device head starts with N....

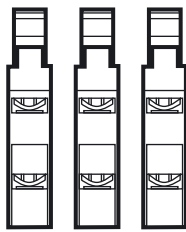
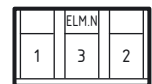
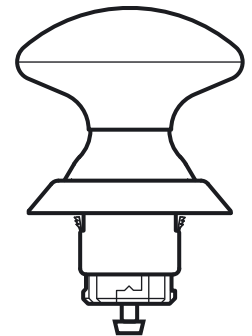
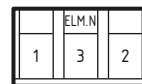
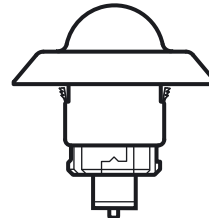
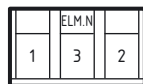
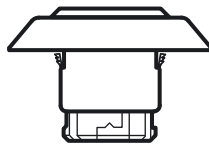
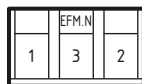
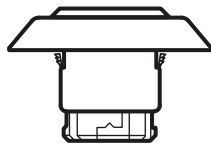
Contact and light terminal blocks

The long-time well tried and tested EF/EL system is used as contact and light terminal block system. This is a modular system consisting of individual elements snapped on to an mounting flange.

Assembly

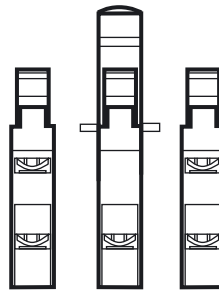
Depending on control device and light indicator up to three blocks can be snapped on to an mounting flange (type EFM.N for unlit control devices, type ELM.N for indicator lights and illuminated pushbuttons as well as EMERGENCY STOP devices). 1-pole contact blocks are available with an NC and

an NO contact. 2-pole contact blocks have one NC/NO contact, two NC or two NO contact combinations. The light terminal blocks ELE... and ELDE.N... as well as the spring element EFR for EMERGENCY STOP devices are intended exclusively for the centre position on the mounting flange.



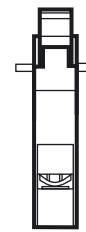
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Contact blocks EF
for contact devices of the
type series N



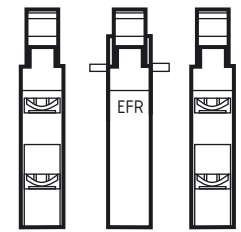
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Light terminal block ELDE
with integrated multi-LED
for illuminated push-
buttons NDL...



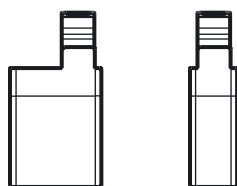
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Light terminal blocks ELE... (voltage
sensor) with Ba9S holder for indicator
light NME... (with integrated multi-LED)
or for illuminated pushbuttons NDL... if
commercially available LEDs Ba9S
(refer to accessories) are to be used

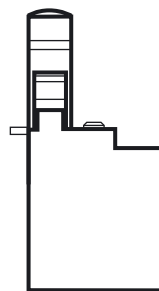


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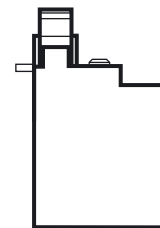
Spring element EFR
for EMERGENCY HALT control
devices, version 2



Contact and light terminal blocks EL...K
or EF...K with WAGO cage clamps
(broad shape: 2-pole contact blocks)
(narrow shape: 1-pole contact block)



ditto for 48 ... 230 VAC



ditto for 48 ... 230 VAC

Control devices and indicator lights – N type series

Product range structure with contact and light terminal blocks of the EF/EL system:

Overview of terminal blocks

Contact blocks



EFK series, 1-/2-pole with WAGO cage clamp terminals, broad shape: 2-pole



EF series, 1-/ 2-pole, either with screw terminals or flat-pin plugs

Light terminal blocks with integrated multi-LED for indicator lights NMLF and illuminated pushbuttons



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 terminal blocks (as voltage supply) with Ba9S holder for indicator lights NMLF and NMLEF and illuminated pushbuttons



ELEK series, 24 V, with WAGO cage clamp terminals



ELE/ELEF series, 24 V, either with screw terminals or flat-pin plugs

Dito



ELE./ELEF 48 VDC/AC and ELE.../ELEF 115 ... 230 VAC, either with screw terminals or flat-pin plugs

Mounting flange with spring element



For EMERGENCY STOP control devices in version 2

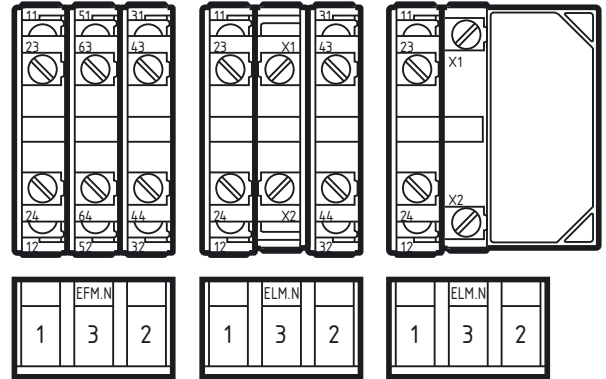
Control devices and indicator lights – N type series

Product range structure with contact and light terminal blocks of the EF/EL system

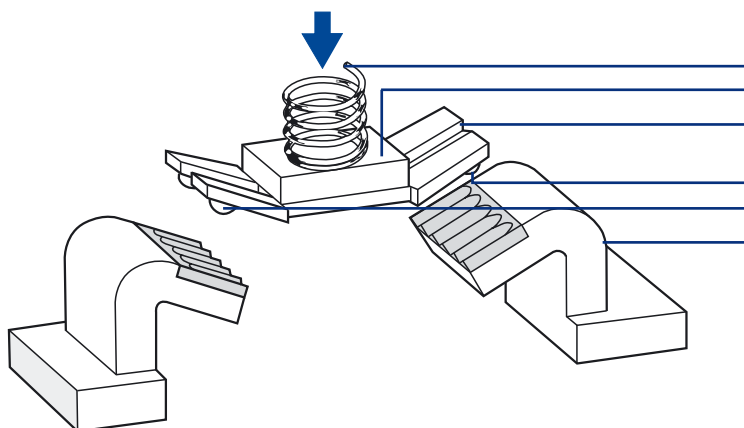
Special design features

All blocks of the EF/EL system have the following special design features:

- A self-cleaning contact bridge system, known as Elan four-way system, which is particularly suitable for very low-voltage and has a lower switching capacity of 5 VDC/3.2 mA (max. 400 VAC/8 A). It is designed in the form of a bent twin contact bridge, with parallel and also diagonal operation.
- A robust block mounting by means of snap-on stainless steel springs.
- Complete terminal designations visible at a glance in compliance with IEC 60947-1 (VDE 0660, Part 100) with a complete function and sequence number (refer also to product ranges). The function number identifies the NC and NO contact, the sequence number specifies the number and the order of the contacts on the complete switching device. When selecting type we recommend that it be decided at which position the block is to be snapped on to the mounting flange.
- NC contacts with positive opening in compliance with IEC EN 60947-5-1 (VDE 0660 Part 200).
- Galvanically isolated contact circuits in 2-pole blocks.
- High resistance to shock and vibrations.
- 5 µm hard gold plating for aggressive ambient conditions: on request.



Example of a complete assignment with 2-pole contact and light terminal blocks in the EF/EL system.



- Contact spring
- Insulating element for the galvanic isolation of the contacts
- Four-way contact bridge with parallel and cross-operating twin contacts
- Contact points made of fine silver
- ditto
- Fixed contact with embossed fine silver plating

The statistical probability of maloperation of the Elan four-way contact system is 0.5 ppm. A variety of special design features (namely the choice of materials and the multi-embossed and angular surface areas of the contacts) provide a high specific contact pressure which, together with a micro-movement, ensures the continuous self-cleaning of the contacts during actuation and reliably eliminates oxide and dirt particles even with the smallest of currents and voltages.

Connection systems

The EF/EL system offers a choice of the following connection systems:

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

Shock-hazard protection to EN DIN 50274 (VDE 0660 Part 514)

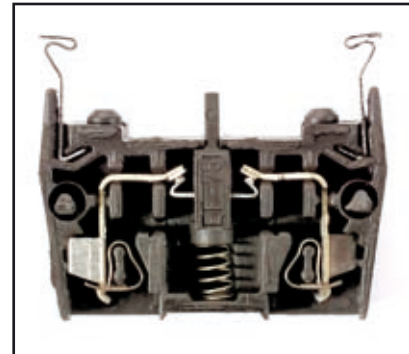
Contact and light terminal blocks with screw terminals and WAGO cage clamp terminals satisfy the shock hazard protection requirements without additional measures in the case of operation of the blocks with dangerous contact voltages.



Warning! Additionally insulated plugs should be used in the case of flat-pin plugs.

Connection system: WAGO cage clamp terminals

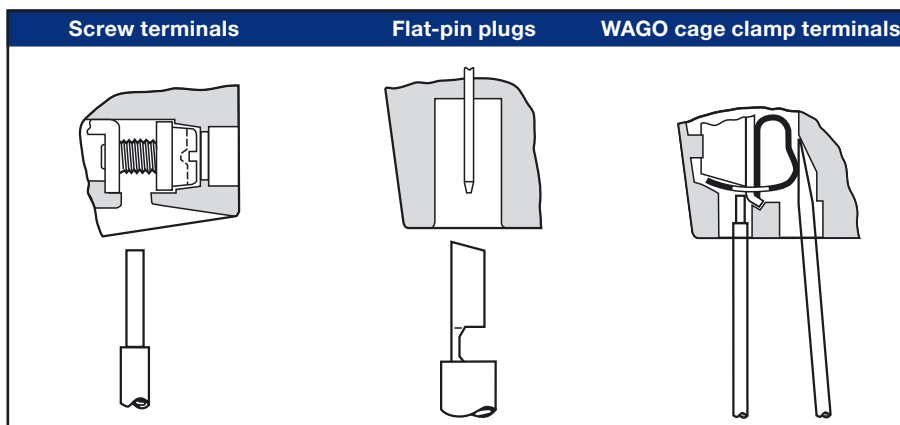
Contact and light terminal blocks with cage clamp terminals do normally not belong to a commercially available range of control and indicating devices. But due to the possibility of saving of wiring time and the fact that WAGO cage clamp terminals are protected from becoming loose even under the effects of strong vibrations, this connection system is also to be found in the Elan type series N.



WAGO cage clamp terminal



Warning! In the case of indicator lights and illuminated pushbuttons the positions not occupied on the mounting flanges must be secured using snap-on covers (type EL-15) offered as accessories (refer to page 59) if operated with dangerous contact voltages.



Two-slotted screws:

Conductor cross-sections $2 \times 0.5 \dots 2.5 \text{ mm}^2$, with wire end ferrule max. 1.5 mm^2 (automatic screwing is possible). The connection screws (recessed head) are screwed on delivery.

Flat-pin plugs

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

WAGO cage clamp terminals:

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

Control devices and indicator lights – N type series

Product range structure with contact and light terminal blocks of the EF/EL system:

Practical assembly instructions

Installation bore hole 22.3 mm

In accordance with IEC 60947-1, the devices are designed for installation bore holes of 22.3 mm + 0.4 mm. An additional lug cut-out as protection against twisting is not necessary. It is possible to install several devices with a minimum grid of 50 × 50 (maintained selector switch/spring return selector switch with long knob: 50 × 60 mm).

The device head is inserted soundly and precisely in the bore hole.

Single hand assembly: lugs on the device sleeves serve self-holding purposes so that the mounting flange fitted to the bayonet from the back of the front plate can then be positioned and screwed tight.

Mounting flange fixing

Please remember: you will achieve optimum fixing of the mounting flange if both screws are tightened evenly only as far as the tip of the screw has reached the front plate. This means you will avoid screwing tight as far as possible (recommended torque: max. 0.6 Nm).

Block fixing

It is recommended that the contacts and light terminal blocks are snapped on to the respective position on the mounting flange in accordance with their terminal designations. In order to simplify this assignment the blocks are marked with .1, .2 and .3 (refer to figure on page 12). If only one block is used we recommend that this be fixed to position 3.

The light terminal blocks ELE... and ELDE..N... are intended exclusively for the centre position of the mounting flange (no. 3). They must be snapped on first before any other EF contact blocks. When dismantling the EF blocks are to be removed first.



Warning! For reasons of hygiene and sealing it is not possible to replace a bulb in both ranges). If the multi-LEDs used in the indicator lights and illuminated pushbuttons become defective or reach the end of their serviceable life the entire device head or the light terminal block should be replaced.



Warning!

- Damaged device heads, in particular devices with damaged seals, must be replaced immediately since otherwise reliable hygiene protection is no longer guaranteed.
- The preferred installation positions for the devices are diagonal and vertical surfaces. It is also possible to use sealed position switches instead of the EF... contact elements – see page 43 et seq.
- However, if the above measures cannot be complied with or implemented, the voltage limitation is 50 VAC and 120 VDC (VDE 0110 part 410).





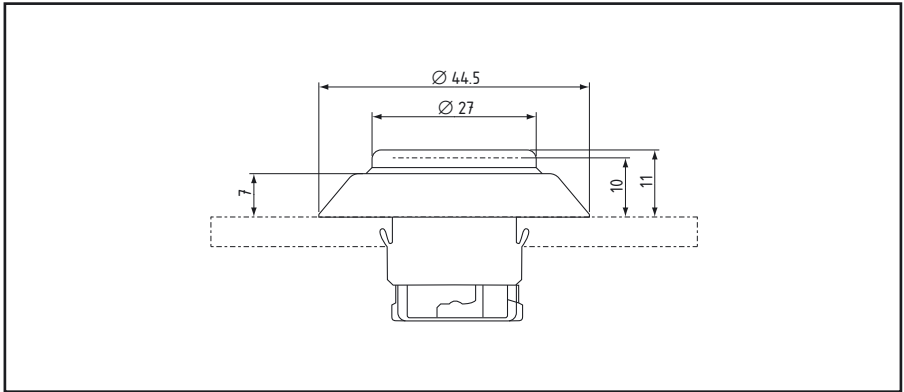
Pushbuttons



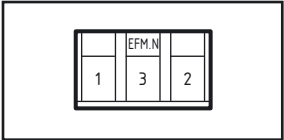
Left: with sealing bellows, colour white (standard)

Right: with sealing bellows, colour black

- Protective collar against unintentional actuation: refer to page 58



Front plate thickness 1.5 ... max. 6 mm, mounting flange EFM.N supplied



Mounting flange EFM.N

Product range							
Devices	Colour	White sealing bellows			Black sealing bellows		
		Type	Catalogue no.	Part no.	Type	Catalogue no.	Part no.
Pushbuttons	black	NDT SW	080 0010	1163559	NDT GR/SW	080 0012	1163567
	yellow	NDT GB	080 0015	1163558	NDT GR/GB	080 0017	1180985
	red	NDT RT	080 0020	1163555	NDT GR/RT	080 0022	1163563
	green	NDT GN	080 0025	1163556	NDT GR/GN	080 0027	1163564
	white	NDT WS	080 0030	1158163	NDT GR/WS	080 0032	1163561
	blue	NDT BL	080 0035	1163557	NDT GR/BL	080 0037	1163565
	grey	NDT GR	080 0040	1163560	NDT GR/GR	080 0042	1163568
Contact blocks: refer to page 35 et seq.							

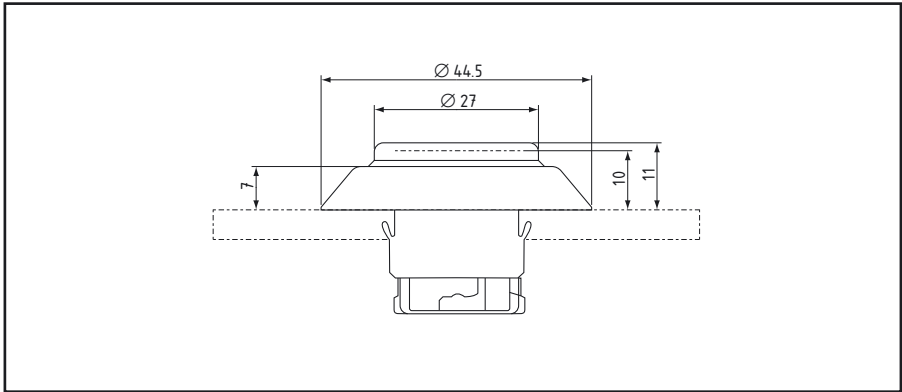
Illuminated pushbuttons



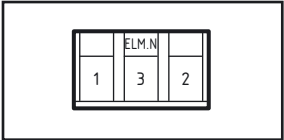
Left: with sealing bellows, colour white (standard)

Right: with sealing bellows, colour black

- For light terminal blocks ELDE... (with integrated “super bright” multi-LED)
- For light terminal blocks ELE... (voltage supply with Ba9S socket for commercially available LEDs, refer to accessories on page 59)
- Protective collar against unintentional actuation: refer to page 58



Front plate thickness 1.5 ... max. 6 mm, mounting flange ELM.N supplied



Mounting flange ELM.N

Product range							
Devices	Colour	White sealing bellows			Black sealing bellows		
		Type	Catalogue no.	Part no.	Type	Catalogue no.	Part no.
Illuminated pushbut- tons	yellow	NDL GB	080 5015	116 3545	NDL GR/GB	080 5017	116 3550
	red	NDL RT	080 5020	116 3544	NDL GR/RT	080 5022	116 3549
	green	NDL GN	080 5025	116 3547	NDL GR/GN	080 5027	116 3554
	white	NDL WS	080 5030	116 2104	NDL GR/WS	080 5032	116 3548
	blue	NDL BL	080 5035	116 3546	NDL GR/BL	080 5037	116 3553
Contact and light terminal blocks: refer to page 35 et seq.							

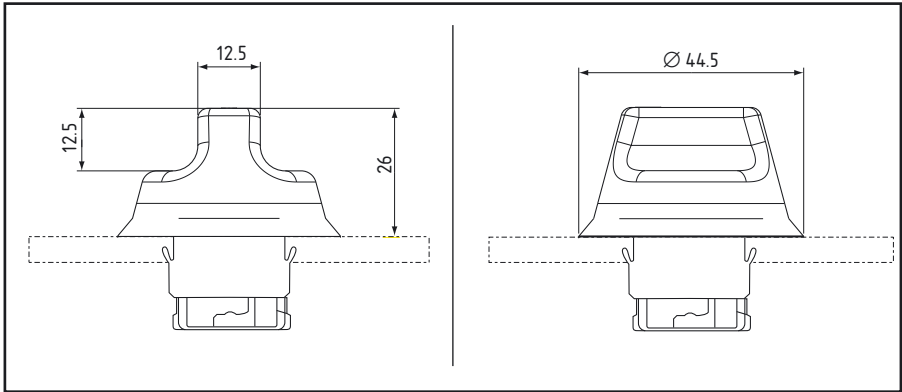
Maintained selector switches, spring return selector switches with short or long knob



Left: with sealing bellows, colour black (standard)

Right: with sealing bellows, colour white

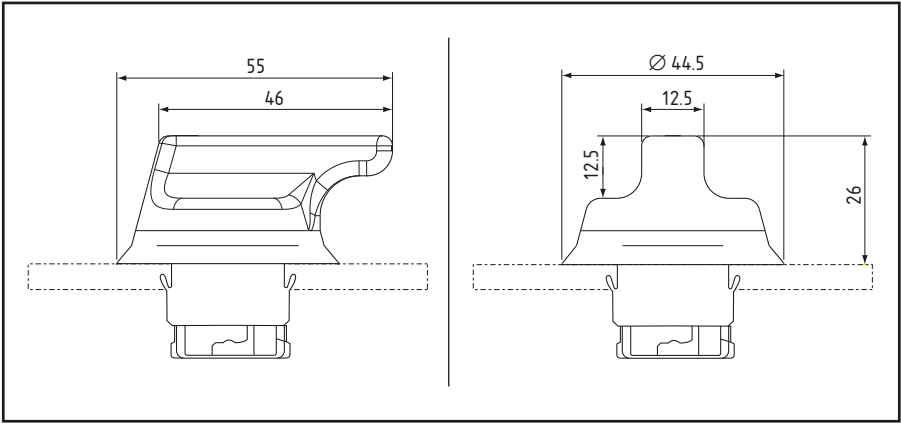
- .1 version with 46 mm long knob: see below and product range table
- Maintained selector switch inhibit refer to page 22



Front plate thickness 1.5 ... max. 6 mm, mounting flange EFM.N supplied

	EFM.N	
1	3	2

Mounting flange EFM.N



Front plate thickness 1.5 ... max. 6 mm, mounting flange EFM.N supplied

Product range							
	Devices	Switching angle	Knob colour	Sealing ring colour	Type ¹	Catalogue no.	Part no.
Maintained selector switches, spring return selector switches with short or long knob	Spring return switch, 2 positions	1 × 55°	grey	black	NWT 21 NWT 21.1	0802000 0802010	1162206 1164761
			white	white	NWT 21 WS NWT 21.1 WS	0802003 0802013	1164762 1164763
	Spring return selector switch, 3 positions	2 × 35°	grey	black	NWT 32 NWT 32.1	0802020 0802030	1164769 1164770
			white	white	NWT 32 WS NWT 32.1 WS	0802023 0802033	1164771 1164772
	Selector switch, 3 positions right – spring return (touch position) left – maintained (latched position)	right 35°	grey	black	NWTS 32 NWTS 32.1	0802035 0802040	1164756 1164757
			white	white	NWTS 32 WS NWTS 32.1 WS	0802038 0802043	1164758 1164759
		left 55°					
	Selector switch, 3 positions right – maintained (latched position) left – spring return (touch position)	right 55°	grey	black	NWTS 321 NWTS 321.1	0802045 0802050	1164752 1164753
			white	white	NWTS 321 WS NWTS 321.1 WS	0802048 0802053	1164754 1164755
		left 35°					
	Maintained selector switch, 2 positions	1 × 70°	grey	black	NWS 21 NWS 21.1	0802060 0802070	1163541 1164774
			white	white	NWS 21 WS NWS 21.1 WS	0802063 0802073	1158707 1164775
	Maintained selector switch, 3 positions	2 × 55°	grey	black	NWS 32 NWS 32.1	0802080 0802090	1164748 1164749
			white	white	NWS 32 WS NWS 32.1 WS	0802083 0802093	1164750 1164751

For contact blocks refer to page 35

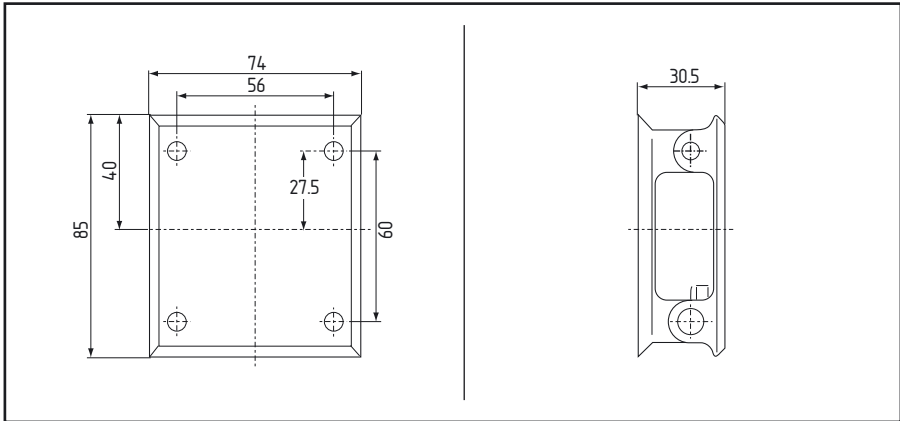
¹ .1 version: long knob (46 mm), maintained selector switches with long knobs require a grid of 50 × 60 mm.

Maintained selector switch inhibit



 Only for maintained selector switches with long knob

- Alternative to key-operated maintained selector switch
- Padlocks not supplied



Assembly instructions

- Mounted from the back. For this purpose there are 4 bore holes of 3.5 mm diameter, 12 mm deep for self-cutting screws. The grid measurement in 60 × 56 mm.

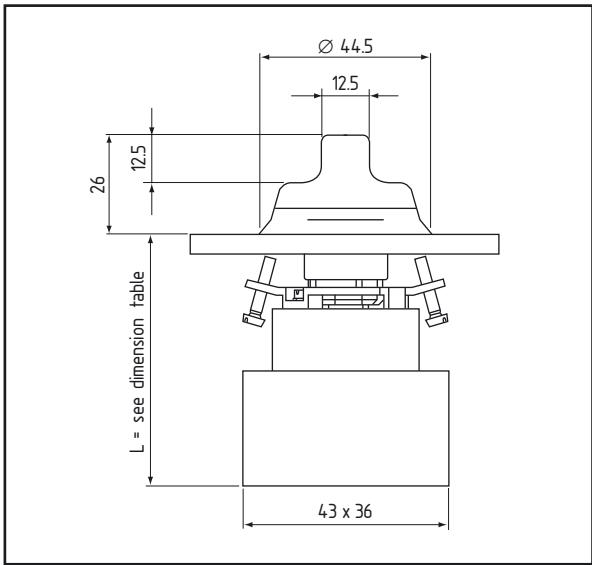
Product range					
	Devices	Colour	Type	Catalogue no.	Part no.
Maintained selector switch inhibit	Maintained selector switch inhibit for 2 position versions	transparent/grey	NWSP 21 GR	0803000	1160848
	Maintained selector switch inhibit for 3 position versions	transparent/grey	NWSP 32 GR	0803020	1160850
Maintained selector switches: refer to page 20					

Step switch with 2 to 12 switching positions



Figure: with sealing bellows, colour black (standard)

Not shown: with sealing bellows, colour white: on request



Design

Step switches with 2 to 12 switching positions consist of a maintained selector switch device head and contact block in cam switch design with locating mechanism (without zero position).

The 2-step switch has 3 poles, all other versions have 1 pole.

If a zero position is required we recommend that step 1 (contact 1) be selected and not occupied.

Options

- .1 version with 46 mm long knob (refer to page 21 and product range)
- Labels: on request

Technical data	
Device heads	see above
Dimensions device heads	see above
Cam switches	Make: Kraus & Naimer, type series CA10
per step	1 NO contact (2-step switch, 3-pole)
Regulation	to IEC 60947-3 (VDE 0660 Part 107)
Insulation voltage U_i	690 V
Thermal rated current	20 A
Power	AC-23: 7.5 A AC-3: 5.5 A
Shock hazard protection	EN DIN 50274 (VDE 0660 Part 514)
Corrosion protection of the electrical parts	Corrosion protection for the electrical elements behind the front plate cannot be guaranteed.

Dimension table	
Number of steps	Installed depth L
2	69.5 mm
3	60.0 mm
4	60.0 mm
5	69.5 mm
6	69.5 mm
7	78.0 mm
8	78.0 mm
9	87.5 mm
10	87.5 mm
11	97.0 mm
12	97.0 mm

Step switch with 2 to 12 switching positions (continued)

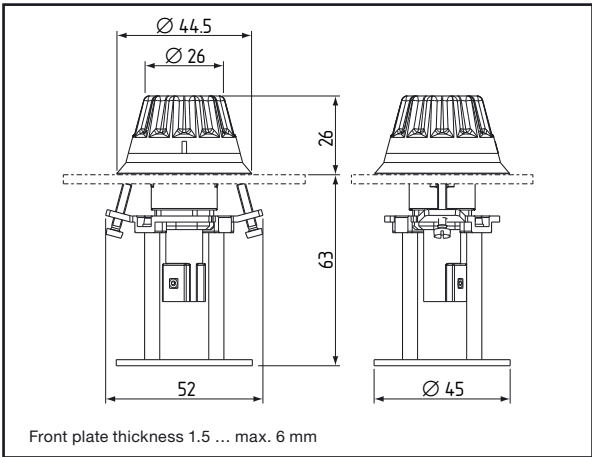
Product range						
Devices	Number of steps	Switching angle	Version	Type ¹	Catalogue no.	Part no.
Stop switch with 2 to 12 switching positions	2	60°	with long knob	NWSE 2K NWSE 2K.1	0803101 0803151	117 7926 119 0128
	3	60°	with long knob	NWSE 3K NWSE 3K.1	0803100 0803150	117 4634 118 9135
	4	60°	with long knob	NWSE 4K NWSE 4K.1	0803102 0803152	117 4635 119 2474
	5	60°	with long knob	NWSE 5K NWSE 5K.1	0803104 0803154	117 4636 119 0552
	6	60°	with long knob	NWSE 6K NWSE 6K.1	0803106 0803156	117 4638 119 7430
	7	45°	with long knob	NWSE 7K NWSE 7K.1	0803108 0803158	117 4639 119 7431
	8	45°	with long knob	NWSE 8K NWSE 8K.1	0803110 0803160	117 4640 119 7432
	9	30°	with long knob	NWSE 9K NWSE 9K.1	0803112 0803162	117 4641 119 7433
	10	30°	with long knob	NWSE 10K NWSE 10K.1	0803114 0803164	117 4642 119 7434
	11	30°	with long knob	NWSE 11K NWSE 11K.1	0803116 0803166	117 4643 119 7435
	12	30°	with long knob	NWSE 12K NWSE 12K.1	0803118 0803168	117 4644 119 7436

¹ .1 version with 46 mm long knob

Potentiometer drives



- Version shortened behind the front plate: on request



Assembly instructions

A central hole fixing and two different three-hole fixings are provided to mount the potentiometer.

The potentiometers are not supplied and must be procured from the respective manufacturers.

On request:

Also available with depth 50 mm (instead of 63 mm): NM... version.

Design

This device consists of a fluted knob and potentiometer receptacle with integrated mounting flange. The potentiometers themselves are not part of the product range.

The potentiometer receptacle already contains the mounting flange function, i.e. the device heads are therefore supplied without the standard mounting flange EFM.N of the EF/EL system.

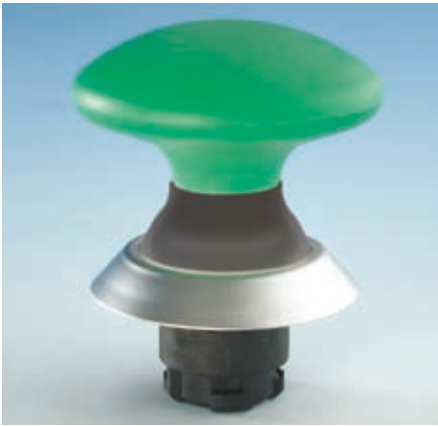
The selector drives for potentiometers are supplied in two assemblies:

- Knob-operated switch with additional position display (arrow)
- Potentiometer receptacle with integrated mounting flange
- However, as complete unit with one type designation and part no.

Technical data	
Wave diameter	up to 6 mm
Wave length	30 ... 40 mm
Material integrated mounting flange	MS vernickelt or V2A

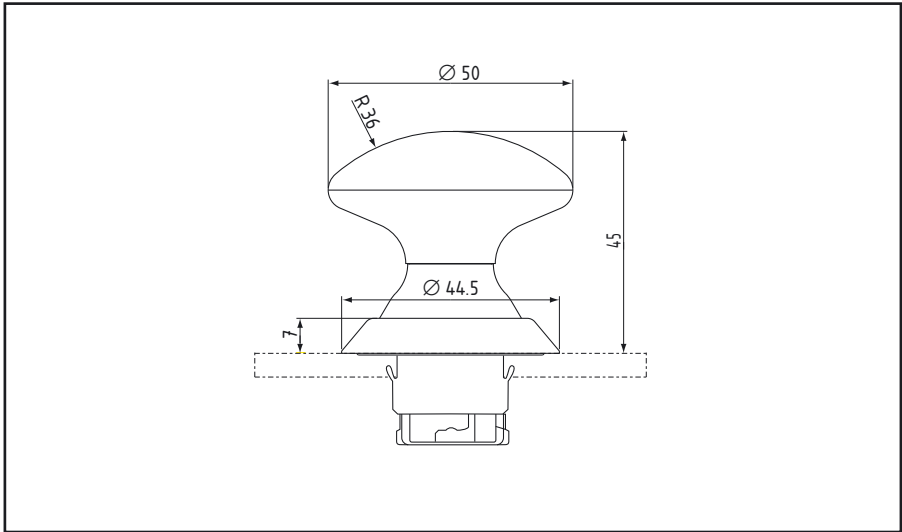
Product range for selector drive for potentiometer				
Devices	Colour seal/ potentiometer handle	Type	Catalogue no.	Part no.
Poti driver (without potentiometer)	black/grey	NDAN 6	0802200	1169823
	white/white	NDAN 6 WS	0802201	1169824

Mushroom buttons

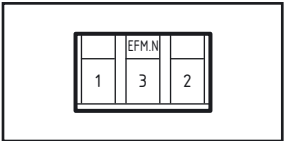


Left: with sealing bellows, colour white (standard)

Right: with sealing bellows, colour black (selectable)



Front plate thickness 1.5 ... max. 6 mm, mounting flange EFM.N supplied



Mounting flange EFM.N

Product range							
Devices	Colour	White sealing bellows			Black sealing bellows		
		Type	Catalogue no.	Part no.	Type	Catalogue no.	Part no.
Mushroom buttons without latch function	black	NDP 50 SW	0800710	1163572	NDP 50 GR/SW	0800712	1163579
	yellow	NDP 50 GB	0800715	1163569	NDP 50 GR/GB	0800717	1163576
	green	NDP 50 GN	0800725	1163571	NDP 50 GR/GN	0800727	1163578
	white	NDP 50 WS	0800730	1163573	NDP 50 GR/WS	0800732	1163580
	blue	NDP 50 BL	0800735	1163570	NDP 50 GR/BL	0800737	1163577

For contact blocks refer to pages 35 and 36

Mushroom buttons with latch function: on request (NDRZ...)

The EMERGENCY STOP control devices comply with the safety requirements to IEC EN 60947-5-5 (VDE 0660 Part 210¹⁾) and EN ISO 13850:2006²⁾.

After reaching a pressure point the device head automatically moves under spring force to the off position. An actuated device is reset by pulling the device head.

There are two versions:

- Version (1): EMERGENCY STOP control devices with snap-action behaviour mechanism in the actuator head
- Version (2): ditto with snap-action behaviour, but operated by a separate spring element, type EFR (refer also to “Version (2): Special features/advantages”).

The two versions differ in their minimum actuation force:

(1) = approx. 60 N

(2) = approx. 40 N

and in the force of reset by pulling the device head:

(1) = approx. 10 N

(2) = approx. 27 N.

Refer to page 29 for additional technical details.



EMERGENCY STOP devices must be replaced immediately if a correct snap-action operation is no longer guaranteed due to the limited mechanical life ($\geq 100,000$ switching cycles). The safety-related positive opening of the device will not be affected.

- Yellow EMERGENCY STOP labels: Refer to accessories on page 56 (enlarged grid dimension 70 x 70 mm)
- EMERGENCY STOP protective collar: refer to page 57.

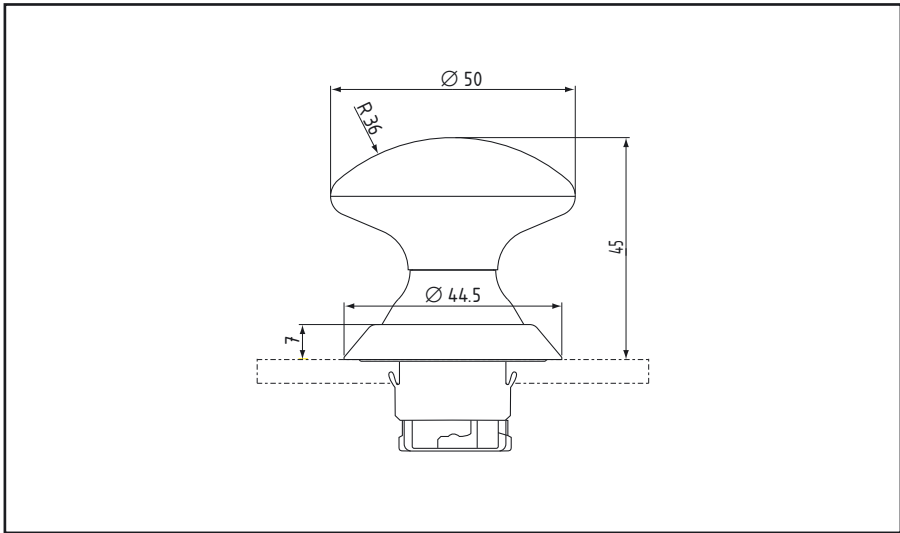
(1) IEC EN 60947-5-5 (VDE 0660 Part 210): Low-voltage switchgear – Part 5-5: control devices and switching elements – electrical EMERGENCY STOP device with mechanical locking

(2) EN ISO 13850:2006: Safety of machines – EMERGENCY STOP, design principles

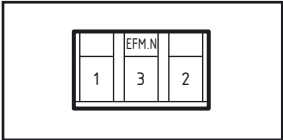


Left: with sealing bellows, colour white (standard)

Right: with sealing bellows, colour black (selectable)



Front plate thickness 1.5 ... max. 6 mm, mounting flange EFM.N supplied



Mounting flange EFM.N

Product range version (1)								
	Device	Colour	White sealing bellows			Black sealing bellows		
			Type	Catalogue no.	Part no.	Type	Catalogue no.	Part no.
EMERGENCY STOP control devices	EMERGENCY STOP slam button	red	NDRZ 50 RT ¹	080 1280	117 7168	NDRZ 50 GR/RT ¹	080 1281	117 7170

For contact blocks refer to page 35;
EMERGENCY STOP protective collar: refer to page 57; EMERGENCY STOP main switch: refer to page 30

¹ Only in connection with NC contacts of the contact blocks EF 220..., EF 303... and EFK 30... (refer to pages 35 and 36).
Other colours (without EMERGENCY STOP): on request.
The following contact combinations may be used with NDRZ 50 ... (other contact combinations: upon request):

- 1 × EF 303.. + 1 × EF 220.. or
- 2 × EF 303.. or
- 3 × EFK.. – 1-pole



Product range version (2)

	Device	Colour	White sealing bellows			Black sealing bellows		
			Type	Catalogue no.	Part no.	Type	Catalogue no.	Part no.
EMERGENCY STOP control devices	EMERGENCY STOP slam button	red	NDRR 50 RT ¹	080 1270	116 3587	NDRR 50 GR/RT ¹	080 1272	116 3594
	Spring element ²		EFR	028 0187	102 0999	EFR	028 0187	102 0999

For contact blocks refer to page 35; EMERGENCY STOP protective collar: refer to page 57.



¹ Only in connection with NC contacts of the contact blocks EF 220..., EF 303... and EFK 30... (refer to pages 35 and 36).

² Installation depth as for EF/EL blocks + 5 mm (refer to pages 38 and 40).

Lower versions (below 30 mm) IP 69K, but not hygiene-conform: on request.

Special features/ advantages

In version 2 the snap action of the EMERGENCY STOP control devices is realised with a separate spring element (type EFR). For this purpose the spring element EFR is snapped on to the centre position of the mounting flange ELM.N. After first actuation the plunger in the EMERGENCY STOP device head positively engages with the spring element.

An additional precautionary measure (as an option) in version 2 is a so-called safety plate (see photo) which fixes the snapped-on contact blocks a second time. The safety plate corrects any incorrect fixing due to the contact blocks not being snapped completely on to the mounting flange, and under extreme conditions of use also serves as a second fixing of the device head, mounting flange and contact block(s).

Protection from circumvention

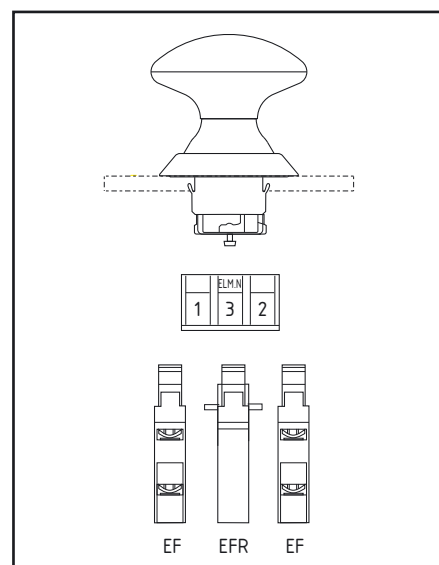
Machine manipulation (= manipulative opening of the NC contact without the device head moving to the OFF position) is nearly ruled out in the version (2).



Spring element EFR with mounting flange



Safety plate (supplied)



NDRR 50 RT

Main switches for food processing machines

Hygiene-conform in compliance with EN 1672-2, IP 67 and IP 69K

Application

A number of special design features and properties make this range (installation diameter: 22.3 mm) suitable for the following applications: applications in food processing machines to comply with the special cleaning requirements of this industry and to prevent the hygiene risk of cross-contamination, particularly with respect to machines processing raw goods such as fish, meat, poultry, milk or eggs.

The range has been designed under analogous consideration of EN 1672-2 "Food Machinery – General Design Principles – Part 2: Hygiene Requirements" as documented by a prototype test with the "hygiene" test certificate of the Prüfstelle der Fleischerei-Berufsgenossenschaft im BG-Prüfzert (Testing Agency of the Employers' Liability Association for the Butcher's Trade).

In addition to the advantages of the IP 69K type of protection and the cleaning friendly shapes of the device heads the following features deserve additional mention in terms of hygienic conformance design:

- Special seals extensively prevent the penetration of product residue in the gaps between the fixed and moving device parts, thereby effectively preventing the formation of bacteria nests in places which cannot be accessed for cleaning.

- Easy to clean due to

- smooth surfaces and the extensive avoidance of areas on which residue could collect

- selection of materials resistant to cleaning agents typical in the food processing industry such as smoke resin removers.

- Use of food-compatible materials only as a matter of course.

Easy to clean

The special shape of the devices, in which corners and edges are largely avoided and smooth surfaces have been created, make cleaning of the device heads simple and effective.

Type of protection IP 67/ IP 69K

All device heads satisfy the protection type tests

- IP 67 to EN 60529 (including protection from the penetration of water when constantly submersed, tested at 1 m water column/30 min.), and

- IP 69K to DIN 40050, Part 9 (1983)

Type of protection IP 69K

In addition to the test for dust-tightness the test for IP 69K (originally conceived as a protection type test for road vehicles) simulates the resistance of devices to high-pressure water cleaners by subjecting the test subjects to a hot (approx. 80 °C) water jet at very high pressure (approx. 100 bars) at 5 revolutions per minute without any damage occurring.

Main switch NHS 40 and NHS 63 in accordance with EN 60947-1 and EN 60947-3

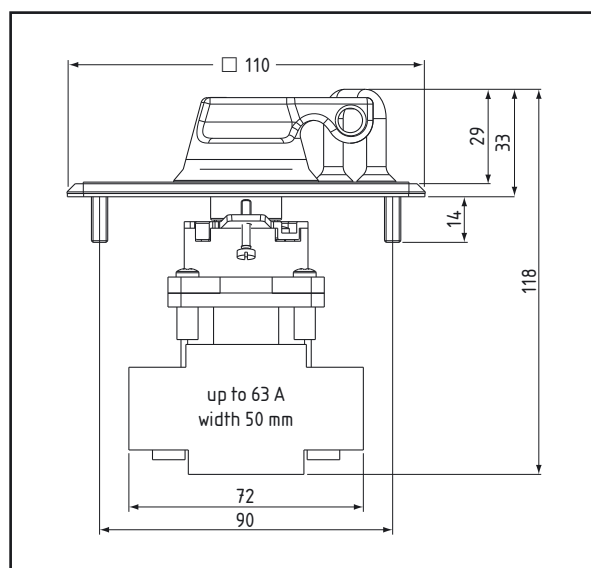
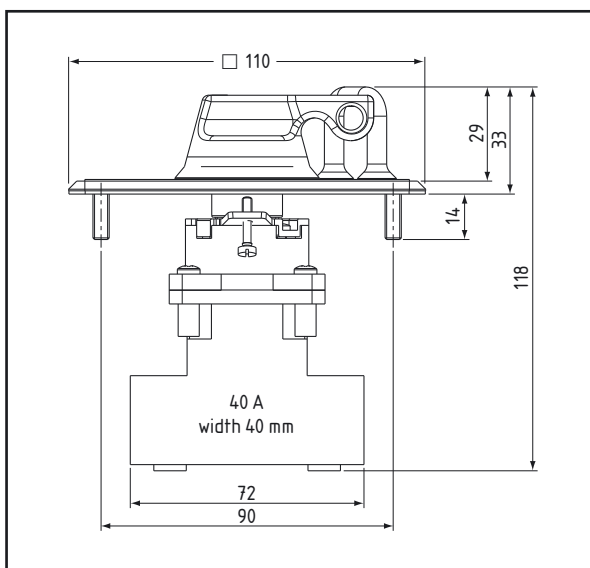
- hygiene-compliant to EN 1672-2/ISO 13849
- class of protection IP 69K front side
- 3-pole
- front fixing 22.3 mm installed diameter
- for a front panel depth of max. 6 mm
- lockable
- black knob
- completely assembled on a stainless steel plate with 4 fixing bolts M5
- 2 versions with different power:
 - up to 40 A
 - up to 63 A

EMERGENCY STOP main switch NHS NH 40 and NHS NH 63

- Version as for NHS 40/ NHS 63, but with red knob and yellow background and with the engraving O–I.

The scope of delivery of a complete device contains the stainless steel panel with 4 threaded bolts, the name plate O–I, the fixing bracket for locking and the rear-side main switch with the main flange.





Product range

Article	Type	Catalogue no.	Part no.
Supply disconnecting device with black handle			
– up to 40 A	NHS 40	0808000	118 5098
– up to 63 A	NHS 63	0808015	118 4920

Remarks:

- The lock is not part of the scope of delivery.
- Individual components or neutral conductor models on request.
- Other switch configurations: on request (IP 69K)

Article	Type	Catalogue no.	Part no.
Emergency switching off device with red knob and yellow underground			
– up to 40 A	NHS NH 40	0808020	118 5097
– up to 63 A	NHS NH 63	0808025	118 4919

Remarks:

- The lock is not part of the scope of delivery.
- Individual components or neutral conductor models on request.

Main switches for food processing machines

Hygiene-conform in compliance with EN 1672-2, IP 67 and IP 69K (continued)

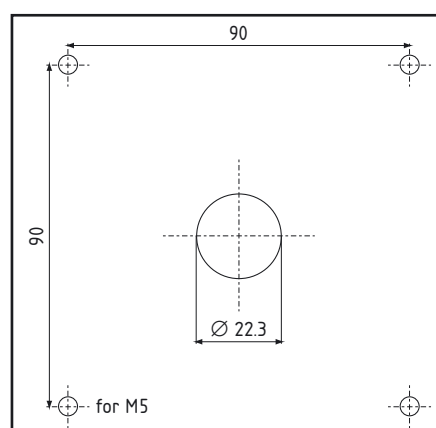
Technical data

Type	on/off switch, 3-pole		
Standards	IEC 60947, EN 60947, IEC 60204, EN 60204, UL 508, CSA 22.2 No. 14		
Mechanical lifespan	> 10 ⁵ switching cycles		
Climatic resistance	damp heat: constant to DIN IEC 60068-2-3; cyclic to DIN IEC 60068-2-30		
Ambient temperature	open +25 °C ... +50 °C; enclosed –25 °C ... +40 °C		
Load carrying capacity in intermittent operation, class 12	AB: 60/40/25%; ED: 1.3/1.6/2 × I _s		
Operational voltage U _s	690 VAC		
Impulse withstand voltage U _{imp}	6 kV		
Uninterrupted current I _U /I _{n/Ine}	NHS 40, NHS NH 40: 40 A; NHS 63, NHS NH 63: 63 A		
Short-circuit rating max. fuse	NHS 40, NHS NH 40: 40 gl; NHS 63, NHS NH 63: 63 gl		
Conditional short-circuit current	16 kA _{eff}		
Isolation characteristics acc. to EN 60947	up to 690 VAC		
Switching angle contacts	90° (8 current paths)		
Terminal capacity			
– solid or stranded	NHS 40, NHS NH 40: 1 mm ² ... 10 mm ² NHS 63, NHS NH 63: 4 ... 16 mm ²		
– flexible or multiwired including ferrule	NHS 40, NHS NH 40: 0.76 mm ² ... 6 mm ² NHS 63, NHS NH 63: 2.6 ... 10 mm ²		
American wire gauge	NHS 40, NHS NH 40: 8 AWG; NHS 63, NHS NH 63: 6 AWG		
Operational current I _s AC-21 A	NHS 40, NHS NH 40: 40 A NHS 63, NHS NH 63: 63 A		
UL/CSA general use, 600 VAC	NHS 40, NHS NH 40: 40 A NHS 63, NHS NH 63: 60 A		
Operational power at 50–60 Hz, 3-phase			
– AC-23A	220 ... 240 V	NHS 40, NHS NH 40: 7.5 kW	NHS 63, NHS NH 63: 16 kW
	380 ... 440 V	15 kW	22 kW
	500 V	15 kW	22 kW
	660 ... 690 V	15 kW	22 kW
– AC-3	220 ... 240 V	5.5 kW	11 kW
	380 ... 440 V	11 kW	22 kW
	500 V	11 kW	22 kW
	660 ... 690 V	11 kW	22 kW
– UL/CSA	110 ... 120 VAC	3 HP	5 HP
	210 VAC	7.5 HP	10 HP
	240 VAC	7.5 HP	15 HP
	480 VAC	15 HP	30 HP
	600 VAC	15 HP	40 HP

Assembly instructions

The main switch is supplied preassembled. The two terminal screws on the rear side towards the front panel must be removed so that the front part can be separated from the switch. Five boreholes according to the diagram are necessary to fix the front part (4 × for the threaded bolts M5 and 1 × 32.3 mm for the knob).

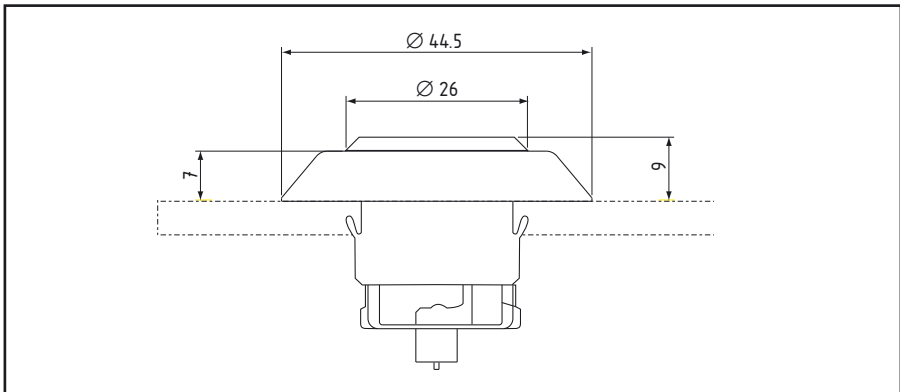
The front part including knob is pushed into the corresponding boreholes from the front and attached at the back using the 4 threaded bolts M5. The main switch is reconnected to the knob in the bayonet and fixed at the back to the front panel using the two screws. The maximum front panel thickness is 6 mm (without stainless steel plate/sealing supplied).



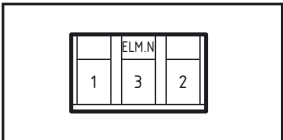
Indicator light with flat cap



- Version NMEF: with integrated “super-bright” multi-LEDs in device head (illuminated over entire surface) for light terminal blocks ELE ... as voltage supply
- Version NML: device head without bulb. For light terminal blocks ELE... as voltage supply. In this case the Ba9S holder accommodates commercially available LEDs (refer to accessories on page 59) or bulbs.
- Symbol printing: on request



Front plate thickness 1.5 ... max. 6 mm, mounting flange ELM.N supplied



Mounting flange ELM.N

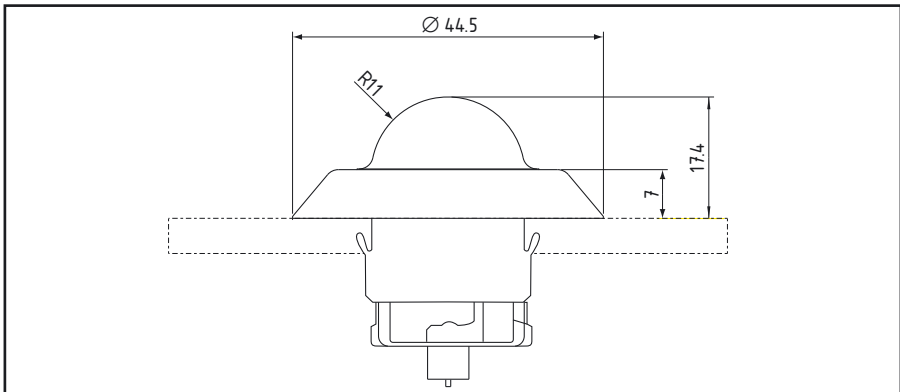
Product range					
Devices		Colour	Type	Catalogue no.	Part no.
With integrated “superbright” multi-LEDs in the device head	Indicator light with flat cap	yellow	NMEF GB	080 7088	116 3604
		red	NMEF RT	080 7079	116 3601
		green	NMEF GN	080 7086	116 3602
		white	NMEF WS	080 7080	116 1886
		blue	NMEF BL	080 7082	116 3603
For Ba9S-LEDs	Indicator light with flat cap	yellow	NML GB	080 7215	117 4520
		red	NML RT	080 7220	117 4522
		green	NML GN	080 7225	117 4521
		white	NML WS	080 7230	117 4523
		blue	NML BL	080 7235	117 4519

Refer to page 37 for light terminal blocks; refer to page 59 for Ba9S-LEDs

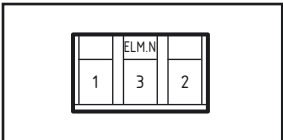
Indicator light with domed cap



- Version NME: with integrated “super-bright” multi-LEDs in device head (illuminated over entire surface) for light terminal blocks ELE... as voltage supply
- Version NMLH: device head without bulb. For light terminal blocks ELE... as voltage supply. In this case the Ba9S holder accommodates commercially available LEDs (refer to accessories on page 59) or bulbs.
- Symbol printing: on request



Front plate thickness 1.5 ... max. 6 mm, mounting flange ELM.N supplied



Mounting flange ELM.N

Product range					
Devices		Colour	Type	Catalogue no.	Part no.
With integrated “superbright” multi-LEDs in the device head, current consumption 15 mA	Indicator light with domed cap	yellow	NME GB	080 7040	116 3600
		red	NME RT	080 7036	116 3597
		green	NME GN	080 7038	116 3598
		white	NME WS	080 7045	116 1885
		blue	NME BL	080 7050	116 3599
For LEDs with Ba9S holder	Indicator light with domed cap	yellow	NMLH GB	080 7315	117 4526
		red	NMLH RT	080 7320	117 4528
		green	NMLH GN	080 7325	117 4527
		white	NMLH WS	080 7330	117 4529
		blue	NMLH BL	080 7335	117 4524

Refer to page 37 for light terminal blocks; refer to page 59 for Ba9S-LEDs

Contact and light terminal block system EF/EL with screw terminals or flat-pin plugs



2-pole contact blocks							
Function/contact travel diagram (mm)	Mounting flange position	with screw terminal			with flat-pin plug		
		Form	Catalogue no.	Part no.	Form	Catalogue no.	Part no.
1 NC ¹ 0 2 4 6 mm 	Pos. 1	EF10.1	028 0010	100 6535	EF10F.1	028 1010	100 6560
	Pos. 2	EF10.2	028 0020	100 6536	EF10F.2	028 1020	100 6561
	Pos. 3	EF10.3	028 0030	100 6537	EF10F.3	028 1030	100 6562
1 NO 0 2 4 6 mm 	Pos. 1	EF03.1	028 0040	100 6538	EF03F.1	028 1040	100 6563
	Pos. 2	EF03.2	028 0050	100 6539	EF03F.2	028 1050	100 6564
	Pos. 3	EF03.3	028 0060	100 6540	EF03F.3	028 1060	100 6565
2 NC ¹ 0 2 4 6 mm 	Pos. 1	EF110.1	028 0070	100 6541	EF110F.1	028 1070	100 6566
	Pos. 2	EF110.2	028 0080	100 6542	EF110F.2	028 1080	100 6567
	Pos. 3	EF110.3	028 0090	100 6543	EF110F.3	028 1090	100 6568
2 NC 0 2 4 6 mm 	Pos. 1	EF220.1	028 1382	102 3927	EF220F.1	028 1388	102 4291
	Pos. 2	EF220.2	028 1384	102 4262	EF220F.2	028 1390	102 4292
	Pos. 3	EF220.3	028 1386	102 3938	EF220F.3	028 1394	102 3939
2 NO 0 2 4 6 mm 	Pos. 1	EF033.1	028 0100	100 6544	EF033F.1	028 1100	100 6569
	Pos. 2	EF033.2	028 0110	100 6545	EF033F.2	028 1110	100 6570
	Pos. 3	EF033.3	028 0120	100 6546	EF033F.3	028 1120	100 6571
1 NC/1 NO ¹ 0 2 4 6 mm 	Pos. 1	EF103.1	028 0130	100 6547	EF103F.1	028 1130	100 6572
	Pos. 2	EF103.2	028 0140	100 6548	EF103F.2	028 1140	100 6573
	Pos. 3	EF103.3	028 0150	100 6549	EF103F.3	028 1150	100 6574
1 NC/1 NO overlapping ¹ 0 2 4 6 mm 	Pos. 1	EF301.1	028 0160	100 6550	EF301F.1	028 1160	100 6575
	Pos. 2	EF301.2	028 0170	100 6551	EF301F.2	028 1170	100 6576
	Pos. 3	EF301.3	028 0180	100 6552	EF301F.3	028 1180	100 6577
1 NC/1 NO simultaneously switching ² 0 2 4 6 mm 	Pos. 1	EF303.1	028 1360	102 2137	EF303F.1	028 1375	102 2140
	Pos. 2	EF303.2	028 1365	102 2138	EF303F.2	028 1380	102 2141
1 NC/1 NO with safety spring, simultaneously switching ^{2, 3} 0 2 4 6 mm 	Pos. 1	EF303.S.1	028 1300	100 6584	EF303SF.1	028 1330	100 6587
	Pos. 2	EF303.S.2	028 1310	100 6585	EF303SF.2	028 1340	100 6588

¹ not suitable for EMERGENCY STOP devices NDRR50/NDRZ50

² not suitable for maintained selector switches NWS/NWT

³ The reset spring of this block is designed as safety spring, i.e. due to the special guide and coiling of the spring the perfect function of the device or contact block is guaranteed also in the case of a spring breaking. We recommend that contact blocks with safety spring be used particularly when special reliability demands are placed on the NO function. NC and NO contacts operate practically simultaneously in this block version, but without overlapping.

N.B.: The terminal designation for the contacts to IEC 60947-1 contains a complete function and classification number. The function number identifies the NC or NO contact, the classification number specifies the number and series of the contacts in the complete switching device. In this respect we recommend that it be determined in the form designation to which position of the mounting flange the contact block is to be attached.

Refer to page 38 for terminal designations

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



1-pole contact blocks				
Function/ contact travel diagram (mm)	Mounting flange position	Form	Catalogue no.	Part no.
1 NC ¹ 0 2 4 6 mm 	Pos. 1	EFK10.1	028 1001	102 2275
	Pos. 2	EFK10.2	028 1002	102 2276
	Pos. 3	EFK10.3	028 1003	102 2277
1 NC 0 2 4 6 mm 	Pos. 1	EFK30.1	028 1005	102 6057
	Pos. 2	EFK30.2	028 1006	102 6058
	Pos. 3	EFK30.3	028 1007	102 6059
1 NO 0 2 4 6 mm 	Pos. 1	EFK03.1	028 1066	102 2272
	Pos. 2	EFK03.2	028 1067	102 2273
	Pos. 3	EFK03.3	028 1068	102 2274

¹ not suitable for EMERGENCY STOP devices NDRR/NDRZ50...



2-pole contact blocks				
Function/ contact travel diagram (mm)	Mounting flange position	Form	Catalogue no.	Part no.
2 NC 0 2 4 6 mm 	Pos. 1	EFK330.1	028 1008	116 2285
	Pos. 2	EFK330.2	028 1009	116 2286
2 NO 0 2 4 6 mm 	Pos. 1	EFK033.1	028 0996	116 7605
	Pos. 2	EFK033.2	028 0997	116 7606
1 NC/1 NO ¹ 0 2 4 6 mm 	Pos. 1	EFK103.1	028 1000	116 7603
	Pos. 2	EFK103.2	028 1004	116 7604

¹ not suitable for EMERGENCY STOP devices NDRR/NDRZ50...

N.B.: The terminal designation for the contacts to IEC 60947-1 contains a complete function and classification number. The function number identifies the NC or NO contact, the classification number specifies the number and series of the contacts in the complete switching device. In this respect we recommend that it be determined in the form designation to which position of the mounting flange the contact block is to be attached.
Refer to page 38 for terminal designations

Contact and light terminal block system EF/EL with screw terminals (continued)

Light terminal blocks with integrated multi-LED for illuminated pushbuttons NDL				
Diagram/ operating voltage	Colour	with screw terminal		
		Form	Catalogue no.	Part no.
 24 VDC/AC	red	ELDE.N RT 24	027 6610	116 5995
	yellow	ELDE.N GB 24	027 6611	116 5998
	green	ELDE.N GN 24	027 6612	116 5997
	blue	ELDE.N BL 24	027 6613	116 5999
	white	ELDE.N WS 24	027 6614	116 6000
 48 VDC/AC	red	ELDE.N RT 48	027 6615	116 7521
	yellow	ELDE.N GB 48	027 6616	116 7522
	green	ELDE.N GN 48	027 6617	116 7523
	blue	ELDE.N BL 48	027 6618	116 7524
	white	ELDE.N WS 48	027 6619	116 7525
 115 ... 230 VAC	red	ELDE.N RT 230	027 6625	116 6022
	yellow	ELDE.N GB 230	027 6626	116 6024
	green	ELDE.N GN 230	027 6627	116 6023
	blue	ELDE.N BL 230	027 6628	116 6025
	white	ELDE.N WS 230	027 6629	116 6026

Light terminal blocks (voltage supply) with Ba9S holder for illuminated pushbuttons NME/NMEF ¹ and NML/NMLH ²			
Diagram/ operating voltage	with screw terminal		
	Form	Catalogue no.	Part no.
 24 VDC/AC	ELE	027 7090	100 6529
 48 VDC/AC	ELE 48	027 7095	100 6532
 primary 115 ... 230 VAC; secondary 24 V	ELE 230	027 7100	100 6534

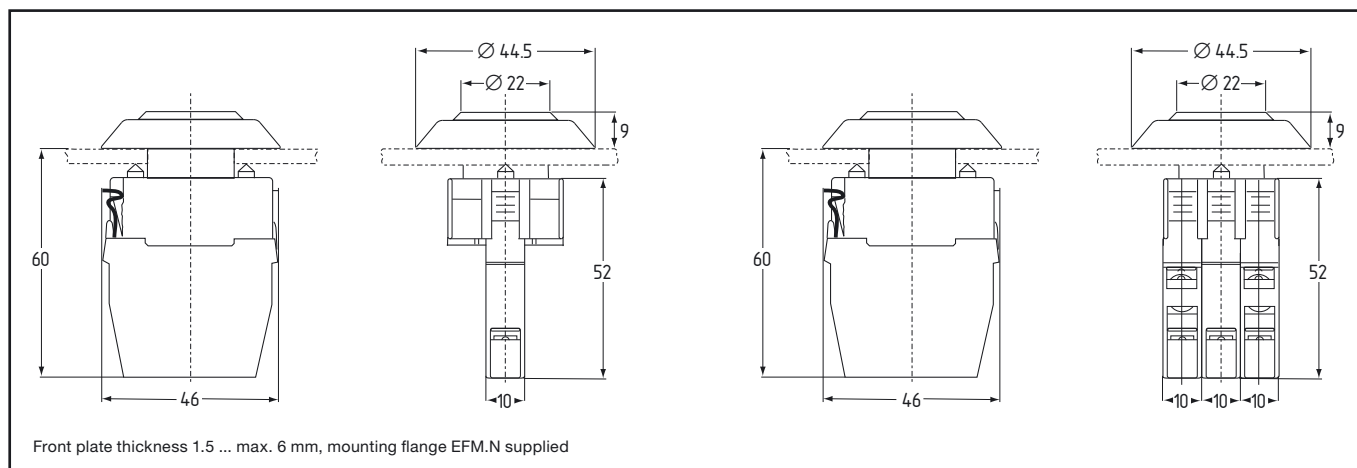
¹ or for illuminated pushbuttons NDL if socket-based LEDs or bulbs are to be used (maximum length 27 mm). Refer also to accessories on page 59.

² LED integrated into the indicator light NME/NMEF

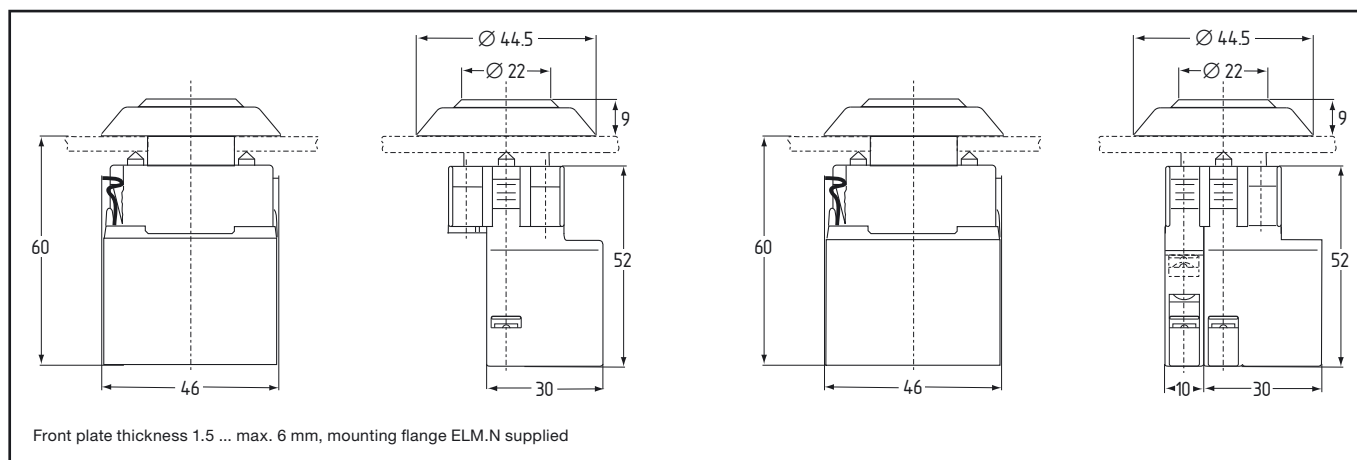


Contact and light terminal block system EF/EL with screw terminals (continued)

Dimensions of contact and light terminal blocks EF/ELDE.N/ELE



Dimensions of light terminal blocks with series resistance ELDE.N 48 VAC/DC, 115 ... 230 VAC/ELE 48 VAC/DC, 115 ... 230 VAC



Terminal designations

Type	Function	Pos. 1	Pos. 2	Pos. 3
with screw terminal/ with flat-pin plug/ with WAGO cage clamp terminals	1 NC	11-12	21-22	31-32
	1 NO	13-14	23-24	33-34
	2 NC	11-12/21-22	31-32/41-42	51-52/61-62 ¹
	2 NO	13-14/23-24	33-34/43-44	53-54/63-64 ¹
	1 NC/1 NO	11-12/23-24	31-32/43-44	51-52/63-64 ¹

¹ not applicable to blocks with WAGO cage clamp terminals



Light terminal blocks with integrated multi-LED for indicator lights NDL and indicator lights NML/NMLH				
Diagram	Colour	Form	Catalogue no.	Part no.
 24 VDC/AC	red	ELDEK RT	027 6650	116 7381
	yellow	ELDEK GB	027 6651	116 7382
	green	ELDEK GN	027 6652	116 7383
	blue	ELDEK BL	027 6653	116 7384
	white	ELDEK WS	027 6654	116 7385



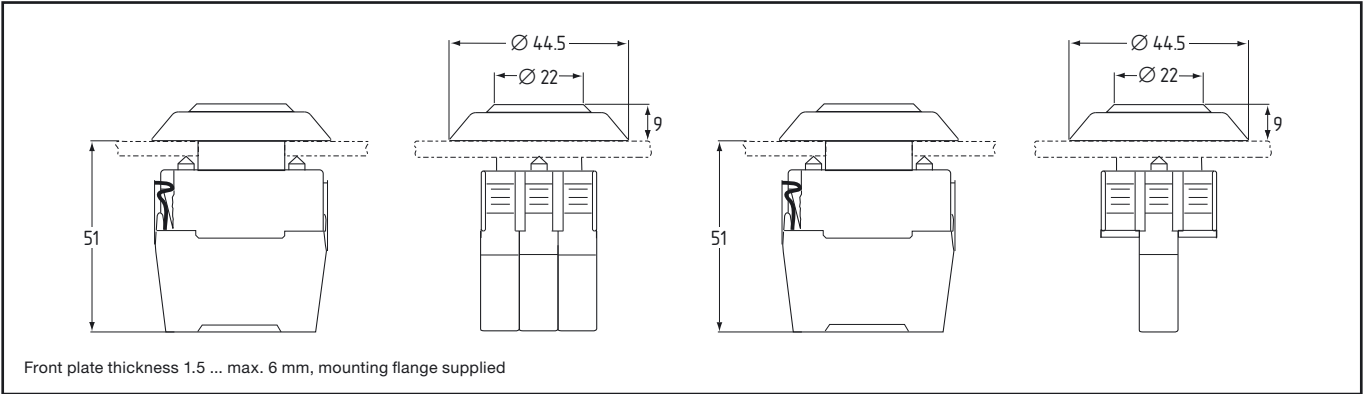
Light terminal blocks (voltage supply) with Ba9S holder for indicator light NME/NMEF ¹ and NML/NMLH ²			
Diagram	Form	Catalogue no.	Part no.
 24 VDC/AC	ELEK	027 7096	116 7368

¹ or for light terminal blocks NDL if socket-based LEDs or bulbs are to be used (maximum length 27 mm). Refer also to accessories on page 59.

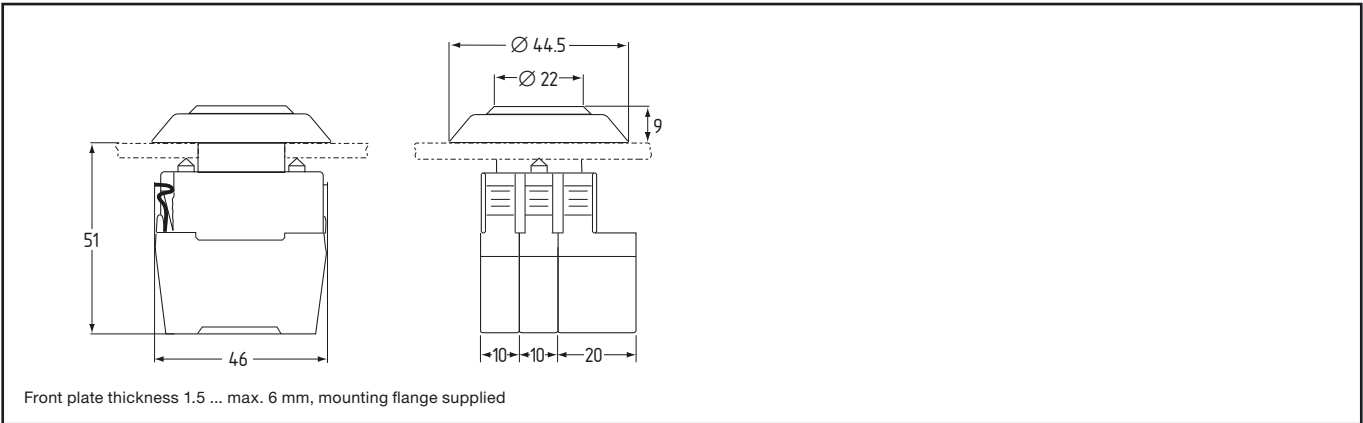
² LED integrated into the indicator light NME/NMEF

Contact and light terminal block system EF/EL
with WAGO cage clamp terminals (continued)

Dimensions of 1-pole contact and light terminal blocks



Dimensions of 2-pole contact and light terminal blocks¹



¹ max. 1 × 2-pole block recommended

Control devices and indicator lights

Type series	N
Regulations (if applicable)	IEC EN 60947-1 (DIN VDE 0660 Part 100), IEC EN 60947-5-1 (VDE 0660 Part 200)
CE conformity	to Directive 89/336/EEC
Installation diameter	D 22 (22.3 mm + 0.4 mm)
Front plate thickness	1.5 ... max. 6 mm
Grid dimensions	50 × 50 mm, 50 × 60 mm for maintained selector switches/spring return selector switches with 46 mm long knob; please observe other exceptions
Type of fixing	mounting flange
Max. torque for fixing screws	approx. 0.6 Nm
Temperature range	– –25 °C ... +80 °C – maintained selector switch/spring return selector switch: 0 °C ... +80 °C – max. ambient temperature for illuminated pushbuttons/indicator lights – max. +80 °C with LEDs from Elan – max. +40 °C with other bulbs (outside makes)
Type of protection	IP 67 to EN DIN 60529, IP 69K to DIN 40050 Part 9 (resistant to high pressure water jet)
Type of sealing	diaphragms, lip seals, shaped seals
Full insulation	yes
Materials	PA GV, ABS, NBR, PA, Silicone; plastics: glass-fibre reinforced, self-extinguishing
Bezel version	ABS galvanically matt chromed
Actuating lift	5 mm



Warning!

- For reasons of hygiene and sealing it is not possible to change LEDs/bulbs. 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 complete device head or the light terminal block must be replaced.
- The preferred installation positions for the devices are diagonal and vertical surfaces. It is also possible to use sealed position switches instead of the EF... contact elements – see page 43.
- Damaged device heads, particularly devices with damaged seals, must be replaced immediately since otherwise reliable hygiene protection is not guaranteed.
- However, if the above measures cannot be complied with or implemented, the voltage limitation is 50 VAC and 120 VDC (VDE 0110 part 410).

EMERGENCY STOP devices

Type series	N
Regulations	EN ISO 13850:2006, IEC EN 60947-5-5 (VDE 0660 Part 210)
CE conformity	to Directive 89/336/EC and 98/37/EC
Mechanical serviceable life of the snap-action function	≥ 100,000 switching cycles ¹
Shock resistance	30 g/18 ms
Other data	see above

¹ The end of the mechanical life of the snap-action function has no influence on the safety function of the positive opening. Nevertheless the device must be replaced immediately.

Contact blocks EF

Regulations (if applicable)	IEC EN 60947-1 (DIN VDE 0660 Part 100), IEC EN 60947-5-1 (VDE 0660 Part 200),
CE conformity	to Directive 89/336/EEC
Rated operating voltage U _e max.	400 V

Contact blocks EF (continued)

Rated insulation voltage U_i	440 V, test voltage to EN 60947-1 Table 12 A: 1,890 V
Rated operating current I_e as dependent on the utilisation 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
Air clearance and creepage to EN DIN 60664-1	4 kV/3
Galvanic isolation of the contact bridges	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 mA
Switching frequency	1,200 s/h
Climatic resistance to IEC EN 60068	Part 2-20
Installed position	random
Mechanical life to IEC EN 60947-5-1 (VDE 0660 Part 200)	10×10^6 switching cycles
Shock resistance	110 g/4 ms – 30 g/18 ms, no chatter (accordingly smaller in the case of operating heads with larger density)
Vibration resistance	> 20 g/10 ... 200 Hz (accordingly smaller in the case of operating heads with larger density)
Chatter time (100 mm/s)	< 5 ms
Housing material	PA GV; plastics: glass-fibre reinforced, self-extinguishing
Terminal designations	to IEC 60947-1 (VDE 0660 Part 100)
Type of protection	IP 20
Contact points, terminal points	Fine silver, feather bronze or Ms carrier
Actuating force at	
– 2 mm lift	4 N
– 4 mm lift	7 N
– 6 mm lift	9 N
Shock hazard protection	refer to page 59
Connections	refer to page 38

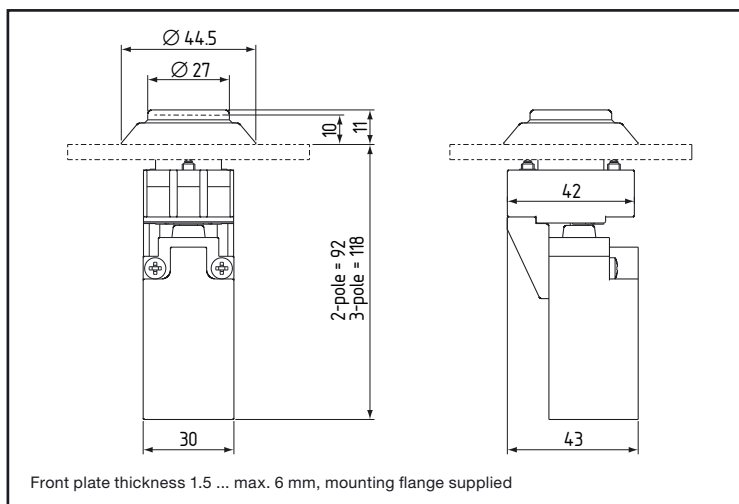
Light terminal blocks and voltage supplies

Regulations (if applicable)	IEC EN 60947-1 (DIN VDE 0660 Part 100), IEC EN 60947-5-1 (VDE 0660 Part 200)
CE conformity	to Directive 89/336/EWG
Rated operating voltage U_e max.	250 V
Rated insulation voltage U_i	440 V, test voltage 2,500 V
Terminal designations	X1/X2 to IEC 60947-1 (DIN VDE 0660 Part 100)
Terminals	non-interchangeable
Other data	refer to EF

Approvals

  (listed Nr. 74C.6)*, 

* in preparation for EFK..., ELE... and ELK...



Example

Pushbutton
without flange (... oFl)

Adapter
with position switch EFMH/SEK...
(refer to page 45)

Design

For applications in which a high class of protection is also required behind the front plate, an adapter is available for the connection of position switches with type of protection IP 65 and IP 67 from the Elan SEK type series (position switches to EN 50047, shape B, vertical plunger).

Actuating heads for the adapter solution include pushbuttons, mushroom buttons, single-plunger selector switches and spring return selector switches as well as EMERGENCY STOP control devices of version 1

(without EFR spring element).

SEK position switches are offered as 2-pole version with snap-action contacts (1 NC/1 NO contact) and with momentary contacts (1 NC/1 NO contact, 2 NC contacts, 2 NO contacts).

The adapter consists of the mounting flange for the device heads and a fixing bracket with position switch attached by the factory, i.e. the device heads are supplied without the standard EFM.N mounting flange from the EF/EL system.

Options (on request)

- 3-pole position switch versions

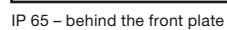
Assembly instructions

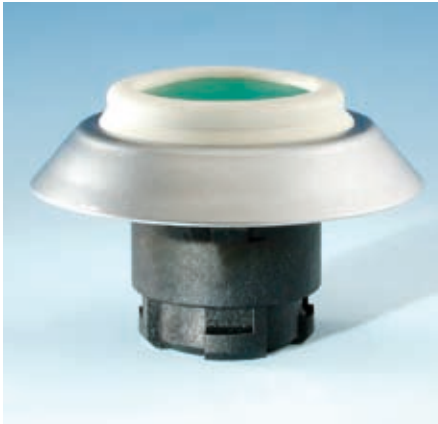
- Before assembly the position switch must be separated from the adapter in order to have access to the fixing level of the mounting flange and then screwed on again.
- In order to wire the position switch the device lid must be removed and then replaced.

Technical data for position switch SEK

Regulations (if applicable)	IEC 947, EN 60947, VDE 0660, EN 50047
Rated operating voltage U_e max.	400 V
Utilisation category to VDE 0660 Part 200	AC-15, DC-13
Rated operating current I_e as dependent on utilisation category and test voltage	8 A: AC-15, 250 VAC 5 A: DC-13, 24 VDC
Thermal rated voltage I_{th} (in air)	10 A
Short-circuit protection	gG 10 A
Air clearance and creepage to DIN VDE 0110/01.89	Degree of pollution 3 Overvoltage category III
Proof of positive opening	2.5 kV surge voltage
Contact system	4-path contact bridge with micro-movement through spring force, contact paths galvanically separated
Contact material	Fk-Ag, silver-plated, passivated
Contact force	0.5 N per contact point – 2 N per contact
Switching of small loads	minimum 24 VDC/10 mA
Chatter time	≤ 5 ms at 100 mm/s
Temperature range	–25... +80 °C
Climatic resistance to IEC EN 60068	Part 2-30
Installed position	random
Mechanical life to IEC EN 60947-5-1 (VDE 0660 Part 200)	30 × 10 ⁶ switching cycles
Switch path (lift)	approx. 6 mm
Impact resistance	30 g/18 ms
Vibration resistance	15 g/10 ... 200 Hz
Terminal designation to DIN EN 50005 or DIN EN 50013	yes
Actuating force at end of lift (1 NC/1 NO contact)	approx. 10 N
Housing material	PA 66 GV, self-extinguishing, hardly flammable
Terminal types	Screwed connection up to 2 × 0.5 ... 2.5 mm ² (with wire-end ferrule up to 1.5 mm ²) single and multicore
Rated isolated voltage U_i	440 V, test voltage 2,500 V
Type of protection for contact block	IP 67
Shock hazard protection of live parts	exists due to lid
Class of protection for the shock hazard protection in accordance with DIN EN 60947-1/A2	D
Approvals	CSA, UL

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* Contacts with pulse function



- Devices as on page 18, but without mounting flange EFM.N
- Flange function in adapter refer to page 45

Product range							
Devices	Colour	White sealing bellows			Black sealing bellows		
		Type	Catalogue no.	Part no.	Type	Catalogue no.	Part no.
Pushbuttons for positions switches	black	NDT SW oFI	0800011	118 4156	NDT GR/SW oFI	080 0013	118 4140
	yellow	NDT GB oFI	0800016	118 4157	NDT GR/GB oFI	080 0018	118 4141
	red	NDT RT oFI	0800021	118 4158	NDT GR/RT oFI	080 0023	118 4142
	green	NDT GN oFI	0800026	118 4159	NDT GR/GN oFI	080 0028	118 4143
	white	NDT WS oFI	0800031	118 4160	NDT GR/WS oFI	080 0033	118 4144
	blue	NDT BL oFI	0800036	118 4161	NDT GR/BL oFI	080 0038	118 4145
	grey	NDT GR oFI	0800041	118 4162	NDT GR/GR oFI	080 0043	118 4146
Adapter with position switch: refer to page 45							



- Devices as on page 20 et seq. but without mounting flange EFM.N
- Flange function in adapter refer to page 45

Product range for spring return selector switches, single plunger for position switch installation						
Devices	Colour of knobs	Colour of sealing ring	Version	Type ¹	Catalogue no.	Part no.
Spring return selector switches, single plunger for position switch installation	grey	black	with long knob	NWT 21 oFI	0802001	119 7422
	grey	black		NWT 21.1 oFI	0802011	119 7423
	white	white	with long knob	NWT 21 WS oFI	0802004	119 7424
	white	white		NWT 21.1 WS oFI	0802014	119 7425
Adapter with position switch: refer to page 45						

¹ .1 version: long knob (46 mm), spring return selector switches with long knob require a grid dimension of 50 × 60 mm

Product range						
Devices	Colour of knobs	Colour of sealing ring	Version	Type ¹	Catalogue no.	Part no.
Maintained selector switches, single plunger for position switch installation	grey	black	with long knob	NWS 21 oFI	0802061	119 7426
	grey	black		NWS 21.1 oFI	0802071	119 7427
	white	white	with long knob	NWS 21 WS oFI	0802064	119 7428
	white	white		NWS 21.1 WS oFI	0802074	119 7429
Adapter with position switch: refer to page 45						

¹ .1 version: long knob (46 mm), maintained selector switches with long knob require a grid dimension of 50 × 60 mm



- Devices as on page 23 et seq. but without mounting flange EFM.N
- Flange function in adapter refer to page 45

Product range for mushroom button for position switch installation							
Devices	Colour of button	White sealing bellows			Black sealing bellows		
		Type	Catalogue no.	Part no.	Type	Catalogue no.	Part no.
Mushroom button for position switch installation	black	NDP 50 SW oFI	0800711	1197725	NDP 50 GR/SW oFI	0800713	1197732
	yellow	NDP 50 GB oFI	0800716	1197726	NDP 50 GR/GB oFI	0800718	1197733
	red	NDP 50 RT oFI	0800721	1197727	NDP 50 GR/RT oFI	0800723	1197734
	green	NDP 50 GN oFI	0800726	1197728	NDP 50 GR/GN oFI	0800728	1197735
	white	NDP 50 WS oFI	0800731	1197729	NDP 50 GR/WS oFI	0800733	1197736
	blue	NDP 50 BL oFI	0800736	1197730	NDP 50 GR/BL oFI	0800738	1197737
Adapter with position switch: refer to page 45							



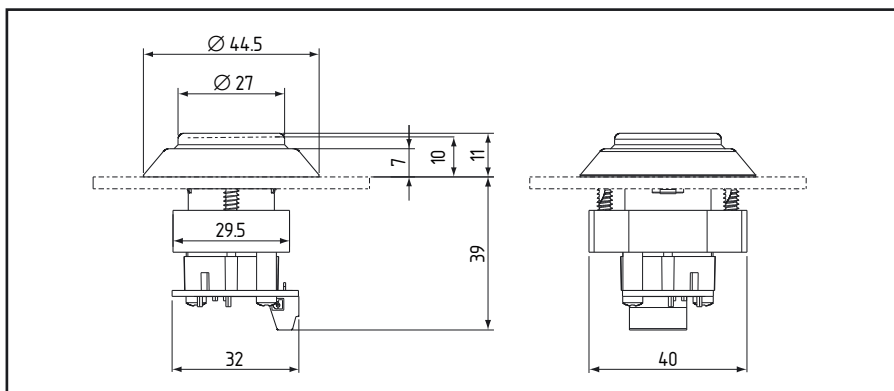
- Device as on page 24 et seq. but without mounting flange EFM.N
- Flange function in adapter refer to page 45
- EN ISO 13850: 2006

Product range for EMERGENCY STOP slam button for position switch installation					
Devices	Colour of button	Colour of sealing bellows	Type	Catalogue no.	Part no.
EMERGENCY STOP slam button for position switch installation	red	white	NDRZ 50 RT oFI	080 1287	118 2405
Adapter with position switch: refer to page 45					

Short-lift pushbutton



With sealing bellows, colour white (standard), optionally in black (not shown)



Front plate thickness 1.5 ... max. 6 mm, mounting flange supplied

Design

In order to facilitate fatigue-free work with frequent actuation of pushbuttons, so-called short-lift pushbuttons supplement the product range. The actuation of the devices is limited to an ergonomic 2 mm switching lift with an actuating force of approx. 15 N.

The short-lift pushbuttons operate on the basis of an electromagnetic principle of action and are available as NC/NO contact combination (3 ... 50 V, max. 100 mA, NC contacts not positively opening).

Assembly instructions

- Complete delivery consisting of device head and keyboard contact block with mounting flange. Despite the similarity with pushbutton NDT, this is a different device design with restricted lift.
- Terminal system: Screw terminals
- Conductor cross-sections:
 - rigid 0.14 ... 1.5 mm²
 - flexible 0.14 ... 1.0 mm²
- for screw-driver 0.4 × 2.5 mm.

Short-lift pushbuttons (continued)

Technical data		
Version	Actuating lift	restricted to 2 mm
	Actuating force	approx. 15 N
	Keyboard contact block	Make: RAFI, type RF 19
Electrical characteristics	Switching voltage min.	3 V
	Switching voltage max.	50 V
	Switching current min.	0.1 mA
	Switching current max.	260 mA
	Switching capacity max. (Ohmic load)	12.5 W
	Volume resistance in new state max.	100 mOhm
	Volume resistance after serviceable life max.	3 Ohm
	Chatter time max.	5 ms
Other details	Operating temperature min.	−25 °C
	Operating temperature max.	+70 °C
	Storage temperature min.	−40 °C
	Climatic resistance	to EN 60068 Part 2-20
	Serviceable	1 × 10 ⁶
	Corrosion protection of the electrical parts	A corrosion protection for the electrical parts behind the front plate cannot be guaranteed.

Product range							
Devices	Colour	White sealing bellows			Black sealing bellows		
		Type	Catalogue no.	Part no.	Type	Catalogue no.	Part no.
Short-lift pushbutton, complete¹	black	NDT 2 KHT SW	0800260	118 1272	NDT 2 KHT GR/SW	0800262	1198439
	yellow	NDT 2 KHT GB	0800265	118 1273	NDT 2 KHT GR/GB	0800267	1198440
	red	NDT 2 KHT RT	0800270	118 1274	NDT 2 KHT GR/RT	0800272	1198441
	green	NDT 2 KHT GN	0800275	118 1275	NDT 2 KHT GR/GN	0800277	1198442
	white	NDT 2 KHT WS	0800280	118 1276	NDT 2 KHT GR/WS	0800282	1198443
	blue	NDT 2 KHT BL	0800285	118 1277	NDT 2 KHT GR/BL	0800287	1198444
	grey	NDT 2 KHT GR	0800290	118 1278	NDT 2 KHT GR/GR	0800292	1198445

¹ including contact block 1 NC/1 NO

Resistance table

• The following details are based on information from our suppliers and are merely to be viewed as guidance without warranty since the resistance will usually depend on several factors (quantity, exposure time, temperature etc.).

• Key
 + = resistant;
 0 = resistant under certain circumstances;
 – = not resistant

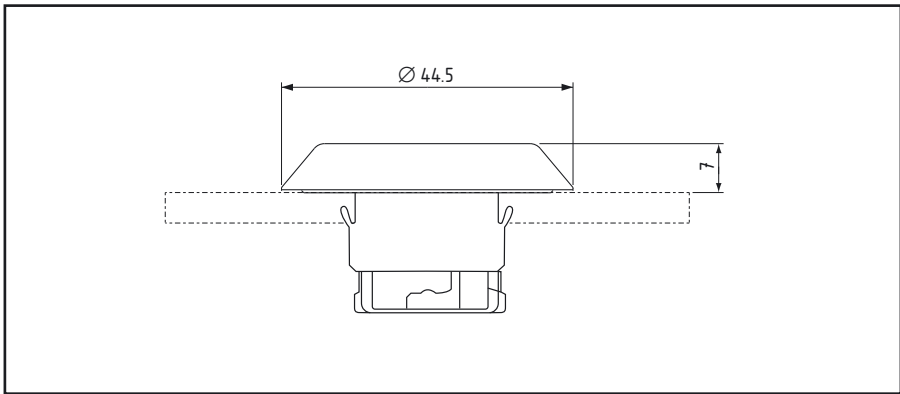
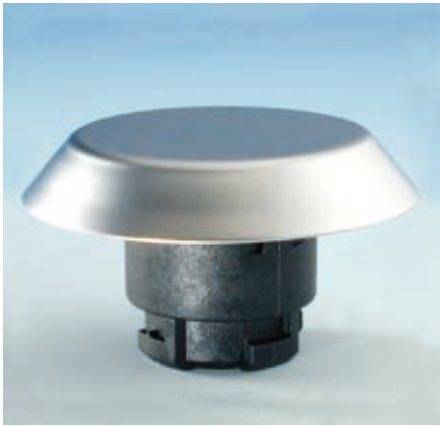
Part	Material	Petrol	Benzene	Diesel oil	Lubricating oils and greases	Mineral oils	Animal and vegetable oils	Weak lyes	Strong lyes	Weak acids	Strong acids	Spirit	Sea water
Adapter ring 22/30 mm	PA GV self-extinguishing	+	+	+	+	+	+	+	–	0	–	+	+
Front plate seal and sealing bellows	Silicone	–	–	0	0	0	0	+	–	+	–	+	+
Bezels	ABS galv. chromed	+	0	+	+	+	+	+	+	+	0	0	+
Caps/symbol carriers	PA 12	+	+	+	+	+	+	+	–	0	±	+	+
Contact blocks	PA GV self-extinguishing	+	+	+	+	+	+	+	–	0	–	+	+
Mounting flange	PA GV	+	+	+	+	+	+	+	–	0	–	+	+
Plunger	PBT	+	0	+	+	+	+	+	0	+	–	+	+
Diffusers	PC film	+	–	+	+	+	+	–	–	+	0	–	+
Edging	PA GV	+	+	+	+	+	+	+	–	0	–	+	+
Selector switch knobs	ABS	+	0	+	+	+	+	+	+	+	0	0	+
Selector switch inhibit	ABS	+	0	+	+	+	+	+	+	+	0	0	+

Accessories/symbols

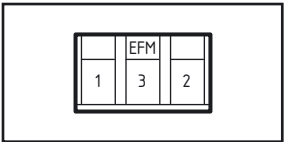
Blanking plug	54
Adapter	55
Labels	56
EMERGENCY STOP protective collar	57
Protective collar against unintentional contact	58
Individual parts/accessories	59
Symbols	60



Blanking plug



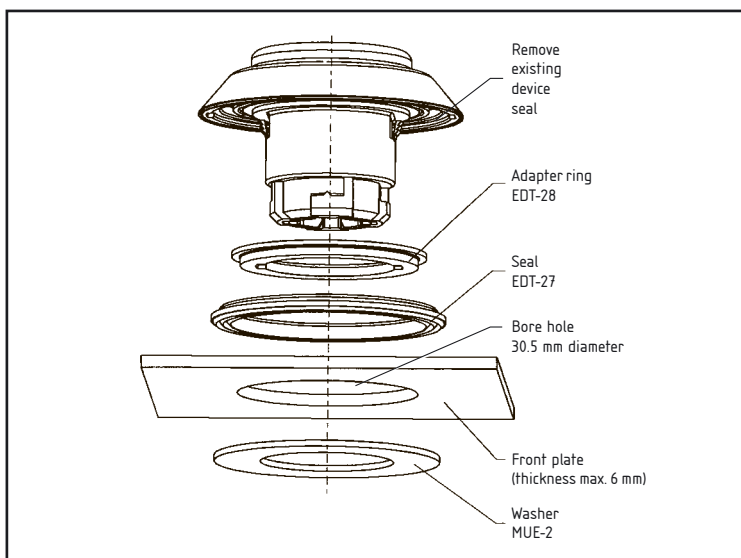
Front plate thickness 1.5 ... max. 6 mm, mounting flange EFM.N supplied



Mounting flange EFM.N

Product range				
Device	Colour	Type	Catalogue no.	Part no.
Blanking plug	metallic	NB	080 0300	116 1887

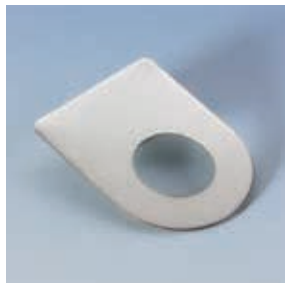
Adapter



Product range			
Device	Type	Catalogue no.	Part no.
Adapter 22/30 mm	NUE ¹	0809000	1164776

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

Labels

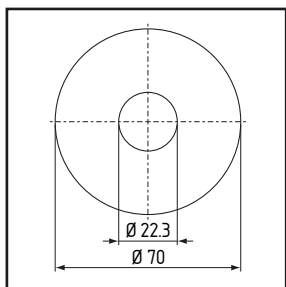


EMERGENCY STOP plates

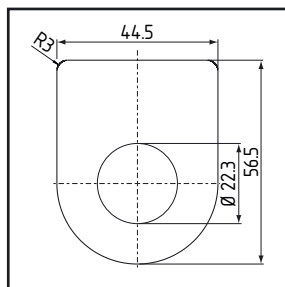
- left: outer diameter 70 mm, V4A version, colour yellow, self-adhesive without lettering
- not shown: ditto, but with lettering EMERGENCY STOP (additional lettering: on request)

Labels

- right: V4A version without lettering



NDP-70

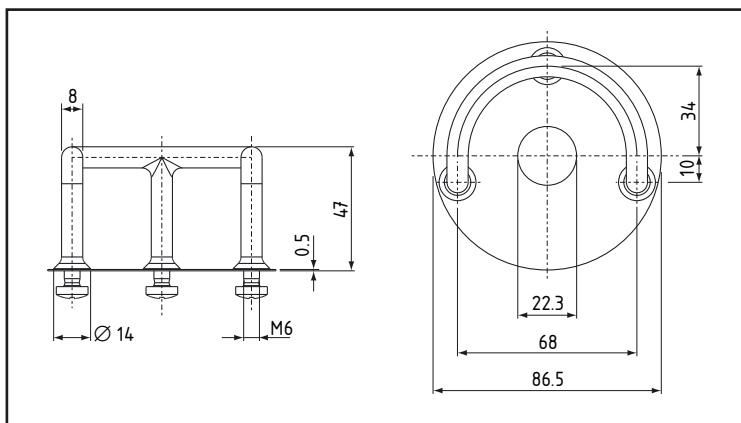


NZSO/V4A

Product range			
Version	Type	Catalogue no.	Part no.
EMERGENCY STOP label, outer diameter 70 mm, V4A version, colour yellow, self-adhesive without lettering	NDP-70	080 1310	117 0003
ditto, but with lettering EMERGENCY STOP	NDP-70/ EMERGENCY-STOP	080 1312	117 9829
Label, H 56.5 mm, B 44.5 mm, V4A version, blank	NZSO/V4A*	080 9030	118 3192
ditto, 1 line with lettering (max. 12 characters)	NZSO/1/V4A*	080 9031	118 4036
ditto, 2 lines with lettering (max. 12 characters per line)	NZSO/2/V4A*	080 9032	118 4037

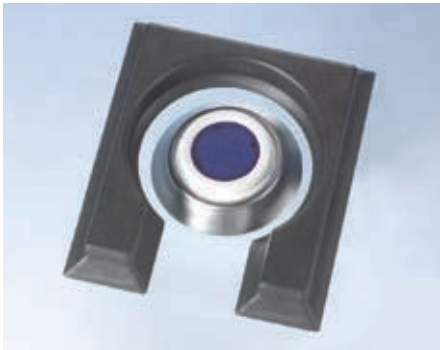
* Longer versions: on request

EMERGENCY STOP protective collar

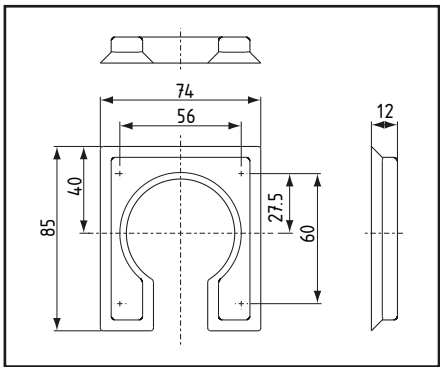


Product range				
Version	Colour	Type	Catalogue no.	Part no.
EMERGENCY STOP protective collar, Material 1.4550, incl. fixing screws	yellow	NSK/V4A/GB	0803042	1183505

Protective collar against unintentional contact



- for pushbuttons and illuminated pushbuttons
- supplied without control device



NSK-..

Product range			
Version	Type	Catalogue no.	Part no.
Protective collar, colour grey	NSK-GR	0803040	1174645
Protective collar, colour white	NSK-WS	0803041	1174725

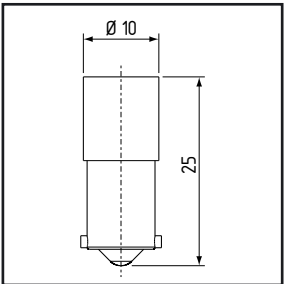


- Multi-LEDs
- with Ba9S socket
 - colour white
 - operating voltage 24 VDC
 - Ba9S bulbs: on request¹

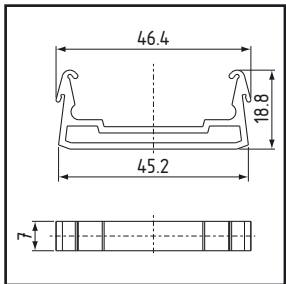
1) The use of bulbs is not recommended due to the necessity to change the bulb behind the front plate (refer also to page 4)



- Snap-on cover
- Measure to protect against contact in the case of illuminated pushbuttons with shock hazard operating voltage. The snap-on cover covers unused mounting flange positions and prevents contact with live parts.



LE 24/9 WS



EL-15

Product range			
Version	Type	Catalogue no.	Part no.
LED white, Ba9S holder, 24 VDC, current consumption 15 mA	LE24/9 WS	069 0030	103 0894
LED white, BA9S holder, 230 VAC, current consumption 3 mA	LE230/9 WS	069 0031	118 6864
Snap-on cover	EL-15	071 3005	100 2367
Add-ons			
Print on pushbutton*	NBSY		On request
Hot embossing on pushbutton (on request)	NHSY		On request

* For symbols refer to page 60 et seq.

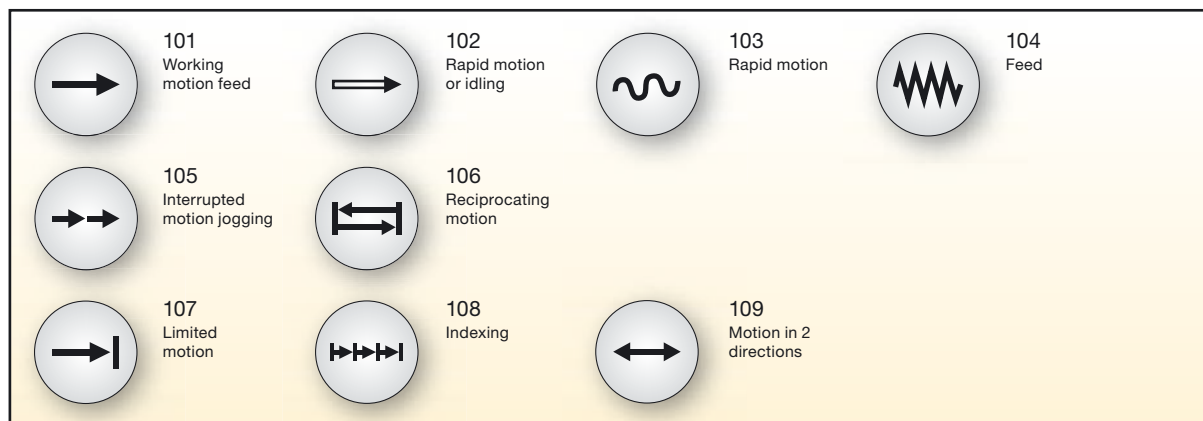
Symbols

- Tampon print on the top side of the button with 2-component paint which is then stoved to increase wear resistance.

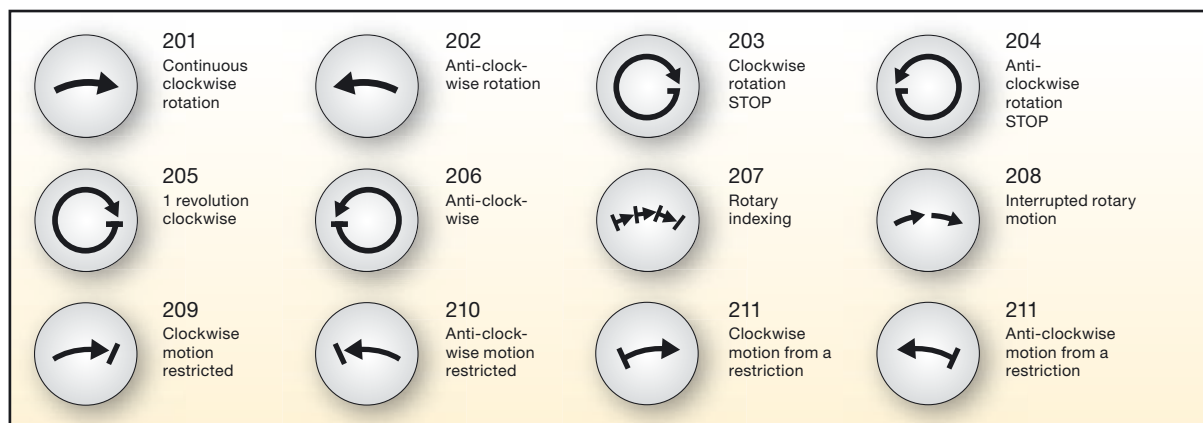
- In accordance with consultation with the Prüfstelle der Fleischerei-Berufsgenossenschaft the

inks used are safe from a hygiene point of view if used correctly

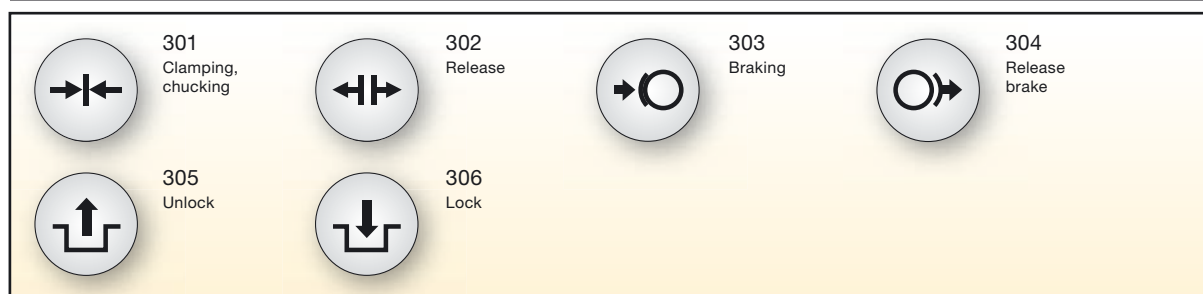
Linear motion



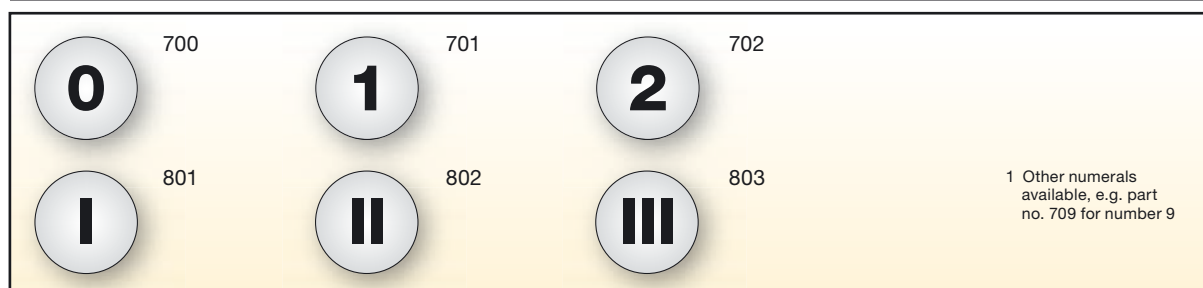
Rotary motion



Additional options



Arabic numerals¹



- The form designation consists of the abbreviation NBSY and the serial number (see below), e.g. NBSY 201.

- Symbols to ISO 7000/DIN 40 101 Part 2 respectively to EN 60417-1/-2: on request

- Hot embossing: on request

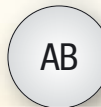
Drives

	401 Electric motor		402 Pump general		403 Gear pump		405 Coolant
	406 Oil lubrication		407 Rotary indexing table		408 Shuttle table forward		409 Backwards
	410 Brake fan		411 Caution – live		412 Clamp table rectangular		413 Electrical machine

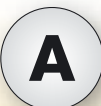
Signals

	501 On		502 Jog		503 Automatic		504 Off
	505 Everything off		506 On – off		507 Increase of a variable		508 Decrease of a variable
	509 Pause (time elapse)		510 Manual operation		511 Visual		512 Hydraulics

Words

	513 START		514 STOP		515 EIN		516 AUS
	517 LINKS		518 RECHTS		519 AUF		520 AB
	521 ZU		522 HALT		523 VOLL		524 LEER

Letters¹

	901 A		902 B		903 C		904 D
---	----------	---	----------	---	----------	---	----------

¹ Further letters available



Mounting boxes (command boxes)

Dimensions	64
Design	66
Option	62
Technical data	67
Product range	67

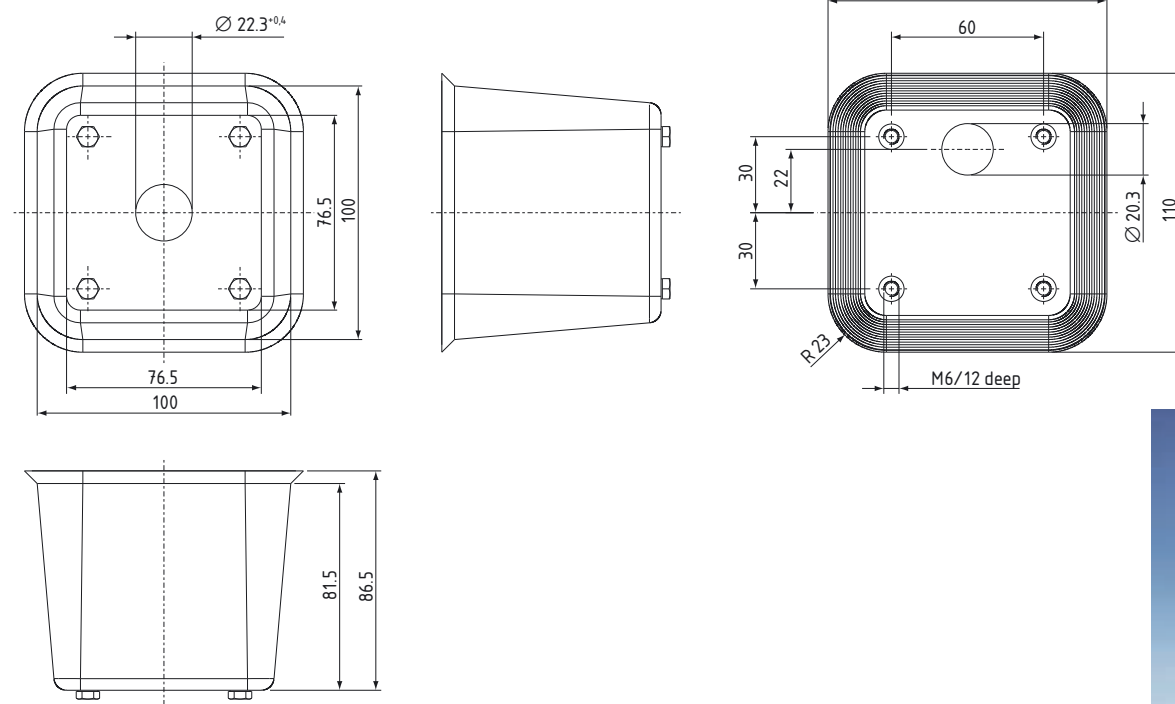


Mounting boxes (command boxes)

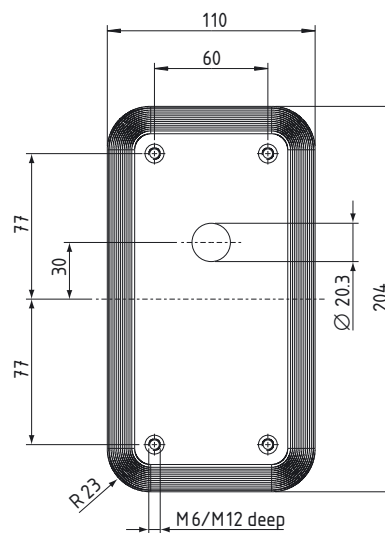
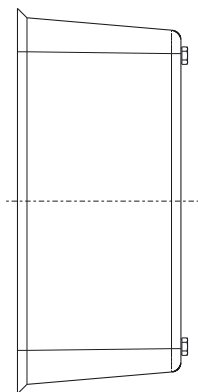


- Empty housing made of V4A material
- Design under consideration of EN 1672-2 and ISO 14159
- Versions for 1, 3 and 5 control points for installation diameter 22.3 mm
- Equipped versions: on request

Dimensions of empty housing with 1 control point

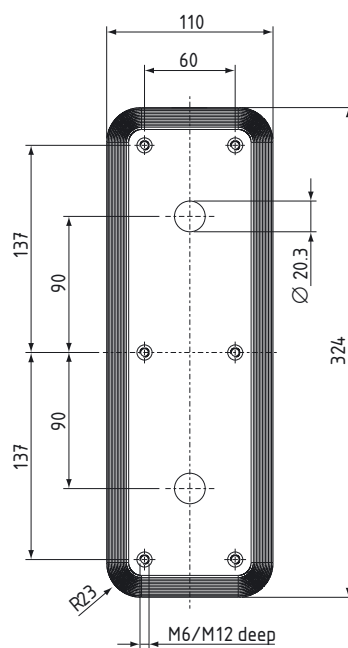
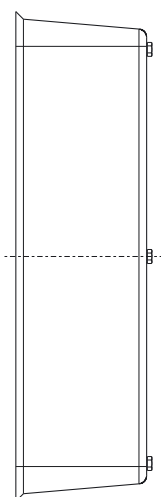


Technical drawing of the 100x194mm stainless steel sink. The drawing shows the top and side views. The top view indicates a rectangular sink with rounded corners, a width of 100mm, and a depth of 194mm. The distance between the centers of the two circular drains is 169.5mm. The distance from the center of each drain to the nearest side wall is 60mm. The distance from the center of each drain to the nearest front wall is 76.5mm. The diameter of each drain is $\varnothing 22.3^{+0.4}$. The side view shows the sink has a height of 81.5mm and a total depth of 86.5mm.



Technical drawing of the 100x289.5mm rectangular container, showing dimensions and features:

- Overall dimensions: 100 mm (width) x 289.5 mm (length).
- Four circular openings, each with a diameter of $\varnothing 22.3^{+0.4}$ mm.
- Distance between the centers of the openings: 60 mm.
- Bottom profile: Tapered shape with a height of 86.5 mm and a bottom width of 81.5 mm.



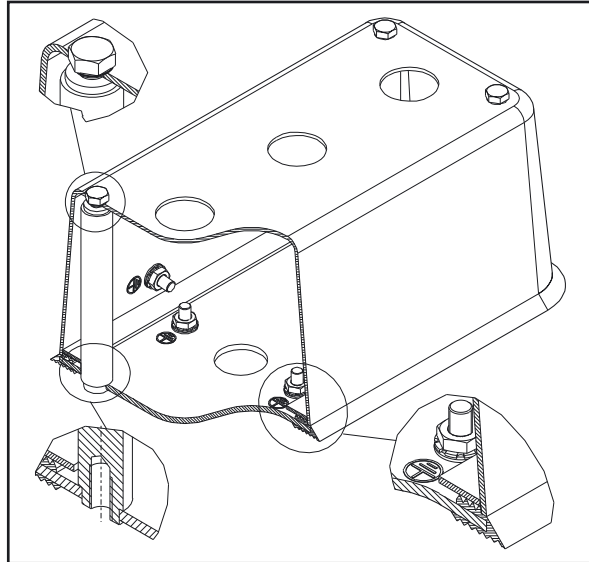
Design

The mounting boxes (control boxes) of the type series NBG (for food processing machines and MBG...O for heavy-duty applications and similar) consist of a housing top part made of V4A material produced using a special deep-drawing process and a bottom part. Versions are available as empty housing with bore holes for 1, 3 and 5 control points (installation diameter: 22.3 mm).

The bottom part of the housing (with 2 earthing screws) has a special seal which covers the edges of the top part of the housing (with 1 earthing screw) and all sides of the bottom part of the housing. The seal for the type series NBG is made of food-safe NBR and in the type series MBG...O from UV and ozone-resistant NBR.

The top and bottom parts of the housing are connected by means of V4A hexagonal screws M 5 × 10 (to ISO 4017 or DIN 933). Under hygiene aspects the screws comply with EN 1672-2 and ISO 14159. With respect to tightness, the screw bushing is additionally protected with special washers (PA) and with an inner O ring (similarly made of food-safe NBR).

The housing is fixed via 4 or 6 threaded boreholes – depending on version – M 6/12 deep. The corresponding screws (M 6) are not supplied.



Option (on request)

- Mounting box equipped with control and indicator devices
- Other installation bore holes
- Other cable glands (refer to assembly instructions)

Assembly instructions

In order to guarantee the class of protection IP 67 and IP 69K for the housing the cable entry is provided via the bottom part. For this purpose there is a cable entry with a diameter of 20.3 mm for boxes with 1 and 3 control points for a cable gland M 20 × 1.5 mm and for 5 control points there are 2 × cable entries with a diameter of 20.3 mm.

Depending on circumstances, we recommend a cable gland with an adequate class of protection.

In the case of different cable entries in the top part of the box a cable gland with class of protection IP 65 and IP 67 or IP 69K may be necessary. Whilst cable glands with type of protection IP 65/IP67 are numerous on the market, cable glands with class of protection IP 69K are very rare.

Please remember that a cable entry in the top part of the box is bored at a 90° angle to it and that therefore the cable entry is not flush with the fixing surface.



Technical data	
Version	Under consideration of EN 1672-2 and ISO 14 159 largely avoiding corners and edges with radiuses > 6 mm
Type of protection	IP 67 and IP 69K*
Material	NIROSTA 1.4571 (AiSi 316Ti)
Use of the material	Food processing machines, apparatus and components of the chemicals industry, textiles industry, cellulose manufacture, dye works as well as in the photo, paint, artificial resin and rubber industry
Corrosion resistance class	III medium (structures with moderate chloride and sulphur dioxide exposure from industry, traffic and sea water atmosphere; a concentration of pollutants must be avoided)

* In connection with control devices and illuminated pushbuttons of the type series N (or suitable integrated devices) as well as cable glands of the appropriate class of protection or a suitable positioning of the cable gland outside the critical area.

Product range						
	Device	Seal	Version	Type	Catalogue no.	Part no.
Type series NBG for food processing machines	Empty housing with bore holes	grey	for 1 control point	NBG 311	080 9500	118 0080
			for 3 control points	NBG 633	080 9510	118 0083
			for 5 control points	NBG 665	080 9520	118 0084
Type series EBG...O for heavy-duty applications and similar, UV- and ozone-resistant	Empty housing with bore holes	black	for 1 control point	EBG 311.O	082 9500	118 1725
			for 3 control points	EBG 633.O	082 9510	118 1726
			for 5 control points	EBG 665.O	082 9520	118 1727

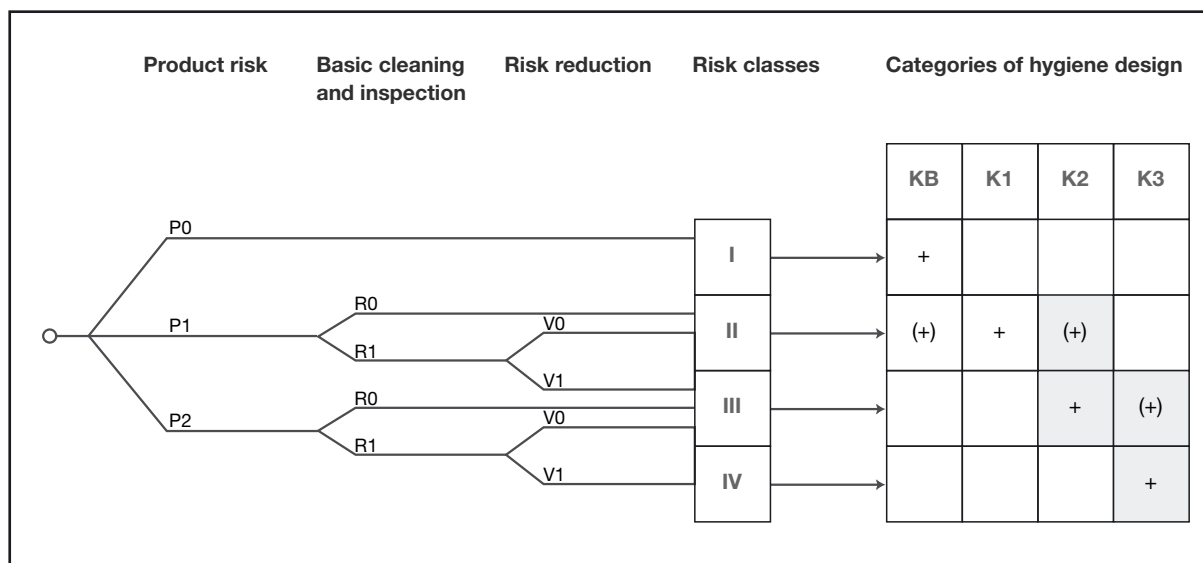


Additional background information

Annex 1: Hygienic conformance design of food processing machines	70
Annex 2: Excerpt from EN 60 204-1 – Electrical equipment of machines: Section 10: operator interface and machine-mounted control devices	75

Hygiene-conform design of food processing machines*

Risk chart showing the hygiene risk in food processing machines



+ = expedient category

(+) = possibly expedient category

P Product risk

P0 Products with low hygiene-sensitivity

P1 Products with moderate hygiene-sensitivity

P2 Products with high hygiene-sensitivity

R Basic cleaning and inspection

R0 Critical points visible and easy to reach

R1 Critical points difficult to see and reach

V Risk reduction

V0 Risk reduction factors present

V1 No effective reduction of risk

K Categories of hygiene design

KB Basic measures

K1 Basic measures and application of basic hygiene principles insofar as practicable

K2 Basic measures and further application of basic hygiene principles insofar as technologically possible

K3 Basic measures and systematic application of basic hygiene principles insofar as technologically possible

Product risk

No primary hygiene risk emanates from a machine. Only a specific product in connection with a machine can lead to a hygiene risk. Machine types of identical design, e.g. mixing machines, may be used for the processing of food or other substances, e.g. plastics. A hygiene risk arises only if these machines are used to process food.

Foods can be divided into those which are more sensitive and those which are less sensitive. It therefore appears to be expedient to use the product as a parameter in determining the basic risk. The hygiene sensitivity will determine the amount of risk on this decision-making level. Hygiene sensitivity will increase proportionate to the perishability of a product and/or the ability to promote pathogenic germs.

The following table shows examples for the assignment of products for the parameters P0, P1 and P2 with indication of classification.

Since a broad range of food processing machines must be considered the classification of a food will depend on the stage of processing.

An example will help explain this: An undamaged egg could be assigned to P0. Once broken a transition is made to P2. After adding flour the dough could be assigned to P1. If the dough is processed into pasta which is then dried then the P0 state will once again be given.

The consideration of product according to processed state will therefore lead to different results depending on the machines used in the different processing levels.

* Source: Handbuch Maschinensicherheit, Ausgabe 1/96, Herausgeber: Berufsgenossenschaft Nahrungsmittel und Gaststätten, Prüf- und Zertifizierungsstelle, Mannheim, ISBN-No. 3-920506-51-0

Assignment of products to the product risk levels (examples)

Possible criteria for product risk assignment:

P0 (products with low hygiene sensitivity)

Products with high salt, sugar, acid, alcohol content, etc.

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

Products with low water content, e.g.

- Cereals
- Spices
- Tobacco
- Flour
- Coffee
- Snacks

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 level of processing

P2 (products with high hygiene sensitivity)

Highly sensitivity products, e.g.

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

Basic cleaning and inspection

Cleaning of an object coming into contact with food is a basic hygiene requirement. This is why it is viewed in the risk chart as a basic factor in addition to the specific product. Cleaning is the basic measure using which the product risk is to be eliminated. However, this applies to a limited extent only if the places which are contaminated by the product are accessible to basic cleaning. Basic cleaning is understood to mean the complete outside cleaning with direct access. This is primarily cleaning by hand or with hand-replacing aids such as water jet, steam jet or cleaning machines. It must be possible to check the result of cleaning by sight.

In this consideration basic cleaning requires that the surfaces coming into contact with the product are easy to access and see. Basic cleaning can therefore only be applied to simple objects or work aids such as troughs, funnels, pots, plates, cutlery, tools.

Complex shapes such as machines and parts of machines 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 viewing the hygiene risk.

Risk-reducing circumstances exist if the situation is such as to favourably influence the hygiene risk as resulting from the treatment or processing of the product or from the properties of the product or from the ambient conditions (see above).

Favourable circumstances can be said to exist if, for example, the product is exposed to processes designed to destroy micro-organisms in a machine or to processes that prevent or restrict the growth of micro-organisms.

The risk reduction can also be effective if the process is applied at a later stage of processing in other machines or plants. This means an accumulation of micro-organisms can be accepted if the micro-organisms will be destroyed or their growth prevented at a later stage as long as the creation of toxins does not present a problem.

This consideration primarily applies to the product (consumer protection). In cases in which machine and plant operators are endangered, risk-reducing factors must be given more restrictive consideration. The protection of operators should, however, only be given prime consideration if a risk exists that distinctly exceeds the general risk of life (e.g. in the household).

In this case an individual consideration will be necessary as for all branches in the risk chart.

Risk-reducing factors

Examples of risk reduction

1. Product processing	2. Measures to extend the life of a product	3. Product properties	4. Ambient conditions
– Baking – Boiling – Drying – Acidifying – Pickling – Smoking	– Pasteurisation – Microwave radiation – Radioactive radiation – Deep-freezing – Addition of Velcorin – A-septic packaging – Cooking – Fermentation	– Low shelf life – High water solubility (cleaning)	– Cooled machine room – Clean-room conditions

Risk classes

Classification according to the risk chart finally ends in one of several risk classes. It is a measure for the level of risk. Risk class I means a low risk; risk class IV signifies a high risk.

Where several risk classes may be applicable due to alternating products or risk-reducing features applying at different times, classification to the highest class must be made.

Even if in this article the hygiene risk chart has been applied to machines and work aids in the food processing industry, there is nothing to stop it being used for other equipment and machinery (e.g. health service, bio-laboratory, pharmaceutical industry and similar). It is also conceivable for the risk chart to be extended to include higher risk classes in order, for example, to cover the handling of medical instruments, body implants or organs.

It would also be possible to incorporate an HACCP concept [7].

Categories on hygiene design

The risk classes now need to be contrasted with suitable measures of hygiene design. A similar procedure is to be found in EN 954-1 for the control of machines. For the area of hygiene 4 categories (KB, K1, K2, K3) of hygiene design are proposed and contrasted with the risk classes.

The number of categories only incidentally corresponds to the number of risk classes.

These categories can be outlined as follows:

- KB Implementation of basic measures
- K1 Implementation of basic measures and application of basic hygiene principles insofar as this is practicable.
- K2 Implementation of basic measures and further application of basic hygiene principles insofar as this is technologically possible.

K3 Implementation of basic measures and systematic application of basic hygiene principles insofar as this is technologically possible.

Basic hygiene principles in the design of machines are understood to mean the principles mentioned at the beginning.

How can the individual categories now be implemented in practice?

Possible measures for the implementation of designs are shown in the Table "Measures for the hygiene-conform design of parts coming into contact with food" (refer to page 69).

The basic measures provide a foundation expected in every other category. This includes the suitability of materials for food coming into contact with them. As explained in [2] and [6], the selection of a suitable material can be very complex, particularly if no experience exists. In the case of higher risk classes the requirements placed on the choice of material will increase so that the basic measure will be more demanding. The

same is true of contact with operating materials such as lubricants. The description of special cleaning procedures will not usually be necessary in the category KB because cleaning will usually be restricted to basic cleaning.

Special requirements are not placed on surface processing. It is assumed that state of the art material processing used in general mechanical engineering will be sufficient.

Increasingly higher requirements are made in categories K1 to K3 under incorporation of the basic measures. These requirements can be supplemented or replaced by measures which have proved to be more successful in practice if this does better justice to the risk level determined in individual cases.

In principle the bundle of measures will always have to be determined in the individual case. It may well be that a higher or lower category will do better justice to the risk class established. In this case it can or must be used.

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

Proposal for the description of hygiene categories

KB (basic measures)	– Use of food-suitable materials – No damaging contact between operating materials and food – Surface roughness of materials as usual in general mechanical engineering
K1	– Basic measures – Described cleaning procedure – Harmful grooves and pores reduced – Dead spaces and blind lines accessible for inspection as far as possible – Possible for product and/or cleaning fluid to run off if necessary (possibly in cleaning position) – Surface roughness: $R_z \leq 30$ insofar as technologically possible – Radius of corners and edges: $r > 1.5$ mm
K2	– Basic measures – Possibly CIP cleaning – Avoid harmful grooves and pores – Avoid dead spaces and blind lines as far as possible, otherwise easily accessible for inspection – Possibility for product and/or cleaning fluid to run off must be guaranteed (possibly in cleaning position) – Surface roughness: $R_z \leq 25$ (depending on material) – Radius of corners and edges: $r > 2.5$ mm
K3	– Basic measures – Contact surfaces made of suitable stainless steel, as far as technologically possible and compatible with basic measures – Possibly CIP cleaning – Possibly sterilisation of the machine – Possibly handling of food under a-septic conditions – Possibly one-off use (cycle or batch) of tools or machine parts – Possibly intermediate cleaning at suitable intervals – No harmful grooves and pores – No avoidable dead spaces and blind lines – Possibility for product and/or cleaning fluid to run off must be guaranteed (possibly in cleaning position) – Surface roughness: $R_z \leq 16$ to 25 (depending on application) – Radius of corners and edges: $r \geq 3.2$ to 3.5 mm (depending on application)

The “risk chart for the hygiene risk of food machines” (refer to page 70) therefore also specifies categories in addition to the expedient categories which may also be consulted.

A higher category may also be necessary due to the intended use of the food and/or consumer expectations. High expectations are placed on baby and infant food, for example, by the population and the Federal Act on Contagious Diseases.

Similar expectations may also be placed on other areas of use.

The risk analysis may also not exclude the use of technologies, procedures or materials which have not led to an unacceptable hygiene risk in the past, particularly if they are technologically expedient or necessary.

The advantage of the methods presented is the systematic approach using which an existing material may be assigned to a hygiene risk class.

Suitable measures may be found by the assigned categories of hygiene design.

It is conceivable to assign other category matrices to the risk classes in addition to the categories for hygiene design, e.g. categories for the hygiene-conform conduct of employees or categories of works hygiene.

In the same way a distinction can be made between the food area, splashing area and other areas by different category matrices.

Annex 1

Hygiene-conform design of food processing machines (continued)

Literature

- [1] Council Directive on the approximation of the laws of the Member States relating to machinery (89/392/EEC), Official Journal of the EC No. L 183/9-32
Amending directives:
(91/368/EEC, Official Journal of the EC No. L 198/16-32;
(93/44/EEC), Official Journal of the EC No. L 175/12-20
- [2] K. Müller, K. Wickert:
Eignung von Werkstoffen für Nahrungsmittelmaschinen, ZFL, 45 (1994), No. 10, 58-64
- [3] Safety of Machinery – Principles of Risk Assessment – EN 1050
- [4] W. Defren: Risikobeurteilung bei Maschinen und Anlagen. Handbuch Maschinensicherheit, Jedermann-Verlag, Postfach 103140, 69021 Heidelberg
- [5] Safety of Machinery – Safety-related Parts of Control Systems, Part 1: General Design Principles– EN 954-1
- [6] K. Müller: Über die Eignung von Werkstoffen für Nahrungsmittelmaschinen. Handbuch Maschinensicherheit, Jedermann-Verlag, Postfach 103140, 69021 Heidelberg
- [7] HACCP – Grundlagen der produkt- und prozeß-spezifischen Risikoanalyse, Hrsg. Pierson/Corlett jr., Behr's Verlag, Hamburg 1993

Annex 2

Excerpt from EN 60204-1 – Electrical Equipment of Machines: Section 10: Operator Interface and Machine-mounted Control Devices

10.1 General information

This section contains the requirements placed on equipment mounted outside or partly outside control housings.

Insofar as feasible, this equipment must be selected, mounted and marked or coded in compliance with IEC 73, IEC 447. (A European standard for basic principles for indicators, actuators and marking is in preparation by CENELEC/TK 44X.

10.1.1 Arrangement and mounting

Insofar as feasible, the machine-mounted control devices must satisfy the following requirements:

- they must be easily accessible for operation and maintenance, and
- mounted in such a way that the possibility of damage by handling equipment or by any other moving equipment is minimised.

The actuating organs of hand-operated control devices must be selected and installed such that

- they are easy to reach no less than 0.6 m above the operating level and from the normal position of the operator;
- the operator does not place himself in a dangerous position when he operates them, and
- the possibility of unintentional operation is reduced.

10.1.2 Protection against external influences

In the intended installation the operator interfaces and the machine-mounted control devices must withstand the burdens of normal use and must have a type of protection of at least IP 54, but preferably IP 55 (refer to EN 60529). Together with other suitable measures, the type of protection must provide protection against the following:

- influences of aggressive fluids, vapours or gases, located in the physical environment or used by the machine, and

- the penetration of dirt (e.g. chips, dust, foreign bodies).

10.1.3 Position sensors

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

10.2 Pushbuttons

10.2.1 Colours

Pushbutton actuators must be marked in accordance with Table 2.

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

The colour RED must be used for emergency stop actuators. The colour of 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 for pushbutton actuators and their meaning

Colour	Meaning	Explanation	Application examples
RED	Emergency	Actuate for dangerous state or in emergency	Emergency stop Initiation of emergency stop functions Refer also to 10.2.1
YELLOW	Non-standard	Actuate in non-standard situations	Action to suppress non-standard state in order to restart an interrupted automatic sequence
GREEN	Safe	Actuate in safe state or to prepare normal state	Refer to 10.2.1
BLUE	Mandatory	Actuate in safe state or to prepare normal state	Reset function
WHITE			START/ON STOP/OFF
GREY			START/ON STOP/OFF
BLACK			START/ON STOP/OFF (preferred)

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

Annex 2

Excerpt from EN 60 204-1 – Electrical Equipment of Machines: Section 10: Operator Interface and Machine-mounted Control Devices (continued)

WHITE, GREY and BLACK are the colours of preference for pushbutton actuators acting alternately 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 initiate an action when depressed and which end the action when released (e.g. inching). The colours RED, YELLOW and GREEN may not be used.

The colour GREEN is reserved for those functions which indicate a reliable or normal state.

The colour YELLOW is reserved for functions which indicate a warning or non-standard state.

The colour BLUE is reserved for mandatory functions,

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

10.2.2 Marking

In addition to the functional marking described in 18.3, it is recommended to mark pushbuttons with symbols next to, or preferably directly on actuators, e.g.:

START or ON	STOP or OFF	Pushbutton functioning either as START and STOP or ON and OFF	Pushbuttons effecting a movement when actuated and stopping a movement when released (e.g. inching)
417-IEC-5007	417-IEC-5008	417-IEC-5010	417-IEC-5011



10.3 Indicator lights and indicators

10.3.1 Types of application

Indicator lights and indicators serve to provide the following information:

- Indication: the operator is to be shown or it is to be indicated that a specific action is to be implemented. The colours RED, YELLOW, GREEN and BLUE are usually used for this type of operation.
- Confirmation: a command, a state or a condition is confirmed, or the end of a change or a transitional period confirmed. The colours BLUE and WHITE are usually used for this type of operation and GREEN may be used in a few cases.

10.3.2 Colours

If nothing has been agreed to the contrary between supplier and operator, the front areas of indicator lights must be marked in colour under consideration of the state of the machine in accordance with Table 3. In compliance with IEC 73, different meanings may be assigned in accordance with one of the following criteria:

- the safety of humans and the environment, or
- the state of the electrical equipment.

(Basic indication principles are being prepared by CEN-ELEC/TC 44X.)

Refer to Table on page 73.

10.3.3 Flashing signals

A flashing light may be used as an additional distinguishing feature or to provide additional information and to underline a particular state, e.g. for the following purposes:

- to attract attention
- to bring about immediate action
- to show a difference between target and current state, and

- to show a change in state (flashing during a transitional period).

It is recommended to allocate the higher flashing frequencies to more important information (refer to IEC 73 for recommended flashing frequencies and pulse/pause relationships). (Basic indication principles are being prepared by CEN-ELEC/TC 44X).

10.4 Illuminated pushbuttons

Actuators for illuminated pushbuttons must agree with the meaning of the colours specified in Tables 2 and 3. If there is a difficulty in assigning a suitable colour, WHITE must be used. The colour effect of RED for the emergency stop actuator may not depend on the illumination.

10.5 Rotary switches

Devices with a rotating part, e.g. rotary potentiometers and selector switches must be attached in such a way that a rotation of the fixed parts is prevented. Friction alone may not suffice.

Table 3: Colours of indicator lights and their meaning with respect to the state of a machine

Colour	Meaning	Explanation	Action by the operator	Application examples
RED	Emergency	Dangerous state	Immediate action to react to a hazardous state (e.g. by actuating the emergency stop)	Pressure/temperature outside safe limits Drop in voltage Breakdown Exceeding of a stop position
YELLOW	Non-standard	Non-standard state; critical state immanent	Monitoring and/or intervention (e.g. by restoring the intended function)	Pressure/temperature within normal ranges, authorisation to continue
GREEN	Normal	Normale state	Optional	Pressure/temperature within normal ranges, authorisation to continue
BLUE	Mandatory	Indication of a state which requires action by the operator	Mandatory action	Order to enter preset values
WHITE	Neutral	Other states; may be assigned if doubt exists as to the use of RED, YELLOW, GREEN or BLUE	Monitor	General information

10.6 Start devices

Actuators used to initiate a start function or the movement of machine parts (e.g. carriages, spindles, drivers) must be constructed and arranged in such a way that unintentional operation is avoided as far as possible. Mushroom buttons may be used for two-hand operation.

10.7 Emergency stop equipment

10.7.1 General

Emergency stop equipment must be present at all operating points and other work stations in which an emergency stop may be necessary (refer also to EN 418).

10.7.2 Versions

Versions of emergency stop equipment include:

- a pushbutton-operated switch
- a pull-wire switch, and
- a foot-pedal switch without mechanical protection.

They must mechanically latch in automatically and be easy to reach.

10.7.3 Functional features

It may not be possible to close the emergency stop circuit before the actuator of the emergency stop device has been reset by hand. If several emergency stop devices are planned the current circuit may not be closed before all previously operated actuators have been reset.

The contacts of manually actuated emergency stop devices must be designed in such a way that they open positively (refer to EN 60947-5-1).

10.7.4 Actuators

Actuators for emergency stop devices must be RED. If there is a background behind the actuator it must be coloured YELLOW. The actuator of a pushbutton-actuated switch must be either palm- or mushroom shaped.

10.7.5 Use of shut-off devices

In the case of specific machines for which emergency stop equipment is not viewed to be necessary in accordance with 10.7.2, the main switch may satisfy the function of an emergency stop device (refer to 5.3.3). In these cases and for any such shut-off equipment, as

described in 5.3.2 a), b) and c), the colours must comply with 10.7.4.

10.8 Indicators

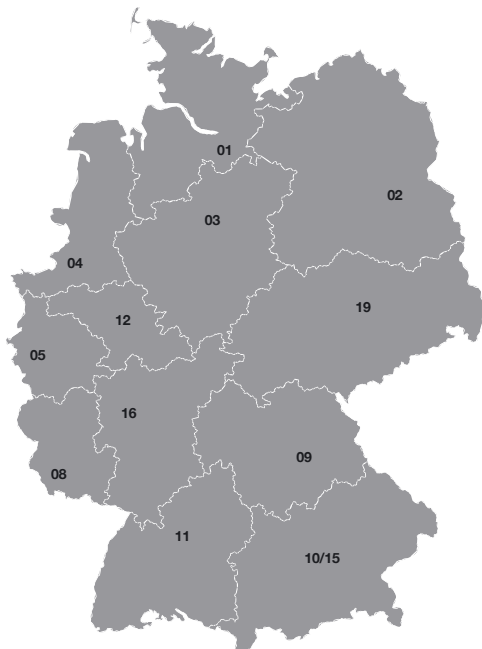
Indicators (e.g. optical, including monitor displays; alarm symbols) must be selected and arranged in such a way that they are visible from the usual working position of the operator. If indicators are provided as warning devices the use of flashing and beacon light is recommended which should be accompanied by an acoustic warning device.

(Basic indication principles are being prepared by CEN-ELEC/TC 44X).





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