

# BALLUFF

sensors worldwide

## Object Detection

Mechanical and Inductive Single and Multiple Position Switches



**more added value**





Balluff is a worldwide leading company in the field of position detection.

Our products range includes electronic sensors, transducers based on various operating principles, identification systems, bus-compatible sensors as well as mechanical and inductive single and multiple position switches. Balluff products are found wherever accuracy and reliability are in demand.

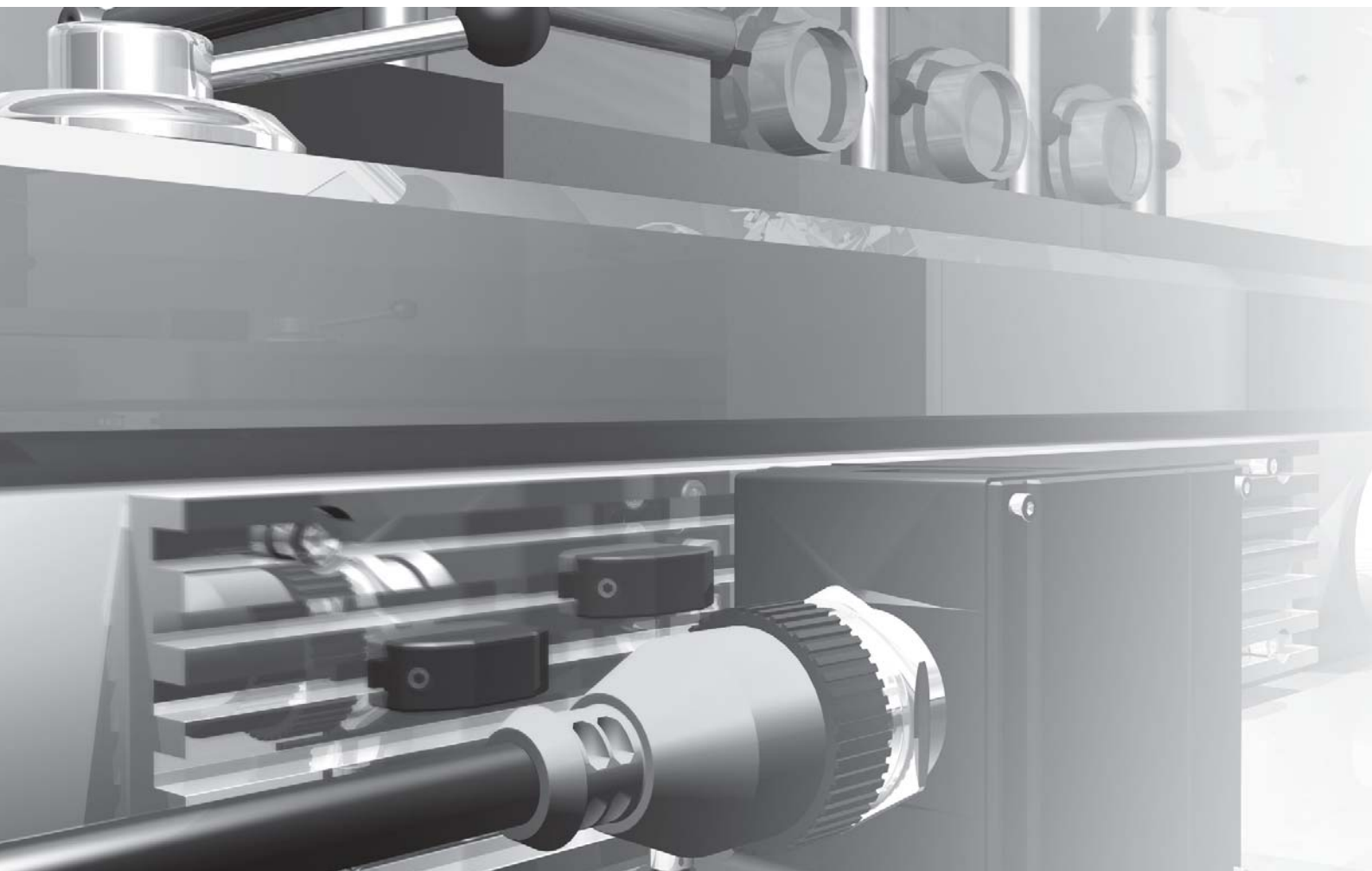
Wherever there is a need to automate, sense objects, or report linear and rotary motion to controllers – Balluff is always the right partner.

Our QM system meets the requirements of DIN EN ISO 9001:2000. Eleven Balluff companies have a certified QM system, two a certified environmental protection system.

By mastering process-capable production and assembly techniques and statistical process control we achieve consistently high product quality. Intensive testing before serial production begins guarantees reliable function.

With more than 50 years of experience in the field of sensor technology, Balluff today is one of the most capable manufacturers of both standardized and custom limit switches. Innovative technology and application-specific customer solutions are the outstanding features of the entire product range.

Highly-qualified development engineers and experienced designers work closely with the manufactures to ensure mature series products that are used successfully in every area of automation – even under extreme and aggressive operating conditions.



## Object Detection



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## General Information

i

## Principles of Mechanical and Inductive Single and Multiple Position Switches



### Mechanical Single and Multiple Position Switches

1.1

### Mechanical Single and Multiple Position Switches with Safety Switch Positions

1.2

### Mechanical Single and Multiple Position Switches with Forced Opening

1.3

### Mechanical Multiple Position Switches with Quick-Change Plunger Unit

1.4

## Inductive Single and Multiple Position Switches

2.1

### Inductive Multiple Position Switches with Extended Switching Distance 4 mm

2.2

## Special Form Factors

3

## Wireless System

4

## Mechanical and Inductive Switch Elements

5.1

## Cam Trays and Cams

5.2

## Connectors and Function Indicators

5.3

**Object Detection**



**Sensor Line**

- Inductive Sensors DC 3-/4-wire
- Inductive Sensors DC 2-wire
- Inductive Sensors AC/DC
- Inductive Sensors with special properties
- Sensors for Pneumatic Cylinders
- Magnetic Field Sensors
- Capacitive Sensors



**Photoelectric Line**

- Diffuse energetic with fore- and background suppression
- Retro-reflective Sensors
- Through-beam Sensors (emitter/receiver)
- Fiberoptic Systems
- Slot Sensors
- Optical Window Sensors
- Light Grids
- Contrast Sensor
- Luminescence Sensors
- Color Sensors
- Photoelectric Distance Sensors



**Mechanical Line**

- Mechanical Single and Multiple Position Switches
- Mechanical Single and Multiple Position Switches with safety switch positions
- Mechanical Single and Multiple Position Switches with forced opening
- Mechanical Single and Multiple Position Switches with quick-change plunger unit
- Inductive Single and Multiple Position Switches
- Inductive Multiple Position Switches with extended switching distance 4 mm
- Special form factors
- Wireless System



**Linear Position and Measurement**



**Displacement Sensing Line**

- Micropulse® Transducer BTL profile series
- Micropulse® Transducer BTL AT series
- Micropulse® Transducer BTL rod series
- Micropulse® Transducer BTL compact rod series
- Micropulse® Processors, BUS modules
- Magnetic Linear Encoder Systems BML
- Incremental and Absolute Encoders BDG/BRG
- Inductive Linear Position Sensor BIW
- Inductive Distance Sensors BAW
- Magneto-inductive Position Sensors BIL
- Photoelectric Distance Sensors BOD



**Industrial Identification**



**Industrial Identification**

- Industrial RFID Systems BIS C
- Industrial RFID Systems BIS L
- Industrial RFID Systems BIS M
- Industrial RFID Systems BIS S
- Vision Sensor BVS



**Industrial Networking and Connectivity**

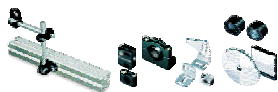


**Industrial Networking and Connectivity**

- Connectors BKS
- Splitter Boxes BSB
- Valve Connectors BNI
- IO-Link
- Remote Inductive Transmission Systems
- BUS Systems
- Wireless
- Electrical Devices



**Mechanical Accessories**



**Mechanical Accessories**

- Attachments
- Mounting System BMS



Please check and send fax!



We also offer a compilation of our entire product lines on CD-ROM or DVD-ROM!



Full product line on CD-ROM



DVD-ROM Full product line with 3D data



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Department

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Postal code/city

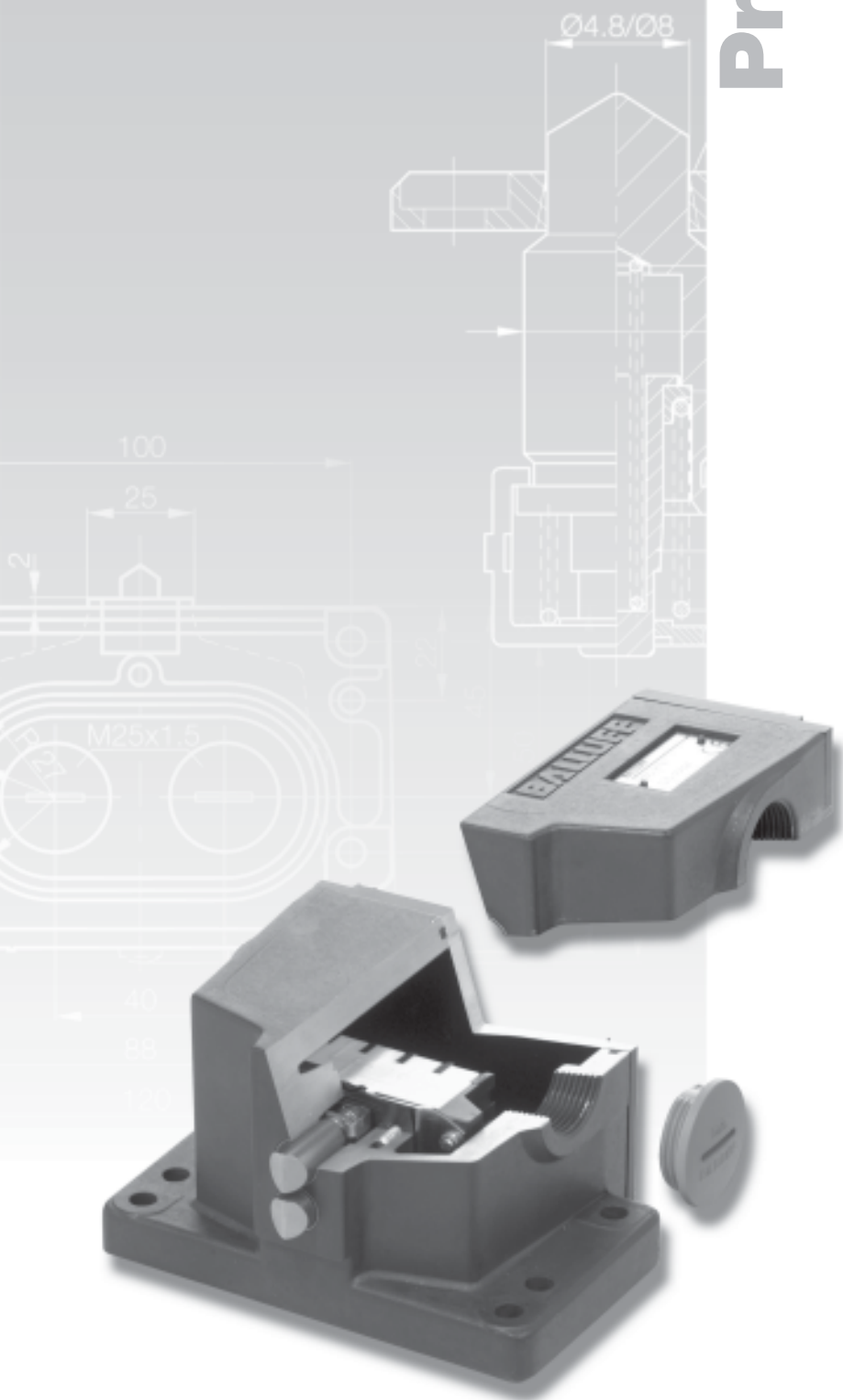
Phone



# Principles

In this section we cover the key concepts, technical details, conditions of use, standards, etc.

10	Applications
12	Design/Construction Form factors Standards
13	Design/Construction Form factors with safety switch positions
14	Design/Construction Form factors with quick-change plunger block
15	Switch Elements, Switching Characteristics
16	Plunger Styles
17	Plunger Systems
18	Design/Construction of Inductive Single and Multiple Position Switches
19	Function Descriptions, Definitions, Protection Circuits Standards
22	Quality
23	Quality
24	Special Solutions
26	Product Overview



Single and multiple position switches are used as actuators for automatic controls, for positioning and for end-of-travel switching on machine tools, transfer lines, transport equipment, in the automobile industry and in machine and equipment building.

Their proven design principle and large number of possible switching operations as well as consistent inspection ensure lasting quality and reliability.

### Reliable switching under extreme conditions

Balluff single and multiple position switches have been proven for decades under harsh conditions. They ensure trouble-free function under conditions of vibration, shock, rapid temperature fluctuations, aggressive coolants and heavy presence of chips. Inductive single and multiple position switches are also characterized by high electromagnetic compatibility.

### Safety of man and machine

For safety functions such as E-Stop or end-of-travel restriction, Balluff designs special safety switches to DIN EN 60204-1/ VDE 0113, which offer the highest level of safety.

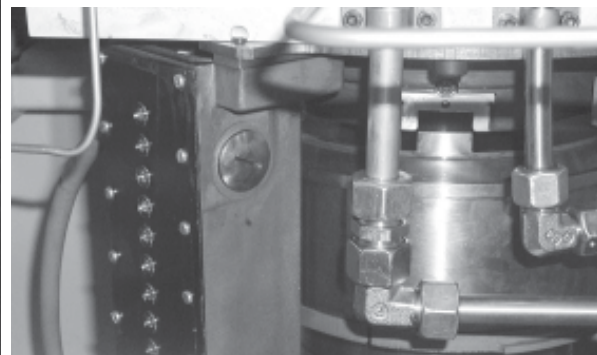
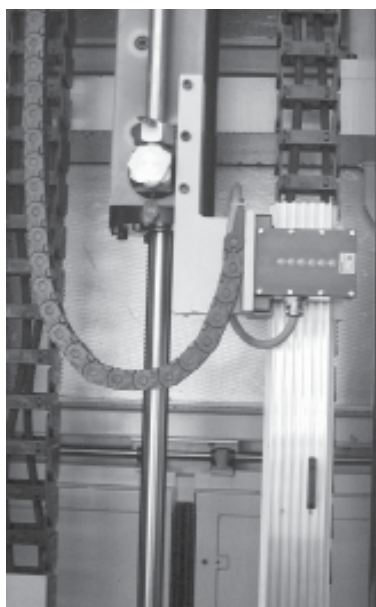
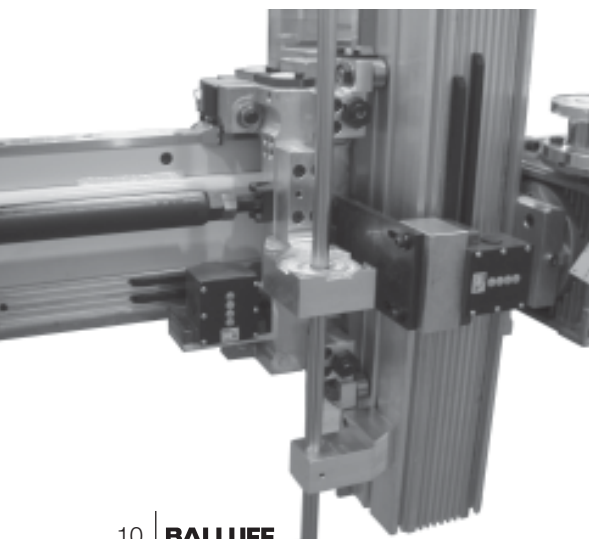
## more added value

High reliability and mature technology for high system availability and economy in production.

## more added value

Proof of safety for mechanical switches is easier to verify than for electronic products.

# The automation classics – Single and multiple limit switches custom tailored for you



## For standard applications

### Mechanical single and multiple position switches

The switching operation is performed using a telescoping plunger. This plunger is used to switch a mechanical switching element in a separate, sealed chamber. Optimum selection of the plunger style in combination with our cams guarantees long service life.

#### Features

- Maintenance-free, self-lubricating slide bearing bush. Slide bearing constructed of three layers: Steel back, bronze and Teflon coating.
- Lowest coefficient of friction
- Can be continuously run without lubrication
- Plunger will not stick after production is stopped even when aggressive coolants are used
- Optional function indicators
- Optional inductive switch elements

## For safety applications:

### Single and multiple limit switches with safety switch positions per DIN EN 60204-1/VDE 0113

The switching operation is initiated by a rigid plunger which actuates a mechanical switching element with positive-opening contacts per DIN EN 60204-1/VDE 0113.

#### Features

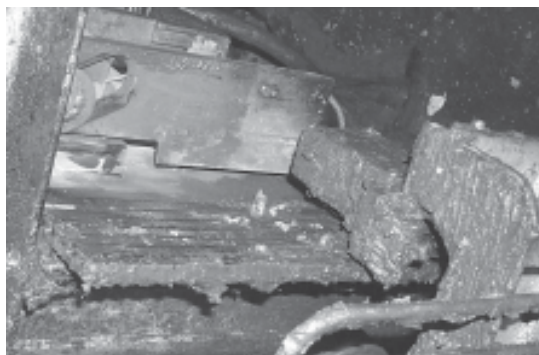
- Housing styles and sizes for a variety of applications
- Various plunger spacings
- Up to 12 switch positions
- Rigid chisel plungers for reliable switching
- Creep or snap switch elements with positive opening in accordance with DIN EN 60204-1/VDE 0113 for the greatest possible safety
- Maintenance-free
- Optional function indicators

## Catalog and custom products

### Standard switches and application-specific switches

For applications with standardized mounting and function dimensions we offer switches per DIN 43693 and DIN 43697. The product range is supplemented by switches with application-specific dimensions.

**more added value**  
 Optimized for your application requirements.  
 Customized products also available.



Mechanical and inductive single and multiple position switches – Position sensing for general machine building

## Construction of mechanical single and multiple position switches

A maintenance-free, self-lubricating plunger guide guarantees reliable switch function.

We offer these switches in a standardized housing per DIN 43693 or DIN 43697. Additional form factors can be found on the following pages.

Highly elastic, wear-free **membrane** made of Viton is used for hermetic sealing between the plunger mechanism and switch interior. This dual chamber design allows us to guarantee an IP 67 rating.

The seals are a critical element for the quality of our products. This is why we use only Viton today for the membrane, cover gasket and O-rings. Compared with the previous NRB material, Viton offers improved resistance to aggressive media over a large temperature range and under pressure.

**Snap and creep switch elements** are available as changeover contacts with self-cleaning effect. A variety of switch elements can be used.

The creep switch element opens and closes depending on the speed with which it is actuated.

The snap switch element opens regardless of its actuation speed.

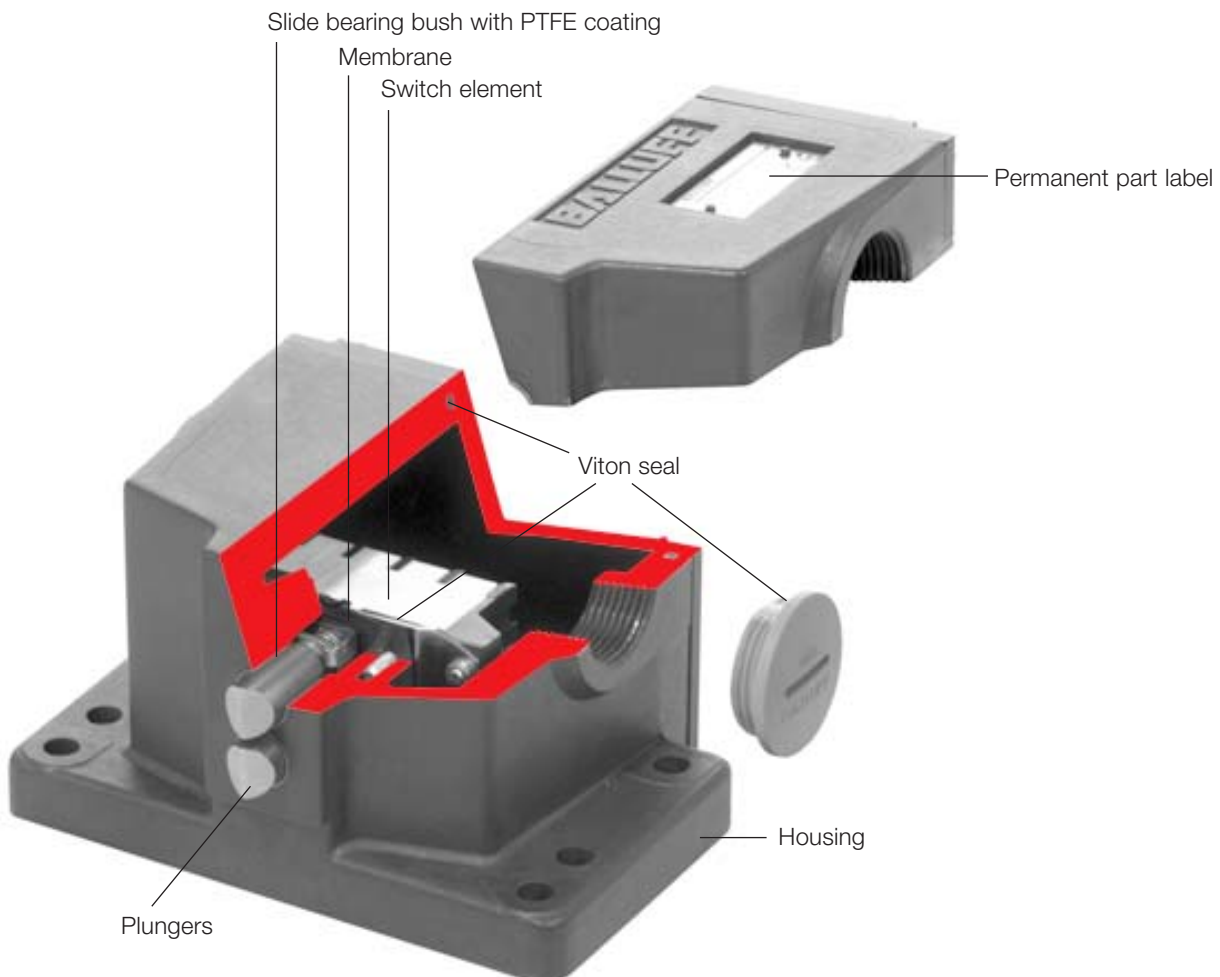
**Function indicator** for the switch positions with LED possible (option). Standard configuration: Metric fitting per EN 50262 or connector S80/S90 (option).

The threads on factory installed connectors are sealed.



### IO-Link

- 3-wire M12 connection
- No cable gland needed, factory sealed to IP 67
- Can be connected in seconds
- COM2 mode (38.4 Kbaud)
- Service data (N.O./N.C. parameter)
- Fitted standard with S4 connector
- Available for all standard form factors



## Construction of the safety switch position

- BSE 61 creep switch element or BSE 85 snap switch element with positive opening per DIN EN 60204-1/ VDE 0113 (see page 116 for technical details)
- For optimum safety we recommend chisel plungers

## Available series

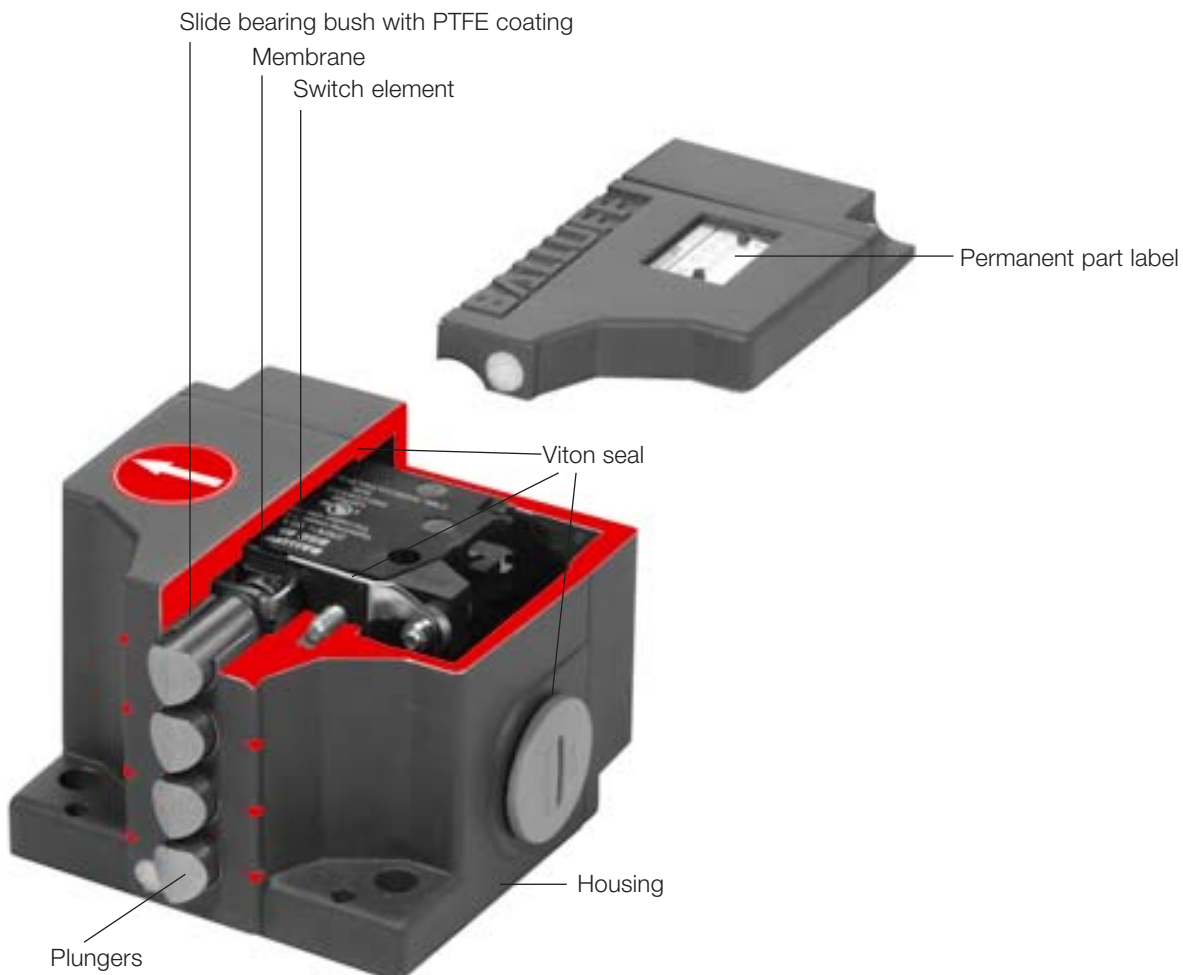
Safety switch positions can be installed in Series 100, 62, 61, 72 and F 60 single and multiple position switches.

## Switch position combinations

Switches with safety switch positions can be assembled using both other mechanical elements and inductive elements. Such mixed assemblies can be provided on request. Refer also to Section 3.

## Note!

Cams for safety switch positions must be installed to fit.





Balluff multiple position switches have for decades proven themselves under the most difficult conditions. The design principle and large number of possible switching types and configurations as well as consistent quality inspection ensure the highest level of quality and reliability.

The plungers are the only moving parts outside of the housing and are subjected to daily exposure to a wide range of unavoidable influences such as

- Abrasive materials
- Weld splatter
- Strongly resinating coolants and lubricants
- Long cam travel
- High speeds

For such applications Balluff offers the Series 100 and 61 switch family with quick-change plunger block as an option to the standard multiple limit switches.

The Balluff multiple position limit switch with quick-change plunger block makes time-consuming plunger replacement a thing of the past. In just a few moments the complete block system can be replaced without the use of special tools and without the risk of wiring mistakes.

The advantages of the quick-change unit as a problem solver are clear:

- Minimal machine downtime
- Low repair costs
- No wiring mistakes
- Simple to install
- Can be used even in the harshest conditions
- No special knowledge necessary
- Plungers are individually replaceable
- Degree of protection IP 67



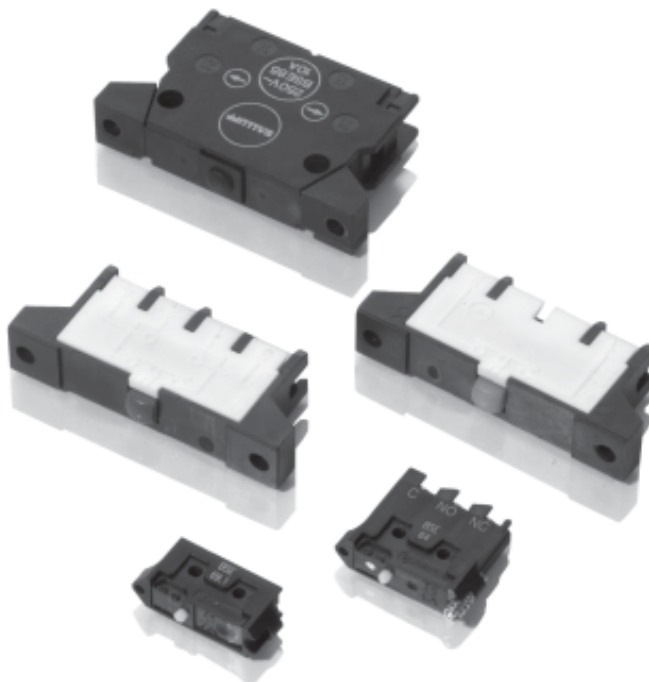


## The right switch element for every application

The switch element determines the switching behavior and, in emergency cases, the switching safety. Balluff offers switch elements for various functions.

## Switch characteristics

The respective application needs to be taken into account when selecting plungers and switch elements.



### Switch elements for standard applications

Switches for standard applications without safety function are fitted with snap switch elements. Available are:

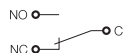
#### Snap switch element BSE 30.0

Dual changeover, one normally open and one normally closed, galvanically isolated.



#### Snap switch elements BSE 69.1/70.1/73.1/74.1

Single-pole changeover



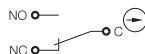
Additional characteristics:  
Snap switch elements BSE 73.1 or BSE 74.1 have specially formed gold contacts making them suitable for low currents from 10...100 mA.

### Switch element with positive opening

were developed for small series. Typical applications include end-of-travel sensing. Available are:

#### Snap switch element BSE 64, BSE 63

Single-pole changeover, NO with snap function, NC with forced opening

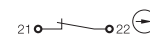


### Switch elements with safety functions

for E-Stop and end-of-travel restriction. These have positive-opening contacts conforming with DIN EN 60204-1/VDE 0113. Available are:

#### Creep switch element BSE 61

NC, double-interrupting, positive-opening.

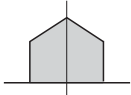


#### Snap switch element BSE 85

Dual-changeover:  
1. Dual-changeover (snap function), 2. Positive-opening (double-interruption), all galvanically isolated

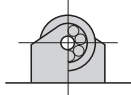


### Chisel plunger for short actuation travel



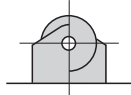
- max. approach velocity 12 m/min
- Typical cam length 100 mm
- Defined approach direction
- Repeatability up to  $\pm 0.002$  mm
- Recommended in conjunction with rigid plunger for safety applications
- Hardened, polished contact surface
- Angle of slope  $30^\circ$
- Hardness 58 HRC

### Roller bearing plunger for long actuation travel



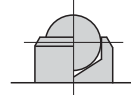
- max. approach velocity 120 m/min
- Typical cam length 1000 mm
- Defined approach direction
- Repeatability up to  $\pm 0.01$  mm
- Not recommended in safety positions
- Low-noise
- Hardness 58 HRC

### Roller plunger for medium actuation travel



- max. approach velocity 50 m/min
- Typical cam length 500 mm
- Defined approach direction
- Repeatability up to  $\pm 0.01$  mm
- Not recommended in safety positions
- Hardness 58 HRC

### Ball plunger actuation from any direction



- max. approach velocity 10 m/min
- Repeatability up to  $\pm 0.002$  mm
- Not recommended in safety positions
- Hardened ball
- Hardness 58 HRC

### Dimensions of

#### Roller and roller bearing plungers

	Series 46, 40, 99, 100	Series 100, 62, 61, 72, F 60
Plunger diameter in mm	6	10
Roller diameter in mm	5	7.8
Roller width in mm	2.8	3.8
Roller bearing diameter in mm		8
Roller bearing width		3.6



The specified approach speeds for all plunger styles apply only in combination with **Balluff mechanical cams** (see page 126)

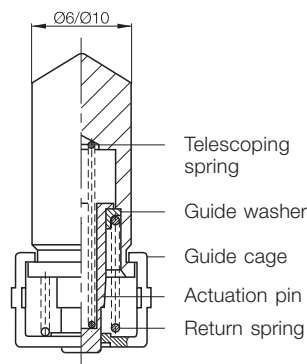
### Telescoping plunger

**mechanism** prevents overloading of the switch element, increases the service life and protects the plunger from sticking. For safety switches the use of rigid plungers is required.

### Telescoping plungers

For standard switch positions

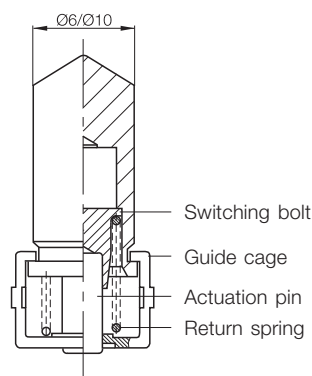
- Maintenance-free, self-lubricating slide bearing bush with Teflon coating (PTFE)
- Can be dry-run in continuous operation with no lubrication
- Lowest coefficient of friction
- Resistant to chemical effects



### Rigid plunger

For use with forced separation and positive opening safety switch positions conforming with DIN EN 60204-1/VDE 0113

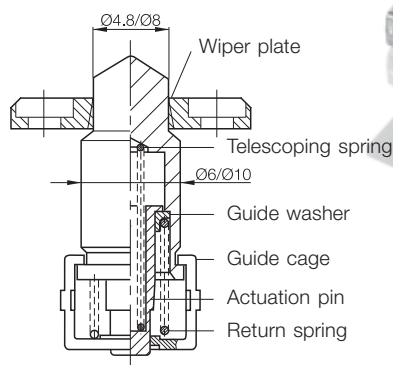
- Reliable opening of the switching circuit even when overload causes contact welding
- In addition to all the positive features of the telescoping plunger



### Telescoping plunger Chisel with wiper plate

Encapsulated version for extreme applications

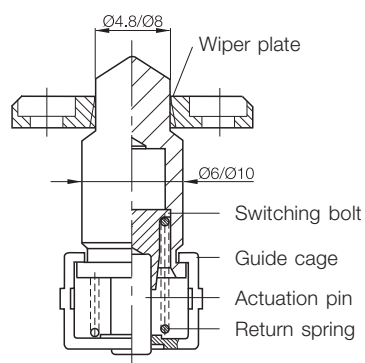
- One-piece, easily replaceable plastic plate with wiper edge
- Protection against sticking, hardened coolants and lubricants
- Breaks up sticking, hardened coolants
- Slide bearing bush is kept clean
- Ideal for use in processing cast materials



### Rigid plunger Chisel with wiper plate

For use with forced separation and positive opening safety switch positions conforming with DIN EN 60204-1/VDE 0113

- Reliable opening of the switching circuit even when overload causes contact welding
- In addition to all the positive features of the telescoping plunger



# Inductive Single and Multiple Position Switches

Design/Construction  
Inductive single and multiple position switches

These switches use the same housing as for the mechanical versions. The switching function is handled by an inductive switch element whose active surface is damped contactlessly by the approach of special electronic cams.

Machine-compatible **housing** per DIN 43697 made of a special cast aluminum alloy or application-specific, absolutely deformation resistant.

**Sensing face**, material PA 12, insensitive to aggressive coolants.

**High quality Viton seal**, insensitive to aggressive coolants (enclosure rating IP 67).

The threads on factory installed connectors are sealed.

**Inductive switch elements** available in two sensing head diameters, 3-/4-wire (DC PNP and NPN), 2-wire (AC and DC), NAMUR.

**Function indicator for each switch position** with LED available (except NAMUR).

**Metric fittings, cable glands or connectors**, flexible cabling for each position.

### Switching distances

For adapting to various working distances we offer switch elements with the following rated switching distances  $s_n$ :

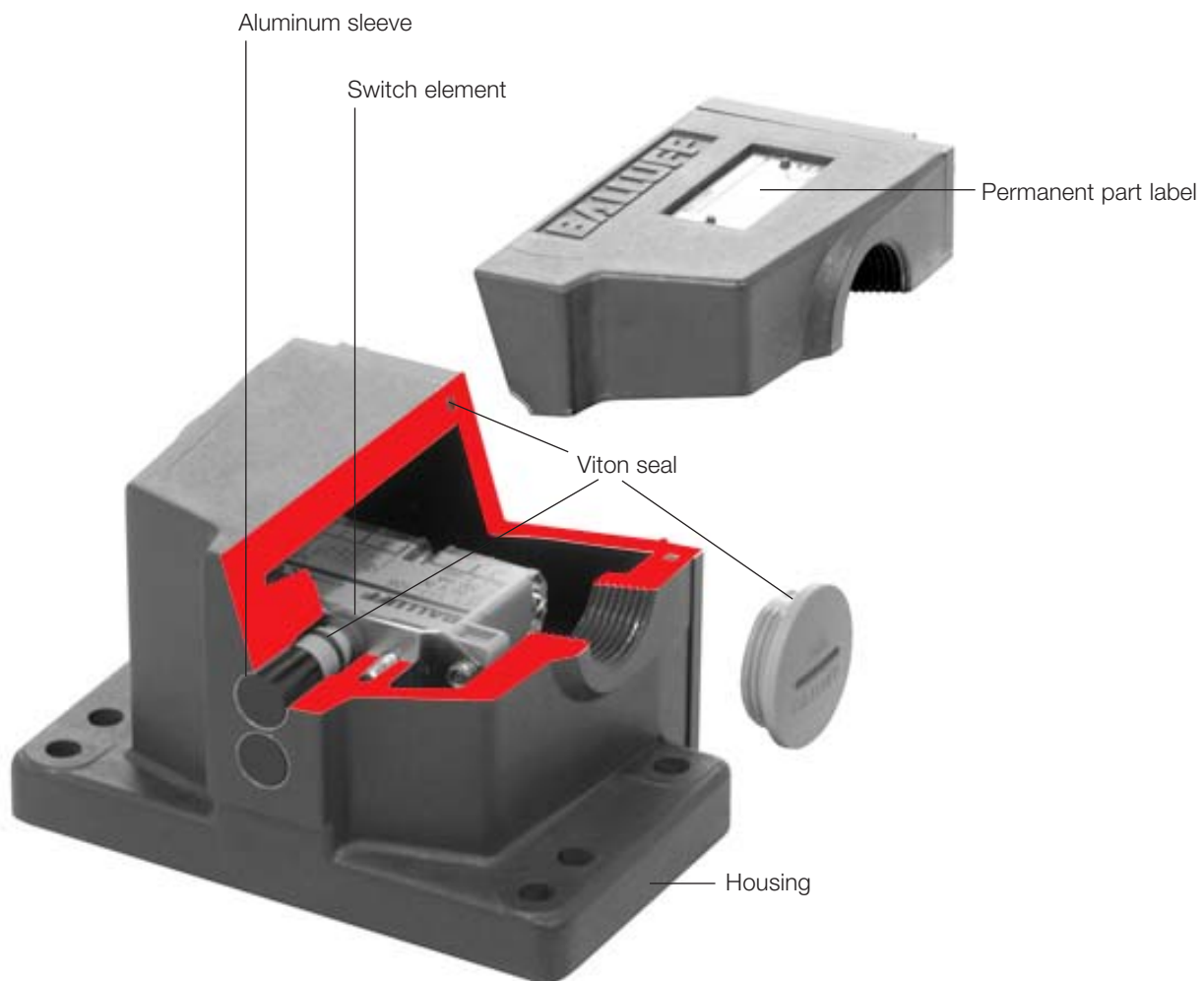
- 0... 1.1 mm
- 0... 2 mm
- 0... 5 mm

Inductive switch elements with extended switching distance available on request!

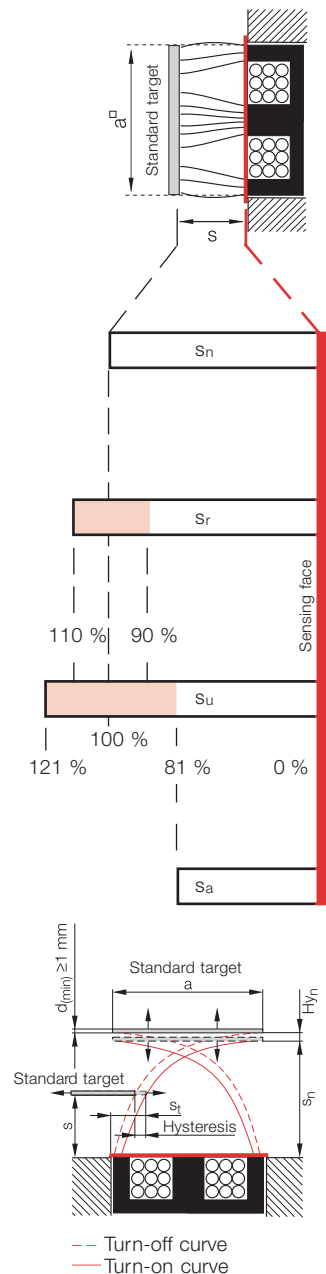
**Utilization categories**  
per EN 60947-5-2/  
IEC 60947-5-2

Category	
AC 12	AC-switch
AC 140	AC-switch
DC 12	DC-switch
DC 13	DC-switch

Typical load applications
Resistive and semiconductor loads, optocouplers
Small electromagnetic load $I_a \leq 0.2$ A; e. g. contactor relay
Resistive and semiconductor loads, optocouplers
Electromagnets



<b>Supply voltage <math>U_B</math></b>	... is the permissible voltage range in which certain safe	operation of the switch is guaranteed (including ripple $\sigma$ ).
<b>Voltage drop <math>U_d</math></b>	... is the voltage measured across the load of a closed	(conducting) switch element at load current $I_e$ .
<b>Rated operating current <math>I_e</math></b>	... is the permissible constant output current that	may flow through the load $R_L$ .
<b>Off-state current <math>I_r</math></b>	... is the residual current flowing through the load	when a switch element is not conducting (open).
<b>Inrush capacity <math>I_k</math></b>	... in the case of alternating current indicates the current $I_k$ ( $A_{eff}$ ) which is permitted to	flow during a given turn-on time $t_k$ (ms) and at a given frequency (Hz).
<b>Minimum operating current <math>I_m</math></b>	... is the smallest load current required for function of the	switch element when ON.
<b>Ambient temperature range <math>T_a</math></b>	... is the temperature range over which the function of	the switch is guaranteed..
<b>Rated operating distance <math>s_n</math></b>	... is a theoretical value, which does not take into account manufacturing	tolerances, operating temperatures, supply voltages, etc.
<b>Effective operating distance <math>s_r</math></b>	... is the switching distance of a single inductive switch element measured under the specified conditions	(installation, voltage, temperature). $T_a = +23\text{ °C} \pm 5$ ( $0.9 s_n \leq s_r \leq 1.1 s_n$ )
<b>Useful operating distance <math>s_u</math></b>	... is the permissible switching distance of an individual switch element within the specified voltage	and temperature conditions. ( $0.81 s_n \leq s_u \leq 1.21 s_n$ ).
<b>Assured operating distance <math>s_a</math></b>	... is the switching distance at which assured operation of the switch element is guaranteed at specified	voltage and temperature conditions. ( $0 \leq s_a \leq 0.81 s_n$ ).
<b>Hysteresis H</b> (switching hysteresis when target is backed off)	... is given as a percentage of the effective operating distance $s_r$ . It is measured at an ambient temperature of $+23\text{ °C} \pm 5$ and at the rated operational voltage. It must	be less than 20 % of the effective operating distance ( $s_r$ ). $H \leq 0.2 s_r$



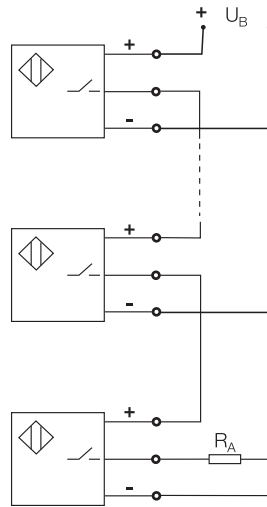
<b>Switching frequency f</b>	... refers to the maximum number of switching operations per second.	Damping is per EN 60947-5-2 with standard targets on a rotating, non-conducting disk. The surface area ratio of iron to non-conductor must be 1 : 2.	The rated value of the switching frequency is reached when – either the turn-on signal $t_1 = 50 \mu s$ or the turn-off signal $t_2 = 50 \mu s$ .
<b>Polarity reversal protected</b>	... protected against any possible lead reversal for inductive switch elements with short circuit protection.	... against reversal of plus/minus leads for inductive switch elements without short circuit protection.	
<b>Short circuit protected</b> (with maximum voltage 60 V DC)	... is achieved for inductive switch elements with pulsing or thermal short circuit protection. The output stage is thereby protected against overload and short circuit.	The trigger current for the short circuit protection is higher than the rated operating current $I_e$ . Currents from switching and load capacitances are specified in	the sensor data and do not result in triggering, but rather are masked by a short delay in the output circuit.
<b>Short circuit/overload protected</b> (for operating with AC or DC supply)	... AC or AC/DC sensors are often operated with a relay or contactor as the load. AC switching devices (contactors/relays) create a significantly higher load (6...10 x rated current) when they are first energized as compared with their static operation due to the fact that the core is still open. The static value of the load (current) is not reached until several milliseconds later.	Not until the magnetic field is closed does the max. permissible rated operating current $I_e$ flow through the sensor. This means that the threshold value for a short circuit condition in these switch elements must lie significantly higher and would, if for example the contactor is prevented for mechanical or electrical reasons from fully closing, result in an overload on the switch elements. This is where the overload protection comes into play. It is designed as slow-acting (time-delayed). Its trigger threshold lies only slightly above the maximum permissible $I_e$ .	A response (i. e. turn-off) is delayed, depending on the magnitude of the overload, by more than 20 milliseconds. This ensures that properly working relays and contactors can be switched normally, while defective devices will not destroy the Balluff switch elements. The short circuit/overload protection is generally of a bi-stable design, which means that it must be reset by turning off the supply voltage to the switch element.



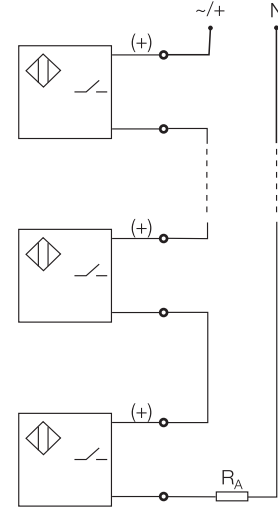
## Series connection

... can cause a time delay (e. g. start-up delay). The number of connected switch elements is limited by the total voltage drop (sum of all  $U_d$ ). In the case of 2-wire sensors it is limited by the addition of the minimum supply voltages. For 3-wire switches, the load capacity of the output stage represents a further limitation, since the current consumption  $I_0$  of all switches is added to the rated current  $I_e$ . The ready delay time  $t_v$  is the ready delay of a sensor  $\times$  (number of sensors  $n-1$ ).

3-wire DC switch elements



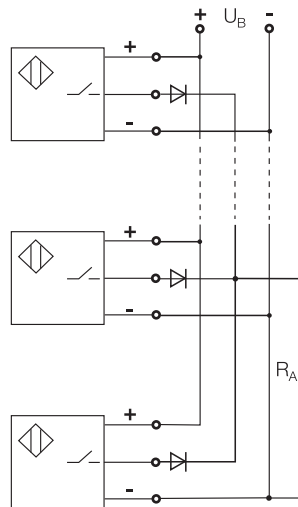
2-wire DC switch elements (AC/DC)



## For parallel connection

... of switch elements with LED it is recommended that the outputs of the individual switches be decoupled using diodes (as shown). This prevents all LED's from lighting-up when the output stage of one switch is turned on.

3-wire DC switch elements



2-wire DC switch elements

Parallel wiring of 2-wire switch elements is not recommended, since missed pulses can be caused by the ready delay while the oscillation is built up.

<b>Switch</b>	Multiple position switches	DIN 43697
	Single position switches	DIN 43693
	Single and multiple position switches with safety switch positions	DIN EN 60204-1/VDE 0113 Part 1
	Metric fitting	EN 50262
<b>Enclosure rating</b>	IP 67	EN 60529/IEC 60529
<b>EMC (electromagnetic compatibility) for switches with inductive switch elements</b>	RF emission from electrical equipment	EN 55011
	Static discharge immunity (ESD)	EN 61000-4-2
	Immunity to electromagnetic fields (RFI)	EN 61000-4-3
	Immunity to fast transients (burst)	EN 61000-4-4
	Immunity to line-carried noise induced by high-frequency fields	EN 61000-4-6
	Surge-voltage stability	EN 60947-5-2
<b>Environmental simulation</b>	Vibration, sinusoidal Frequency range: 10...500 Hz Amplitude: 3 mm <sub>P-P</sub> /20 g Oscillation duration: 40 sweeps in 3 axes	EN 60068-2-6/IEC 60068-2-6
	Shock Pulse shape: half-sine Peak acceleration: 100 g Pulse duration: 6 ms Number of shocks: 25 positive, 25 negative in 3 axes	EN 60068-2-27/IEC 60068-2-27
	Continuous shock Pulse shape: half-sine Peak acceleration: 100 g Pulse duration: 6 ms Number of shocks: 4000 positive, 4000 negative in 3 axes	EN 60068-2-29/IEC 60068-2-29

## Quality Management System

per DIN EN ISO 9001:2000

### Balluff company

Balluff GmbH	Germany
Balluff Elektronika KFT	Hungary
Nihon Balluff Com. Ltd.	Japan
Balluff U.K. Ltd.	Great Britain
Balluff Automation s.r.l.	Italy
Balluff Inc.	USA
Balluff GmbH	Austria
Balluff CZ	Czech Republic
Hy-Tech AG	Switzerland
Balluff Sensortechnik AG	Switzerland
Balluff Controles Eléctricos Ltda.	Brazil



## Environmental Management System

per DIN EN ISO 14001:2005

### Balluff company

Balluff GmbH	Germany
Balluff Elektronika KFT	Hungary

## Balluff products meet the EU Directives

Products requiring marking are subjected to a conformity evaluation process according to the EU Directive and the product is marked with the

CE Marking. Balluff products fall under the following EU Directives:



2004/108/EG	EMC Directive
2006/95/EG	Low-Voltage Directive applies to AC and AC/DC sensors

## Approvals

... are granted by national and international institutions. Their symbols affirm that our products meet the specifications of these institutions.

„US Safety System“ and „Canadian Standards Association“ under the auspices of Underwriters Laboratories Inc. (cUL).

CCC Marking by the Chinese CQC.



## Balluff is a member of ALPHA

ALPHA, an association for testing and certification of low-voltage devices, promotes the individual responsibility of the manufacturer of such devices by means of uniform test procedures according to current standards and thereby supports the attainment of high product quality.

ALPHA also grants nationally recognized product certificates when certain prerequisites are met. Through ALPHA's membership in LOVAG (Low Voltage Agreement Group), its certificates are also recognized in other European countries.

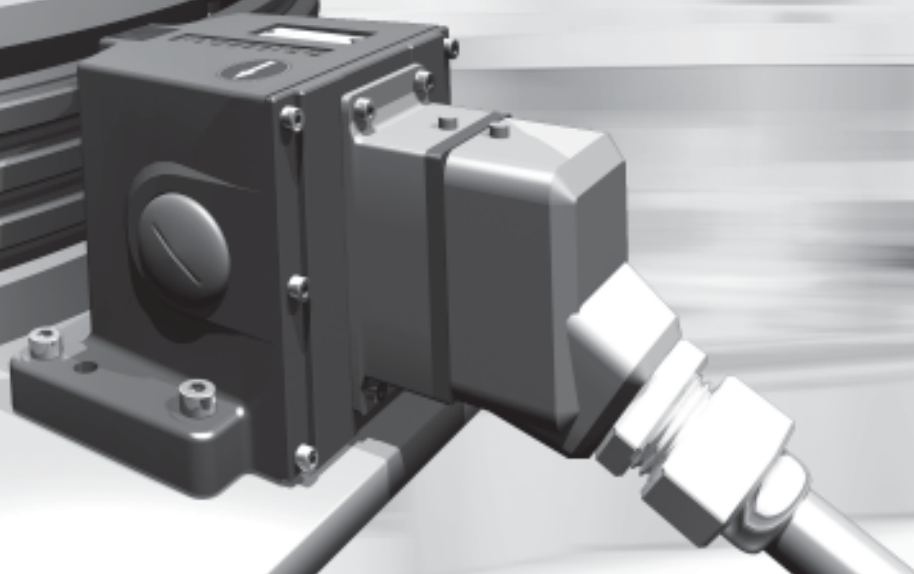
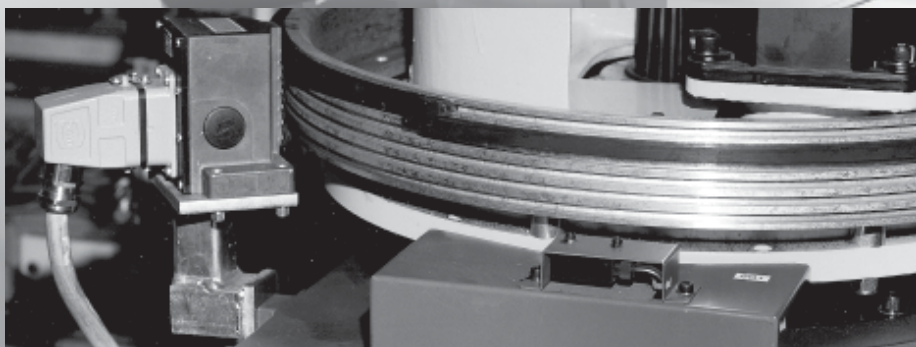


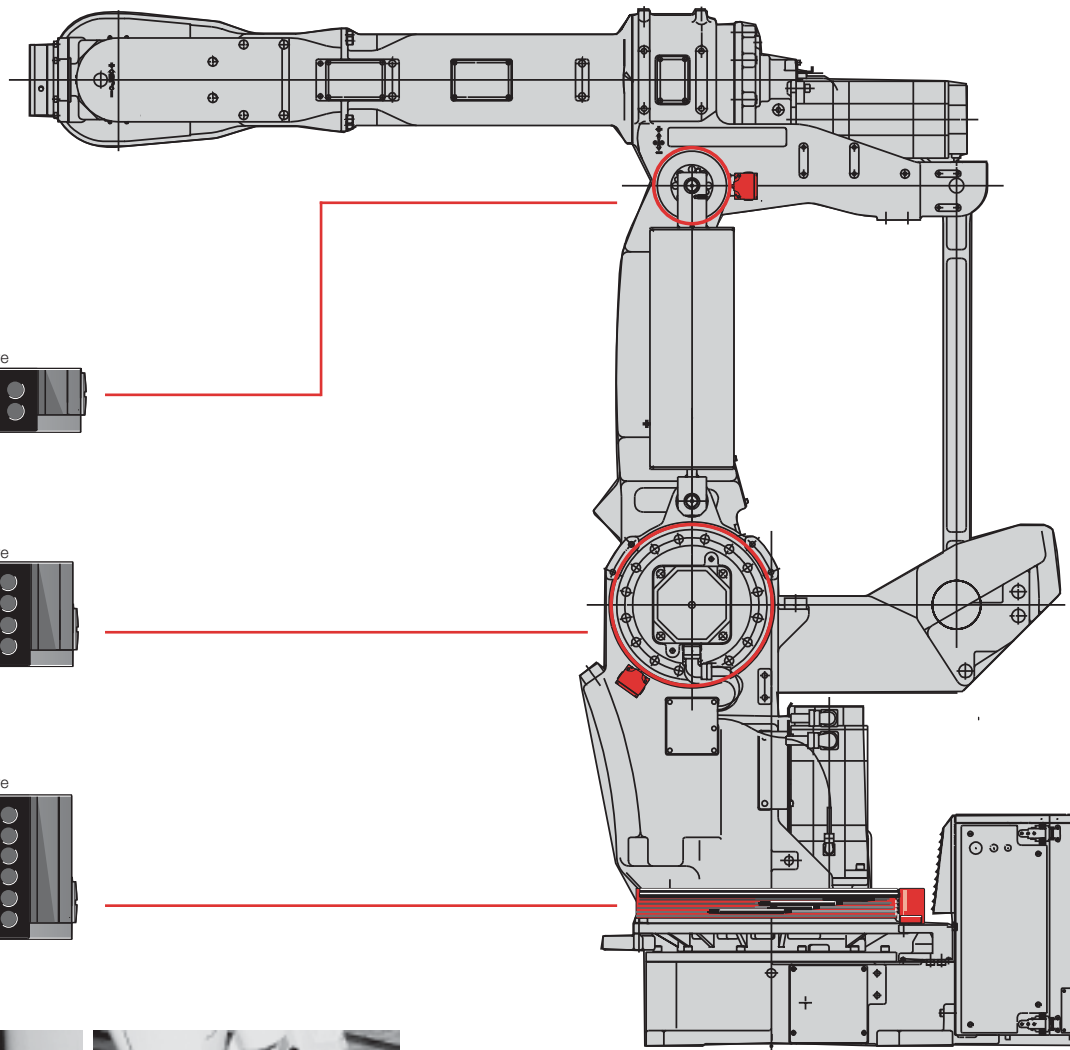
## Zone monitoring on robots

One task – two solutions

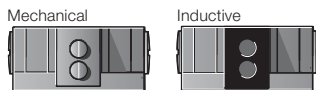
If two physical channels (1 normally and 1 normally closed) are powered by a switching power supply, this will enable cross-connection detection. In such a system different signals must be sent to the controller.

In case of error (short circuit, miswiring, ...) both signals are identical and are recognized by the controller as a cross-connection fault condition. Monitoring can be handled by a safety programmable controller or with a Pilz safety switching device.

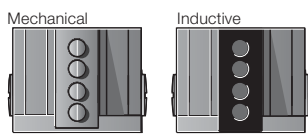




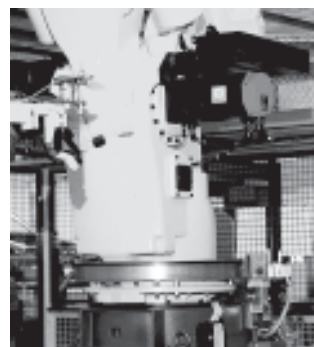
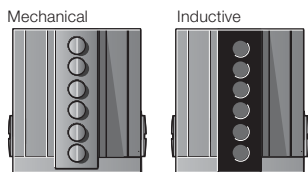
## Axis 3



## Axis 2



## Axis 1



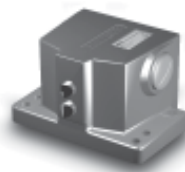
### Two solutions – simple installation and setup of the allowed zone

#### Solution 1 Mechanical switches – the classic solution

- Reliability assured by rugged cast housing for harsh industrial environments
- Safety ensured by switch elements with positive-opening contacts and rigid plungers as well as proper selection of the cam tracks
- Long service life thanks to maintenance-free, self-lubricating plunger guide with slide bearing bush

#### Solution 2 Inductive switch – the modern solution

- Likewise in rugged cast housing for harsh industrial applications
- Function monitoring using safety controller with pulsed supply voltage for the switches
- Non-contacting, wear-free,
- For extremely high traverse speeds



Page

<b>Mechanical single and multiple position switches</b>	Series 100 page 30 CE, CCC, CSA	Series 62 page 32 CE, CCC, CSA	Series 61 page 34 CE, CCC, CSA
<b>Mechanical single and multiple position switches with safety switch positions</b>	Series 100 page 48 CE, CCC, CSA	Series 62 page 50 CE, CCC, CSA	Series 61 page 52 CE, CCC, CSA
<b>Mechanical single and multiple position switches with forced opening</b>			
<b>Mechanical multiple position switches with quick-change plunger unit</b>	Series 100 page 68 CE		Series 61 page 72 CE
<b>Inductive single and multiple position switches</b>	Series 602-11 page 80 CE, CCC		Series 610...613-11 page 82 CE, CCC
<b>Inductive multiple position switches with extended switching distance 4 mm</b>	Series X603-...-602-11 page 97 CE, CCC		Series X603-...-610-11 page 98 CE, CCC
<b>Special form factors</b>	Series 602-11 page 102 CE, CCC		Series 610...613-11 page 102 CE, CCC
<b>Wireless system</b>			
<b>Mechanical and inductive switch elements</b>	page 116...	page 116...	page 116...
<b>Cam trays and cams</b>	page 124...	page 124...	page 124...
<b>Connectors and function indicators</b>	page 132...	page 132...	page 132...

**Features**

- Mounting and function dimensions per DIN 43697
- IO-Link on request
- Smaller flange dimensions compared with Series 100
- Smaller cable wiring chamber
- IO-Link on request
- Compact housing with smaller cable wiring chamber
- IO-Link on request





Series 72 page 36 CE, CCC, CSA	Series 46 page 38 CE, CCC, CSA	Series 40 page 40 CE, CCC, CSA	Series F 60 page 42 CE, CCC	Series 99/100 page 44 CE, CCC
Series 72 page 54 CE, CCC, CSA			Series F 60 page 56 CE, CCC	
	Series 46 page 60 CE	Series 40 page 62 CE		Series 99/100 page 64 CE
Series 605-11 page 84 CE, CCC	Series 603-11 page 86 CE, CCC	Series 650-11 page 88 CE, CCC	Series 161/160-H3 page 90 CE	Series 340/341/344/346-H2 page 90 CE
Series X603-...-605-11 page 99 CE, CCC				
Series 605-11 page 102 CE, CCC	Series 603-11 page 103 CE, CCC	Series 650-11 page 103 CE, CCC		
			Series F 60 page 110 CE	
page 116...	page 116...	page 116...	page 116...	page 116...
page 124...	page 124...	page 124...	page 124...	page 124...
page 132...	page 132...	page 132...	page 132...	page 132...

– Horizontal plunger arrangement

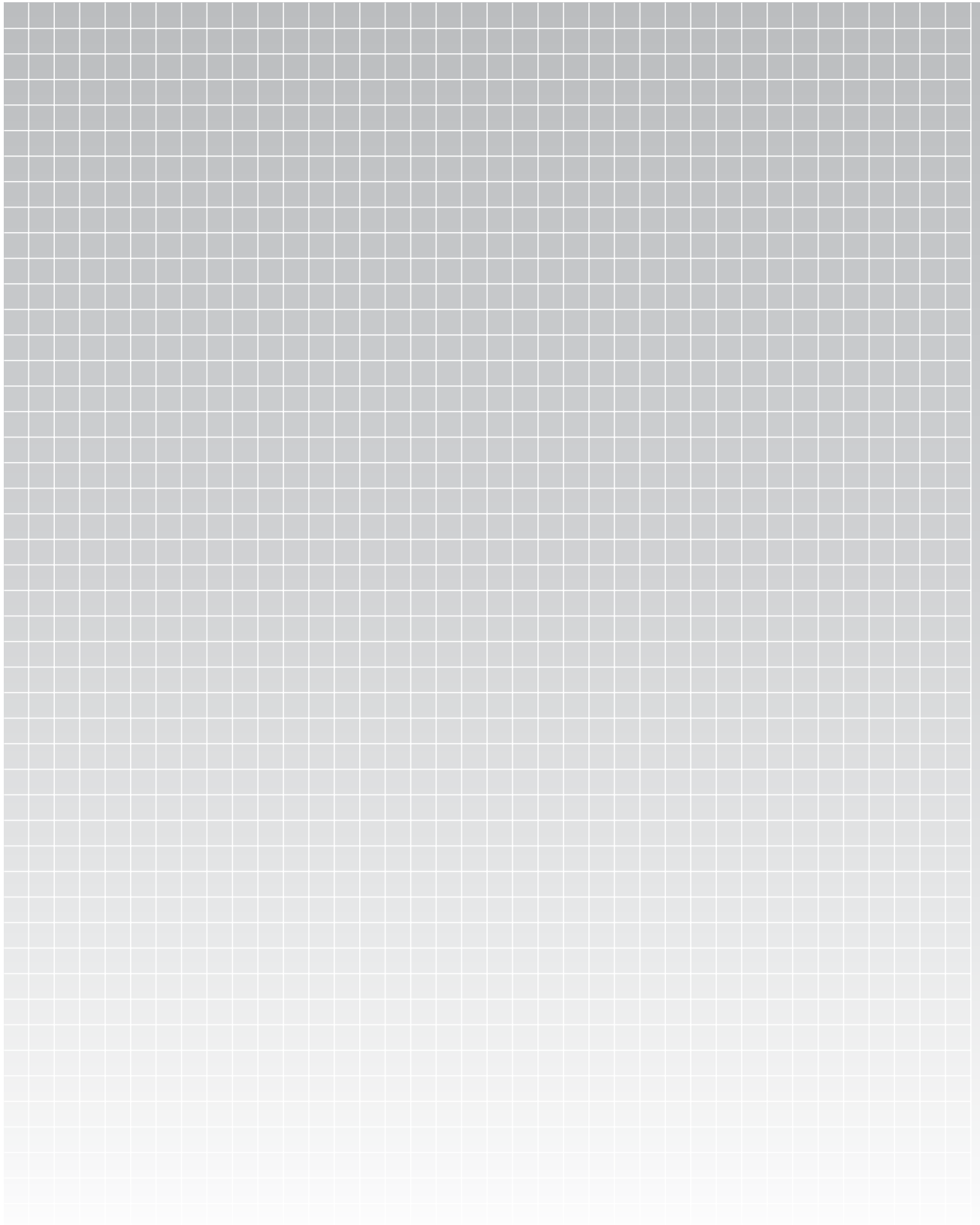
– Small housing with mounting flange  
– Smallest axis distance (spacing)  
– Switch elements for low power  
– IO-Link on request

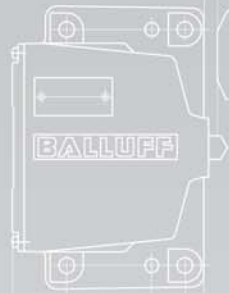
– Small housing  
– Smallest axis distance (spacing)  
– Switch elements for low power  
– IO-Link on request

– Mounting and function dimensions per DIN 43693  
– Compact position switch

– Smallest form factor  
– Switch elements for low power

**Not for new applications. Still available for replacements.**





**more added value**

- Long service life
- Rugged housing for extreme applications



**Mechanical multiple position switches**

30	Series 100 per DIN 43697
32	Series 62
34	Series 61
36	Series 72
38	Series 46
40	Series 40

**Mechanical single position switches**

42	Series F 60 per DIN 43693
44	Series 99 and Series 100

**1.1**

Multiple position switches series

- 100
- 62
- 61
- 72
- 46
- 40

Single Position Switches Series

- F 60
- 99
- 100

**5.1**

**5.2**

**5.3**



### Multiple position switches per DIN 43697 for standard applications

- Dual-chamber system with IP 67 protection: wear-free membrane with hermetic sealing from plunger mechanism and switch chamber
- Maintenance-free, self-lubricating plunger guide with slide bearing

### Multiple position switches with wiper plate

- Increased function security under extreme conditions of use
- Wiper plate prevents plunger from sticking in the guide
- For use in wet areas with strongly adhering media

### Connection options

- Thread for cable gland M25×1.5 on side and in flange (Gaskets and plugs included)
- Connector (note permissible operating voltage for the connectors, see page 132).

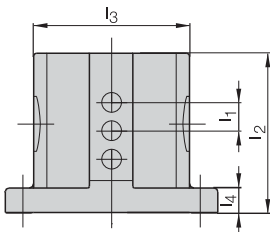
### Multiple position switches with function indication

- Function indication for dual voltage range option

### Available sizes

Number of plungers		2	3	4	5	6	8	10	12
Dimension l <sub>2</sub> when	Dimension l <sub>1</sub> = 12 mm	70	80	90	105	120	140	170	200
	Dimension l <sub>3</sub>	88	88	88	88	88	80	80	80
	Dimension l <sub>4</sub>	14	14	14	14	14	20	20	20
	Dimension l <sub>1</sub> = 16 mm	70	90	105	120	140	170	200	240
Dimension l <sub>3</sub>		88	88	88	88	80	80	80	80
	Dimension l <sub>4</sub>	14	14	14	14	20	20	20	20
Number of connectors	S80 without FD/FE	1	1	2	2	2			
	S80 with FD/FE	1	2	2	3	3			
	S90 without FD/FE	1	1	1	1	1	1	1	2
	S90 with FD/FE	1	1	1	1	1	1	2	2
	S4 without FD (IO-Link)	1	1	1	1	1	1	1	1
S4 with FD (IO-Link)	1	1	1	1	1	1	1	1	

Dimensions in mm



Ordering example:

**BNS 819-D02-D16-100-10-FE-S80R**

**BNS 819-D - -100-10- - -**

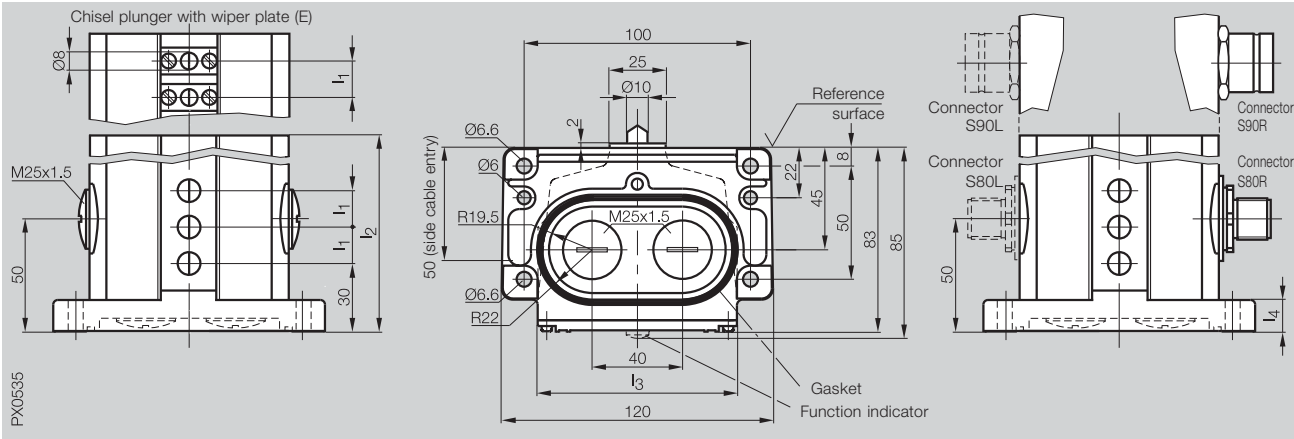
No. of plungers	Plunger type	Plunger spacing	optional Function indication	optional Connector
<b>02</b> 2x	<b>D</b> Chisel	<b>12</b> 12 mm	<b>FD</b> 6...60 V AC/DC	<b>S80R</b> 5-pin, right
<b>03</b> 3x	<b>K</b> Ball	<b>16</b> 16 mm	<b>FE</b> 90...250 V AC/DC	<b>S80L</b> 5-pin, left
<b>04</b> 4x	<b>R</b> Roller			<b>S80S</b> 5-pin, right and left
...	<b>L</b> Roller bearing			<b>S90R</b> 12-pin, right
	<b>E</b> Chisel with wiper plate			<b>S90L</b> 12-pin, left
				<b>S90S</b> 12-pin, right and left
				<b>S4R-I</b> 4-pin, right only for IO-Link
				<b>S4L-I</b> 4-pin, left only for IO-Link



# Mechanical Multiple Position Switches

Series 100  
per DIN 43697

Type	Multiple position switch
Plunger spacing	12 mm or 16 mm
Mounting and function dimensions	per DIN 43697



Plunger style	Chisel (D), Ball (K), Roller (R), Roller bearing (L) or Chisel with wiper plate (E)
Plunger material	Stainless steel, contact surfaces induction hardened
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	M25x1.5 for connector or cable gland
Ambient temperature range	-5...+85 °C
Degree of protection per IEC 60529	IP 67
Function indicator	LED 6...60 V AC/DC (FD) or 90...250 V AC/DC (FE)

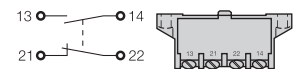


## IO-Link

For additional information see IO-Link brochure!

With switch element  
Ordering code  
Wiring diagram, style

<b>BSE 30.0</b>
BNS 819-D - -100-10- -

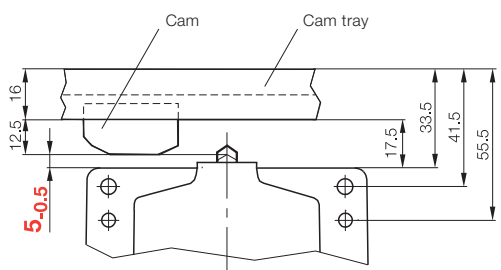


<b>Switch element</b>	
Contact material	Silver, gold plated
Switching principle	Snap switch
Contact system	Dual changeover, one normally-open and one normally-closed, galvanically isolated
Electrical data	see page 116
Approval	UL, CSA, CCC

<b>Mechanical data</b>	
Plunger point to reference surface	8 mm
Switchpoint to reference surface	6 mm
Maximum plunger travel D, K, R, L	5.5 mm
Maximum plunger travel E	4 mm
Switching actuating force on plunger	min. 20 N
Switching frequency	max. 300/min
Approach speed	Plunger D: 40 m/min Plunger E: 30 m/min Plunger K: 10 m/min Plunger R: 60 m/min Plunger L: 120 m/min
Repeatability	Plunger D, E, K: ± 0.002 mm Plunger R, L: ± 0.01 mm



### Installation



**Note!**  
To ensure switching function, the dimension 5.0.5 is especially critical.

<b>1.1</b>
Multiple position switches series
100
62
61
72
46
40
Single Position Switches Series
F 60
99
100

<b>5.1</b>
<b>5.2</b>
<b>5.3</b>

### Multiple position switches for standard applications

- Dual-chamber system with IP 67 protection: wear-free membrane with hermetic sealing from plunger mechanism and switch chamber
- Maintenance-free, self-lubricating plunger guide with slide bearing

### Multiple position switches with wiper plate

- Increased function security under extreme conditions of use
- Wiper plate prevents plunger from sticking in the guide
- For use in wet areas with strongly adhering media

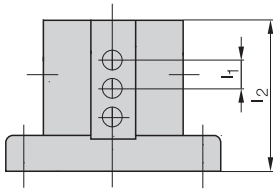
### Connection options

- Thread for cable gland M20×1.5 on side and in flange (Gaskets and plugs included)
- Connector (note permissible operating voltage for the connectors, see page 132).

### Multiple position switches with function indication

- Function indication for dual voltage range option

### Available sizes



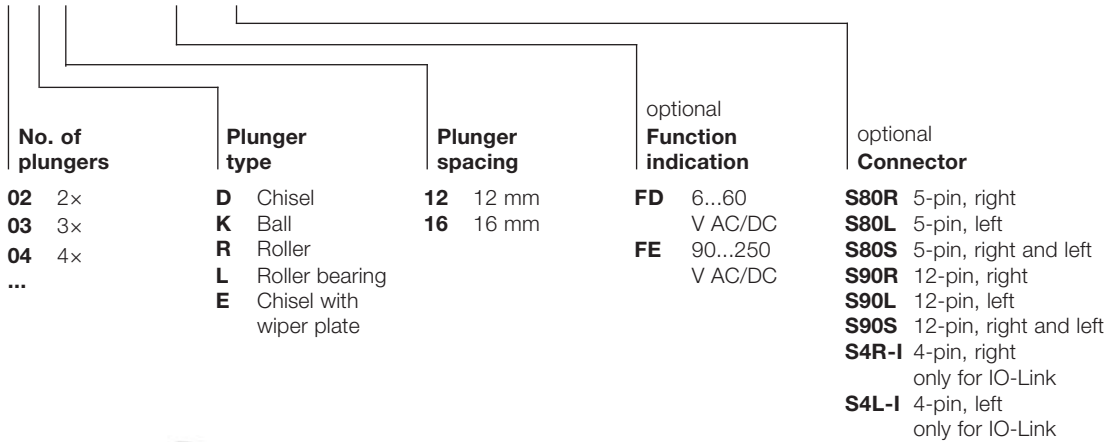
Number of plungers		2	3	4	5	6	8	10
Dimension $l_1 = 12$ mm		64	72	84	96	112	130	160
$l_2$ when $l_1 = 16$ mm		64	84	96	112	130	160	192
Number of connectors	S80 without FD/FE	1	1	2	2	2		
	S80 with FD/FE	1	2	2	3	3		
	S90 without FD/FE	1	1	1	1	1	1	1
	S90 with FD/FE	1	1	1	1	1	1	2
	S4 without FD (IO-Link)	1	1	1	1	1	1	1
S4 with FD (IO-Link)	1	1	1	1	1	1	1	

Dimensions in mm

Ordering example:

**BNS 819-D04-D12-62-10-FD-S80R**

**BNS 819-D** - - - **-62-10-** - - -







### Multiple position switches for standard applications

- Dual-chamber system with IP 67 protection: wear-free membrane with hermetic sealing from plunger mechanism and switch chamber
- Maintenance-free, self-lubricating plunger guide with slide bearing

### Multiple position switches with wiper plate

- Increased function security under extreme conditions of use
- Wiper plate prevents plunger from sticking in the guide
- For use in wet areas with strongly adhering media

### Connection options

- Thread for cable gland M20x1.5 on side and in flange (Gaskets and plugs included)
- Connector (note permissible operating voltage for the connectors, see page 132).

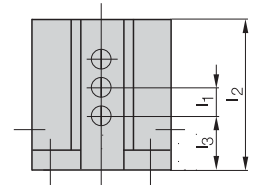
### Multiple position switches with function indication

- Function indication for dual voltage range option

### Available sizes

No. of plungers	Plunger spacing		Housing B Standard		Housing B		Housing C		Number of connectors S80 without FD/FE	Number of connectors S80 with FD/FE	Number of connectors S90 without FD/FE	Number of connectors S90 with FD/FE	Number of connectors S4 without FD (IO-Link)	Number of connectors S4 with FD (IO-Link)
	Dimension l <sub>1</sub>	Dimension l <sub>2</sub>	Dimension l <sub>3</sub>	Dimension l <sub>2</sub>	Dimension l <sub>3</sub>	Dimension l <sub>2</sub>	Dimension l <sub>3</sub>							
2	12	36	12	60	30	48	24	60	30	1	1	1	1	1
3	12	48	12	60	24	60	24	60	24	1	2	1	1	1
4	12	60	12							2	2	1	1	1
5	12	72	12							2	3	1	1	1
6	12	84	12							2	3	1	1	1
2	16	48	16	60	30	60	30	60	30	1	1	1	1	1
3	16	72	16							1	2	1	1	1
4	16	84	16							2	2	1	1	1

Dimensions in mm



Ordering example:

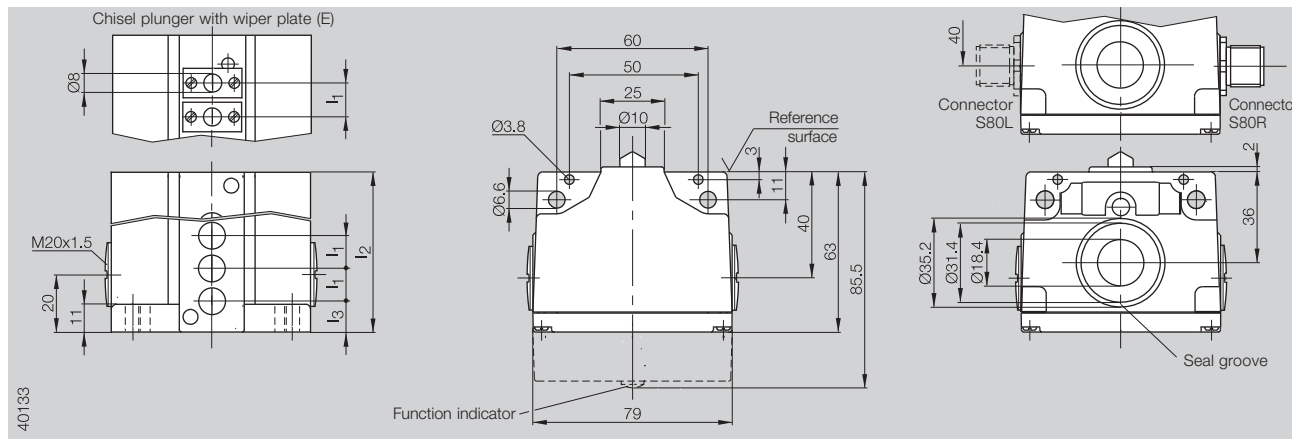
**BNS 819-B04-D12-61-12-10-FD-S80R**

**BNS 819- - -61- -10- -**

Housing style	No. of plungers	Plunger type	Plunger spacing	Distance l <sub>3</sub>	optional Function indication	optional Connector
<b>B</b> Standard 2x M20x1.5 on side	<b>02</b> 2x	<b>D</b> Chisel	<b>12</b> 12 mm	<b>12</b> 12 mm	<b>FD</b> 6...60	
	<b>03</b> 3x	<b>K</b> Ball	<b>16</b> 16 mm	<b>16</b> 16 mm	<b>FE</b> V AC/DC	
<b>B</b> 3x M20x1.5 on side and in flange	<b>04</b> 4x	<b>R</b> Roller		<b>24</b> 24 mm		
	...	<b>L</b> Roller bearing		<b>30</b> 30 mm		
<b>C</b> 2x M20x1.5 on side and cable entry in flange		<b>E</b> Chisel with wiper plate				



Type	Multiple position switch
Plunger spacing	12 mm or 16 mm



Plunger style	Chisel (D), Ball (K), Roller (R), Roller bearing (L) or Chisel with wiper plate (E)
Plunger material	Stainless steel, contact surfaces induction hardened
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	M20x1.5 for connector or cable gland
Ambient temperature range	-5...+85 °C
Degree of protection per IEC 60529	IP 67
Function indicator	LED 6...60 V AC/DC (FD) or 90...250 V AC/DC (FE)



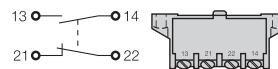
For additional information see IO-Link brochure!

With switch element

**BSE 30.0**

Ordering code **BNS 819- - -61- -10- -**

Wiring diagram, style



### Switch element

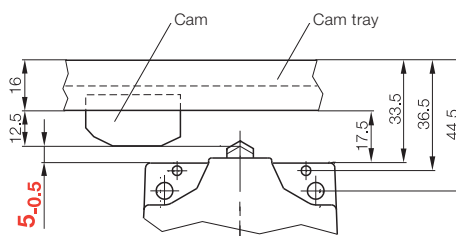
Contact material	Silver, gold plated
Switching principle	Snap switch
Contact system	Dual changeover, one normally-open and one normally-closed, galvanically isolated
Electrical data	see page 116
Approval	UL, CSA, CCC

### Mechanical data

Plunger point to reference surface	8 mm
Switchpoint to reference surface	6 mm
Maximum plunger travel D, K, R, L	5.5 mm
Maximum plunger travel E	4 mm
Switching actuating force on plunger	min. 20 N
Switching frequency	max. 300/min
Approach speed	Plunger D 40 m/min
	Plunger E 30 m/min
	Plunger K 10 m/min
	Plunger R 60 m/min
	Plunger L 120 m/min
Repeatability	Plunger D, E, K ± 0.002 mm
	Plunger R, L ± 0.01 mm



### Installation



**Note!**  
To ensure switching function, the dimension 5.0-5 is especially critical.

**1.1**

**Multiple position switches series**

- 100
- 62
- 61**
- 72
- 46
- 40
- Single Position Switches Series
- F 60
- 99
- 100

**5.1**

**5.2**

**5.3**



### Multiple position switches for standard applications

- Dual-chamber system with IP 67 protection: wear-free membrane with hermetic sealing from plunger mechanism and switch chamber
- Maintenance-free, self-lubricating plunger guide with slide bearing

### Multiple position switches with wiper plate

- Increased function security under extreme conditions of use
- Wiper plate prevents plunger from sticking in the guide
- For use in wet areas with strongly adhering media

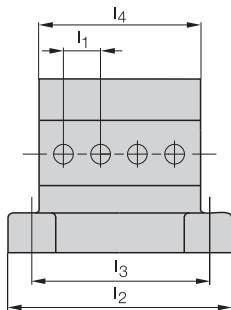
### Connection options

- Thread for cable gland M25×1.5 on side and in flange (Gaskets and plugs included)
- Connector (note permissible operating voltage for the connectors, see page 132).

### Multiple position switches with function indication

- Function indication for dual voltage range option

### Available sizes



Number of plungers		2	3	4	5	6	8	10
Dimension $l_2$ when $l_1 = 12$ mm		84	84	100	116	132	164	180
Dimension $l_3$ when $l_1 = 12$ mm		66	66	82	98	114	146	162
Dimension $l_4$ when $l_1 = 12$ mm		54	54	68	84	100	132	148
Dimension $l_2$ when $l_1 = 16$ mm		84	100	116	132	148	180	212
Dimension $l_3$ when $l_1 = 16$ mm		66	82	98	114	130	162	194
Dimension $l_4$ when $l_1 = 16$ mm		54	68	84	100	116	148	180
Number of connectors	S80 without FD/FE	1	1	2	2	2		
	S80 with FD/FE	1	2	2	3	3		
	S90 without FD/FE	1	1	1	1	1	1	2
	S90 with FD/FE	1	1	1	1	1	2	2

Dimensions in mm

Ordering example:

**BNS 819-B04-D12-72-10-FD-S80R**

**BNS 819-B - - -72-10- - -**

**No. of plungers**

**02** 2×  
**03** 3×  
**04** 4×  
...

**Plunger style**

**D** Chisel  
**K** Ball  
**R** Roller  
**L** Roller bearing  
**E** Chisel with wiper plate

**Plunger spacing**

**12** 12 mm  
**16** 16 mm

optional  
**Function indication**

**FD** 6...60  
V AC/DC  
**FE** 90...250  
V AC/DC

optional  
**Connector**

**S80R** 5-pin, right  
**S80L** 5-pin, left  
**S80S** 5-pin, right and left  
**S90R** 12-pin, right  
**S90L** 12-pin, left  
**S90S** 12-pin, right and left

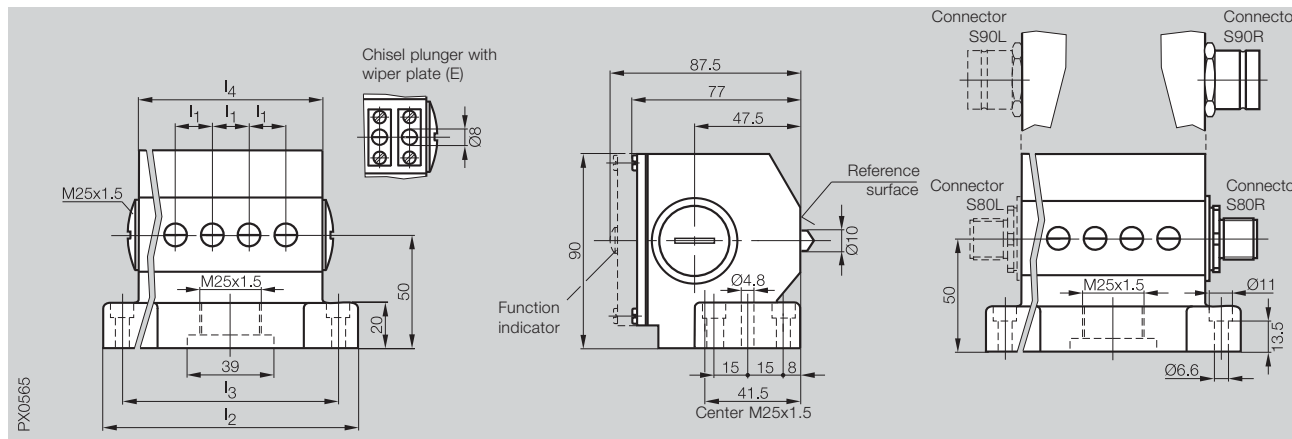


**Not for new applications.  
Still available for replacements.**

# Mechanical Multiple Position Switches

Series 72

Type	Multiple position switch
Plunger spacing	12 mm or 16 mm



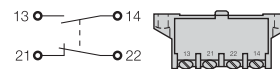
Plunger style	Chisel (D), Ball (K), Roller (R), Roller bearing (L) or Chisel with wiper plate (E)
Plunger material	Stainless steel, contact surfaces induction hardened
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	M25x1.5 for connector or cable gland
Ambient temperature range	-5...+85 °C
Degree of protection per IEC 60529	IP 67
Function indicator	LED 6...60 V AC/DC (FD) or 90...250 V AC/DC (FE)

With switch element

**BSE 30.0**

Ordering code **BNS 819-B - -72-10- - - - -**

Wiring diagram, style



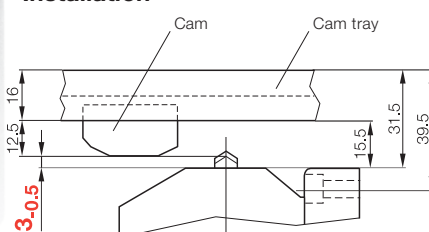
### Switch element

Contact material	Silver, gold plated
Switching principle	Snap switch
Contact system	Dual changeover, one normally-open and one normally-closed, galvanically isolated
Electrical data	see page 116
Approval	UL, CSA, CCC

### Mechanical data

Plunger point to reference surface	6 mm
Switchpoint to reference surface	4 mm
Maximum plunger travel D, K, R, L	5.5 mm
Maximum plunger travel E	4 mm
Switching actuating force on plunger	min. 20 N
Switching frequency	max. 300/min
Approach speed	Plunger D 40 m/min
	Plunger E 30 m/min
	Plunger K 10 m/min
	Plunger R 60 m/min
	Plunger L 120 m/min
Repeatability	Plunger D, E, K ± 0.002 mm
	Plunger R, L ± 0.01 mm

### Installation



**Note!**  
To ensure switching function, the dimension 3-0.5 is especially critical.



**1.1**

Multiple position switches series

- 100
- 62
- 61
- 72
- 46
- 40

Single Position Switches Series

- F 60
- 99
- 100

**5.1**

**5.2**

**5.3**





### Multiple position switches for standard applications

- Smallest plunger spacing for mechanical multiple position switches (8 mm or 10 mm)
- Dual-chamber system with IP 67 protection: wear-free membrane with hermetic sealing from plunger mechanism and switch chamber
- Maintenance-free, self-lubricating plunger guide with slide bearing

### Multiple position switches with wiper plate

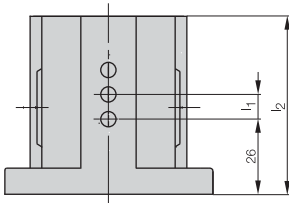
- Increased function security under extreme conditions of use
- Wiper plate prevents plunger from sticking in the guide
- For use in wet areas with strongly adhering media

### Connection options

- Thread for cable gland M16×1.5 on side and in flange (Scope of delivery: Seals and cover screws)
- Connector (note permissible operating voltage for the connectors, see page 132).

### Switching elements for low-current applications

Snap switch elements BSE 73.1 or BSE 74.1 have specially formed gold contacts making them suitable for low currents  $\geq 10$  mA.



### Available sizes

Number of plungers	2	3	4	5	6	8	10
Dimension $l_1 = 8$ mm	49	59	64	72	80	96	112
Dimension $l_2$ when $l_1 = 10$ mm	49	59	72	80	89	112	129
Number of connectors							
S80 without FC	1	1	2	2	2		
S80 with FC	1	2	2	3	3		
S4 without FC (IO-Link)	1	1	1	1	1	1	1
S4 with FC (IO-Link)	1	1	1	1	1	1	1

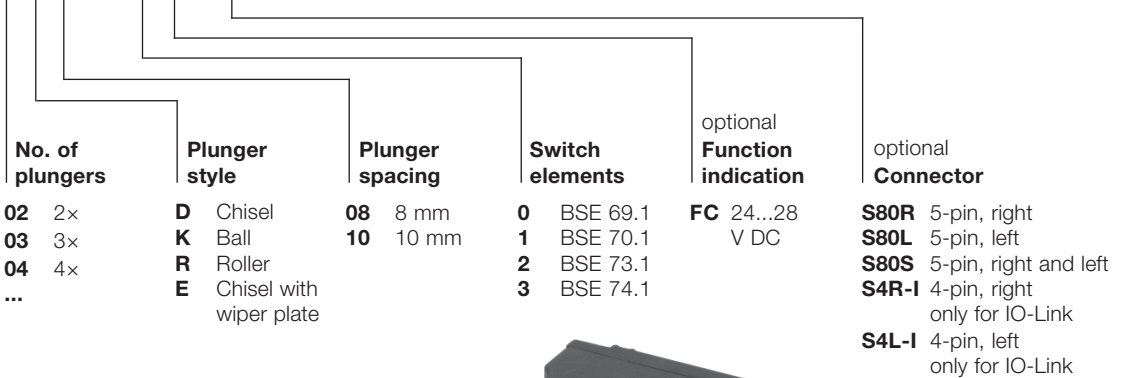
Dimensions in mm

Size 12× with 8 mm spacing on request.

Ordering example:

**BNS 819-B04-D08-46-11-FC-S80R**

**BNS 819-B - - -46-1 - - -**

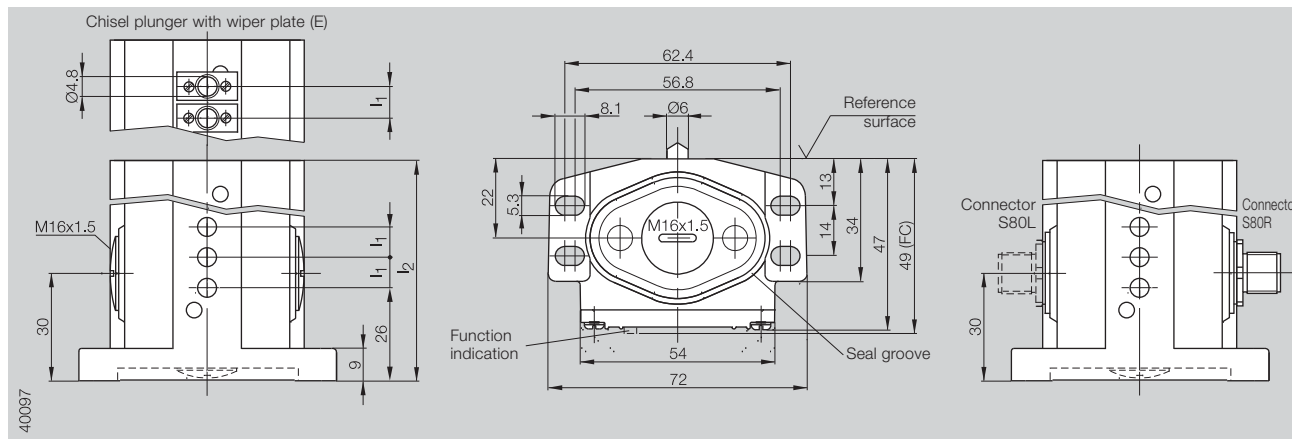


Only with BSE 69.1 or BSE 73.1.





Type	Multiple position switch
Plunger spacing	8 mm or 10 mm



Plunger style	Chisel (D), Ball (K), Roller (R) or Chisel with wiper plate (E)
Plunger material	Stainless steel, contact surfaces induction hardened
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	M16x1.5 for cable gland or connector
Ambient temperature range	-5...+85 °C
Degree of protection per IEC 60529	IP 67
Function indicator	LED 24...28 V DC (FC)

With switch element	<b>BSE 69.1</b>	<b>BSE 73.1</b>	<b>BSE 70.1</b>	<b>BSE 74.1</b>
Ordering code	BNS 819-...-46-10	BNS 819-...-46-12	BNS 819-...-46-11	BNS 819-...-46-13
Wiring diagram, style				

### Switch element

Contact material	Silver	Gold	Silver	Gold
Switching principle	Snap switch		Snap switch	
Contact system	Single-pole changeover		Single-pole changeover	
Connection type	Solder connection		Screw terminal	
Electrical data	see page 117		see page 117	
Approval	UL, CSA, CCC		UL, CSA, CCC	

### Mechanical data

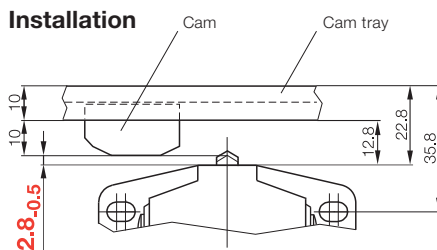
Plunger point to reference surface	4 mm	4 mm
Switchpoint to reference surface	3.5 mm	3.5 mm
Maximum plunger travel	3.5 mm	3.5 mm
Switching actuating force on plunger	min. 8 N	min. 8 N
Switching frequency	max. 200/min	max. 200/min
Approach speed	Plunger D: 20 m/min Plunger E: 10 m/min Plunger K: 9 m/min Plunger R: 60 m/min	Plunger D: 20 m/min Plunger E: 10 m/min Plunger K: 9 m/min Plunger R: 60 m/min
Repeatability	Plunger D, E: ±0.02 mm Plunger K: ±0.03 mm Plunger R: ±0.05 mm	Plunger D, E: ±0.02 mm Plunger K: ±0.03 mm Plunger R: ±0.05 mm



## IO-Link

For additional information see IO-Link brochure!

### Installation



**Note!**  
To ensure switching function, the dimension 2.8<sub>-0.5</sub> is especially critical.

**1.1**

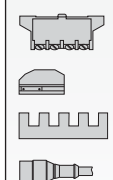
Multiple position switches series

- 100
- 62
- 61
- 72
- 46**
- 40
- Single Position Switches Series
- F 60
- 99
- 100

**5.1**

**5.2**

**5.3**



### Multiple position switches for standard applications

- Smallest plunger spacing for electromechanical multiple position switches (8 mm)
- Dual-chamber system with IP 67 protection: wear-free membrane with hermetic sealing from plunger mechanism and switch chamber
- Maintenance-free, self-lubricating plunger guide with slide bearing

### Multiple position switches with wiper plate

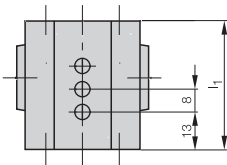
- Increased function security under extreme conditions of use
- Wiper plate prevents plunger from sticking in the guide
- For use in wet areas with strongly adhering media

### Connection options

- Thread for cable gland M16×1.5 on side (Scope of delivery: Seals and cover screws)
- Connector (note permissible operating voltage for the connectors, see page 132).

### Switching elements for low-current applications

Snap switch elements BSE 73.1 or BSE 74.1 have specially formed gold contacts making them suitable for low currents  $\geq 10$  mA.



### Available sizes

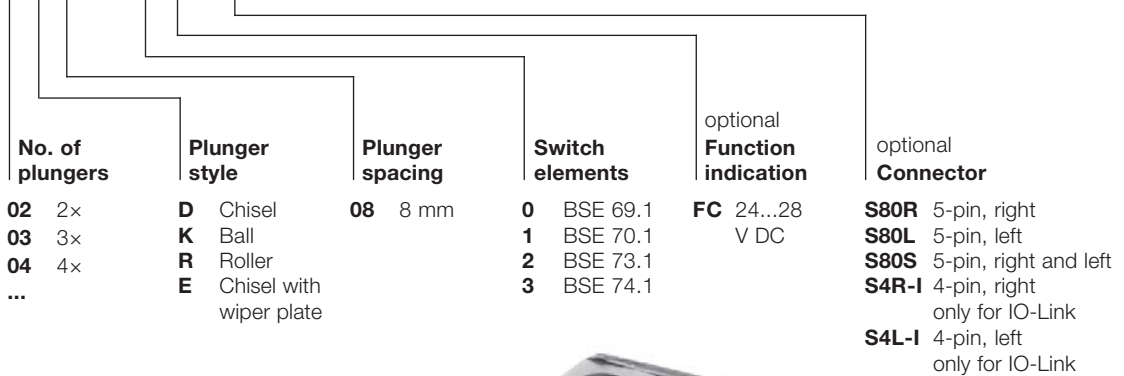
Number of plungers	2	3	4	5	6
Dimension I <sub>1</sub>	34	42	50	58	66
Number of S80 without FC connectors	1	1	2	2	2
S80 with FC	1	2	2		
S4 without FC (IO-Link)	1	1	1	1	1
S4 with FC (IO-Link)	1	1	1	1	1

Dimensions in mm

Ordering example:

**BNS 819-B04-D08-40-10-FC-S80R**

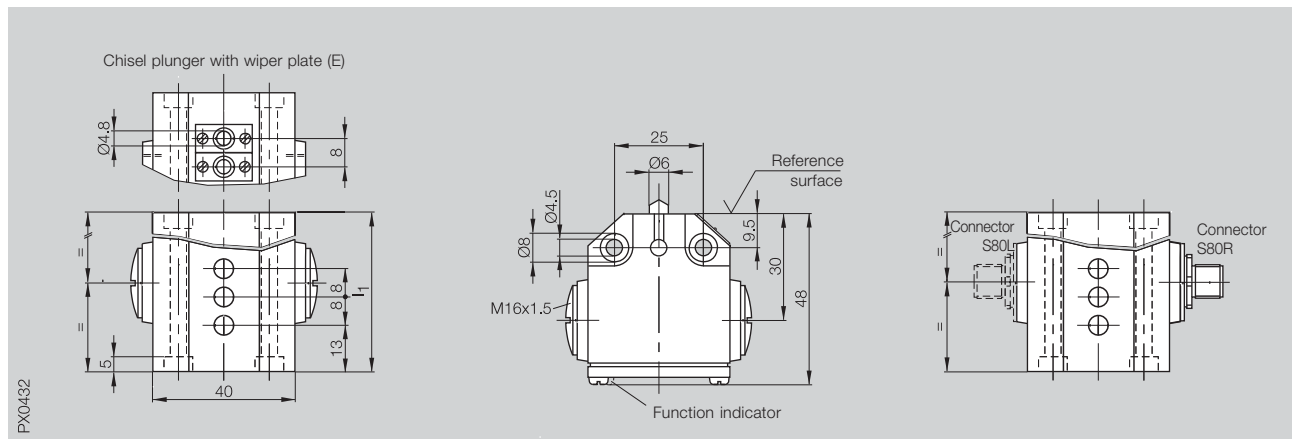
**BNS 819-B - - -40-1 - - -**



Only with BSE 69.1 or BSE 73.1.



Type	Multiple position switch
Plunger spacing	8 mm



Plunger style	Chisel (D), Ball (K), Roller (R) or Chisel with wiper plate (E)
Plunger material	Stainless steel, contact surfaces induction hardened
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	M16x1.5 for cable gland or connector
Ambient temperature range	-5...+85 °C
Degree of protection per IEC 60529	IP 67
Function indicator	LED 24...28 V DC (FC)

With switch element	<b>BSE 69.1</b>	<b>BSE 73.1</b>	<b>BSE 70.1</b>	<b>BSE 74.1</b>
Ordering code	BNS 819-...-40-10	BNS 819-...-40-12	BNS 819-...-40-11	BNS 819-...-40-13
Wiring diagram, style				

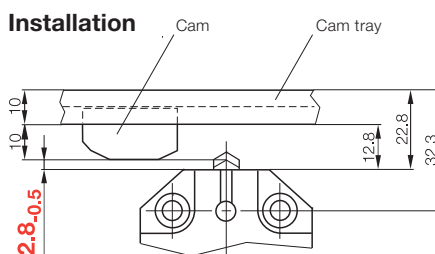
Switch element	Silver	Gold	Silver	Gold
Contact material	Silver	Gold	Silver	Gold
Switching principle	Snap switch		Snap switch	
Contact system	Single-pole changeover		Single-pole changeover	
Connection type	Solder connection		Screw terminal	
Electrical data	see page 117		see page 117	
Approval	UL, CSA, CCC		UL, CSA, CCC	

Mechanical data			
Plunger point to reference surface		4 mm	4 mm
Switchpoint to reference surface		3.5 mm	3.5 mm
Maximum plunger travel		3.5 mm	3.5 mm
Switching actuating force on plunger		min. 8 N	min. 8 N
Switching frequency		max. 200/min	max. 200/min
Approach speed	Plunger D	20 m/min	20 m/min
	Plunger E	10 m/min	10 m/min
	Plunger K	9 m/min	9 m/min
	Plunger R	60 m/min	60 m/min
Repeatability	Plunger D, E	± 0.02 mm	± 0.02 mm
	Plunger K	± 0.03 mm	± 0.03 mm
	Plunger R	± 0.05 mm	± 0.05 mm



**IO-Link**

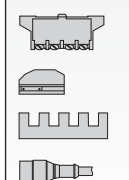
For additional information see IO-Link brochure!



**Note!**  
To ensure switching function, the dimension 2.8-0.5 is especially critical.

**1.1**  
Multiple position switches series  
100  
62  
61  
72  
46  
**40**  
Single Position Switches Series  
F 60  
99  
100

**5.1**  
**5.2**  
**5.3**



## Single position switches per DIN 43693 for standard applications

- Dual-chamber system with IP 67 protection: wear-free membrane with hermetic sealing from plunger mechanism and switch chamber
- Maintenance-free, self-lubricating plunger guide with slide bearing
- Plunger can be rotated in two approach directions

## Single position switch with wiper plate

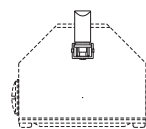
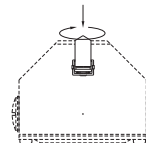
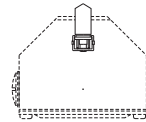
- Increased function security under extreme conditions of use
- Wiper plate prevents plunger from sticking in the guide
- For use in wet areas with strongly adhering media

## Connection options

- Thread for cable gland M16×1.5 (Scope of delivery: Seals and cover screws)
- Connector (note permissible operating voltage for the connectors, see page 132).

## Approach from two directions possible (parallel and diagonally)

Press plunger down and turn to desired direction; release plunger.



## Single position switch with function indicator

- Function indication for dual voltage range option

Ordering example:

**BNS 819-FD-60-101-FE-S80R**

**BNS 819-F** -60-101- - -

### Plunger style

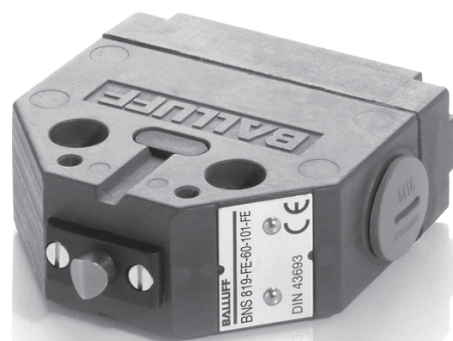
- D** Chisel
- K** Ball
- R** Roller
- L** Roller bearing
- E** Chisel with wiper plate

### optional Function indication

- FD** 6...60 V AC/DC
- FE** 90...250 V AC/DC

### optional Connector

- S80R** 5-pin, right
- S80L** 5-pin, left





### Single position switches for standard applications

- Dual-chamber system with IP 67 protection: wear-free membrane with hermetic sealing from plunger mechanism and switch chamber
- Maintenance-free, self-lubricating plunger guide with slide bearing
- Plunger can be rotated in two approach directions

### Single position switch with wiper plate

- Increased function security under extreme conditions of use
- Wiper plate prevents plunger from sticking in the guide
- For use in wet areas with strongly adhering media

### Switching elements for low-current applications

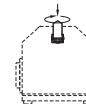
Snap switch elements BSE 73.1 or BSE 74.1 have specially formed gold contacts making them suitable for low currents  $\geq 10$  mA.

### Connection variants

- Thread for cable gland M12x1.5 for series 99, Thread for cable gland M16x1.5 for series 100
- Connector (note permissible operating voltage for the connectors, see page 132).

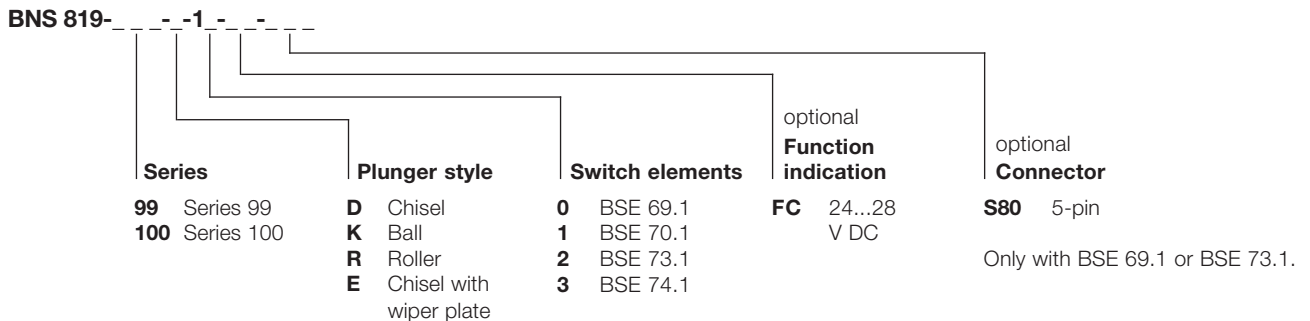
### Approach from two directions possible (parallel and diagonally)

Press plunger down and turn to desired direction; release plunger.



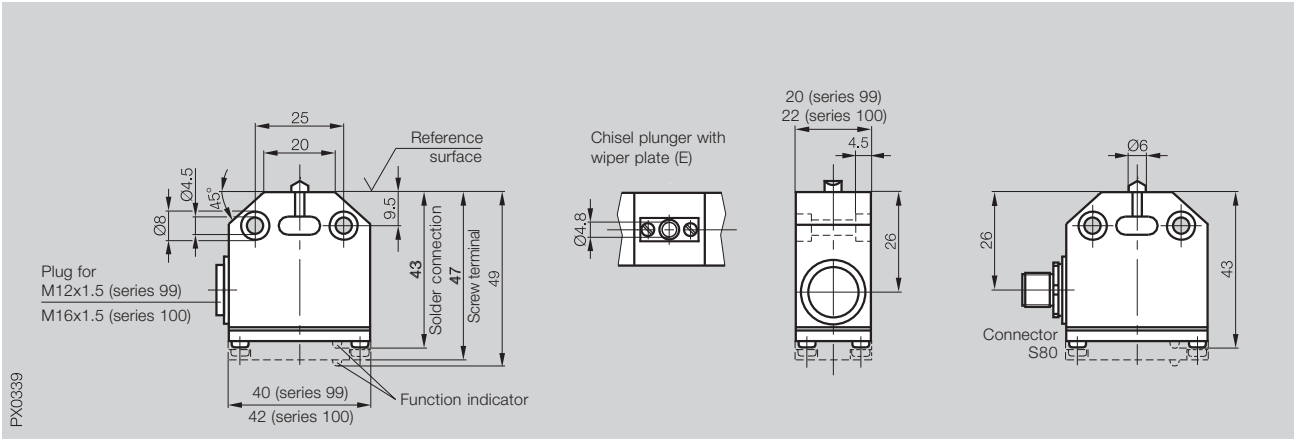
Ordering example:

**BNS 819-100-E-12-FC-S80**





Type	Single position switch



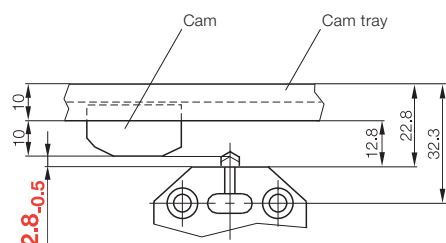
Plunger style	Chisel (D), Ball (K), Roller (R) or Chisel with wiper plate (E)
Plunger material	Stainless steel, contact surfaces induction hardened
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	Cable gland (M12x1.5 series 99, M16x1.5 series 100) or connector
Ambient temperature range	-5...+85 °C
Degree of protection per IEC 60529	IP 67
Function indicator	LED 24...28 V DC (FC)

With switch element	<b>BSE 69.1</b>	<b>BSE 73.1</b>	<b>BSE 70.1</b>	<b>BSE 74.1</b>
Ordering code	BNS 819-99/100-_-10	BNS 819-99/100-_-12	BNS 819-99/100-_-11	BNS 819-99/100-_-13
Wiring diagram, style				

<b>Switch element</b>				
Contact material	Silver	Gold	Silver	Gold
Switching principle	Snap switch		Snap switch	
Contact system	Single-pole changeover		Single-pole changeover	
Connection type	Solder connection		Screw terminal	
Electrical data	see page 117		see page 117	
Approval	UL, CSA, CCC		UL, CSA, CCC	

<b>Mechanical data</b>				
Plunger point to reference surface	4 mm		4 mm	
Switchpoint to reference surface	3.5 mm		3.5 mm	
Maximum plunger travel	3.5 mm		3.5 mm	
Switching actuating force on plunger	min. 8 N		min. 8 N	
Switching frequency	max. 200/min		max. 200/min	
Approach speed	Plunger D	20 m/min	Plunger D	20 m/min
	Plunger E	10 m/min	Plunger E	10 m/min
	Plunger K	9 m/min	Plunger K	9 m/min
	Plunger R	60 m/min	Plunger R	60 m/min
Repeatability	Plunger D, E	± 0.02 mm	Plunger D, E	± 0.02 mm
	Plunger K	± 0.03 mm	Plunger K	± 0.03 mm
	Plunger R	± 0.05 mm	Plunger R	± 0.05 mm

## Installation



**Note!**  
To ensure switching function, the dimension 2.8-0.5 is especially critical.

**1.1**

Multiple position switches series

100  
62  
61  
72  
46  
40

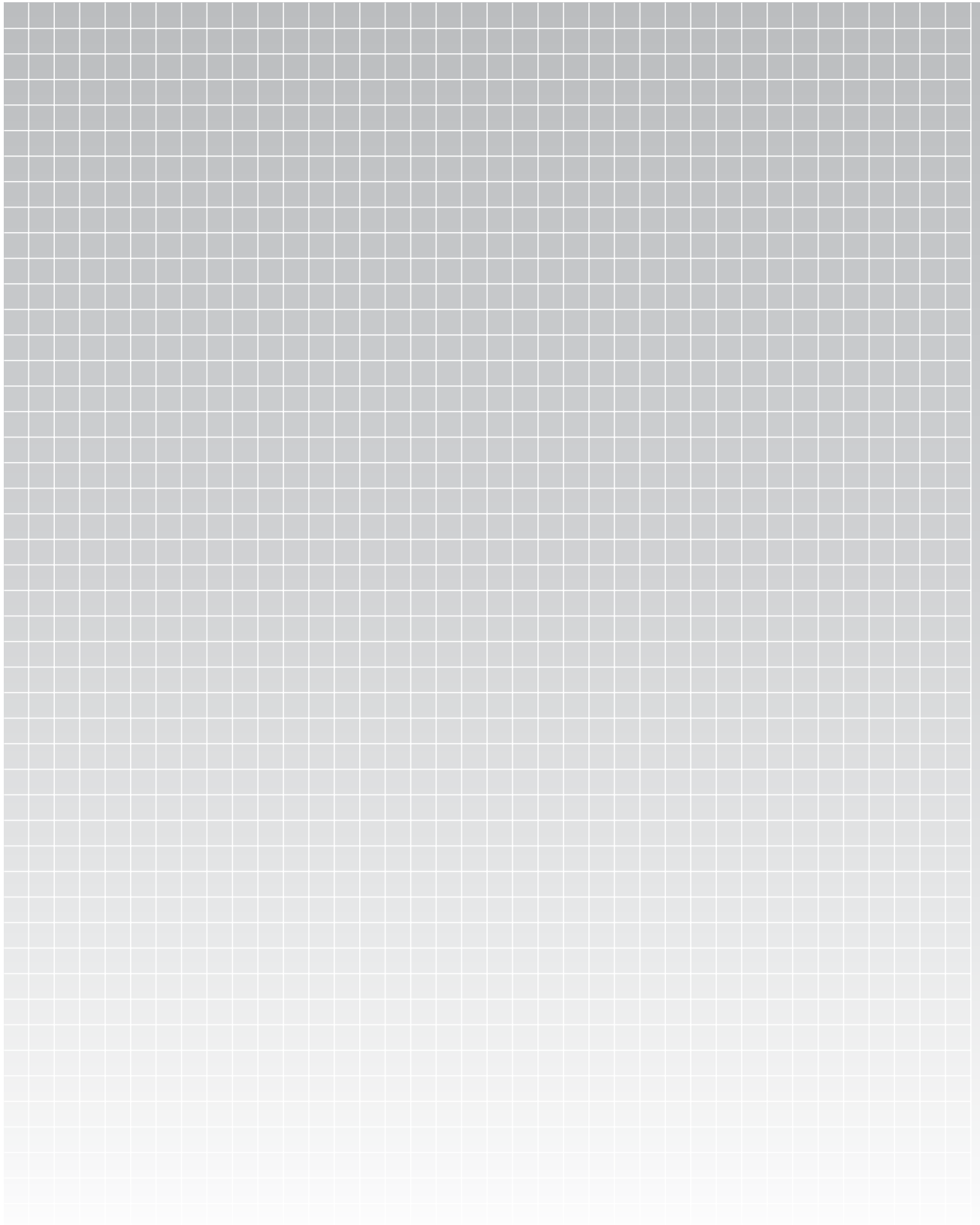
Single position switches series

F 60  
99  
100

**5.1**

**5.2**

**5.3**



# DIN EN 60204-1 VDE 0113



## Mechanical multiple position switches with safety switch positions

48	Series 100 per DIN 43697
50	Series 62
52	Series 61
54	Series 72

## Mechanical single position switches with safety switch position

56	Series F 60 per DIN 43693
----	------------------------------

## 1.2

Multiple position switches series
100
62
61
72

Single position switches series
F 60

### more added value

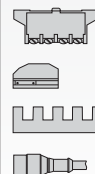
- Long service life
- Positive-opening contacts for increased security



## 5.1

## 5.2

## 5.3



**Multiple position switches per DIN 43697 with safety switch positions per DIN EN 60204-1/VDE 0113**

- Positive-opening contacts and rigid plungers for additional security per DIN EN 60204-1/VDE 0113
- Dual-chamber system with IP 67 protection: wear-free membrane with hermetic sealing from plunger mechanism and switch chamber

- Maintenance-free, self-lubricating plunger guide with slide bearing

**Multiple position switches with function indicator**

- Function indication for selectable three voltage ranges

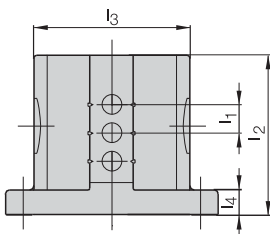
**Multiple position switches with wiper plate**

- Increased function security under extreme conditions of use
- Wiper plate prevents plunger from sticking in the guide
- For use in wet areas with strongly adhering media

**Connection options**

- Thread for cable gland M25x1.5 on side and in flange (Gaskets and plugs included)
- Connector (note permissible operating voltage for the connectors, see page 132).

**Available sizes**



Number of plungers		2	3	4	5	6	8	10	12
Dimension $l_1 = 12$ mm	Dimension $l_3$	70	80	90	105	120	140	170	200
$l_2$ when	Dimension $l_3$	88	88	88	88	88	80	80	80
	Dimension $l_4$	14	14	14	14	14	20	20	20
	Dimension $l_1 = 16$ mm	70	90	105	120	140	170	200	240
	Dimension $l_3$	88	88	88	88	80	80	80	80
	Dimension $l_4$	14	14	14	14	20	20	20	20
Number of connectors*	S80 without FD/FE	1	1	2	2	2			
	S80 with FD/FE	1	2	2	3	3			
	S90 without FD/FE	1	1	1	1	1	1	1	2
	S90 with FD/FE	1	1	1	1	1	1	2	2

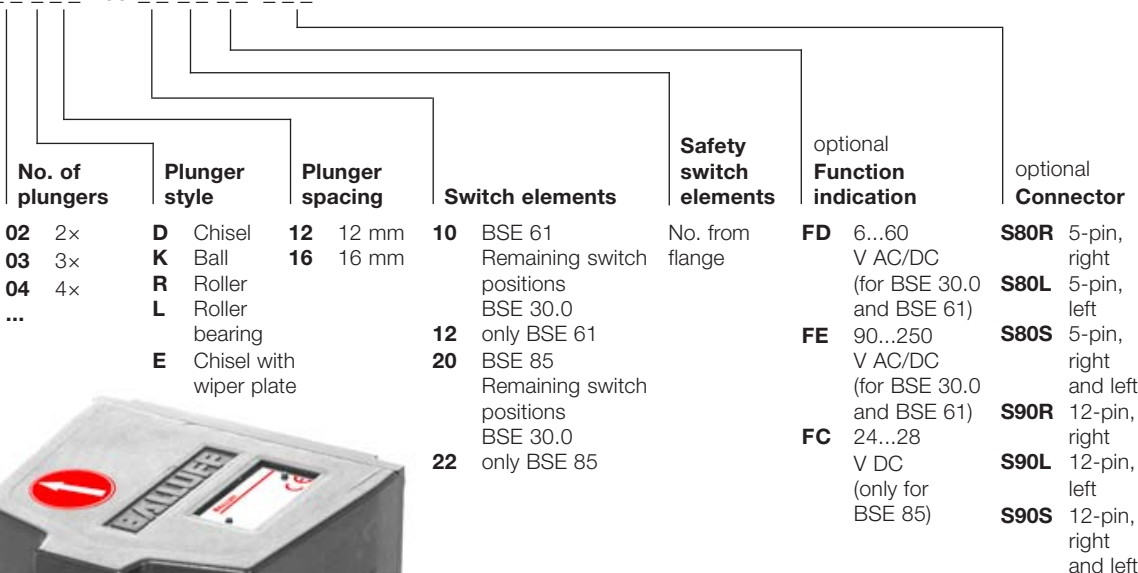
Dimensions in mm

\*Number of connectors BSE 85 on request.

Ordering example:

**BNS 813-D04-D12-100-20-03-FE-S80R**

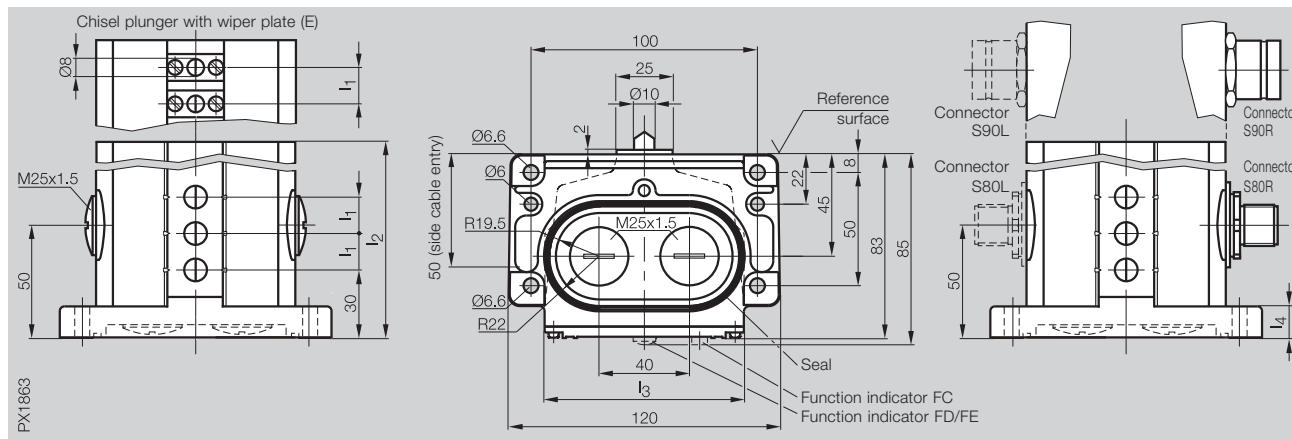
**BNS 813-D - -100-**



# Mechanical Multiple Position Switches with Safety Switch Positions

Series 100  
per DIN 43697

Type	Multiple position switch with positive-opening contacts
Plunger spacing	12 mm or 16 mm
Mounting and function dimensions	per DIN 43697



Plunger style	Chisel (D), Ball (K), Roller (R), Roller bearing (L) or Chisel with wiper plate (E)
Plunger material	Stainless steel, contact surfaces induction hardened
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	M25x1.5 for connector or cable gland
Ambient temperature range	-5...+85 °C
Degree of protection per IEC 60529	IP 67
Function indicator	LED 6...60 V AC/DC (FD), 90...250 V AC/DC (FE) or 24...28 V DC (FC)

With switch element

	BSE 61 per DIN EN 60204-1/VDE 0113	BSE 85 per DIN EN 60204-1/VDE 0113	BSE 30.0
Ordering code	BNS 813-D - -100-1 - -	BNS 813-D - -100-2 - -	BNS 813-D - -100-0 - -
Wiring diagram, style			

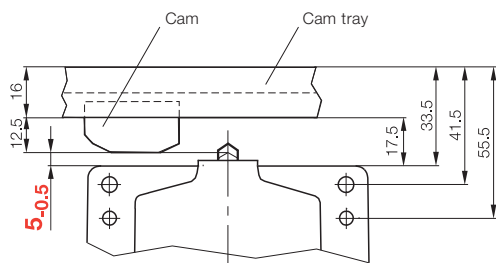
### Switch element

Contact material	Silver	Silver	Silver, gold plated
Switching principle	Creep switch, Positive-opening	Snap switch, positive opening (normally-closed)	Snap switch
Contact system	Normally-closed, double interruption	Dual-changeover: 1. NO (snap function), 2. Positive-opening (double-interruption), all galvanically isolated	dual changeover, one normally-open and one normally-closed, galvanically isolated
Electrical data	see page 116	see page 116	see page 116
Approval	CSA, CCC	cULus, CSA, CCC	UL, CSA, CCC

### Mechanical data

Plunger point to reference surface	8 mm	8 mm	8 mm
Switchpoint to reference surface	7 mm	6.5 mm	6 mm
Maximum plunger travel	4 mm	4 mm	5.5 mm
Assured opening after plunger travel	2.5 mm	2.5 mm	
Switching actuating force on plunger	min. 15 N	min. 30 N	min. 20 N
Switching frequency	max. 300/min	max. 160/min	max. 300/min
Approach speed	Plunger D: 40 m/min Plunger E: 30 m/min Plunger K: 10 m/min Plunger R: 60 m/min Plunger L: 120 m/min	Plunger D: 40 m/min Plunger E: 30 m/min Plunger K: 10 m/min Plunger R: 60 m/min Plunger L: 80 m/min	Plunger D: 40 m/min Plunger E: 30 m/min Plunger K: 10 m/min Plunger R: 60 m/min Plunger L: 120 m/min
Repeatability	Plunger D, E, K: ± 0.002 mm Plunger R, L: ± 0.01 mm	Plunger D, E, K: ± 0.02 mm Plunger R, L: ± 0.02 mm	Plunger D, E, K: ± 0.002 mm Plunger R, L: ± 0.01 mm

### Installation



**Note!**  
To ensure switching function, the dimension 5-0.5 is especially critical.

1.2

Multiple position switches series

100

62

61

72

Single position switches series

F 60

5.1

5.2

5.3



**Multiple position switches with safety switch positions per DIN EN 60204-1/VDE 0113**

- Positive-opening contacts and rigid plungers for additional security per DIN EN 60204-1/VDE 0113
- Dual-chamber system with IP 67 protection: wear-free membrane with hermetic sealing from plunger mechanism and switch chamber

- Maintenance-free, self-lubricating plunger guide with slide bearing

**Multiple position switches with function indicator**

- Function indication for selectable three voltage ranges

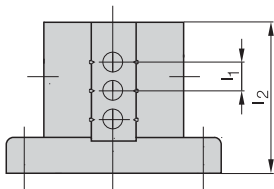
**Multiple position switches with wiper plate**

- Increased function security under extreme conditions of use
- Wiper plate prevents plunger from sticking in the guide
- For use in wet areas with strongly adhering media

**Connection options**

- Thread for cable gland M20x1.5 on side and in flange (seals and plugs included)
- Connector (note permissible operating voltage for the connectors, see page 132).

**Available sizes**



Number of plungers		2	3	4	5	6	8	10
Dimension $l_1 = 12$ mm		64	72	84	96	112	130	160
Dimension $l_2$ when $l_1 = 16$ mm		64	84	96	112	130	160	192
Number of S80 without FD/FE		1	1	2	2	2		
Connector* S80 with FD/FE		1	2	2	3	3		
S90 without FD/FE		1	1	1	1	1	1	2
S90 with FD/FE		1	1	1	1	1	2	2

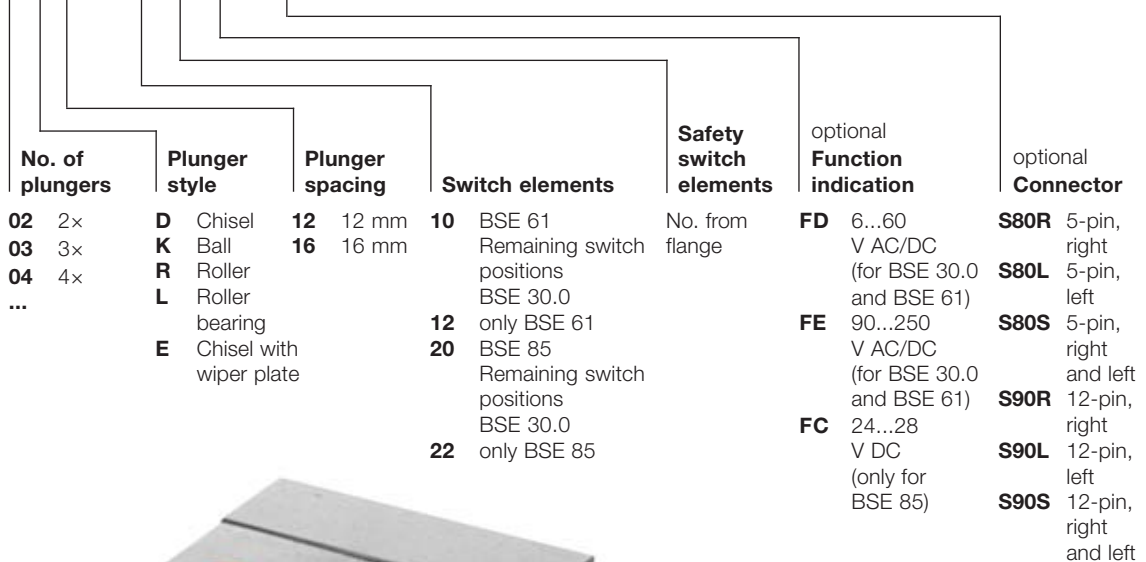
Dimensions in mm

\*Number of connectors BSE 85 on request.

Ordering example:

**BNS 813-D04-R12-62-10-02-FD-S80R**

**BNS 813-D - -62- - - -**







**Multiple position switches with safety switch positions per DIN EN 60204-1/VDE 0113**

- Positive-opening contacts and rigid plungers for additional security per DIN EN 60204-1/VDE 0113
- Dual-chamber system with IP 67 protection: wear-free membrane with hermetic sealing from plunger mechanism and switch chamber

- Maintenance-free, self-lubricating plunger guide with slide bearing

**Multiple position switches with function indicator**

- Function indication for selectable three voltage ranges

**Multiple position switches with wiper plate**

- Increased function security under extreme conditions of use
- Wiper plate prevents plunger from sticking in the guide
- For use in wet areas with strongly adhering media

**Connection options**

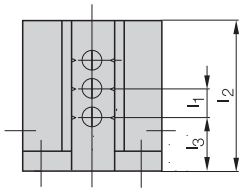
- Thread for cable gland M20×1.5 on side and in flange (seals and plugs included)
- Connector (note permissible operating voltage for the connectors, see page 132).

**Available sizes**

No. of plungers	Plunger spacing Dimension	Housing B Standard		Housing B		Housing C		Number of connectors* S80 without FD/FE	Number of connectors* S80 with FD/FE	Number of connectors* S90 without FD/FE	Number of connectors* S90 with FD/FE
		Dimension	Dimension	Dimension	Dimension						
2	12	$l_2$	$l_3$	$l_2$	$l_3$	$l_2$	$l_3$	1	1	1	1
		36	12	60	30	48	24				
3	12	48	12	60	24	60	24	1	2	1	1
4	12	60	12					2	2	1	1
5	12	72	12					2	3	1	1
6	12	84	12					2	3	1	1
2	16	48	16	60	30	60	30	1	1	1	1
3	16	72	16					1	2	1	1
4	16	84	16					2	2	1	1

Dimensions in mm

\*Number of connectors BSE 85 on request.



Ordering example:

**BNS 813-B06-K12-61-A-12-02-FE-S80R**

**BNS 813- - - -61- - - -**

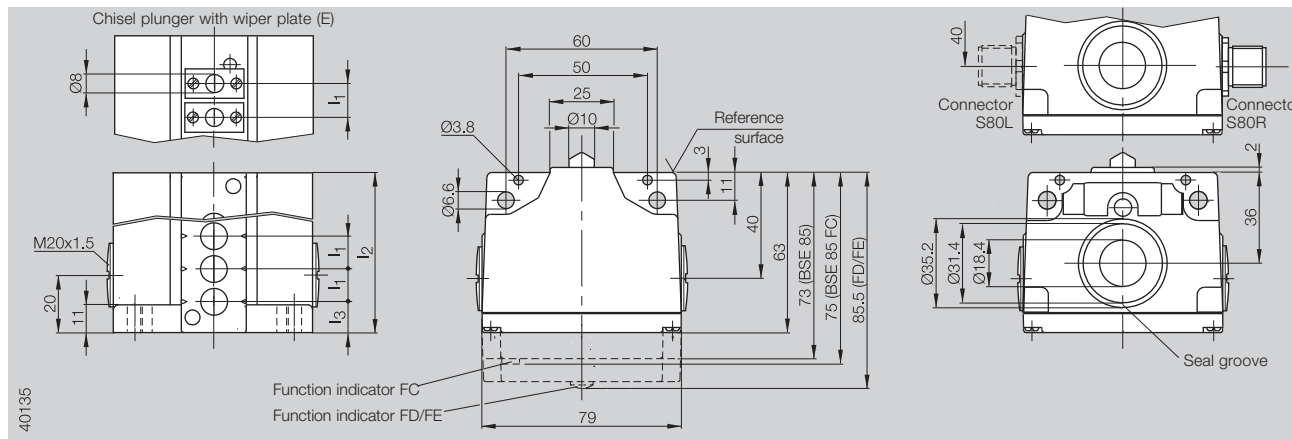
Housing style	No. of plungers	Plunger style	Plunger spacing	Distance $l_3$	Switching elements	Safety switch elements	optional Function indication	optional Connector
<b>B</b> Standard 2× M20×1.5 on side	<b>02</b> 2× <b>03</b> 3× <b>04</b> 4×	<b>D</b> Chisel <b>K</b> Ball <b>R</b> Roller <b>L</b> Roller bearing <b>E</b> Chisel with wiper plate	<b>12</b> 12 mm <b>16</b> 16 mm	<b>A</b> 12 mm <b>B</b> 16 mm <b>C</b> 24 mm <b>D</b> 30 mm	<b>10</b> BSE 61 Remaining switch positions BSE 30.0 <b>12</b> only BSE 61 <b>20</b> BSE 85 Remaining switch positions BSE 30.0 <b>22</b> only BSE 85	No. from flange	<b>FD</b> 6...60 V AC/DC (for BSE 30.0 and BSE 61) <b>FE</b> 90...250 V AC/DC (for BSE 30.0 and BSE 61) <b>FC</b> 24...28 V DC (only for BSE 85)	<b>S80R</b> 5-pin, right <b>S80L</b> 5-pin, link <b>S80S</b> 5-pin, right and left <b>S90R</b> 12-pin, right <b>S90L</b> 12-pin, left <b>S90S</b> 12-pin, right and left



# Mechanical Multiple Position Switches with Safety Switch Positions

Series 61

Type	Multiple position switch with positive-opening contacts
Plunger spacing	12 mm or 16 mm



Plunger style	Chisel (D), Ball (K), Roller (R), Roller bearing (L) or Chisel with wiper plate (E)
Plunger material	Stainless steel, contact surfaces induction hardened
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	M20x1.5 for connector or cable gland
Ambient temperature range	-5...+85 °C
Degree of protection per IEC 60529	IP 67
Function indicator	LED 6...60 V AC/DC (FD), 90...250 V AC/DC (FE) or 24...28 V DC (FC)

With switch element

	BSE 61 per DIN EN 60204-1/VDE 0113	BSE 85 per DIN EN 60204-1/VDE 0113	BSE 30.0
Ordering code	BNS 813- - -61-1 - -	BNS 813- - -61-2 - -	BNS 813- - -61-0 - -
Wiring diagram, style			

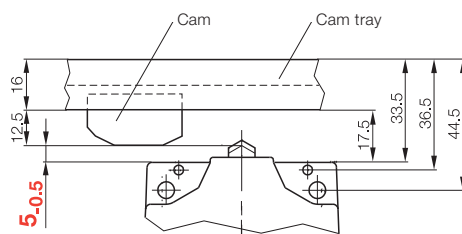
### Switch element

Contact material	Silver	Silver	Silver, gold plated
Switching principle	Creep switch, positive-opening	snap switch, positive opening (normally-closed)	Snap switch
Contact system	Normally-closed, double interruption	Dual-changeover: 1. NO (snap function), 2. Positive-opening (double-interruption), all galvanically isolated	dual changeover, one normally-open and one normally-closed, galvanically isolated
Electrical data	see page 116	see page 116	see page 116
Approval	CSA, CCC	cULus, CSA, CCC	UL, CSA, CCC

### Mechanical data

Plunger point to reference surface	8 mm	8 mm	8 mm
Switchpoint to reference surface	7 mm	6.5 mm	6 mm
Maximum plunger travel	4 mm	4 mm	5.5 mm
Assured opening after plunger travel	2.5 mm	2.5 mm	
Switching actuating force on plunger	min. 15 N	min. 30 N	min. 20 N
Switching frequency	max. 300/min	max. 160/min	max. 300/min
Approach speed	Plunger D: 40 m/min Plunger E: 30 m/min Plunger K: 10 m/min Plunger R: 60 m/min Plunger L: 120 m/min	Plunger D: 40 m/min Plunger E: 30 m/min Plunger K: 10 m/min Plunger R: 60 m/min Plunger L: 80 m/min	Plunger D: 40 m/min Plunger E: 30 m/min Plunger K: 10 m/min Plunger R: 60 m/min Plunger L: 120 m/min
Repeatability	Plunger D, E, K: ± 0.002 mm Plunger R, L: ± 0.01 mm	Plunger D, E, K: ± 0.02 mm Plunger R, L: ± 0.02 mm	Plunger D, E, K: ± 0.002 mm Plunger R, L: ± 0.01 mm

### Installation



**Note!**  
To ensure switching function, the dimension 5<sub>0.5</sub> is especially critical.

1.2

Multiple position switches series

100  
62  
61  
72

Single position switches series  
F 60

5.1

5.2

5.3



**Multiple position switches with safety switch positions per DIN EN 60204-1/VDE 0113**

- Positive-opening contacts and rigid plungers for additional security per DIN EN 60204-1/VDE 0113
- Dual-chamber system with IP 67 protection: wear-free membrane with hermetic sealing from plunger mechanism and switch chamber

- Maintenance-free, self-lubricating plunger guide with slide bearing

**Multiple position switches with function indicator**

- Function indication for selectable three voltage ranges

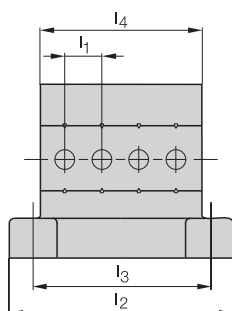
**Multiple position switches with wiper plate**

- Increased function security under extreme conditions of use
- Wiper plate prevents plunger from sticking in the guide
- For use in wet areas with strongly adhering media

**Connection options**

- Thread for cable gland M25x1.5 on side and in flange (Gaskets and plugs included)
- Connector (note permissible operating voltage for the connectors, see page 132).

**Available sizes**



Number of plungers	2	3	4	5	6	8	10
Dimension l <sub>2</sub> when l <sub>1</sub> = 12 mm	84	84	100	116	132	164	180
Dimension l <sub>3</sub> when l <sub>1</sub> = 12 mm	66	66	82	98	114	146	162
Dimension l <sub>4</sub> when l <sub>1</sub> = 12 mm	54	54	68	84	100	132	148
Dimension l <sub>2</sub> when l <sub>1</sub> = 16 mm	84	100	116	132	148	180	212
Dimension l <sub>3</sub> when l <sub>1</sub> = 16 mm	66	82	98	114	130	162	194
Dimension l <sub>4</sub> when l <sub>1</sub> = 16 mm	54	68	84	100	116	148	180
Number of Connector*	S80 without FD/FE	1	1	2	2	2	
	S80 with FD/FE	1	2	2	3	3	
	S90 without FD/FE	1	1	1	1	1	1
	S90 with FD/FE	1	1	1	1	1	2

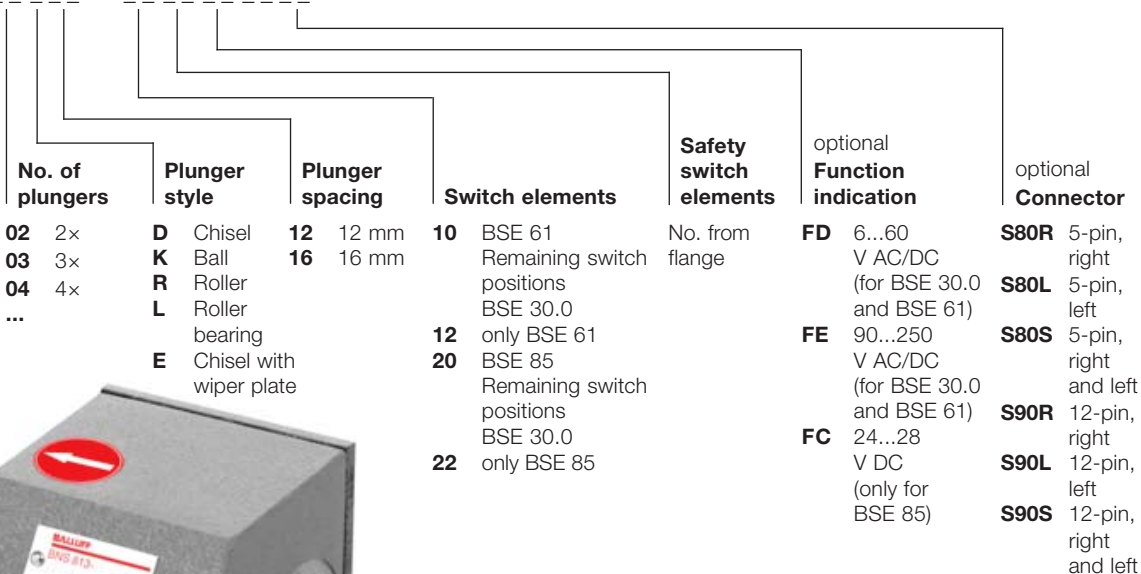
Dimensions in mm

\*Number of connectors BSE 85 on request.

Ordering example:

**BNS 813-B04-R12-72-10-01-FD-S80R**

**BNS 813-B - - -72- - - -**

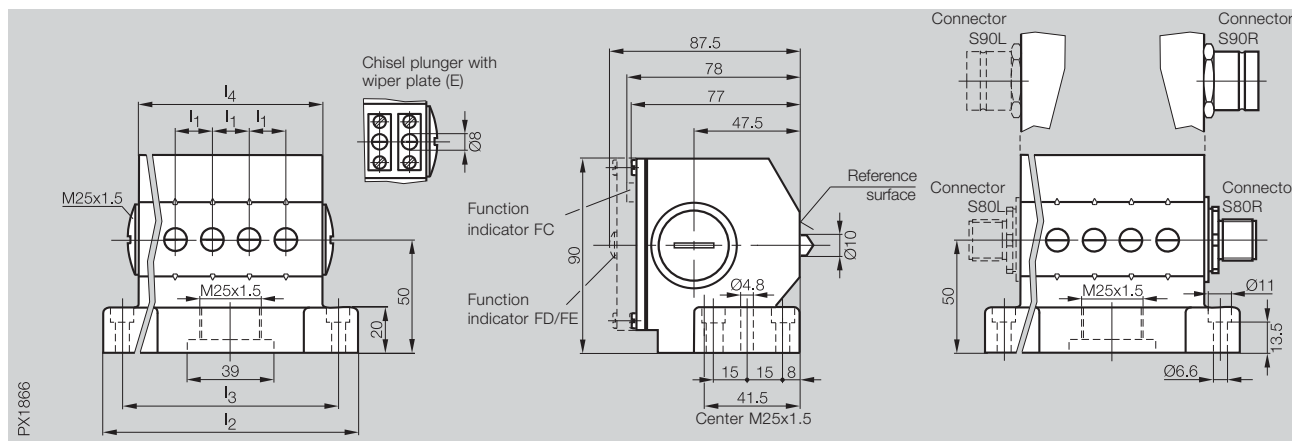


**Not for new applications.**  
**Still available for replacements.**

# Mechanical Multiple Position Switches with Safety Switch Positions

Series 72

Type	Multiple position switch with positive-opening contacts
Plunger spacing	12 mm or 16 mm



Plunger style	Chisel (D), Ball (K), Roller (R), Roller bearing (L) or Chisel with wiper plate (E)
Plunger material	Stainless steel, contact surfaces induction hardened
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	M25x1.5 for connector or cable gland
Ambient temperature range	-5...+85 °C
Degree of protection per IEC 60529	IP 67
Function indicator	LED 6...60 V AC/DC (FD), 90...250 V AC/DC (FE) or 24...28 V DC (FC)

With switch element

	BSE 61 per DIN EN 60204-1/VDE 0113	BSE 85 per DIN EN 60204-1/VDE 0113	BSE 30.0
Ordering code	BNS 813-B - -72-1 - -	BNS 813-B - -72-2 - -	BNS 813-B - -72-0 - -
Wiring diagram, style			

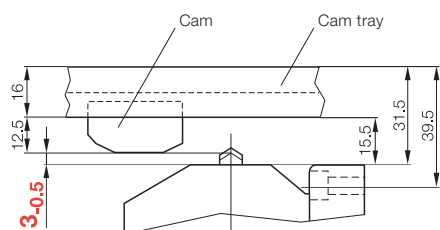
### Switch element

Contact material	Silver	Silver	Silver, gold plated
Switching principle	Creep switch, positive-opening	snap switch, positive opening (normally-closed)	Snap switch
Contact system	Normally-closed, double interruption	Dual-changeover: 1. NO (snap function), 2. Positive-opening (double-interruption), all galvanically isolated	dual changeover, one normally-open and one normally-closed, galvanically isolated
Electrical data	see page 116	see page 116	see page 116
Approval	CSA, CCC	cULus, CSA, CCC	UL, CSA, CCC

### Mechanical data

Plunger point to reference surface	6 mm	6 mm	6 mm
Switchpoint to reference surface	5 mm	4.5 mm	4 mm
Maximum plunger travel	4 mm	4 mm	5.5 mm
Assured opening after plunger travel	2.5 mm	2.5 mm	
Switching actuating force on plunger	min. 15 N	min. 30 N	min. 20 N
Switching frequency	max. 300/min	max. 160/min	max. 300/min
Approach speed	Plunger D: 40 m/min Plunger E: 30 m/min Plunger K: 10 m/min Plunger R: 60 m/min Plunger L: 120 m/min	Plunger D: 40 m/min Plunger E: 30 m/min Plunger K: 10 m/min Plunger R: 60 m/min Plunger L: 80 m/min	Plunger D: 40 m/min Plunger E: 30 m/min Plunger K: 10 m/min Plunger R: 60 m/min Plunger L: 120 m/min
Repeatability	Plunger D, E, K: ± 0.002 mm Plunger R, L: ± 0.01 mm	± 0.02 mm ± 0.02 mm	± 0.002 mm ± 0.01 mm

### Installation



**Note!**  
To ensure switching function, the dimension 3.0.5 is especially critical.

1.2

Multiple position switches series

- 100
- 62
- 61
- 72

Single position switches series  
F 60

5.1

5.2

5.3



**Single position switches per DIN 43693 with safety switch positions per DIN EN 60204-1/VDE 0113**

- Positive-opening contacts and rigid plungers for additional security per DIN EN 60204-1/VDE 0113
- Dual-chamber system with IP 67 protection: wear-free membrane with hermetic sealing from plunger mechanism and switch chamber

- Maintenance-free, self-lubricating plunger guide with slide bearing
- Plunger not rotatable, approach direction cannot be changed (see ordering code)

**Single position switch with function indicator**

- Function indication for selectable three voltage ranges

**Single position switch with wiper plate**

- Increased function security under extreme conditions of use
- Wiper plate prevents plunger from sticking in the guide
- For use in wet areas with strongly adhering media

**Connection options**

- Thread for cable gland M16x1.5 (Scope of delivery: Seals and cover screws)
- Connector (note permissible operating voltage for the connectors, see page 132).

Ordering example:

**BNS 813-FD-60-183-FD-S80R**

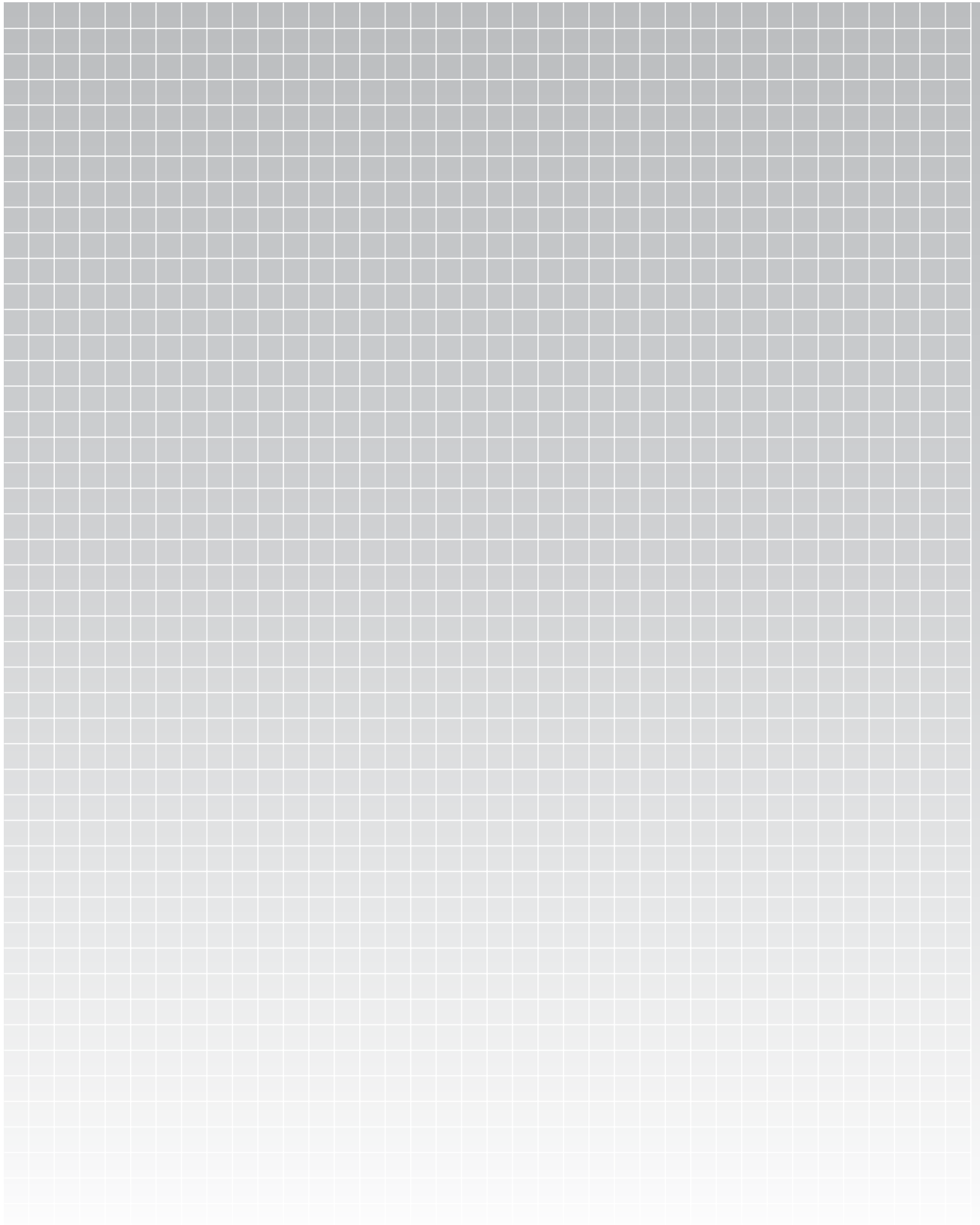
**BNS 813-F -60-18 - - -**

Plunger style	Switch elements	optional Function indication	optional Connector
<b>D</b> Chisel	<b>3</b> BSE 61 Approach direction longitudinal, parallel to mounting surface	<b>FD</b> 6...60 V AC/DC (for BSE 61)	<b>S80R</b> 5-pin, right
<b>K</b> Ball		<b>FE</b> 90...250 V AC/DC (for BSE 61)	<b>S80L</b> 5-pin, left
<b>R</b> Roller	<b>5</b> BSE 61 Approach direction lateral, 90° to mounting surface	<b>FC</b> 24...28 V DC (for BSE 85)	
<b>L</b> Roller bearing	<b>6</b> BSE 85 Approach direction longitudinal, parallel to mounting surface		
<b>E</b> Chisel with wiper plate	<b>7</b> BSE 85 Approach direction lateral, 90° to mounting surface		











## Mechanical single and multiple position switches with forced opening

60 Series 46  
62 Series 40

## Mechanical single position switches with forced opening

64 Series 99 and 100

# 1.3

Multiple position switches series

46  
40

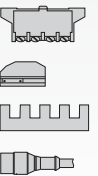
Single position switches series

99  
100

# 5.1

# 5.2

# 5.3



**more added value**

- Long service life
- Compact form factor for ease of installation



### Multiple position switches with forced opening

- Smallest plunger spacing for mechanical multiple position switches (8 mm)
- Switch element with forced opening
- Dual-chamber system with IP 67 protection: wear-free membrane with hermetic sealing from plunger mechanism and switch chamber

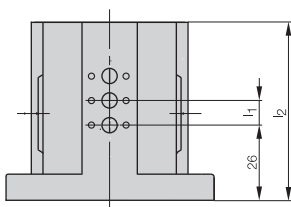
- Maintenance-free, self-lubricating plunger guide with slide bearing
- All switch positions with forced opening: Rigid plungers

### Multiple position switches with wiper plate

- Increased function security under extreme conditions of use
- Wiper plate prevents plunger from sticking in the guide
- For use in wet areas with strongly adhering media

### Connection options

- Thread for cable gland M16x1.5 on side and in flange (seals and plugs included)
- Connector (note permissible operating voltage for the connectors, see page 132).



### Available sizes

Number of plungers		2	3	4	5	6	8	10
Dimension l <sub>2</sub> when	l <sub>1</sub> = 8 mm	49	59	64	72	80	96	112
	l <sub>1</sub> = 10 mm	49	59	72	80	89	112	129
Number of connectors	S80 without FC	1	1	2	2	2	3	3
	S80 with FC	1	2	2	3	3		

Dimensions in mm

Size 12x with 8 mm spacing on request.

Ordering example:

**BNS 813-B02-D08-46-49-01-FC-S80R**

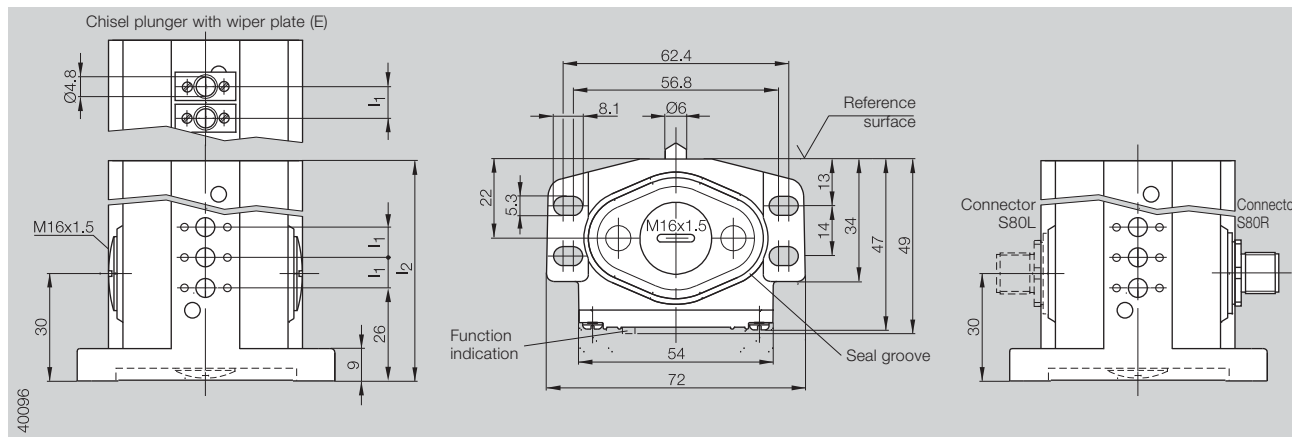
**BNS 813-B - - -46- - - -**

No. of plungers	Plunger style	Plunger spacing	Switch elements	Switch elements with forced opening	optional Function indication	optional Connector
<b>02</b> 2x	<b>D</b> Chisel	<b>08</b> 8 mm	<b>30</b> BSE 63, remaining switch positions BSE 69.1	No. from flange	<b>FC</b> 24...28 V DC	<b>S80R</b> 5-pin, right
<b>03</b> 3x	<b>K</b> Ball	<b>10</b> 10 mm	<b>32</b> BSE 63, remaining switch positions BSE 73.1			<b>S80L</b> 5-pin, left
<b>04</b> 4x	<b>R</b> Roller		<b>39</b> all BSE 63			<b>S80S</b> 5-pin, right and left
...	<b>E</b> Chisel with wiper plate		<b>41</b> BSE 64, remaining switch positions BSE 70.1			Only with BSE 69.1, BSE 73.1 or BSE 63.
			<b>43</b> BSE 64, remaining switch positions BSE 74.1			
			<b>49</b> all BSE 64			

# Mechanical Multiple Position Switches with Forced Opening

Series 46

Type	Multiple position switch with forced opening contacts
Plunger spacing	8 mm or 10 mm



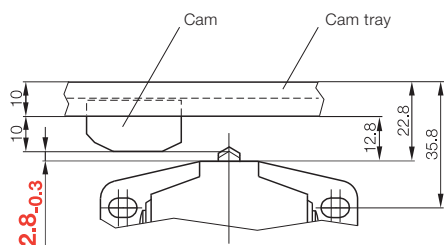
Plunger style	Chisel (D), Ball (K), Roller (R), Roller bearing (L) or Chisel with wiper plate (E)
Plunger material	Stainless steel, contact surfaces induction hardened
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	M16x1.5 for cable gland or connector
Ambient temperature range	-5...+85 °C
Degree of protection per IEC 60529	IP 67
Function indicator	LED 24...28 V DC (FC)

With switch element	<b>BSE 63</b>	<b>BSE 64</b>
Ordering code	BNS 813-...-46-3_	BNS 813-...-46-4_
Wiring diagram, style		

<b>Switch element</b>		
Contact material	Silver	Silver
Switching principle	Snap switch	Snap switch
Contact system	Single-pole change-over, NO with snap function, NC with forced opening	Single-pole change-over, NO with snap function, NC with forced opening
Connection type	Solder connection	Screw terminal
Electrical data	see page 117	see page 117
Approvals	UL, CSA, CCC	UL, CSA, CCC

<b>Mechanical data</b>		
Plunger point to reference surface	4 mm	4 mm
Switchpoint to reference surface	3.5 mm	3.5 mm
Maximum plunger travel	2.1 mm	2.1 mm
Assured separation after plunger travel	1 mm	1 mm
Switching actuating force on plunger	min. 8 N	min. 8 N
Switching frequency	max. 200/min	max. 200/min
Approach speed	Plunger D: 20 m/min Plunger E: 10 m/min Plunger K: 9 m/min Plunger R: 60 m/min	20 m/min 10 m/min 9 m/min 60 m/min
Repeatability	Plunger D, E: ±0.02 mm Plunger K: ±0.03 mm Plunger R: ±0.05 mm	±0.02 mm ±0.03 mm ±0.05 mm

## Installation



**Note!**  
To ensure switching function, the dimension 2.8<sub>-0.3</sub> is especially critical.

1.3

Multiple position switches series 46  
40  
Single position switches series 99  
100

5.1

5.2

5.3



### Multiple position switches with forced opening

- Smallest plunger spacing for mechanical multiple position switches (8 mm)
- Switch element with forced opening
- Dual-chamber system with IP 67 protection: wear-free membrane with hermetic sealing from plunger mechanism and switch chamber

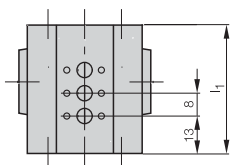
- Maintenance-free, self-lubricating plunger guide with slide bearing
- All switch positions with forced opening: Rigid plungers

### Multiple position switches with wiper plate

- Increased function security under extreme conditions of use
- Wiper plate prevents plunger from sticking in the guide
- For use in wet areas with strongly adhering media

### Connection options

- Thread for cable gland M16x1.5 on side (Scope of delivery: Seals and cover screws)
- Connector (note permissible operating voltage for the connectors, see page 132).



### Available sizes

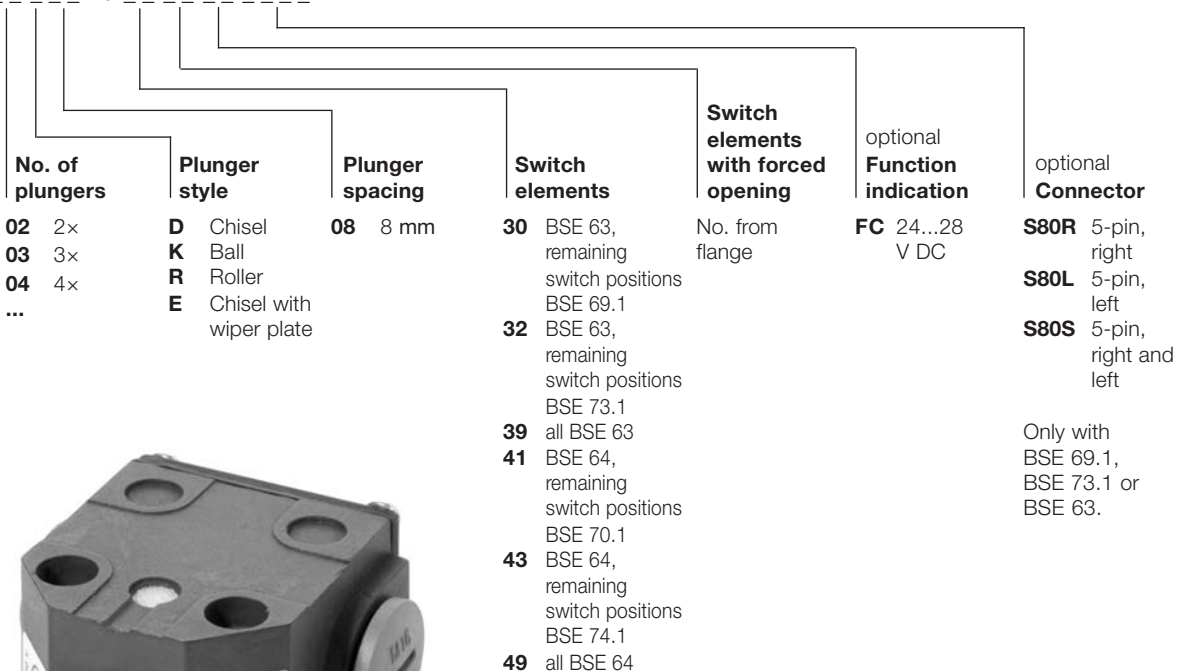
No. of plungers	2	3	4	5	6
Dimension I <sub>1</sub>	34	42	50	58	66
S80 without FC	1	1	2	2	2
S80 with FC	1	2	2		

Dimensions in mm

Ordering example:

**BNS 813-B04-D08-40-49-01-FC-S80R**

**BNS 813-B - - -40- - - -**

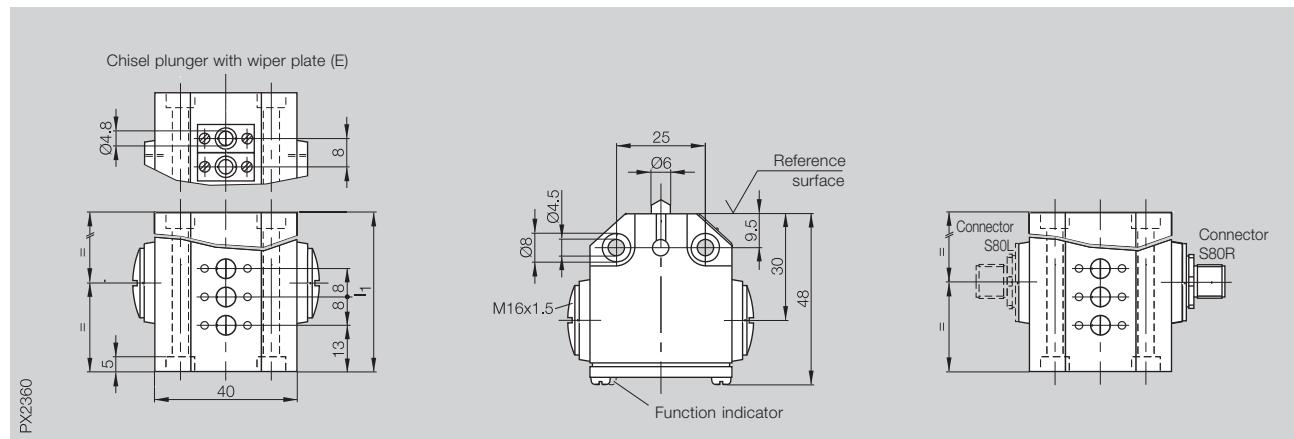




# Mechanical Multiple Position Switches with Forced Opening

Series 40

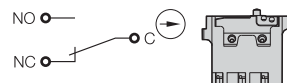
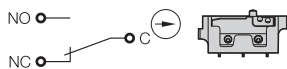
Type	Multiple position switch with forced opening contacts
Plunger spacing	8 mm



Plunger style	Chisel (D), Ball (K), Roller (R), Roller bearing (L) or Chisel with wiper plate (E)
Plunger material	Stainless steel, contact surfaces induction hardened
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	M16x1.5 for cable gland or connector
Ambient temperature range	-5...+85 °C
Degree of protection per IEC 60529	IP 67
Function indicator	LED 24...28 V DC (FC)

With switch element  
Ordering code  
Wiring diagram, style

<b>BSE 63</b>	<b>BSE 64</b>
BNS 813-...-40-3_	BNS 813-...-40-4_



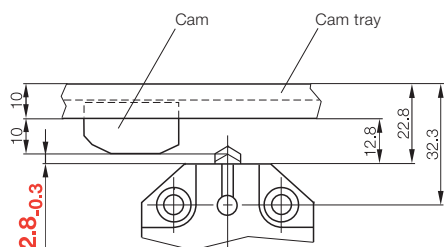
### Switch element

Contact material	Silver	Silver
Switching principle	Snap switch	Snap switch
Contact system	Single-pole change-over, NO with snap function, NC with forced opening	Single-pole change-over, NO with snap function, NC with forced opening
Connection type	Solder connection	Screw terminal
Electrical data	see page 117	see page 117
Approval	UL, CSA, CCC	UL, CSA, CCC

### Mechanical data

Plunger point to reference surface	4 mm	4 mm
Switchpoint to reference surface	3.5 mm	3.5 mm
Maximum plunger travel	2.1 mm	2.1 mm
Assured separation after plunger travel	1 mm	1 mm
Switching actuating force on plunger	min. 8 N	min. 8 N
Switching frequency	max. 200/min	max. 200/min
Approach speed	Plunger D: 20 m/min Plunger E: 10 m/min Plunger K: 9 m/min plunger R: 60 m/min	20 m/min 10 m/min 9 m/min 60 m/min
Repeatability	Plunger D, E: ±0.02 mm Plunger K: ±0.03 mm Plunger R: ±0.05 mm	±0.02 mm ±0.03 mm ±0.05 mm

### Installation



**Note!**  
To ensure switching function, the dimension 2.8<sub>-0.3</sub> is especially critical.

1.3

Multiple position switches series

46  
40

Single position switches series

99  
100

5.1

5.2

5.3



### Single position switches with forced opening

- Switch element with forced opening
- Dual-chamber system with IP 67 protection: wear-free membrane with hermetic sealing from plunger mechanism and switch chamber
- Maintenance-free, self-lubricating plunger guide with slide bearing
- Switch position with forced opening: Rigid plunger
- Plunger not rotatable, approach direction cannot be changed (see ordering code)

### Single position switch with wiper plate

- Increased function security under extreme conditions of use
- Wiper plate prevents plunger from sticking in the guide
- For use in wet areas with strongly adhering media

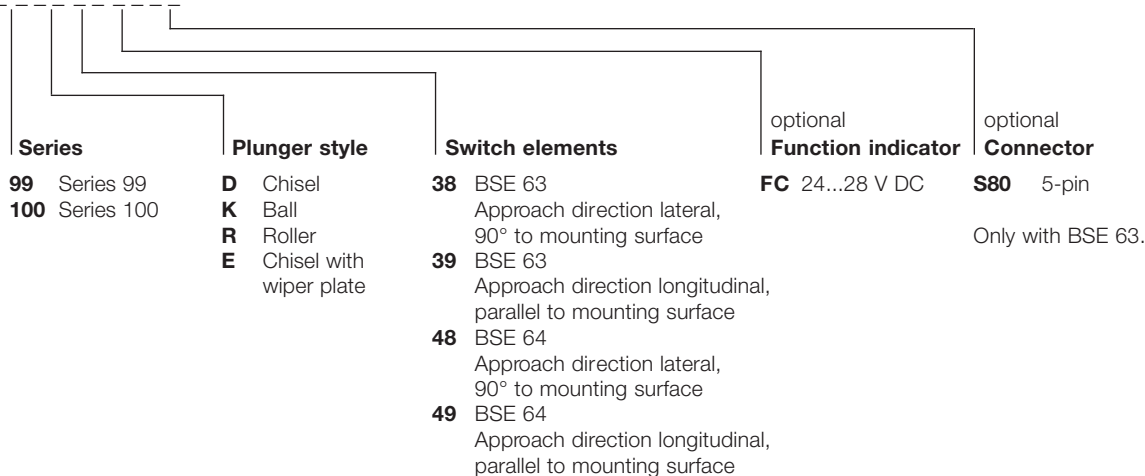
### Connection options

- Thread for cable gland M12×1.5 for Series 99, Thread for cable gland M16×1.5 for Series 100
- Connector (note permissible operating voltage for the connectors, see page 132).

Ordering example:

**BNS 813-100-E-49-FC-S80**

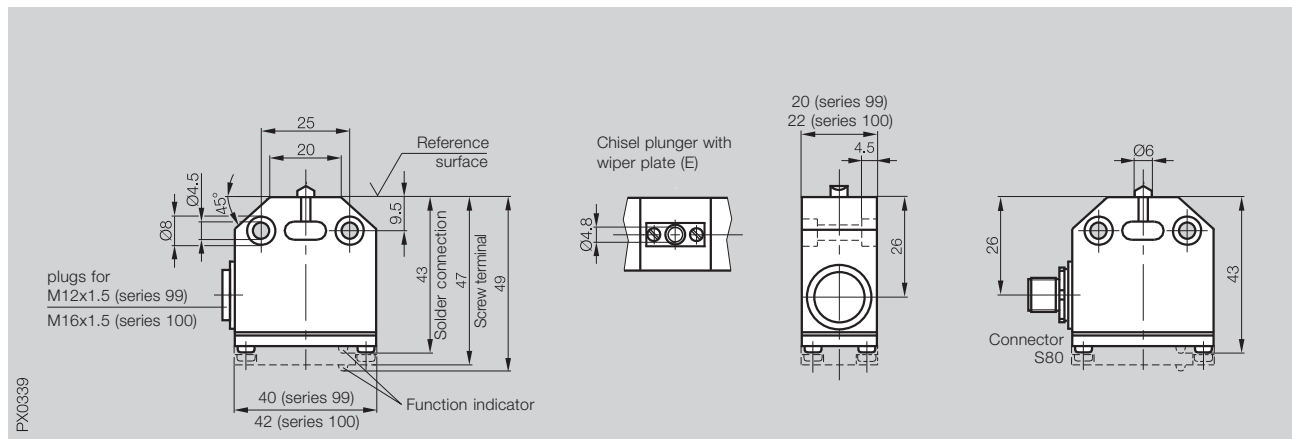
**BNL 813**



# Mechanical Single Position Switches with Forced Opening

Series 99 and 100

Type	Single position switch with forced opening contacts



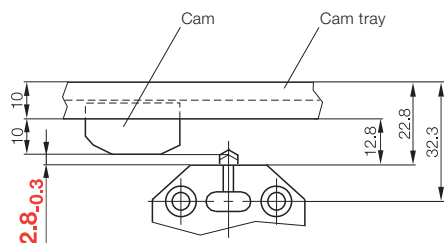
Plunger style	Chisel (D), Ball (K), Roller (R), Roller bearing (L) or Chisel with wiper plate (E)
Plunger material	Stainless steel, contact surfaces induction hardened
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	Cable gland (M12x1.5 series 99, M16x1.5 series 100) or connector
Ambient temperature range	-5...+85 °C
Degree of protection per IEC 60529	IP 67
Function indicator	LED 24...28 V DC (FC)

With switch element	<b>BSE 63</b>	<b>BSE 64</b>
Ordering code	BNS 813-99/100- -3 - - -	BNS 813-99/100- -4 - - -
Wiring diagram, style		

<b>Switch element</b>		
Contact material	Silver	Silver
Switching principle	Snap switch	Snap switch
Contact system	Single-pole change-over, NO with snap function, NC with forced opening	Single-pole change-over, NO with snap function, NC with forced opening
Connection type	Solder connection	Screw terminal
Electrical data	see page 117	see page 117
Approval	UL, CSA, CCC	UL, CSA, CCC

<b>Mechanical data</b>		
Plunger point to reference surface	4 mm	4 mm
Switchpoint to reference surface	3.5 mm	3.5 mm
Maximum plunger travel	2.1 mm	2.1 mm
Assured separation after plunger travel	1 mm	1 mm
Switching actuating force on plunger	min. 8 N	min. 8 N
Switching frequency	max. 200/min	max. 200/min
Approach speed	Plunger D: 20 m/min Plunger E: 10 m/min Plunger K: 9 m/min Plunger R: 60 m/min	20 m/min 10 m/min 9 m/min 60 m/min
Repeatability	Plunger D, E: ±0.02 mm Plunger K: ±0.03 mm Plunger R: ±0.05 mm	±0.02 mm ±0.03 mm ±0.05 mm

## Installation



**Note!**  
To ensure switching function, the dimension 2.8<sub>-0.3</sub> is especially critical.

1.3

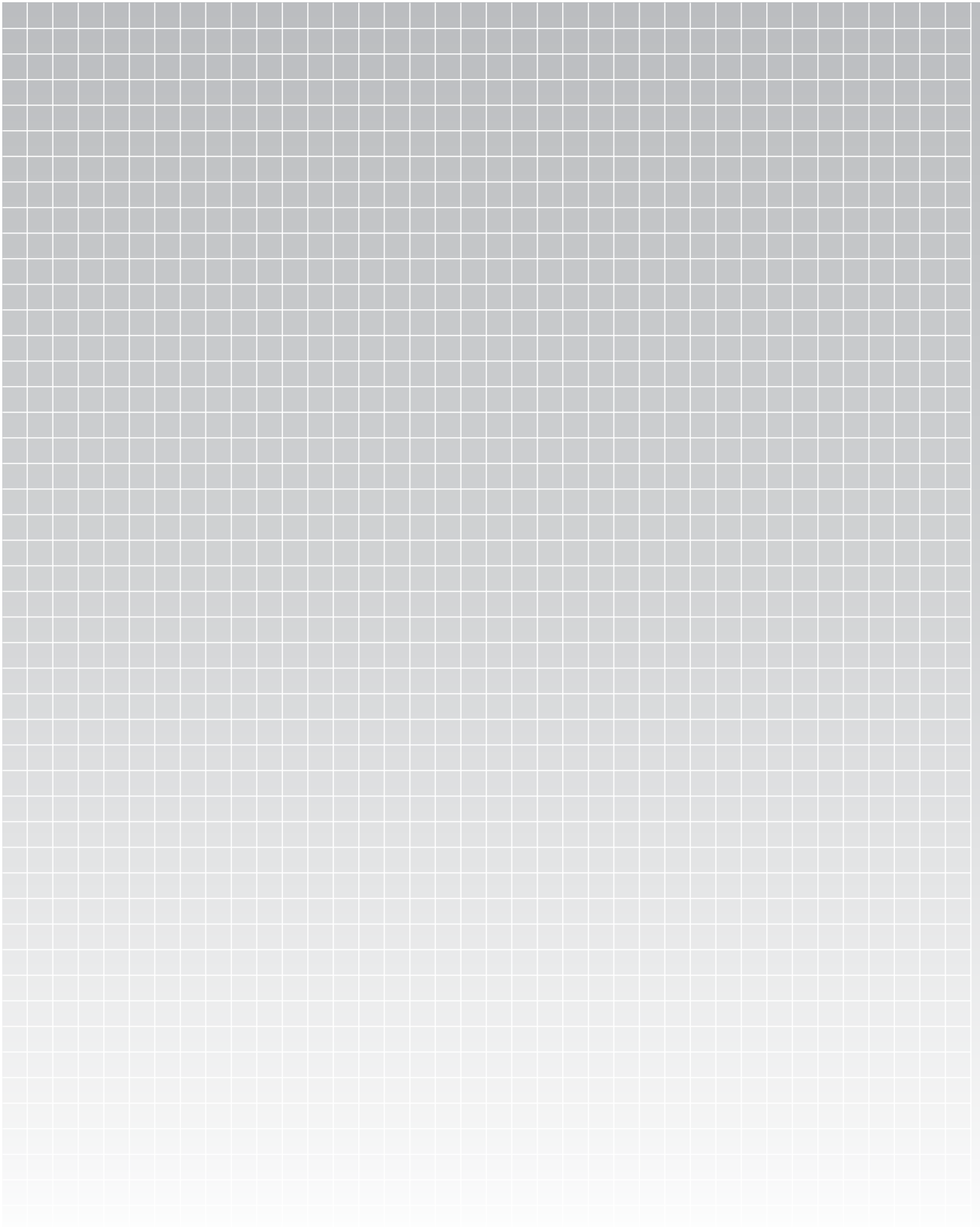
Multiple position switches series 46 40  
Single position switches series 99 100

5.1

5.2

5.3





**Mechanical  
multiple position  
switches with  
quick-change  
plunger unit**

68	Series 100 per DIN 43697
70	Series 100 per DIN EN 60204-1/ VDE 0113
72	Series 61
74	Series 61 per DIN EN 60204-1/ VDE 0113
76	Quick-change block for series 100
77	Quick-change block for series 61

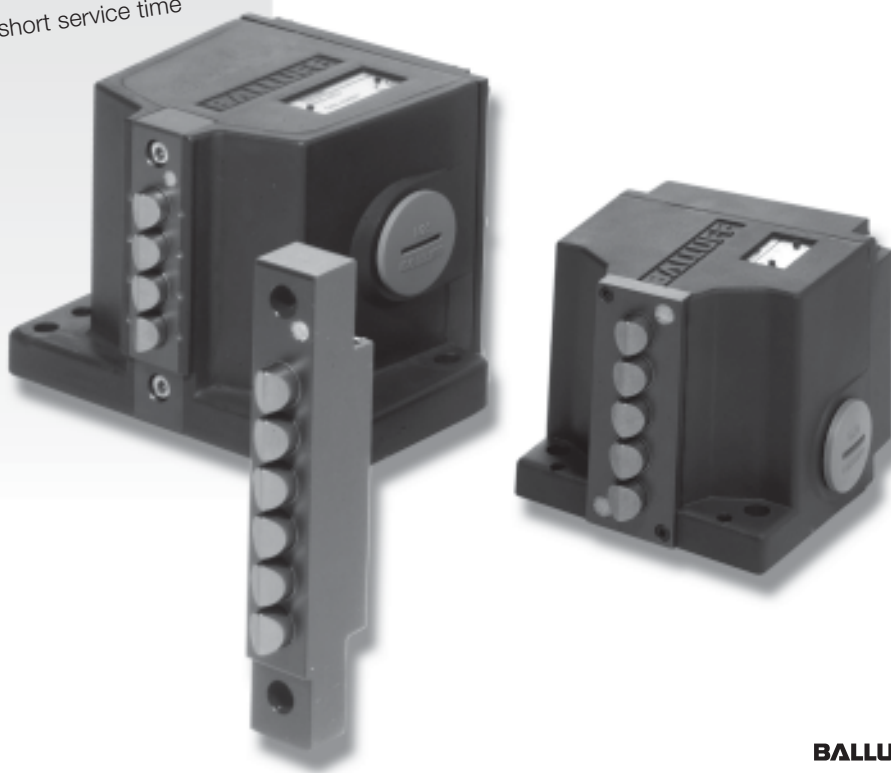
**1.4**

Multiple  
position  
switches  
series  
100  
61

Quick-  
change block  
for series  
100  
61

**more added value**

- For the most extreme applications
- Long service life
- Quick-change plunger unit for short service time



**5.1**

**5.2**

**5.3**



## Multiple position switches per DIN 43697 for standard applications with quick-change plunger unit

- Dual-chamber system with IP 67 protection: wear-free membrane with hermetic sealing from plunger mechanism and switch chamber
- Maintenance-free, self-lubricating plunger guide with slide bearing

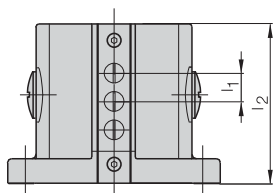
## Connection options

- Thread for cable gland M25×1.5 on side and in flange (Gaskets and plugs included)
- Connector (note permissible operating voltage for the connectors, see page 132).

## Multiple position switches with function indication

- Function indication for dual voltage range option

## Available sizes



No. of plungers	2	3	4	5	6
Dimension $l_1 = 12$ mm	70	80	90	105	120
$l_2$ when $l_1 = 16$ mm	70	90	105	120	
Number of S80 without FD/FE	1	1	2	2	2
Connector S80 with FD/FE	1	2	2	3	3
S90 without FD/FE	1	1	1	1	1
S90 with FD/FE	1	1	1	1	1
S4 without FD (IO-Link)	1	1	1	1	1
S4 with FD (IO-Link)	1	1	1	1	1

Dimensions in mm

Ordering example:

**BNS 829-D02-D16-100-10-FE-S80R**

**BNS 829-D - -100-10-**

**No. of plungers**

**02** 2×  
...  
**06** 6×

**Plunger style**

**D** Chisel  
**K** Ball  
**R** Roller  
**L** Roller bearing

**Plunger spacing**

**12** 12 mm  
**16** 16 mm

**optional Function indicator**

**FD** 6...60  
V AC/DC  
**FE** 90...250  
V AC/DC

**optional Connector**

**S80R** 5-pin, right  
**S80L** 5-pin, left  
**S80S** 5-pin, right and left  
**S90R** 12-pin, right  
**S90L** 12-pin, left  
**S90S** 12-pin, right and left  
**S4R-I** 4-pin, right only for IO-Link  
**S4L-I** 4-pin, left only for IO-Link

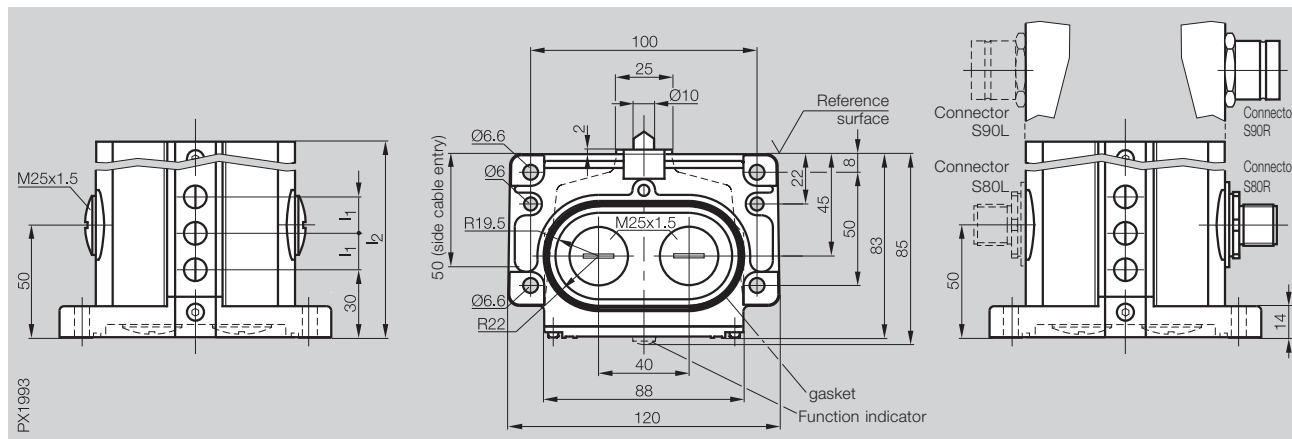




# Mechanical Multiple Position Switches with Quick-Change Plunger Unit

Series 100  
per DIN 43697

Type	Multiple position switch
Plunger spacing	12 mm or 16 mm
Mounting and function dimensions	per DIN 43697



Plunger style	Chisel (D), Ball (K), Roller (R) or Roller Bearing (L)
Plunger material	Stainless steel, contact surfaces induction hardened
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	M25x1.5 for connector or cable gland
Ambient temperature range	-5...+85 °C
Degree of protection per IEC 60529	IP 67
Function indicator	LED 6...60 V AC/DC (FD) or 90...250 V AC/DC (FE)



**IO-Link**

For additional information  
see IO-Link brochure!

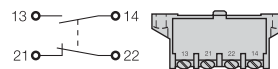
With switch element

Ordering code

Wiring diagram, style

**BSE 30.0**

BNS 829-D - -100-10- -



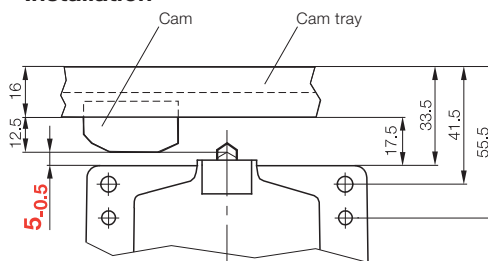
### Switch element

Contact material	Silver, gold plated
Switching principle	Snap switch
Contact system	Dual changeover, one normally-open and one normally-closed, galvanically isolated
Electrical data	see page 116
Approval	UL, CSA, CCC

### Mechanical data

Plunger point to reference surface	8 mm
Switchpoint to reference surface	6 mm
Maximum plunger travel	5.5 mm
Switching actuating force on plunger	min. 20 N
Switching frequency	max. 300/min
Approach speed	Plunger D: 40 m/min Plunger K: 10 m/min Plunger R: 60 m/min Plunger L: 120 m/min
Repeatability	Plunger D, K: ± 0.002 mm Plunger R, L: ± 0.01 mm

### Installation



**Note!**  
To ensure switching function, the dimension 5.0.5 is especially critical.

**1.4**

Multiple position switches series

100

61

Quick-change block for series

100

61

**5.1**

**5.2**

**5.3**



**Multiple position switches per DIN 43697 with safety switch positions per DIN EN 60240-1/VDE 0113 and quick-change plunger unit**

- Forced-opening contacts and rigid plungers for additional security per DIN EN 60204-1/VDE 0113

- Dual-chamber system with IP 67 protection: wear-free membrane with hermetic sealing from plunger mechanism and switch chamber
- Maintenance-free, self-lubricating plunger guide with slide bearing

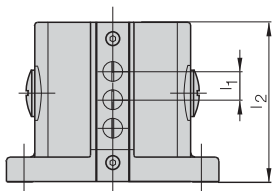
**Connection options**

- Thread for cable gland M25×1.5 on side and in flange (Gaskets and plugs included)
- Connector (note permissible operating voltage for the connectors, see page 132).

**Multiple position switches with function indication**

- Function indication for selectable three voltage ranges

**Available sizes**



No. of plungers	2	3	4	5	6
Dimension $l_1 = 12$ mm	70	80	90	105	120
$l_2$ when $l_1 = 16$ mm	70	90	105	120	
Number of S80 without FD/FE	1	1	2	2	2
Connector* S80 with FD/FE	1	2	2	3	3
S90 without FD/FE	1	1	1	1	1
S90 with FD/FE	1	1	1	1	1

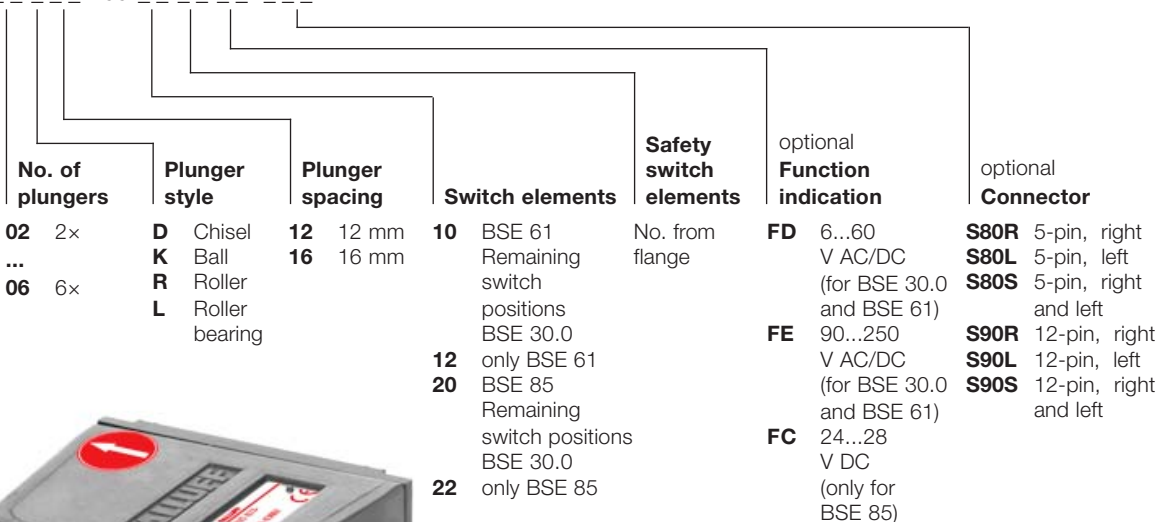
Dimensions in mm

\*Number of connectors with BSE 85 on request.

Ordering example:

**BNS 823-D02-D12-100-20-03-FE-S80R**

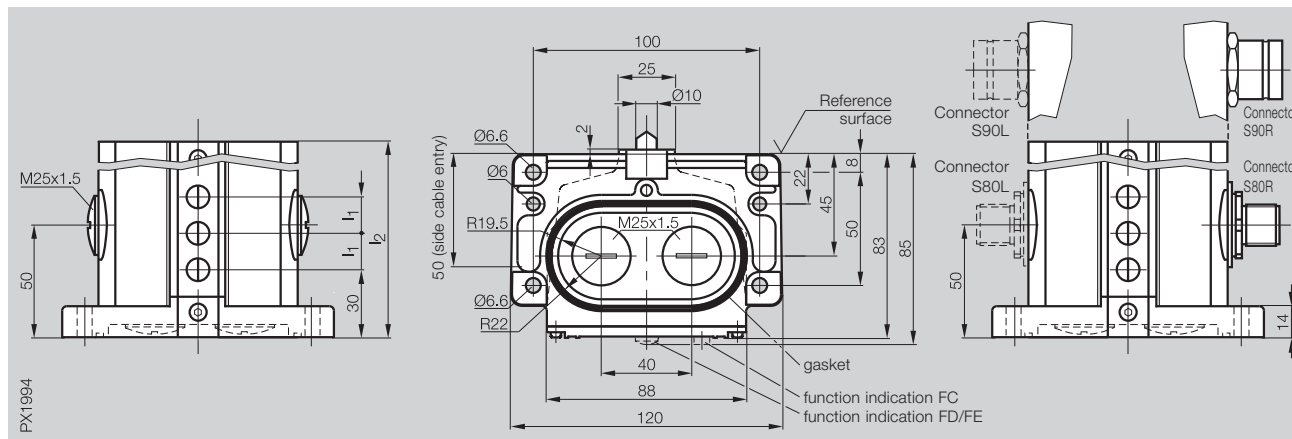
**BNS 823-D - -100-**



# Mechanical Multiple Position Switches with Quick-Change Plunger Unit

Series 100  
per DIN 43697

Type	Multiple position switch with forced-opening contacts
Plunger spacing	12 mm or 16 mm
Mounting and function dimensions	per DIN 43697



Plunger style	Chisel (D), Ball (K), Roller (R) or Roller Bearing (L)
Plunger material	Stainless steel, contact surfaces induction hardened
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	M25x1.5 for connector or cable gland
Ambient temperature range	-5...+85 °C
Degree of protection per IEC 60529	IP 67
Function indicator	LED 6...60 V AC/DC (FD), 90...250 V AC/DC (FE) or 24...28 V DC (FC)

With switch element

	BSE 61 per DIN EN 60204-1/VDE 0113	BSE 85 per DIN EN 60204-1/VDE 0113	BSE 30.0
Ordering code	BNS 823-D - - -100-1 - - -	BNS 823-D - - -100-2 - - -	BNS 823-D - - -100-0 - - -
Wiring diagram, style			

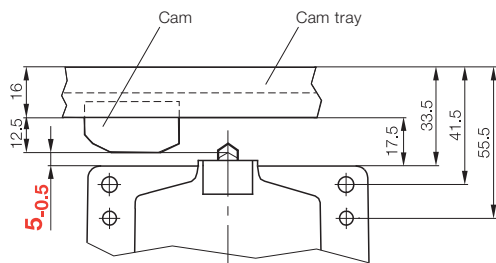
### Switch element

Contact material	Silver	Silver	Silver, gold plated
Switching principle	creep switch, forced-opening	snap switch, forced-opening (normally-closed)	Snap switch
Contact system	Normally-closed, double interruption	Dual-changeover: 1. NO (snap function), 2. Positive-opening (double-interruption), all galvanically isolated	dual changeover, one normally-open and one normally-closed, galvanically isolated
Electrical data	see page 116	see page 116	see page 116
Approval	CSA, CCC	cULus, CSA, CCC	UL, CSA, CCC

### Mechanical data

Plunger point to reference surface	8 mm	8 mm	8 mm
Switchpoint to reference surface	7 mm	6.5 mm	6 mm
Maximum plunger travel	4 mm	4 mm	5.5 mm
Assured opening after plunger travel	2.5 mm	2.5 mm	
Switching actuating force on plunger	min. 15 N	min. 30 N	min. 20 N
Switching frequency	max. 300/min	max. 160/min	max. 300/min
Approach speed	Plunger D: 40 m/min Plunger K: 10 m/min Plunger R: 60 m/min Plunger L: 120 m/min	40 m/min 10 m/min 60 m/min 80 m/min	40 m/min 10 m/min 60 m/min 120 m/min
Repeatability	Plunger D, K: ± 0.002 mm Plunger R, L: ± 0.01 mm	± 0.02 mm ± 0.02 mm	± 0.002 mm ± 0.01 mm

### Installation



**Note!**  
To ensure switching function, the dimension 5.0±0.5 is especially critical.

1.4

Multiple position switches series 100

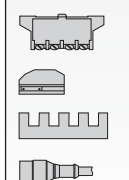
Quick-change block for series

100

5.1

5.2

5.3



## Multiple position switches for standard applications with quick-change plunger block

- Dual-chamber system with IP 67 protection: wear-free membrane with hermetic sealing from plunger mechanism and switch chamber
- Maintenance-free, self-lubricating plunger guide with slide bearing

## Connection options

- Thread for cable gland M20x1.5 on side and in flange (seals and plugs included)
- Connector (note permissible operating voltage for the connectors, see page 132).

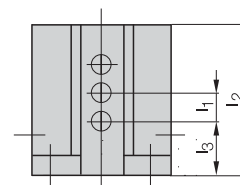
## Multiple position switches with function indication

- Function indication for dual voltage range option

## Available sizes

No. of plungers	Plunger spacing	Housing B Standard		Housing B		Housing C		Number of connectors S80 without FD/FE	Number of connectors S80 with FD/FE	Number of connectors S90 without FD/FE	Number of connectors S90 with FD/FE	Number of connectors S4 without FD (IO-Link)	Number of connectors S4 with FD (IO-Link)
		Dimension l <sub>2</sub>	Dimension l <sub>3</sub>	Dimension l <sub>2</sub>	Dimension l <sub>3</sub>	Dimension l <sub>2</sub>	Dimension l <sub>3</sub>						
2	12	36	12	60	30	48	24	1	1	1	1	1	1
3	12	48	12	60	24	60	24	1	2	1	1	1	1
4	12	60	12					2	2	1	1	1	1
5	12	72	12					2	3	1	1	1	1
6	12	84	12					2	3	1	1	1	1
2	16	48	16	60	30	60	30	1	1	1	1	1	1
3	16	72	16					1	2	1	1	1	1
4	16	84	16					2	2	1	1	1	1

Dimensions in mm



Ordering example:

**BNS 829-B02-D12-61-12-10-FD-S80R**

**BNS 829- - -61- -10- - -**

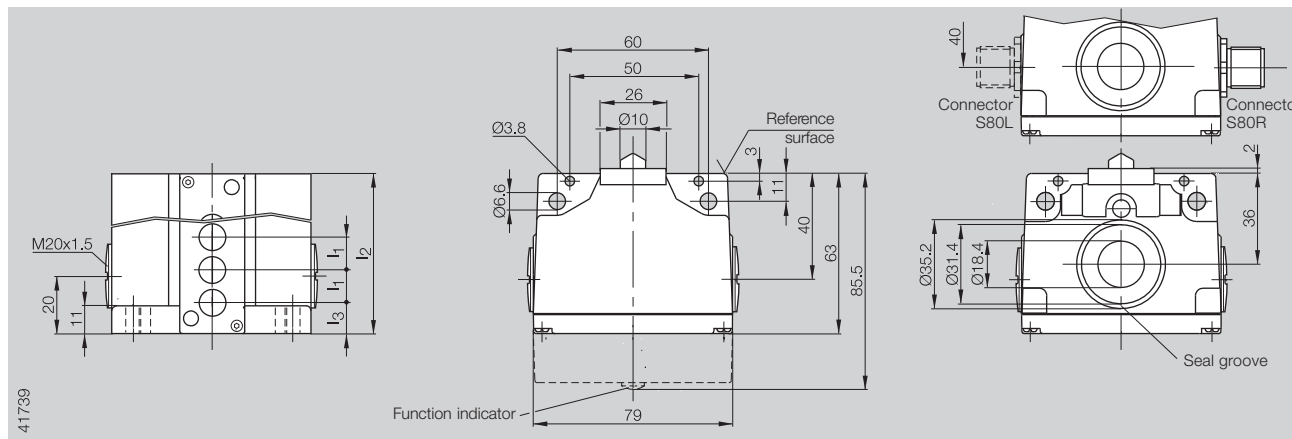
<p><b>Housing style</b></p> <p><b>B</b> Standard 2x M20x1.5 on side</p> <p><b>B</b> 3x M20x1.5 on side and in flange</p> <p><b>C</b> 2x M20x1.5 on side and cable entry in flange</p>	<p><b>No. of plungers</b></p> <p><b>02</b> 2x <b>03</b> 3x <b>04</b> 4x ...</p>	<p><b>Plunger style</b></p> <p><b>D</b> Chisel <b>K</b> Ball <b>R</b> Roller <b>L</b> Roller bearing</p>	<p><b>Plunger spacing</b></p> <p><b>12</b> 12 mm <b>16</b> 16 mm <b>24</b> 24 mm <b>30</b> 30 mm</p>	<p><b>Distance l<sub>3</sub></b></p> <p><b>12</b> 12 mm <b>16</b> 16 mm <b>24</b> 24 mm <b>30</b> 30 mm</p>	<p>optional <b>Function indicator</b></p> <p><b>FD</b> 6...60 V AC/DC <b>FE</b> 90...250 V AC/DC</p>	<p>optional <b>Connector</b></p> <p><b>S80R</b> 5-pin, right <b>S80L</b> 5-pin, left <b>S80S</b> 5-pin, right and left <b>S90R</b> 12-pin, right <b>S90L</b> 12-pin, left <b>S90S</b> 12-pin, right and left <b>S4R-I</b> 4-pin, right only for IO-Link <b>S4L-I</b> 4-pin, left only for IO-Link</p>
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# Mechanical Multiple Position Switches with Quick-Change Plunger Unit

Series 61

Type	Multiple position switch
Plunger spacing	12 mm or 16 mm



Plunger style	Chisel (D), Ball (K), Roller (R) Roller Bearing (L)
Plunger material	Stainless steel, contact surfaces induction hardened
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	M20x1.5 for connector or cable gland
Ambient temperature range	-5...+85 °C
Degree of protection per IEC 60529	IP 67
Function indicator	LED 6...60 V AC/DC (FD) or 90...250 V AC/DC (FE)



**IO-Link**

For additional information see IO-Link brochure!

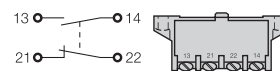
With switch element

Ordering code

Wiring diagram, style

**BSE 30.0**

BNS 829- - -61- -10- -



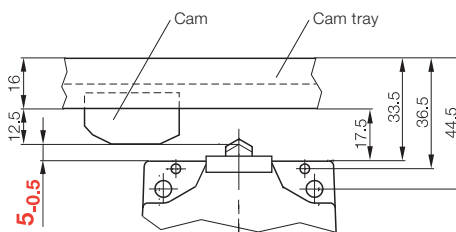
### Switch element

Contact material	Silver, gold plated
Switching principle	Snap switch
Contact system	Dual changeover, one normally-open and one normally-closed, galvanically isolated
Electrical data	see page 116
Approval	UL, CSA, CCC

### Mechanical data

Plunger point to reference surface	8 mm
Switchpoint to reference surface	6 mm
Maximum plunger travel	5.5 mm
Switching actuating force on plunger	min. 20 N
Switching frequency	max. 300/min
Approach speed	Plunger D: 40 m/min Plunger K: 10 m/min Plunger R: 60 m/min Plunger L: 120 m/min
Repeatability	Plunger D, K: ± 0.002 mm Plunger R, L: ± 0.01 mm

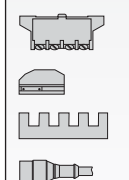
### Installation



**Note!**  
To ensure switching function, the dimension 5.0-0.5 is especially critical.

**1.4**  
Multiple position switches series  
100  
61  
Quick-change block for series  
100  
61

**5.1**  
**5.2**  
**5.3**



### Multiple position switches with safety switch positions per DIN EN 60204-1/VDE 0113 and quick-change plunger unit

- Positive-opening contacts and rigid plungers for additional security per DIN EN 60204-1/VDE 0113

- Dual-chamber system with IP 67 protection: wear-free membrane with hermetic sealing from plunger mechanism and switch chamber
- Maintenance-free, self-lubricating plunger guide with slide bearing

### Connection options

- Thread for cable gland M20x1.5 on side and in flange (seals and plugs included)
- Connector (note permissible operating voltage for the connectors, see page 132).

### Multiple position switches with function indication

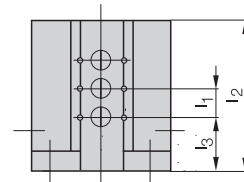
- Function indication for selectable three voltage ranges

### Available sizes

No. of plungers	Plunger spacing dimension	Housing B standard dimension		Housing B dimension		Housing C dimension		Number of connectors* S80 without FD/FE	Number of connectors* S80 with FD/FE	Number of connectors* S90 without FD/FE	Number of connectors* S90 with FD/FE
		l <sub>2</sub>	l <sub>3</sub>	l <sub>2</sub>	l <sub>3</sub>	l <sub>2</sub>	l <sub>3</sub>				
2	12	36	12	60	30	48	24	1	1	1	1
3	12	48	12	60	24	60	24	1	2	1	1
4	12	60	12					2	2	1	1
5	12	72	12					2	3	1	1
6	12	84	12					2	3	1	1
2	16	48	16	60	30	60	30	1	1	1	1
3	16	72	16					1	2	1	1
4	16	84	16					2	2	1	1

Dimensions in mm

\*Number of connectors with BSE 85 on request.



Ordering example:

**BNS 823-B02-K12-61-A-12-02-FE-S80R**

**BNS 823- - - - -61- - - - -**

Housing style	No. of plungers	Plunger style	Plunger spacing	Distance l <sub>3</sub>	Switch elements	Safety switch elements	optional Function indication	optional Connector
<b>B</b> Standard 2x M20x1.5 on side	<b>02</b> 2x	<b>D</b> Chisel	<b>12</b> 12 mm	<b>A</b> 12 mm	<b>10</b> BSE 61 Remaining switch positions BSE 30.0	No. from flange	<b>FD</b> 6...60 V AC/DC (for BSE 30.0 and BSE 61)	<b>S80R</b> 5-pin, right
<b>B</b> 3x M20x1.5 on side and in flange	<b>03</b> 3x	<b>K</b> Ball	<b>16</b> 16 mm	<b>B</b> 16 mm	<b>12</b> only BSE 61		<b>FE</b> 90...250 V AC/DC (for BSE 30.0 and BSE 61)	<b>S80L</b> 5-pin, left
<b>C</b> 2x M20x1.5 on side and cable entry in flange	<b>04</b> 4x	<b>R</b> Roller		<b>C</b> 24 mm	<b>20</b> BSE 85 Remaining switch positions BSE 30.0		<b>FC</b> 24...28 V DC (only for BSE 85)	<b>S80S</b> 5-pin, right and left
	<b>...</b>	<b>L</b> Roller bearing		<b>D</b> 30 mm	<b>22</b> only BSE 85			<b>S90R</b> 12-pin, right
								<b>S90L</b> 12-pin, left
								<b>S90S</b> 12-pin, right and left

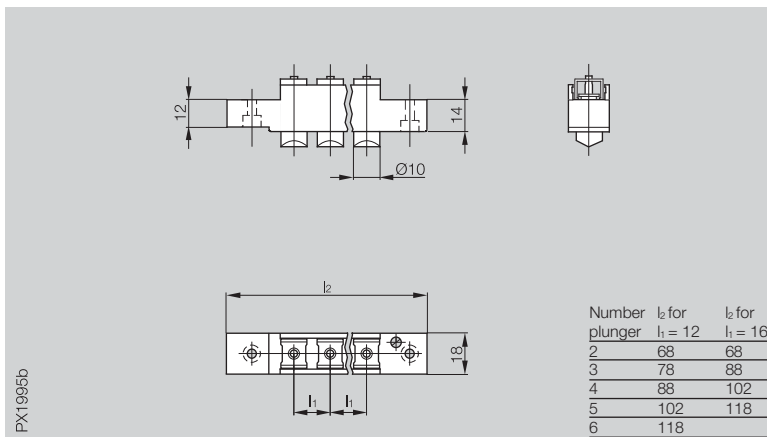




# Mechanical Multiple Position Switches with Quick-Change Plunger Unit

Quick-change block  
for Series 100

Type	BNP quick-change block/Plunger
Plunger spacing	12 mm or 16 mm



Ordering code	BNP 2 _ _ _ -100
Plunger style	Chisel ( <b>D</b> ), Ball ( <b>K</b> ), Roller ( <b>R</b> ) or Roller Bearing ( <b>L</b> )
Plunger material	Stainless steel, contact surfaces induction hardened
Cam tray material	aluminum, barrel finished, blue anodized finish

Ordering example for standard application:  
**BNP 29-04-D12-100**

**BNP 29- - -100**

No. of plungers	Plunger style	Plunger spacing l <sub>1</sub>
02 2x	<b>D</b> Chisel	<b>12</b> 12 mm
...	<b>K</b> Ball	<b>16</b> 16 mm
06 6x	<b>R</b> Roller	
	<b>L</b> Roller bearing	

Ordering example for safety application:  
**BNP 23-04-D12-100-01**

**BNP 23- - -100-**

No. of plungers	Plunger style	Plunger spacing l <sub>1</sub>	Safety switch elements
02 2x	<b>D</b> Chisel	<b>12</b> 12 mm	No. from flange
...	<b>K</b> Ball	<b>16</b> 16 mm	
06 6x	<b>R</b> Roller		
	<b>L</b> Roller bearing		

### Note!

Safety switch positions to DIN EN 60204-1/ VDE 0113 may only be operated with a rigid plunger.



# Mechanical Multiple Position Switches with Quick-Change Plunger Unit

Quick-change block  
for Series 61

Type	BNP quick-change block/Plunger
Plunger spacing	12 mm or 16 mm



Number of plungers	Plungers spacing		Housing B standard		Housing B see p. 74		Housing C	
	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	l <sub>2</sub>	l <sub>3</sub>	l <sub>2</sub>	l <sub>3</sub>	
2	12	35	12	59	30	47	24	
3	12	47	12	59	24			
4	12	59	12					
5	12	71	12					
6	12	83	12					
2	16	47	16	59	30			
3	16	71	16					
4	16	83	16					

Ordering code	BNP 2 - - - -61 - -
Plunger style	Chisel ( <b>D</b> ), Ball ( <b>K</b> ), Roller ( <b>R</b> ) or Roller Bearing ( <b>L</b> )
Plunger material	Stainless steel, contact surfaces induction hardened
Cam tray material	Aluminum, barrel finished, blue anodized finish

Ordering example for standard application:

**BNP 29-04-D12-61-12**

BNP 29- - -61-		No. of plungers	Plunger style	Plunger spacing l <sub>1</sub>	Distance l <sub>3</sub>
02	2x	<b>D</b>	Chisel	12 12 mm	12 12 mm
...		<b>K</b>	Ball	16 16 mm	16 16 mm
06	6x	<b>R</b>	Roller	24 24 mm	24 24 mm
		<b>L</b>	Roller bearing	30 30 mm	30 30 mm

Ordering example for safety application:

**BNP 23-04-D12-61-A-01**

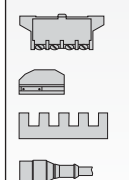
BNP 23- - -61- -		No. of plungers	Plunger style	Plunger spacing l <sub>1</sub>	Distance l <sub>3</sub>	Safety switch elements
02	2x	<b>D</b>	Chisel	12 12 mm	<b>A</b> 12 mm	No. from flange
...		<b>K</b>	Ball	16 16 mm	<b>B</b> 16 mm	
06	6x	<b>R</b>	Roller	24 24 mm	<b>C</b> 24 mm	
		<b>L</b>	Roller bearing	30 30 mm	<b>D</b> 30 mm	

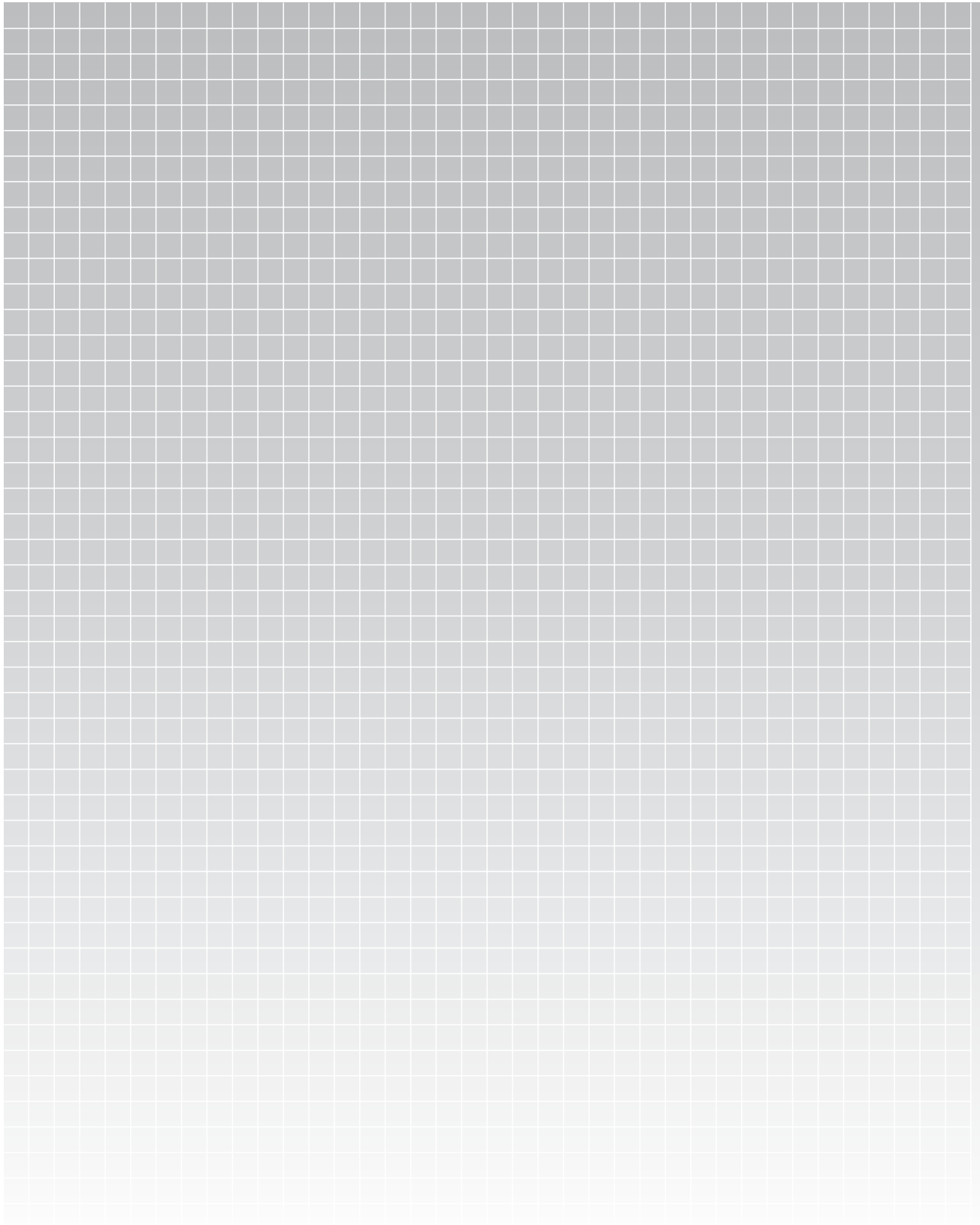
### Note!

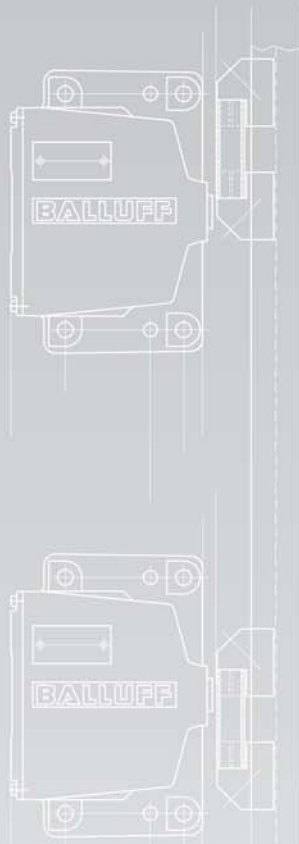
Safety switch positions to DIN EN 60204-1/ VDE 0113 may only be operated with a rigid plunger.

**1.4**  
Multiple position switches series 100 61  
**Quick-change block for series 100 61**

**5.1**  
**5.2**  
**5.3**







## more added value

- Long service life
- Non-contacting, wear-free,
- Compatible with mechanical switches



### Inductive multiple position switches

- 80 Series 602-11 per DIN 43697
- 82 Series 610-11 Series 611-11 Series 612-11 Series 613-11
- 84 Series 605-11
- 86 Series 603-11
- 88 Series 650-11

### Inductive single position switches

- 90 Series H2 and H3 DC connectors M12 connection (S4) for Series H2
- 93 DC connectors M8 connection (S49) for Series H2

## 2.1

Multiple position switches series

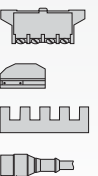
- 602-11
- 610-11
- 611-11
- 612-11
- 613-11
- 605-11
- 603-11
- 650-11

Single position switches series H2 and H3

## 5.1

## 5.2

## 5.3



### Multiple position switches per DIN 43697 for standard applications

- Can be used under extreme conditions such as shock, temperature fluctuations and coolant flooding
- Reliability comparable with inductive sensors

### Multiple position switches with function indication

- The inductive switch elements are equipped standard with an LED. The light is highly visible on the housing cover.

### Connection options

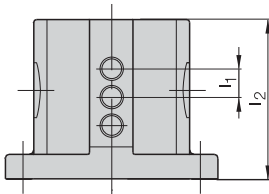
- Thread for cable gland M25×1.5 on side and in flange (Gaskets and plugs included)
- Connector (note permissible operating voltage for the connectors, see page 132).

### Available sizes

Number of switch positions		2	3	4	5	6	8	10	12
Dimension $l_1 = 12$ mm		70	80	90	105	120	140	170	200
Dimension $l_2$ when	Dimension $l_4$	88	88	88	88	88	80	80	80
	Dimension $l_5$	14	14	14	14	14	20	20	20
Dimension $l_1 = 16$ mm		70	90	105	120	140	170	200	240
	Dimension $l_4$	88	88	88	88	80	80	80	80
	Dimension $l_5$	14	14	14	14	20	20	20	20

Number of connectors	S80	on request
	S90	on request
Dimension $l_3$	4 mm for inductive switch elements with sensing head $\varnothing$ 10 mm	
	2 mm for inductive switch elements with sensing head $\varnothing$ 15.5 mm	

Dimensions in mm



Ordering example:

**BNS 816-B12-THA-16-602-11-S80R**

**BNS 816-B - - -602-11-**

**No. of switch positions**

**02** 2x  
**03** 3x  
**04** 4x  
...

**Code for switch elements**

(see table at right)

**Plunger spacing**

**12** 12 mm  
**16** 16 mm

optional  
**Connector**

**S80R** 5-pin, right  
**S80L** 5-pin, left  
**S80S** 5-pin, right and left  
**S90R** 12-pin, right  
**S90L** 12-pin, left  
**S90S** 12-pin, right and left







# Inductive Multiple Position Switches

Series  
610-11, 611-11,  
612-11, 613-11

## Multiple position switches for standard applications

- Can be used under extreme conditions such as shock, temperature fluctuations and coolant flooding
- Reliability comparable with inductive sensors

## Multiple position switches with function indication

- The inductive switch elements are equipped standard with an LED. The light is highly visible on the housing cover.

## Connection options

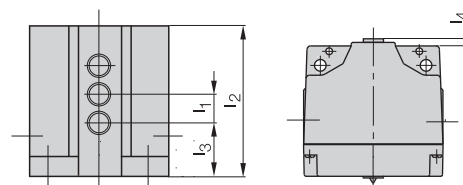
- Thread for cable gland M20×1.5 on side and in flange (seals and plugs included)
- Connector (note permissible operating voltage for the connectors, see page 132).

## Available sizes

No. of Switch positions	No. of connectors S80/S90	Switch position spacing Dimension l <sub>1</sub>	Series 610 Housing B Standard Dimension		Series 611 Housing B Standard Dimension		Series 612 Housing B Dimension		Series 612 housing C Dimension		Series 613 Housing B Dimension		Series 613 housing C Dimension	
			l <sub>2</sub>	l <sub>3</sub>	l <sub>2</sub>	l <sub>3</sub>	l <sub>2</sub>	l <sub>3</sub>	l <sub>2</sub>	l <sub>3</sub>	l <sub>2</sub>	l <sub>3</sub>	l <sub>2</sub>	l <sub>3</sub>
2		12	36	12					48	24	60	30	60	30
3		12	48	12			60	24	60	24				
4	on request	12	60	12										
5		12	72	12										
6		12	84	12										
2		16			48	16					60	30	60	30
3		16			72	16								
4		16			84	16								

Dimensions in mm

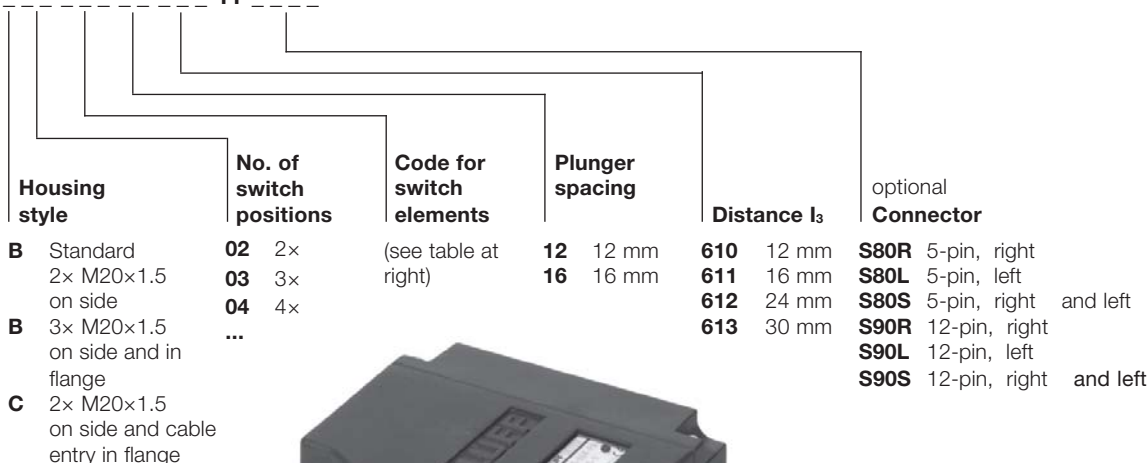
Dimension l<sub>4</sub> = 4 mm for inductive switch elements with sensing head Ø 10 mm  
Dimension l<sub>4</sub> = 2 mm for inductive switch elements with sensing head Ø 15.5 mm



Ordering example:

**BNS 816-B04-KHG-12-610-11-S80R**

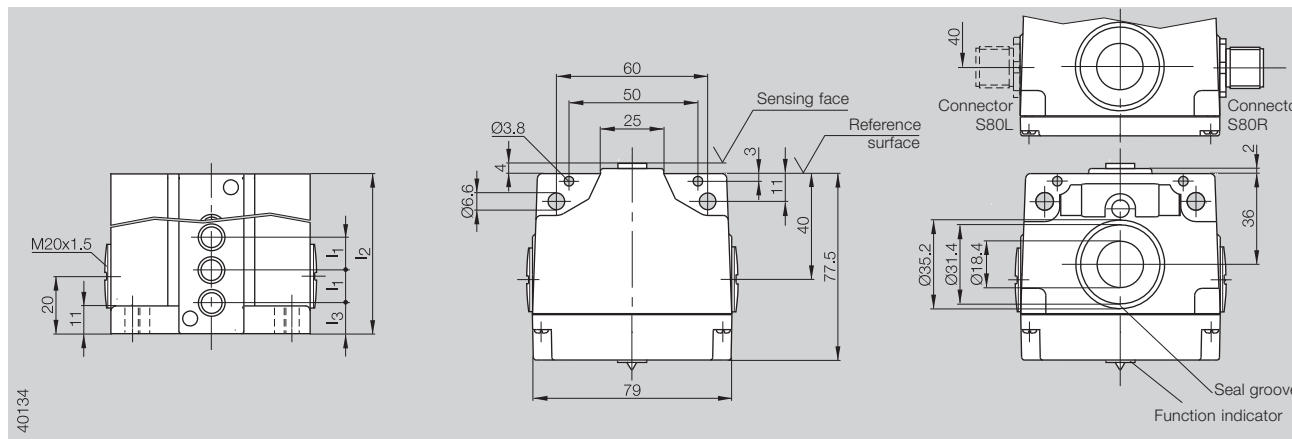
**BNS 816- - - - -11-**



# Inductive Multiple Position Switches

Series  
610-11, 611-11,  
612-11, 613-11

Type	Multiple position switch
Switch position spacing	12 mm or 16 mm



Ordering code	BNS 816-B _ _ _ _ -610/611/612/613-11- _ _
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	M20x1.5 for connector or cable gland
Ambient temperature range	-25...+70 °C
Degree of protection per IEC 60529	IP 67
Function indicator	LED

### Inductive switch elements with sensing head $\varnothing$ 10 mm, for use with switch position spacing 12 and 16 mm

Code	Ordering code for replacement switch elements	Electrical version	Rated operating distance $s_n$	Assured operating distance $s_a$
<b>PA</b>	BES 517-110	PNP, complementary, 10...60 V DC, short circuit protected	2 mm	0...1.6 mm
<b>NA</b>	BES 517-108	NPN, complementary, 10...60 V DC, short circuit protected	2 mm	0...1.6 mm
<b>WS</b>	BES 517-410	NO, up to 250 V AC	2 mm	0...1.6 mm
<b>WO</b>	BES 517-421	NC, up to 250 V AC	2 mm	0...1.6 mm
<b>KHG</b>	BES 517-560-H	2-wire, NO, 10...55 V DC, short circuit protected	2 mm	0...1.6 mm
<b>KHH</b>	BES 517-561-H	2-wire, NC, 10...55 V DC, short circuit protected	2 mm	0...1.6 mm
<b>NG</b>	BES 516-314-N	2-wire, NAMUR, 7.7... 9 V DC	2 mm	0...1.6 mm

### Inductive switch elements with sensing head $\varnothing$ 15.5 mm, for use with switch position spacing 16 mm

Code	Ordering code for replacement switch elements	Electrical version	Rated operating distance $s_n$	Assured operating distance $s_a$
<b>THA</b>	BES 517-142-Y	PNP, complementary, 10...30 V DC, short circuit protected	5 mm	0...4 mm
<b>EJA</b>	BES 517-463	NO, up to 250 V AC	5 mm	0...4 mm
<b>AAA</b>	BES 517-464	NC, up to 250 V AC	5 mm	0...4 mm

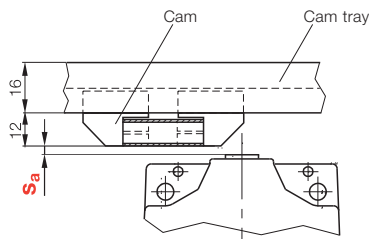
### Hybrid switch element with sensing head 15.5 mm, for use with switch position spacing 16 mm

Code	Ordering code for replacement switch elements	Electrical version	Additional information on request!
<b>DH</b>	BES 516-110-D	PNP, complementary, 10...30 V DC	

For additional electrical data see pages 118 to 121.



### Installation



**Note!**  
To ensure switching function  $s_a$  must be in a range of  $0 < s_a \leq 0.81 s_n$ .

**2.1**

Multiple position switches series

602-11

**610-11**

**611-11**

**612-11**

**613-11**

605-11

603-11

650-11

Single position switches series

H2 and H3

**5.1**

**5.2**

**5.3**



### Multiple position switches for standard applications

- Can be used under extreme conditions such as shock, temperature fluctuations and coolant flooding
- Reliability comparable with inductive sensors

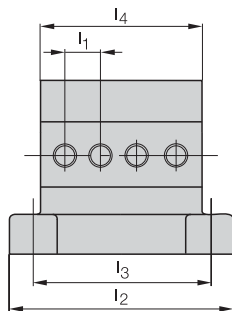
### Multiple position switches with function indication

- The inductive switch elements are equipped standard with an LED. The light is highly visible on the housing cover.

### Connection options

- Thread for cable gland M25×1.5 on side and in flange (Gaskets and plugs included)
- Connector (note permissible operating voltage for the connectors, see page 132).

### Available sizes



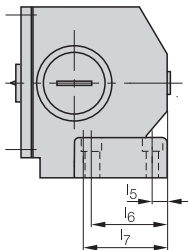
Number of switch positions	2	3	4	5	6	7	8	10	12
Dimension l <sub>2</sub> for l <sub>1</sub> = 12 mm	84	84	100	116	132	148	164	180	
Dimension l <sub>3</sub> for l <sub>1</sub> = 12 mm	66	66	82	98	114	130	146	162	
Dimension l <sub>4</sub> for l <sub>1</sub> = 12 mm	54	54	68	84	100	116	132	148	
Dimension l <sub>2</sub> for l <sub>1</sub> = 16 mm	84	100	116	132	148	164	180	212	244
Dimension l <sub>3</sub> for l <sub>1</sub> = 16 mm	66	82	98	114	130	146	162	194	226
Dimension l <sub>4</sub> for l <sub>1</sub> = 16 mm	54	68	84	100	116	132	148	180	212
Number of connectors	S80	on request							
	S90	on request							

Dimensions when using inductive switch elements with sensing head Ø 10 mm

Dimension l<sub>5</sub> 10 mm

Dimension l<sub>6</sub> 40 mm

Dimension l<sub>7</sub> 43.5 mm



Dimensions when using inductive switch elements with sensing head Ø 15.5 mm

Dimension l<sub>5</sub> 8 mm

Dimension l<sub>6</sub> 38 mm

Dimension l<sub>7</sub> 41.5 mm

Dimensions in mm

Ordering example:

**BNS 816-B10-THA-12-605-11-S80R**

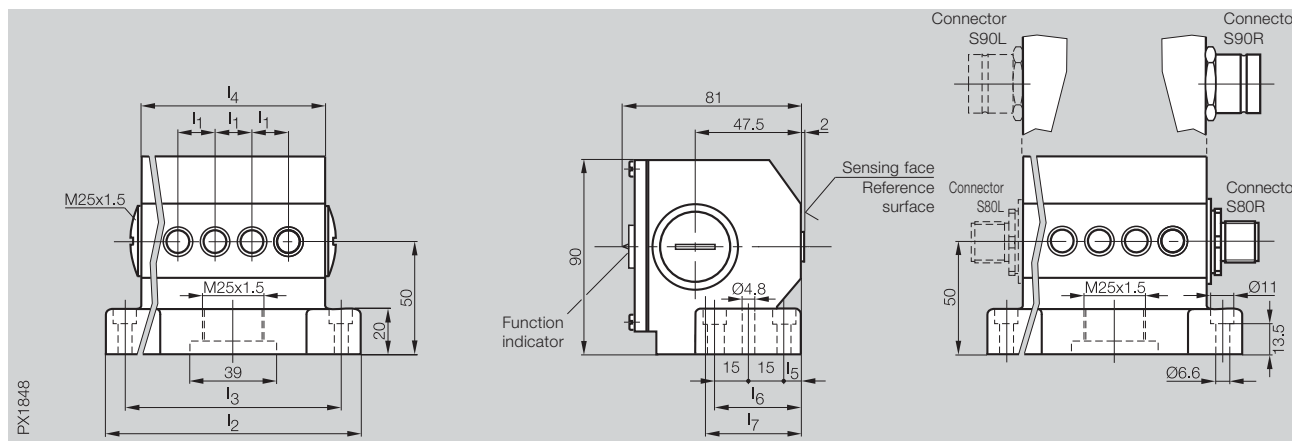
**BNS 816-B - - -605-11-**

No. of switch positions	Code for switch elements	Plunger spacing	optional Connector
02 2×	(see table at right)	12 12 mm	S80R 5-pin, right
03 3×		16 16 mm	S80L 5-pin, left
04 4×			S80S 5-pin, right and left
...			S90R 12-pin, right
			S90L 12-pin, left
			S90S 12-pin, right and left



**Not for new applications. Still available for replacements.**

Type	Multiple position switch
Switch position spacing	12 mm or 16 mm



Ordering code	BNS 816-B _ _ _ _ -605-11- _ _ _
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	M25x1.5 for connector or cable gland
Ambient temperature range	-25...+70 °C
Degree of protection per IEC 60529	IP 67
Function indicator	LED

### Inductive switch elements with sensing head Ø 10 mm, for use with switch position spacing 12 and 16 mm

Code	Ordering code for replacement switch elements	Electrical version	Rated operating distance $s_n$	Assured operating distance $s_a$
<b>PA</b>	BES 517-110	PNP, complementary, 10...60 V DC, short circuit protected	2 mm	0...1.6 mm
<b>NA</b>	BES 517-108	NPN, complementary, 10...60 V DC, short circuit protected	2 mm	0...1.6 mm
<b>WS</b>	BES 517-410	NO, up to 250 V AC	2 mm	0...1.6 mm
<b>WO</b>	BES 517-421	NC, up to 250 V AC	2 mm	0...1.6 mm
<b>KHG</b>	BES 517-560-H	2-wire, NO, 10...55 V DC, short circuit protected	2 mm	0...1.6 mm
<b>KHH</b>	BES 517-561-H	2-wire, NC, 10...55 V DC, short circuit protected	2 mm	0...1.6 mm
<b>NG</b>	BES 516-314-N	2-wire, NAMUR, 7.7... 9 V DC	2 mm	0...1.6 mm

### Inductive switch elements with sensing head Ø 15.5 mm, for use with switch position spacing 16 mm

Code	Ordering code for replacement switch elements	Electrical version	Rated operating distance $s_n$	Assured operating distance $s_a$
<b>THA</b>	BES 517-142-Y	PNP, complementary, 10...30 V DC, short circuit protected	5 mm	0...4 mm
<b>EJA</b>	BES 517-463	NO, up to 250 V AC	5 mm	0...4 mm
<b>AAA</b>	BES 517-464	NC, up to 250 V AC	5 mm	0...4 mm

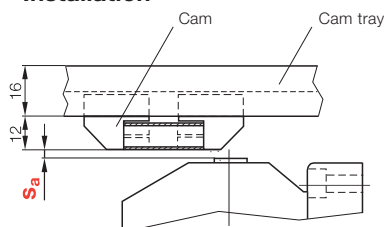
### Hybrid switch element with sensing head 15.5 mm, for use with switch position spacing 16 mm

Code	Ordering code for replacement switch elements	Electrical version	Additional information on request!
<b>DH</b>	BES 516-110-D	PNP, complementary, 10...30 V DC	

For additional electrical data see pages 118 to 121.



### Installation



**Note!**  
To ensure switching function  $s_a$  must be in a range of  $0 < s_a \leq 0.81 s_n$ .

**2.1**

Multiple position switches series

602-11

610-11

611-11

612-11

613-11

**605-11**

603-11

650-11

Single position switches series

H2 and H3

**5.1**

**5.2**

**5.3**



### Multiple position switches for standard applications

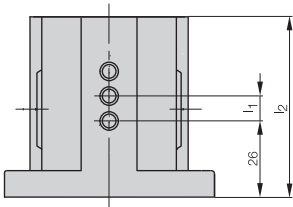
- Smallest plunger spacing for inductive multiple position switches (8 mm or 10 mm)
- Can be used under extreme conditions such as shock, temperature fluctuations and coolant flooding
- Reliability comparable with inductive sensors

### Multiple position switches with function indication

- The inductive switch elements are equipped standard with an LED. The light is highly visible on the housing cover.

### Connection options

- Thread for cable gland M16×1.5 on side and in flange (seals and plugs included)
- Connector (note permissible operating voltage for the connectors, see page 132).



### Available sizes

Number of switch positions		2	3	4	5	6	8	10
Dimension $l_2$ for	$l_1 = 8 \text{ mm}$	49	59	64	72	80	96	112
	$l_1 = 10 \text{ mm}$	49	59	72	80	89	112	129
Number of connectors	S80	on request						

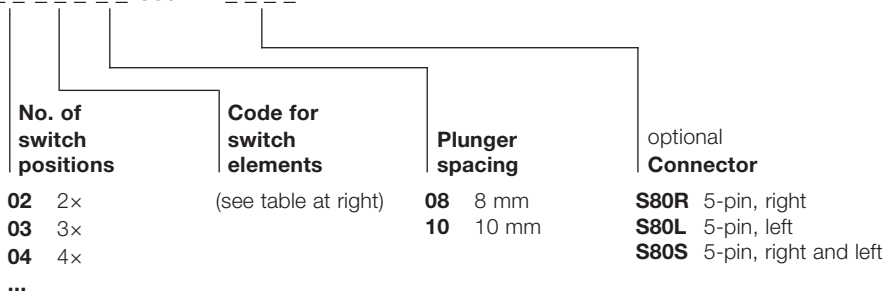
Dimensions in mm

Size 12x with 8 mm spacing on request.

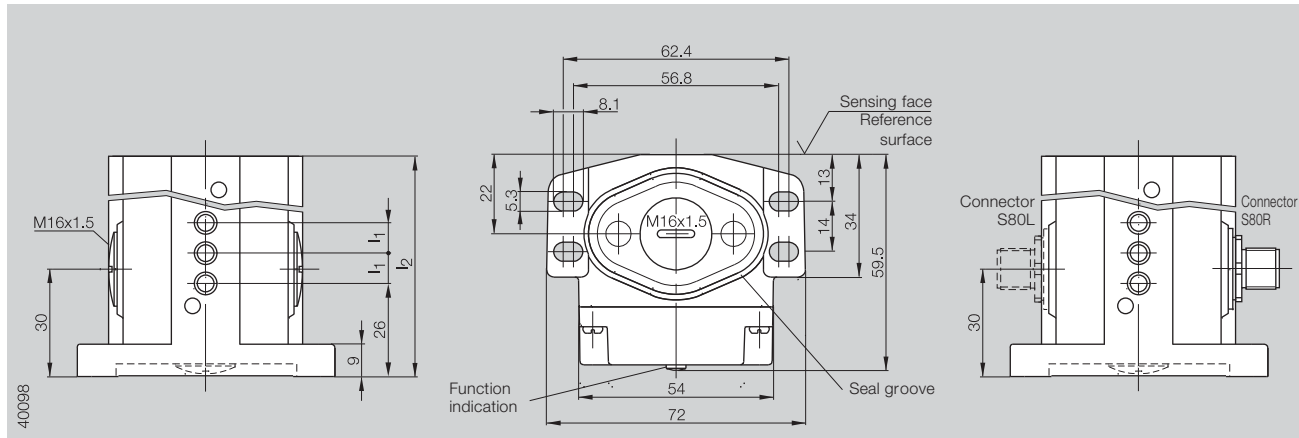
Ordering example:

**BNS 816-B04-TOB-08-603-11-S80R**

**BNS 816-B - - -603-11-**



Type	Multiple position switch
Switch position spacing	8 mm or 10 mm



Ordering code	BNS 816-B _ _ _ _ -603-11- _ _
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	M16x1.5 for cable gland or connector
Ambient temperature range	-25...+70 °C
Degree of protection per IEC 60529	IP 67
Function indicator	LED

### Inductive switch elements

Code	Ordering code for replacement switch elements	Electrical version	Rated operating distance $s_n$	Assured operating distance $s_a$
<b>TOB</b>	BES 517-312-Y	PNP, NO, 10...30 V DC, short circuit protected	1.1 mm	0...0.9 mm
<b>TNB</b>	BES 517-311-Y	NPN, NO, 10...30 V DC, short circuit protected	1.1 mm	0...0.9 mm

For additional electrical data see page 118

## 2.1

### Multiple position switches series

- 602-11
- 610-11
- 611-11
- 612-11
- 613-11
- 605-11

### 603-11

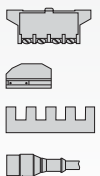
- 650-11

Single position switches series  
H2 and H3

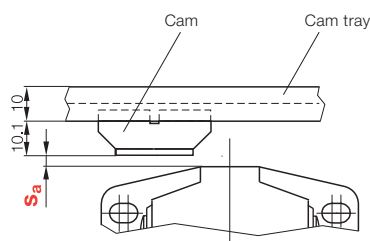
## 5.1

## 5.2

## 5.3



### Installation



**Note!**  
To ensure switching function  $s_a$  must be in a range of  $0 < s_a \leq 0.81 s_n$ .

### Multiple position switches for standard applications

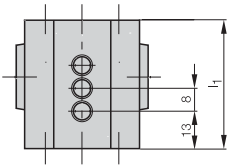
- Smallest plunger spacing for inductive multiple position switches (8 mm)
- Can be used under extreme conditions such as shock, temperature fluctuations and coolant flooding
- Reliability comparable with inductive sensors

### Multiple position switches with function indicator

- The inductive switch elements are equipped standard with an LED. The light is highly visible on the housing cover.

### Connection options

- Thread for cable gland M16×1.5 on side (Scope of delivery: Seals and cover screws)
- Connector (note permissible operating voltage for the connectors, see page 132).



### Available sizes

Number of switch positions	2	3	4	5	6
Dimension l <sub>1</sub>	34	42	50	58	66
Number of connectors S80	on request				

Dimensions in mm

Ordering example:

**BNS 816-B04-TNB-08-650-11-S80R**

**BNS 816-B - - -650-11-**

**No. of switch positions**

- 02** 2x
- 03** 3x
- 04** 4x
- ...

**Code for switch elements**

(see table at right)

**Plunger spacing**

**08** 8 mm

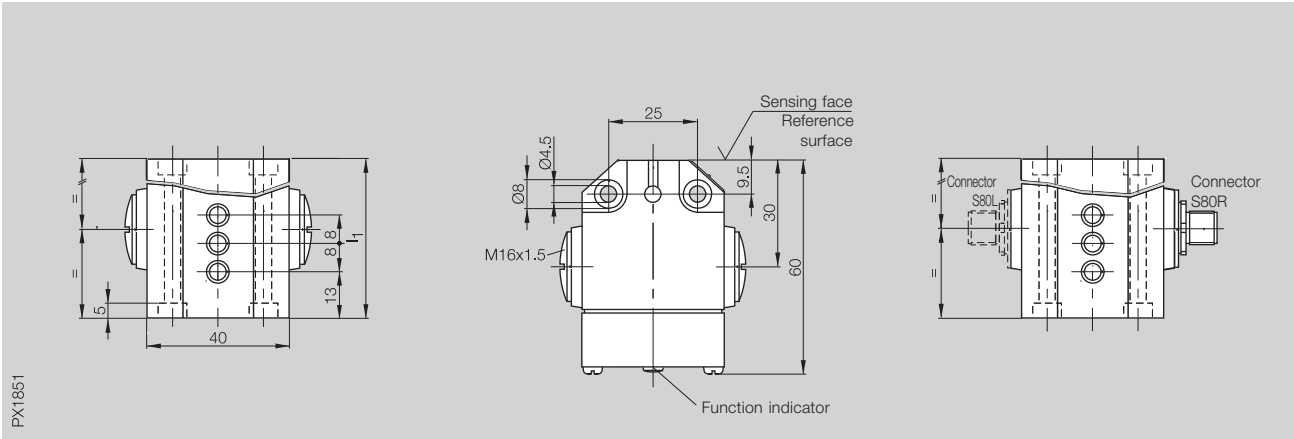
**optional Connector**

- S80R** 5-pin, right
- S80L** 5-pin, left
- S80S** 5-pin, right and left





Type	Multiple position switch
Switch position spacing	8 mm



Ordering code	BNS 816-B _ _ _ _ -650-11- _ _ _
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	M16x1.5 for cable gland or connector
Ambient temperature range	-25...+70 °C
Degree of protection per IEC 60529	IP 67
Function indicator	LED

### Inductive switch elements

Code	Ordering code for replacement switch elements	Electrical version	Rated operating distance $s_n$	Assured operating distance $s_a$
<b>TOB</b>	BES 517-312-Y	PNP, NO, 10...30 V DC, short circuit protected	1.1 mm	0...0.9 mm
<b>TNB</b>	BES 517-311-Y	NPN, NO, 10...30 V DC, short circuit protected	1.1 mm	0...0.9 mm

For additional electrical data see page 118

## 2.1

### Multiple position switches series

- 602-11
- 610-11
- 611-11
- 612-11
- 613-11
- 605-11
- 603-11

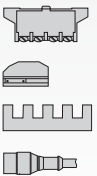
### 650-11

Single position switches series  
H2 and H3

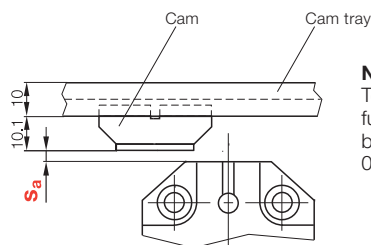
## 5.1

## 5.2

## 5.3



### Installation



**Note!**  
To ensure switching function  $s_a$  must be in a range of  $0 < s_a \leq 0.81 s_n$ .

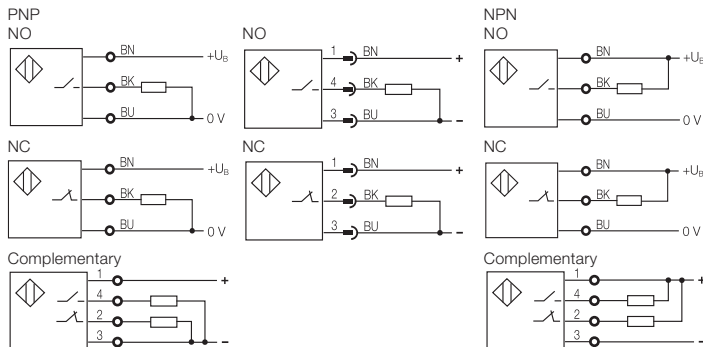
These series offer the combined advantages of the inductive system with the benefits of our mechanical housing series for position switches.

The basis for all electrical versions is the wide variety of tubular sensors.

### Features

- Reliable inductive operating principle
- All switches equipped with LEDs
- The mounting dimensions of standardized mechanical housing styles can be used
- Simple combination with bus-compatible systems using customer-specific connectors

### Wiring diagrams



Housing size	
Mounting	
Rated operating distance $s_n$	
Assured operating distance $s_a$	



PNP	NO	
	NC	
	Complementary	
NPN	NO	
	NC	
	Complementary	

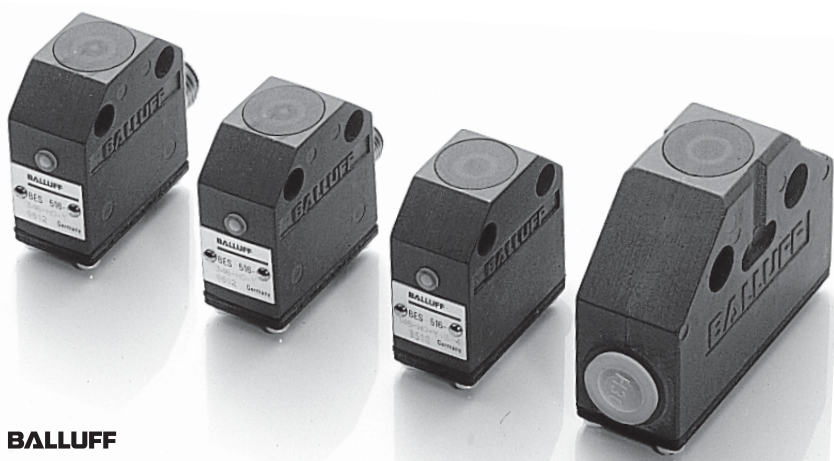
Supply voltage $U_B$	
Voltage drop $U_d$ at $I_e$	
Rated insulation voltage $U_i$	
Rated operational current $I_e$	
No-load supply current $I_0$ max.	
Polarity reversal protected	
Short circuit protected	

Repeat accuracy R	
Ambient temperature range $T_a$	
Switching frequency f	
Utilization category	
Function indicator	

Degree of protection per IEC 60529	
------------------------------------	--

Housing material	
Material of sensing face	
Connection type	
max. conductor cross-section	

Recommended connector	
See next page for connectors	



# Inductive Single Position Switches

Series H2 and H3

42×48×22 mm	42×48×22 mm	42×48×22 mm	74×60.5×28 mm
Flush	Flush	Flush	Flush
5 mm	5 mm	5 mm	7 mm
0...4.1 mm	0...4.1 mm	0...4.1 mm	0...5.7 mm
BES 516-346-H2-Y-S4 BES 516-341-H2-Y-S4	BES 516-346-H2-Y-S49	BES 516-346-H2-Y BES 516-341-H2-Y	BES 516-161-H3-L
		BES 516-344-H2-Y BES 516-340-H2-Y	BES 516-160-H3-L
10...30 V DC ≤ 3.5 V 75 V DC 130 mA ≤ 25 mA yes yes	10...30 V DC ≤ 3.5 V 75 V DC 130 mA ≤ 25 mA yes yes	10...30 V DC ≤ 3.5 V 75 V DC 130 mA ≤ 25 mA yes yes	10...30 V DC ≤ 1.5 V 75 V DC 400 mA ≤ 30 mA yes no
≤ 5 % -25...+70 °C 500 Hz DC 13 yes	≤ 5 % -25...+70 °C 500 Hz DC 13 yes	≤ 5 % -25...+70 °C 500 Hz DC 13 yes	≤ 5 % -25...+70 °C 300 Hz DC 13 yes
IP 67	IP 67	IP 67	IP 67
Anodized GD-Al PA 12 Connectors	Anodized GD-Al PA 12 Connectors	Anodized GD-Al PA 12 Screw terminals up to 2.5 mm <sup>2</sup>	Anodized GD-Al PA 12 Screw terminals up to 2.5 mm <sup>2</sup>
BKS-_ 19/BKS-_ 20	BKS-_ 48/BKS-_ 49		

## 2.1

Multiple position switches series

602-11  
610-11  
611-11  
612-11  
613-11  
605-11  
603-11  
650-11

Single position switches series

H2 and H3

## 5.1

## 5.2

## 5.3

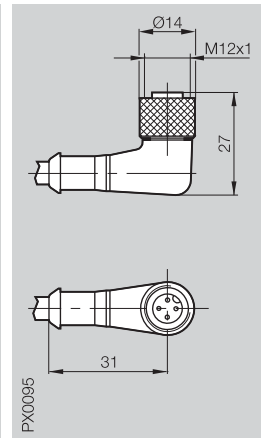
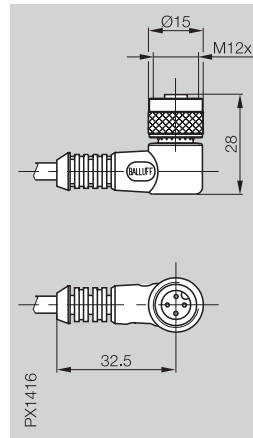
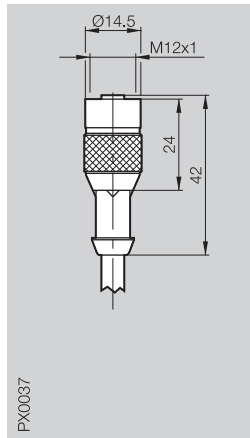
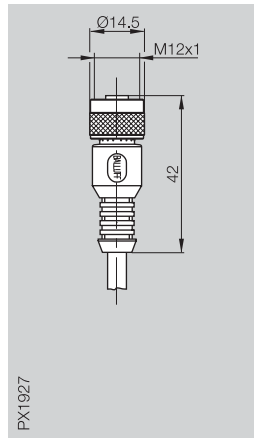


# Inductive Single Position Switches

DC connectors  
M12 connection (S4)  
for Series H2

# M12

Connector	<b>BKS-B 19</b>	<b>BKS-S 19</b>	<b>BKS-B 20</b>	<b>BKS-S 20</b>
Version	Straight female	Straight female	Right angle female	Right angle female
Use	Position switch S4	Position switch S4	Position switch S4	Position switch S4



no LED, NO	BKS-B 19-1-03	BKS-S 19-1-PU-03	BKS-B 20-1-03	BKS-S 20-1-PU-03
no LED, NC				BKS-S 20-2-PU-05
no LED, NC or NO				
with 2 LED's, NO	BKS-B 19-4-05	BKS-S 19-4-PU-03	BKS-B 20-4-03	BKS-S 20-4-PU-03
with 2 LED's, NC				BKS-S 20-5-PU-03
with LED, NC or NO				

Supply voltage $U_B$	10...30 V DC	10...30 V DC	10...30 V DC	10...30 V DC
Cable	3 m/5 m molded PVC	3 m molded PUR	3 m molded PVC	3 m/5 m molded PUR
No. of wires × cross-section	3×0.34 mm <sup>2</sup>	3×0.34 mm <sup>2</sup>	3×0.34 mm <sup>2</sup>	3×0.34 mm <sup>2</sup>
Degree of protection per IEC 60529	IP 67	IP 68 per BWN Pr. 20	IP 67	IP 68 per BWN Pr. 20
Ambient temperature range $T_a$	-25...+85 °C	-25...+70 °C	-25...+85 °C	-25...+70 °C

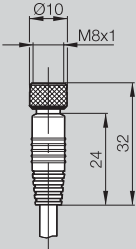
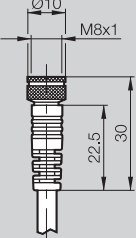
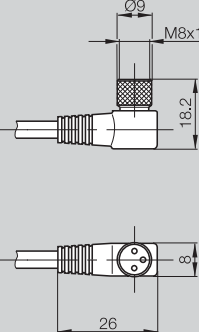
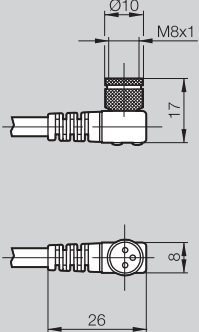
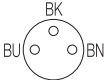
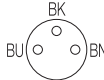
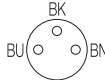
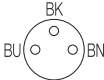
View of female side				
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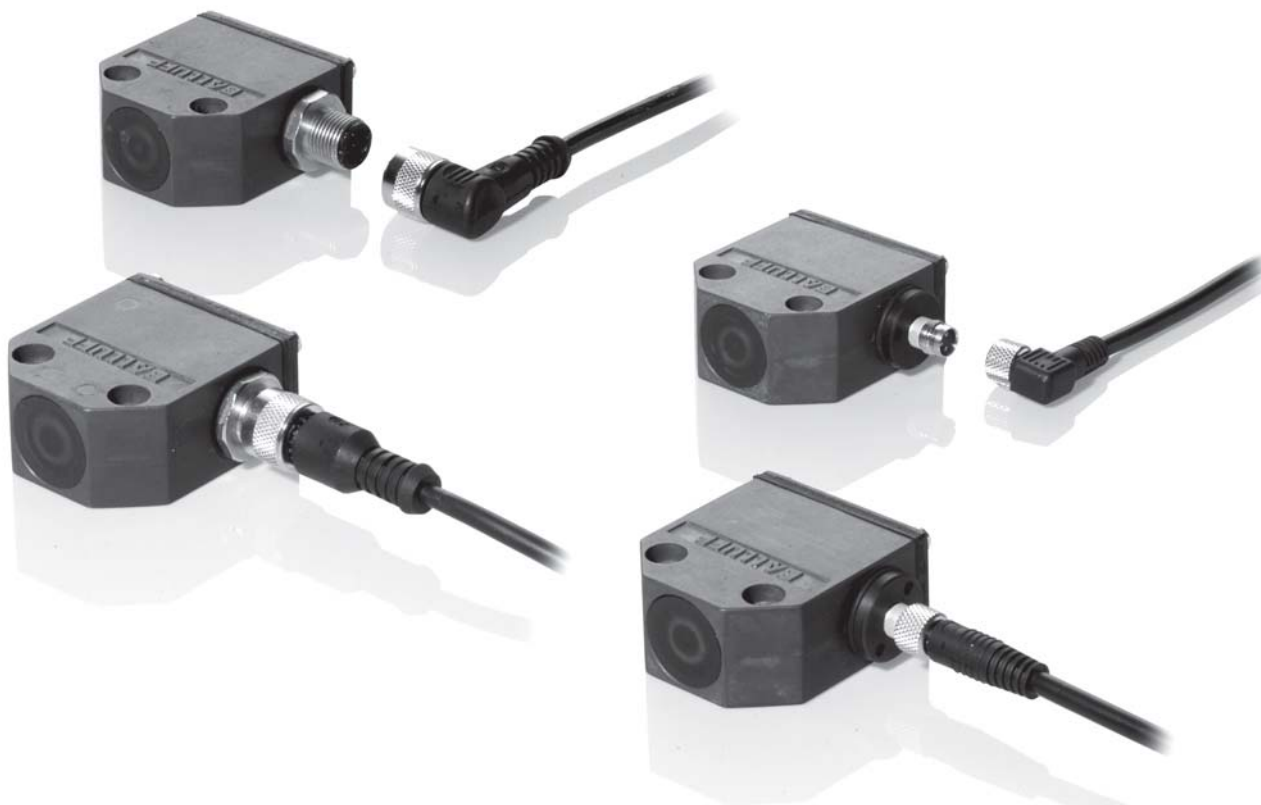
Other cable lengths and qualities on request.

# M8

## Inductive Single Position Switches

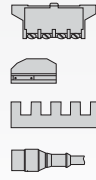
DC connectors  
M8 connection (S49)  
Series H2

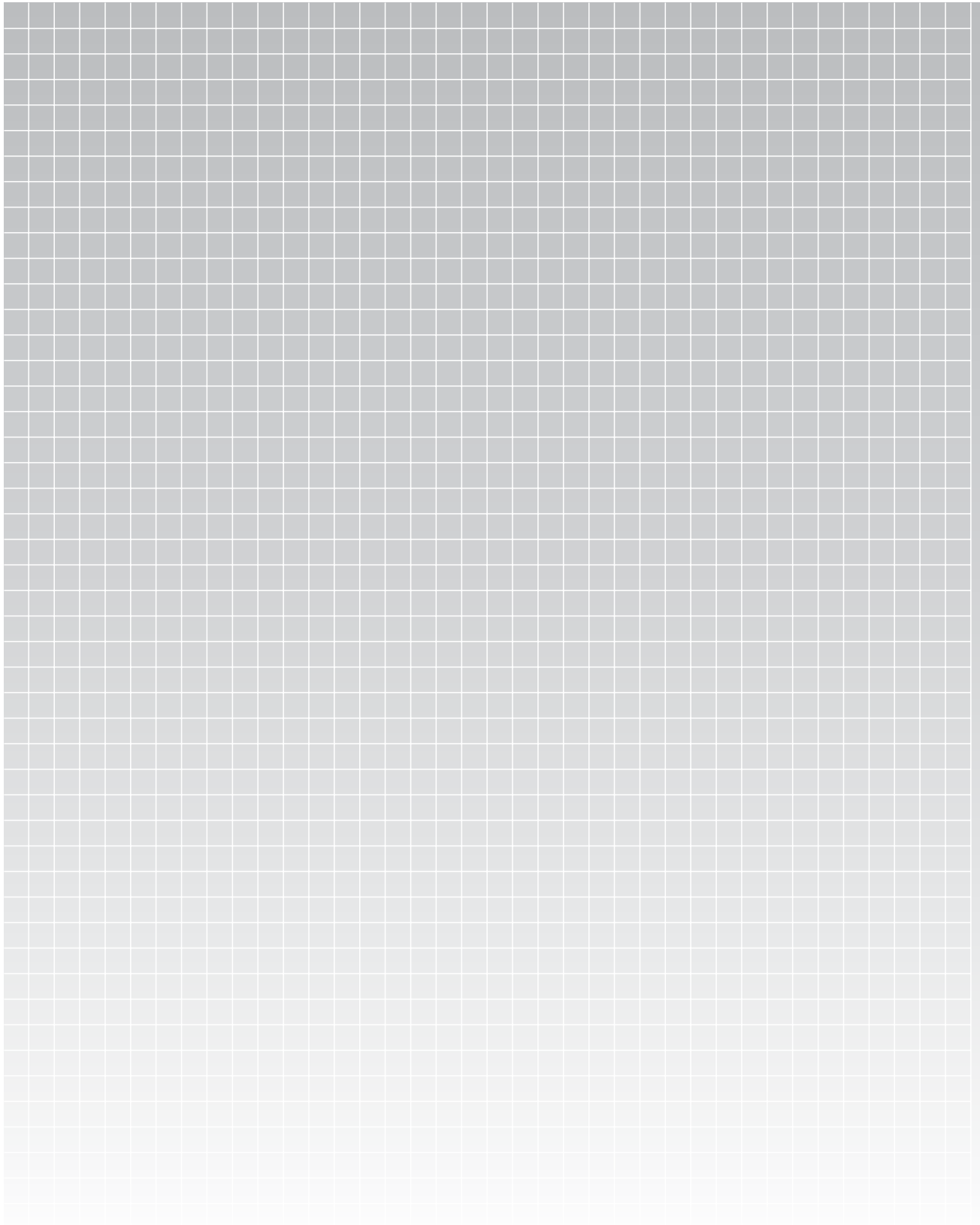
<b>BKS-B 48</b> Straight female	<b>BKS-S 48</b> Straight female	<b>BKS-B 49</b> Right angle female	<b>BKS-S 49</b> Right angle female
Position switch S49		Position switch S49	
 <p>PX1600</p>	 <p>PX0240</p>	 <p>PX1601</p>	 <p>PX0196</p>
<p>BKS-B 48-1-03</p>	<p>BKS-S 48-1-03</p>	<p>BKS-B 49-1-03</p>	<p>BKS-S 49-1-PU-03</p>
<p>10...30 V DC 3 m molded PVC 3x0.25 mm<sup>2</sup> IP 67 -20...+85 °C</p>	<p>10...30 V DC 3 m molded PVC 3x0.34 mm<sup>2</sup> IP 67 -25...+90 °C</p>	<p>10...30 V DC 3 m molded PVC 3x0.25 mm<sup>2</sup> IP 67 -20...+85 °C</p>	<p>10...30 V DC 3 m molded PUR 3x0.34 mm<sup>2</sup> IP 67 -25...+90 °C</p>
			



**2.1**  
Multiple position switches series  
602-11  
610-11  
611-11  
612-11  
613-11  
605-11  
603-11  
650-11  
Single position switches series  
H2 and H3

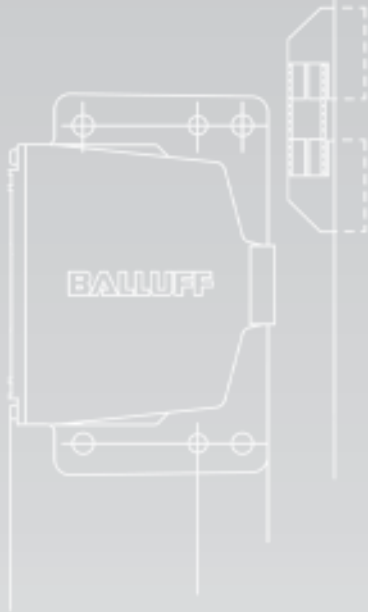
**5.1**  
**5.2**  
**5.3**





**Inductive multiple  
position switches  
with extended  
switching  
distance 4 mm**

96	Principles
97	Series 602-11 per DIN 43697
98	Series 610-11
99	Series 605-11



**more added value**

- Very long service life
- Highly reliable,  
especially for robotic applications



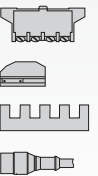
**2.2**

Multiple  
position  
switches  
series  
602-11  
610-11  
605-11

**5.1**

**5.2**

**5.3**





# Inductive Multiple Position Switches with Extended Switching Distance 4 mm

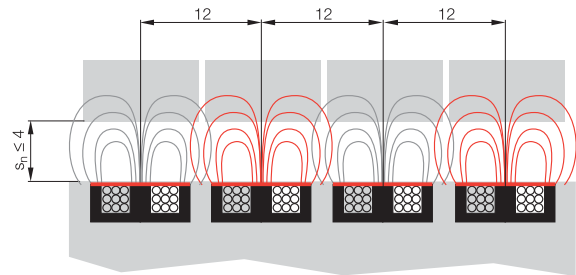
## Principles

Inductive multiple position switches in this series are characterized by a compact housing and generous switching distances. The result is a non-contacting, wear-free sensor.

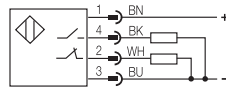
The tuned sending frequencies of the inductive switch elements allow them to be located very close to each other.

Mutual interference is precluded at 12 mm spacing and 4 mm switching distance.

The inductive switch elements are already factory installed.



Complementary inductive switch elements can be used as normally open or normally closed.



### Robot Movement Safety

If two physical channels (1 normally and 1 normally closed) are powered by a switching power supply, this will enable cross-connection detection.

In such a system different signals must be sent to the controller.

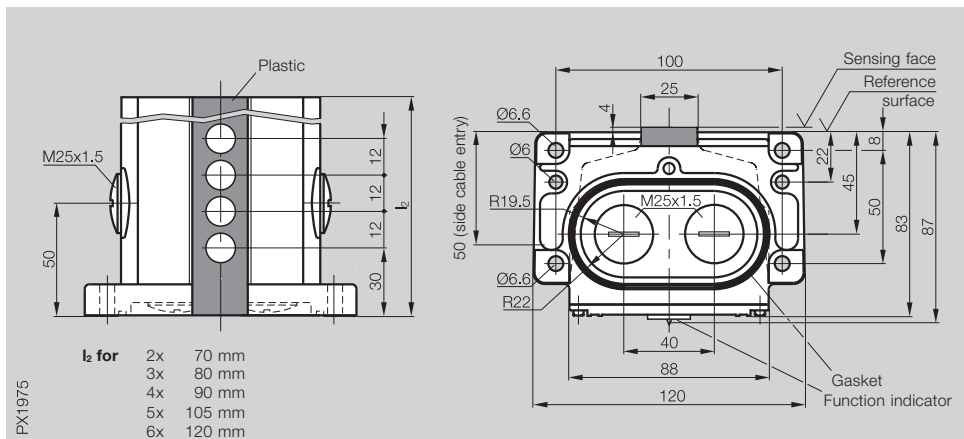
In case of error (short circuit, miswiring, ...) both signals are identical and are recognized by the controller as a cross-connection fault condition. Monitoring can be handled by a safety programmable controller or with a Pilz type safety switching device.



# Inductive Multiple Position Switches with Extended Switching Distance 4 mm

Series 602-11  
per DIN 43697

Type	Multiple position switch
Switch position spacing	12 mm
Mounting and function dimensions	per DIN 43697



Ordering code	BNS 816-X603-B_-00-12-602-11
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	M25x1.5 for connector or cable gland
Ambient temperature range	-25...+70 °C
Degree of protection per IEC 60529	IP 67
Function indicator	LED

## Inductive switch elements with head Ø 10 mm

Inductive switch elements	Electrical version	Rated operating distance $s_n$	Assured operating distance $s_a$
BES 517-100-S42, ...-S43, ...-S44	PNP, complementary, 10...60 V DC, short circuit protected	4 mm	0...3.2 mm

Ordering example:

**BNS 816-X603-B04-00-12-602-11**

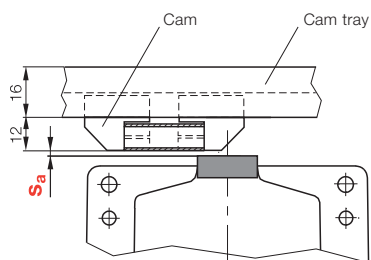
**BNS 816-X603-B\_-00-12-602-11**

### No. of switch positions

- 02** 2x
- 03** 3x
- 04** 4x
- 05** 5x
- 06** 6x

Other sizes and connectors on request.

## Installation



**Caution!**  
To ensure switching function  $s_a$  must be in a range of  $0 < s_a \leq 0.81 s_n$ .



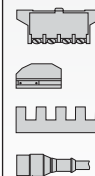
**2.2**

Multiple position switches series  
**602-11**  
610-11  
605-11

**5.1**

**5.2**

**5.3**

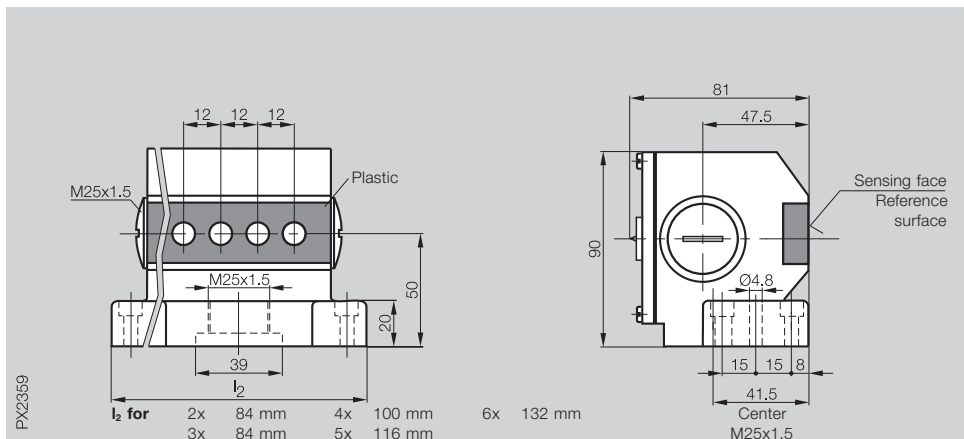




# Inductive Multiple Position Switches with Extended Switching Distance 4 mm

Series 605-11

Type	Multiple position switch
Switch position spacing	12 mm



Ordering code	BNS 816-X603-B_ _-00-12-605-11
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	M25x1.5 for connector or cable gland
Ambient temperature range	-25...+70 °C
Degree of protection per IEC 60529	IP 67
Function indicator	LED

## Inductive switch elements with head Ø 10 mm

Inductive switch elements	Electrical version	Rated operating distance $s_n$	Assured operating distance $s_a$
BES 517-100-S42, ...-S43, ...-S44	PNP, complementary, 10...60 V DC, short circuit protected	4 mm	0...3.2 mm

Ordering example:

**BNS 816-X603-B04-00-12-605-11**

**BNS 816-X603-B\_ \_-00-12-605-11**

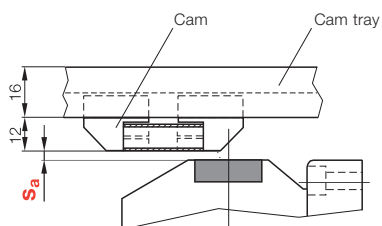
### No. of switch positions

- 02 2x
- 03 3x
- 04 4x
- 05 5x
- 06 6x

Inquire for connectors.

**Not for new applications.  
Still available for replacements.**

## Installation



**Caution!**  
To ensure switching function  $s_a$  must be in a range of  $0 < s_a \leq 0.81 s_n$ .



**2.2**

Multiple position switches series

602-11

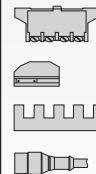
610-11

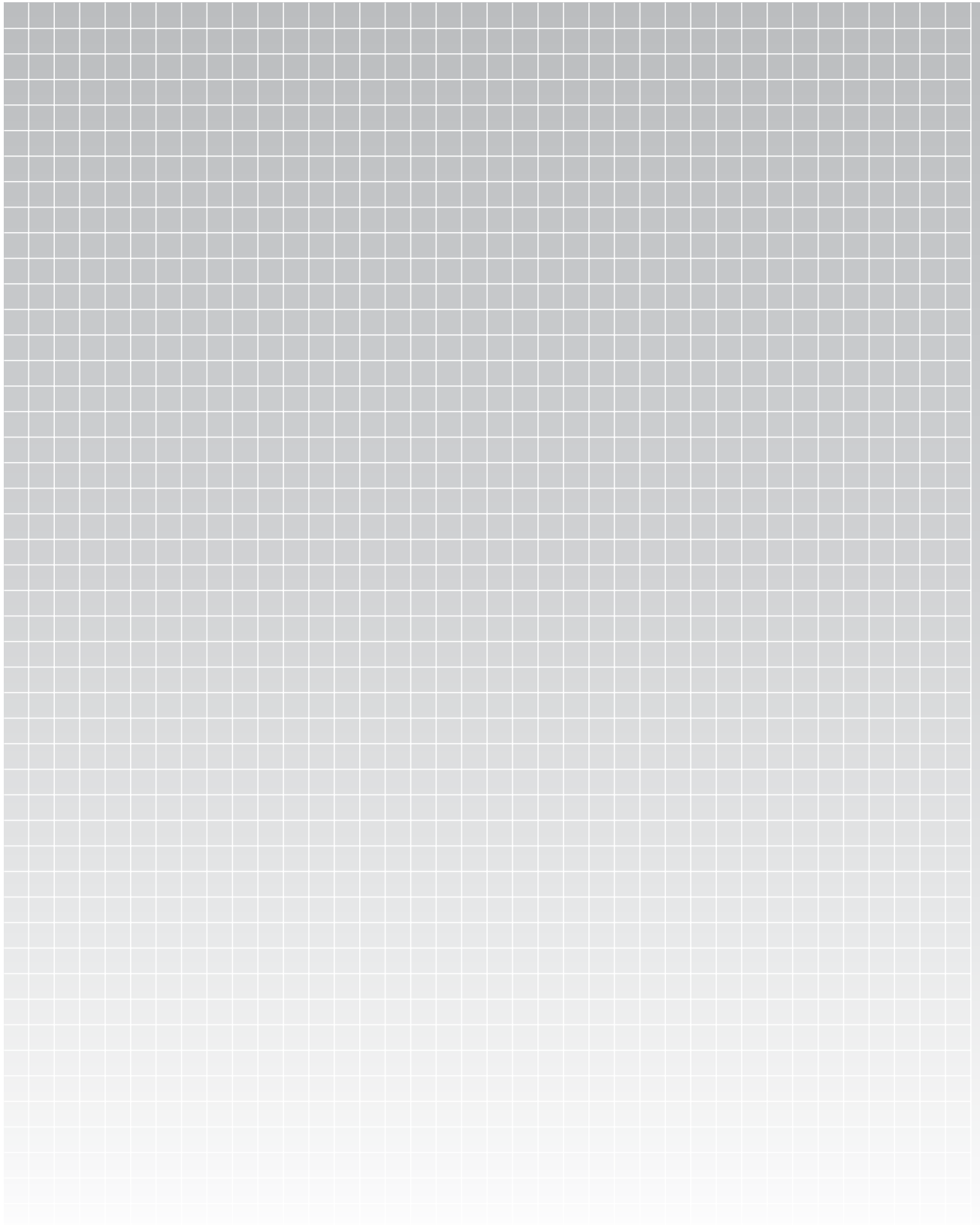
605-11

**5.1**

**5.2**

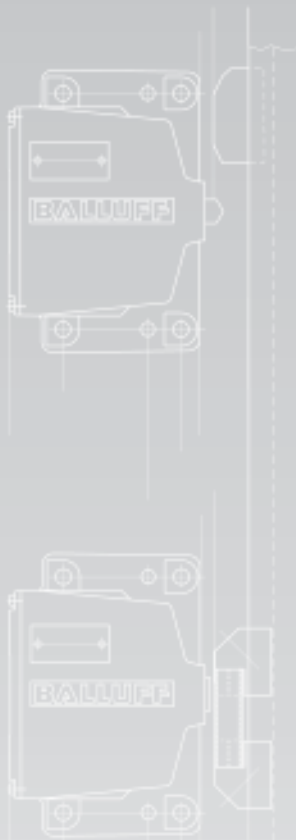
**5.3**





**Special form factors**

- 102 Multiple position switches with mechanical and inductive switch positions
- 104 Custom products



**more added value**

- Long service life
- Optimized for your requirements and applications

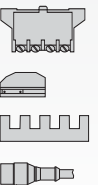


**3**

**5.1**

**5.2**

**5.3**



### Mechanical and inductive switch positions in one multiple switch housing

For applications in which different requirements need to be met, mixed assemblies can be used. For example, simple position sensing can be done using inductive switch elements, and safety-relevant functions handled using safety switch positions.

The following possibilities are available:

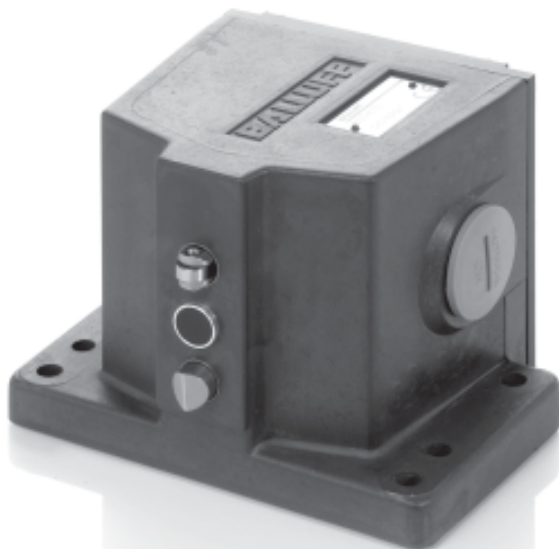
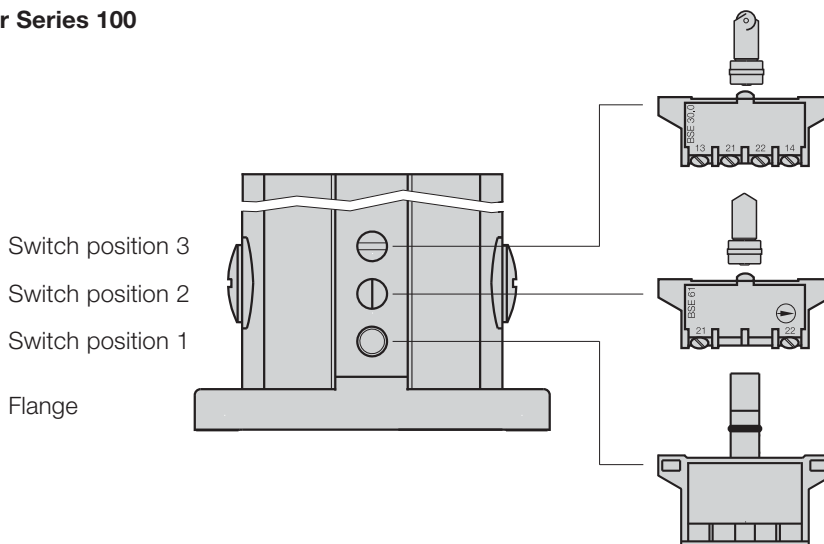
- Mechanical switch element actuated with telescoping plunger
- Safety switch element per DIN EN 60204-1/VDE 0113 actuated with rigid plunger
- Inductive switch element

### Mixing options

When ordering please indicate the **individual switch positions** in plain text. Begin with the first switch position as seen from the mounting surface.

Mixed assembly switches get a special ordering code.

### Example for Series 100



### Plunger styles

- Chisel (**D**)
- Ball (**K**)
- Roller (**R**)
- Roller bearing (**L**)

### Mechanical switch elements

- BSE 30.0
- BSE 61 to
- DIN EN 60204-1/VDE 0113,
- BSE 85 to
- DIN EN 60204-1/VDE 0113

### Inductive switch elements

- PA BES 517-110
- NA BES 517-108
- WS BES 517-410
- WO BES 517-421
- KHG BES 517-560-H
- KHH BES 517-561-H
- NG BES 516-314-N
- THA BES 517-142-Y
- EJA BES 517-463
- AAA BES 517-464
- DH BES 516-110-D

Optional

### Function indicators

**FD/FE/FC** for mechanical switch positions

**Connector S80/S90** to make installation easier



**Note for standard series**

The standard versions are described in:

**Section 1**  
Mechanical Single and Multiple Position Switches

**Section 2**  
Inductive Single and Multiple Position Switches

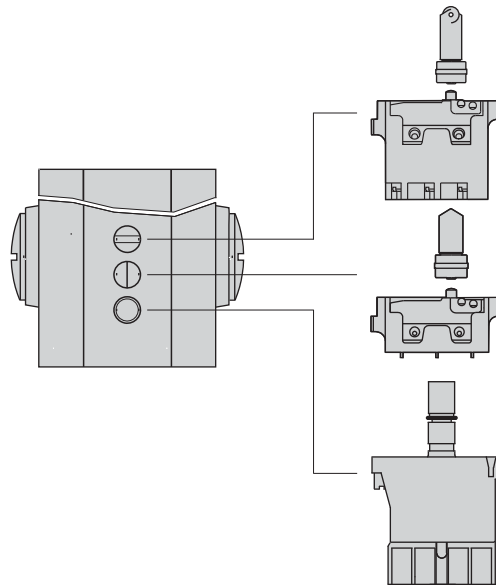
Detailed information on switch elements and plungers can be found in:

**Section 5.1**  
Mechanical and Inductive Switch Elements

Section   
Principles

**Example for Series 40**

Switch position 3  
Switch position 2  
Switch position 1



**Plunger styles**

- Chisel (**D**)
- Ball (**K**)
- Roller (**R**)

**Mechanical switch elements**

- BSE 63 with forced-opening
- BSE 64 with forced-opening
- BSE 69.1
- BSE 70.1
- BSE 73.1
- BSE 74.1

**Inductive switch elements**

- TNB BES 517-311-Y
- TOB BES 517-312-Y

Optional **Function indicator FC** for mechanical switch positions  
**Connector S80** to make installation easier



**3**

**5.1**

**5.2**

**5.3**



**Make use of the Balluff offering in the customer-specific products area**

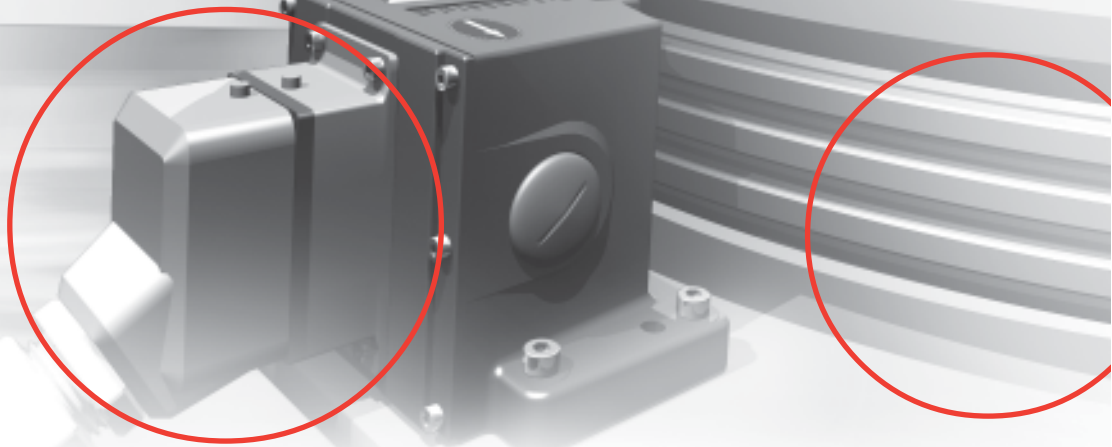
Mixed assembly switches optimized for your requirements and applications

Your Balluff sales team will be glad to help you select the right switch.

**more added value**

Customer-specific products  
Increasing your productivity





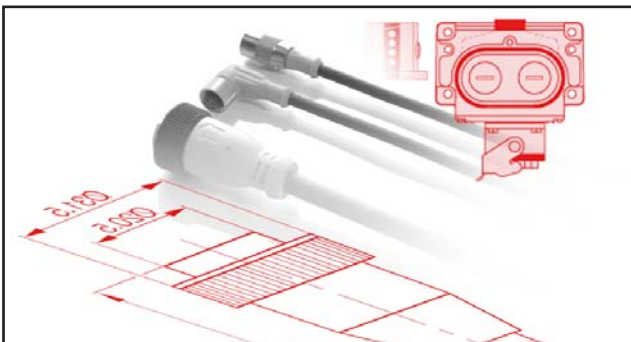
3

5.1

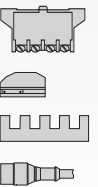
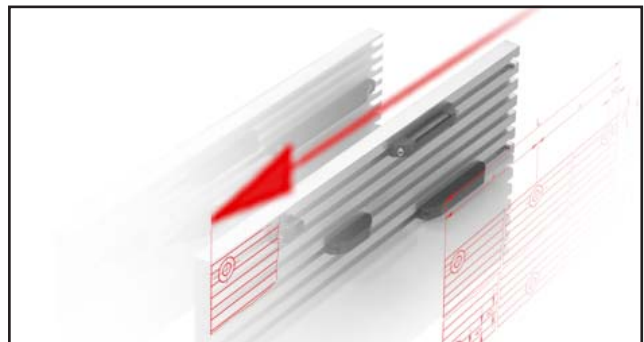
5.2

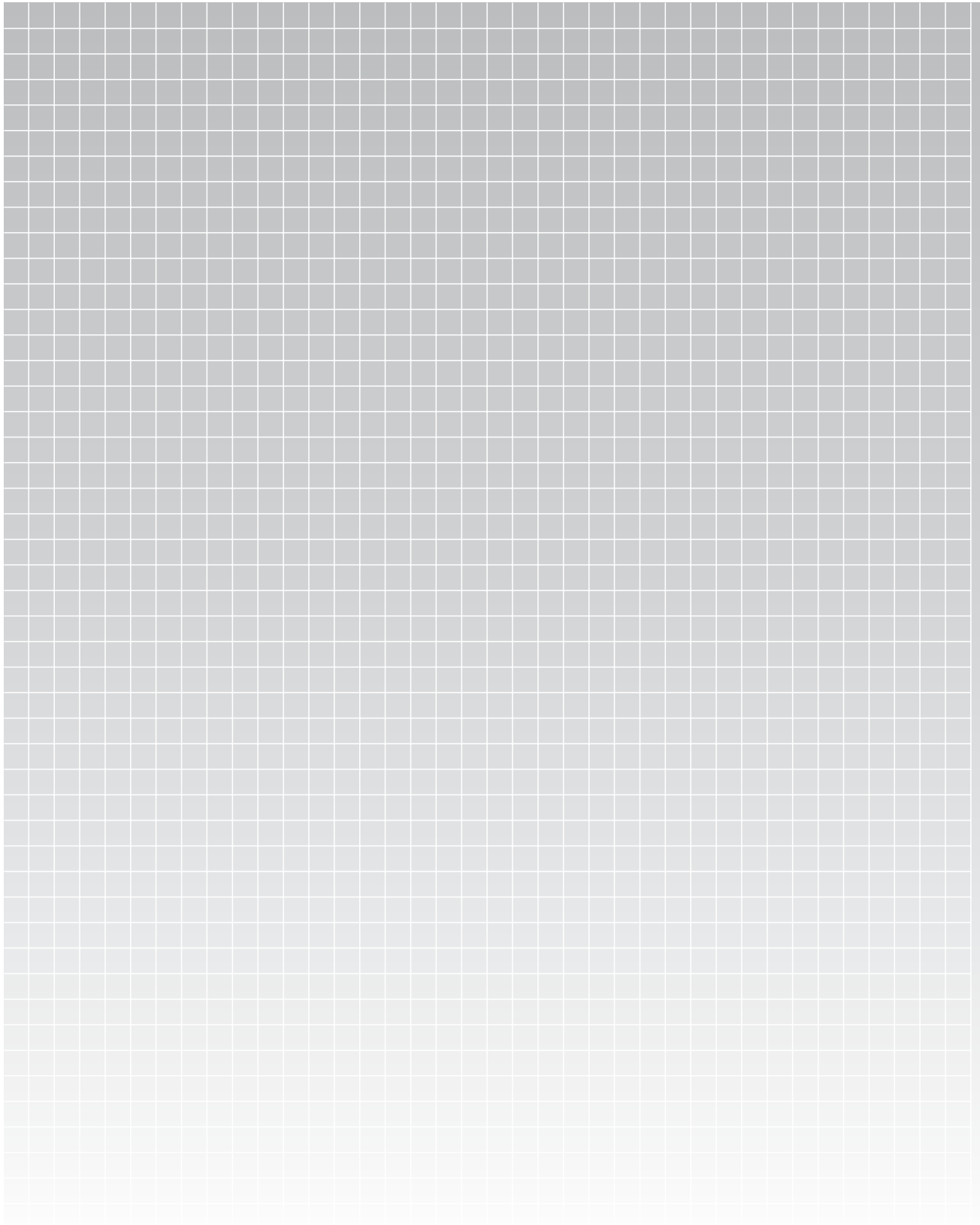
5.3

Customer-specific connectors



Cam trays in flexible lengths



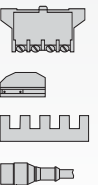


**Wireless system**

108 Principles  
110 Wireless  
Position Switches  
Series F 60  
per DIN 43693  
112 Wireless Receiver Box  
BWT R1-4R1D-10\_-T

**more added value**

- Simplest and most economical installation
- For flexible use
- Also ideal for retrofits





**Wireless transmission system for mechanical switches**

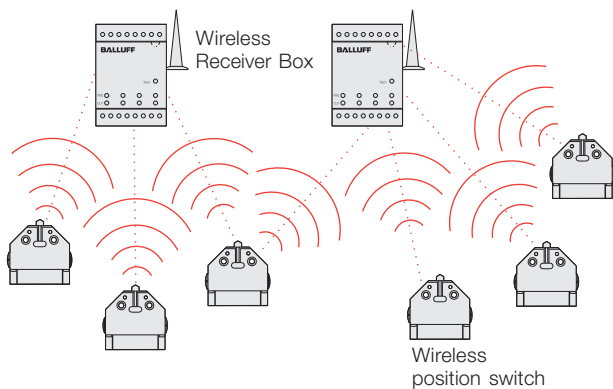
- Self-contained transmitter with no separate power supply
- 868 MHz standard transmission frequency, no license fees
- Simplest installation with no wiring complexity
- Mounting and function dimensions per DIN 43693

**Applications**

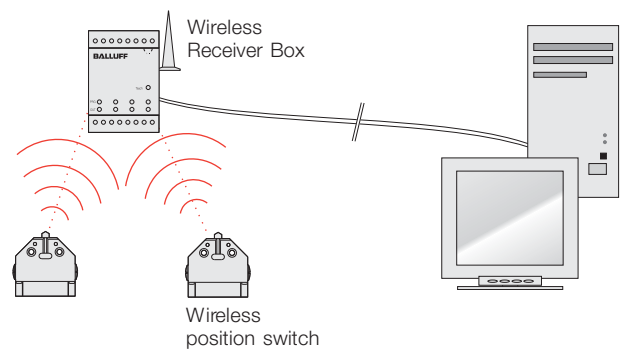
- Grippers
- Rotary index tables
- Specialty machine building
- Retrofitting



**Multi-network capable**



**Serial data output**





**Advantages of the wireless position switch**

- Simple installation, no wiring complexity for the switch
- For flexible use
- Also ideal for retrofitting machines and equipment

**Ranges**

- approx. 30 m on plant floors, up to 300 m outdoors
- approx. 20 m through max. 5 walls (plaster board/dry wood)
- approx. 10 m through max. 2 walls (tile/aerated concrete)

**Wireless position switch per DIN 43693**

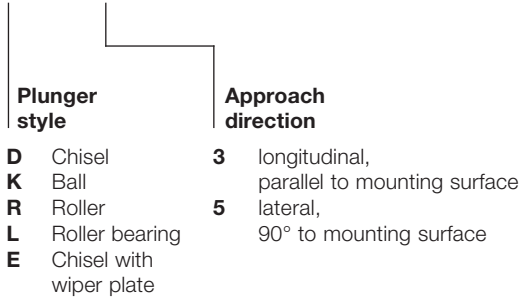
- Dual-chamber system with IP 67 protection: wear-free membrane with hermetic sealing from plunger mechanism and switch chamber
- Maintenance-free, self-lubricating plunger guide with slide bearing

**Wireless position switch with wiper plate**

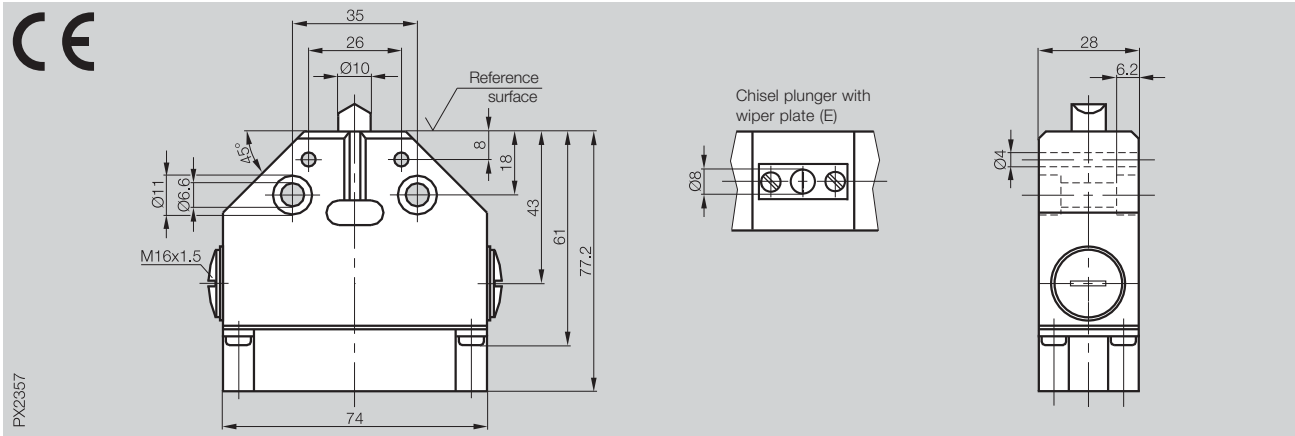
- Increased function security under extreme conditions of use
- Wiper plate prevents plunger from sticking in the guide
- For use in wet areas with strongly adhering media

Ordering example:  
**BNS 819-FD-60-W13**

**BNS 819-F -60-W1**



Type	Wireless position switches
Mounting and function dimensions	per DIN 43693



Plunger style	Chisel (D), Ball (K), Roller (R), Roller bearing (L) or Chisel with wiper plate (E)
Plunger material	Stainless steel, contact surfaces induction hardened
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Ambient temperature range	0...+70 °C
Degree of protection per IEC 60529	IP 67

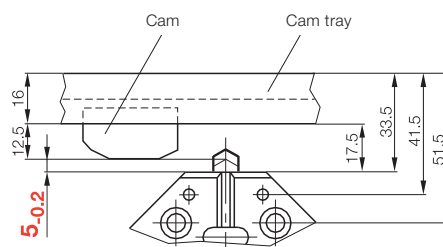
With switch element	<b>BWT T1-185-01</b>
Ordering code	BNS 819-F_-60-W1_

<b>Switch element</b>	
Transmitting frequency	868 MHz
Switching and transmission principle	snap switch, Electro-generated power production, 14-byte protocol, duty cycle 1 %, 3 protocols per send procedure Uni-directional transmission from switch to receiver

<b>Mechanical data</b>	
Plunger point to reference surface	8 mm
Switchpoint to reference surface	5.5 mm
Maximum plunger travel	3.7 mm
Switching actuating force on plunger	min. 20 N
Switching frequency	max. 60/min
Approach speed	Plunger D, E: 10 m/min Plunger K: 8 m/min Plunger R: 20 m/min Plunger L: 60 m/min
Repeatability	± 0.2 mm

For applications with very limited space, smaller form factors with battery on request.

### Installation



**Note!**  
To ensure switching function, the dimension 5-0.2 is especially critical.



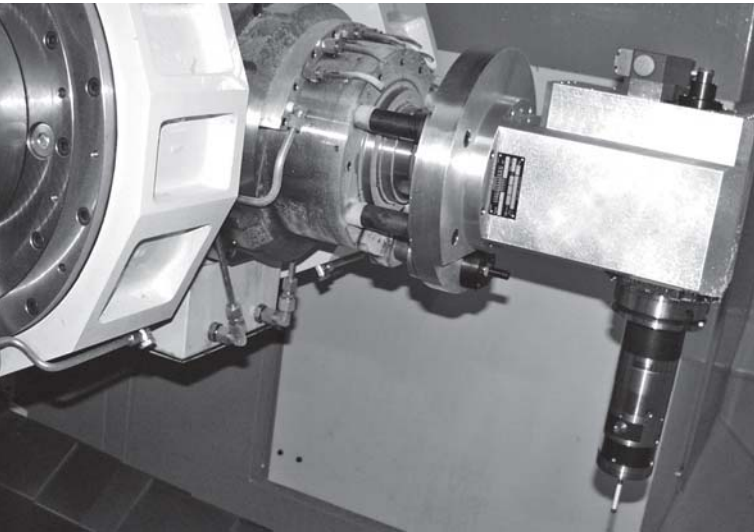


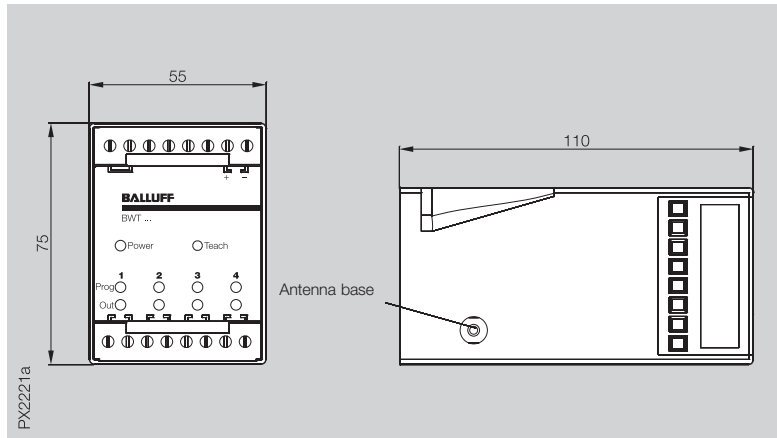
Photo credit: MCM

**Advantages**

- Simple installation using teach-in and active range restriction in programming mode
- Power-Down function with BWT R1-4R1D-102-T for storing the last signal status when receiver power is interrupted
- Protection against inadvertent teaching with programming jumper
- LED for visualizing programming
- LED's for indicating switching states
- 4 programmable outputs – normally open or normally closed
- Antenna socket for SMB plug
- Easy mounting on DIN rail
- Reset function



Type	Wireless receiver box	Wireless receiver box with Power-Down function



Ordering code	BWT R1-4R1D-101-T	BWT R1-4R1D-102-T
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### Electrical data

Rated operational voltage $U_e$	24 V DC
Supply voltage $U_B$	20.4...28.8 V DC
Ripple	$\leq 5\%$ of $U_e$
No-load supply current $I_0$ max.	20 mA
Current consumption	1.5 W
Max. load	2 A/30 V DC
Min. relay switching frequency (1 A, 30 V DC, resistive load)	$2 \times 10^5$

### Mechanical data

Housing material	PC
Connection type	Clamping terminal
Degree of protection per IEC 60529	IP 20
Contamination class	2

### Ambient data

Max. range	30 m
Range reduction during the programming procedure	0.5 m
Receive frequency	868 MHz
Ambient temperature range $T_a$	+5...+65 °C
Utilization category	DC 13

### Antenna

#### BWT A4-01-50R-SMB-02,5

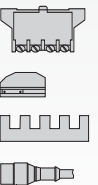
please order separately!

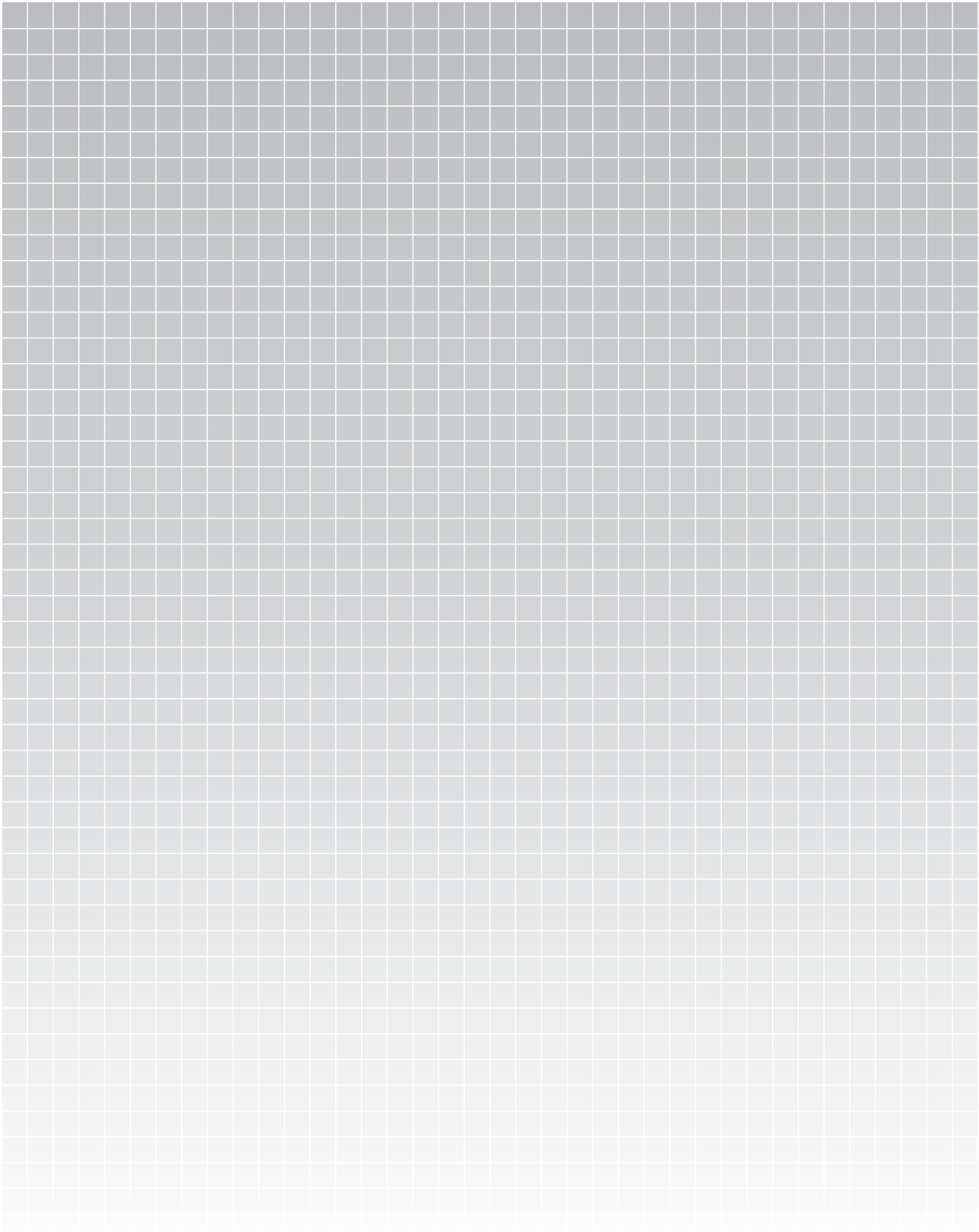
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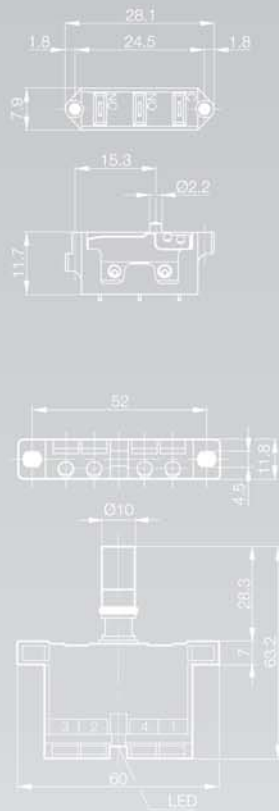
5.1

5.2

5.3







**more added value**

- Mechanical and inductive principle selectable
- Sensors and accessories ideally matched



116 Snap switch elements, Creep switch element BSE

117 Snap switch elements BSE

118 Inductive switch elements DC 3/4-wire

120 Inductive switch elements AC, DC 2-wire

122 Snap switch element BWT for wireless position switch F 60

# Mechanical switch elements

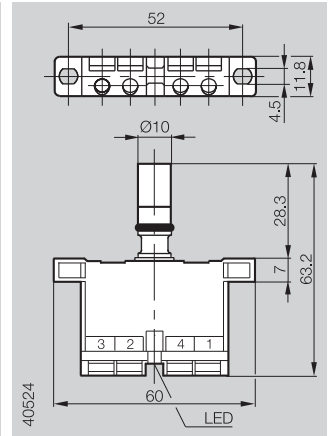
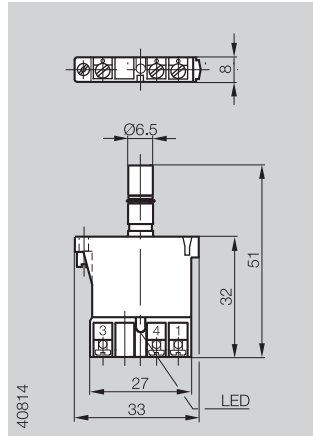
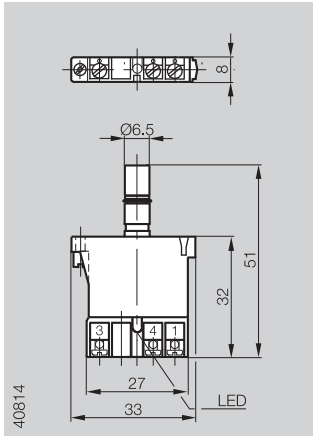
## Snap switch elements, creep switch element BSE

Type	Snap switch element BSE 30.0	Creep switch element BSE 61 to DIN EN 60204-1	Snap switch element BSE 85 to DIN EN 60204-1
for multiple position switches series	100, 62, 61, 72	100, 62, 61, 72	100, 62, 61, 72
for single position switches series	F 60	F 60	F 60
Order code for replacement switch elements	BSE 30.0	BSE 61	BSE 85
<b>Construction</b>	<b>Silver, gold plated</b>	<b>Silver</b>	<b>Silver</b>
Contact material	Snap switch	Creep switch, positive-opening	Snap switch, positive opening (normally-closed)
Switching principle	Dual changeover, one normally open and one normally closed, galvanically isolated.	Normally-closed, double interruption	Dual-changeover: 1. NO (snap function), 2. Positive-opening (double-interruption), all galvanically isolated
Contact system	NO 13 + 14 NC 21 + 22	NC 21 + 22	NO 13 + 14 NC 21 + 22
Contact arrangement			
Wire cross-section (with end ferrule)	max. 2x1.5 mm <sup>2</sup>	max. 2x1.5 mm <sup>2</sup>	max. 2x1.5 mm <sup>2</sup>
Connection type	Screw connection M3	Screw connection M3	Screw terminal M3.5
<b>Mechanical data</b>			
Switching actuation force on telescoping plunger	min. 20 N		min. 30 N
Switching actuation force on rigid plunger		min. 15 N	
Bounce time	≤ 1.5 ms		≤ 3 ms
Switchover time	≤ 10 ms		≤ 5 ms
Switching frequency	300 operations/min	300 operations/min	160 operations/min
Housing material	Duro- and Thermoplast	Duro- and Thermoplast	Thermoplast
Tightening torque max.	0.5 Nm	0.5 Nm	0.9 Nm
Ambient temperature range T <sub>a</sub>	-5...+85 °C	-5...+85 °C	-5...+85 °C
<b>Electrical data</b>			
Isolation	Group C (VDE 0110)	Group C (VDE 0110)	Group C (VDE 0110)
Nominal voltage	240 V AC	250 V AC	250 V AC
Constant current	6 A	6 A	6 A
Minimum load at 24 V DC	≥ 20 mA	≥ 20 mA	≥ 20 mA
Contact resistance	< 40 mΩ	< 40 mΩ	< 40 mΩ
Switching capacity	AC 250 V, 40...60 Hz	Depends on traverse speed and switching frequency	2 A, cos φ = 0.8
	DC 220 V		
	DC 24 V		
	6 A, cos φ = 1 2 A, cos φ = 0.8 1 A, cos φ = 0.4		
	0.5 A, L/R = 200 ms 4 A, L/R = 200 ms		
<b>Service life</b>			
Mechanical data	> 30 mil. switching operations (VDE 0660)	> 30 mil. switching operations (VDE 0660)	> 1 mil. switching operations (VDE 0660)
Electrical data	Depending on load, switching frequency and traverse speed	Depending on load, switching frequency and traverse speed	Depending on load, switching frequency and traverse speed
Approval	UL, CSA, CCC	CSA, CCC	cULus, CSA, CCC



Snap switch element BSE 69.1, BSE 73.1		Snap switch element BSE 70.1, BSE 74.1		Snap switch element with positive-opening BSE 63		Snap switch element with positive-opening BSE 64	
46, 40		46, 40		46, 40		46, 40	
99, 100		99, 100		99, 100		99, 100	
42729		42730		42729		42730	
BSE 69.1    BSE 73.1		BSE 70.1    BSE 74.1		BSE 63		BSE 64	
<b>Silver    Gold</b>		<b>Silver    Gold</b>		<b>Silver</b>		<b>Silver</b>	
Snap switch		Snap switch		Snap switch		Snap switch	
Single-pole changeover		Single-pole changeover		Single-pole changeover		Single-pole changeover	
 max. 0.75 mm <sup>2</sup> Solder connection		 max. 0.75 mm <sup>2</sup> Screw terminal		 max. 0.75 mm <sup>2</sup> Solder connection		 max. 0.75 mm <sup>2</sup> Screw terminal	
min. 8 N		min. 8 N		min. 7.5 N		min. 7.5 N	
≤ 2 ms		≤ 2 ms		≤ 2 ms		≤ 2 ms	
≤ 10 ms		≤ 10 ms		≤ 10 ms		≤ 10 ms	
200 operations/min		200 operations/min		200 operations/min		200 operations/min	
Thermoplast		Thermoplast		Thermoplast		Thermoplast	
0.12 Nm		0.12 Nm		0.12 Nm		0.12 Nm	
-5...+85 °C		-5...+85 °C		-5...+85 °C		-5...+85 °C	
Group C (VDE 0110)		Group C (VDE 0110)		Group C (VDE 0110)		Group C (VDE 0110)	
250 V AC    30 V DC		250 V AC    30 V DC		250 V AC		250 V AC	
5 A		5 A		5 A		5 A	
≥ 20 mA    ≥ 10 mA		≥ 20 mA    ≥ 10 mA		≥ 20 mA		≥ 20 mA	
< 240 mΩ		< 240 mΩ		< 100 mΩ		< 100 mΩ	
2 A, cos φ = 0.8		2 A, cos φ = 0.8		5 A, cos φ = 0.75		5 A, cos φ = 0.75	
5 A, L/R = 10 ms		5 A, L/R = 10 ms		5 A, L/R = 10 ms		5 A, L/R = 10 ms	
> 10 mil. switching operations (VDE 0660)		> 10 mil. switching operations (VDE 0660)		> 10 mil. switching operations (VDE 0660)		> 10 mil. switching operations (VDE 0660)	
Depending on load, switching frequency and traverse speed		Depending on load, switching frequency and traverse speed		Depending on load, switching frequency and traverse speed		Depending on load, switching frequency and traverse speed	
UL, CSA, CCC		UL, CSA, CCC		cULus, CSA, CCC		cULus, CSA, CCC	

Code for inductive switch elements	<b>TOB</b> <b>1.1 mm</b>	<b>TNB</b> <b>1.1 mm</b>	<b>PA</b> <b>2 mm</b>
Rated operating distance $s_n$			
Assured operating distance $s_a$	0...0.9 mm	0...0.9 mm	0...1.6 mm
for multiple position switches series	603, 650	603, 650	602, 610...613, 605

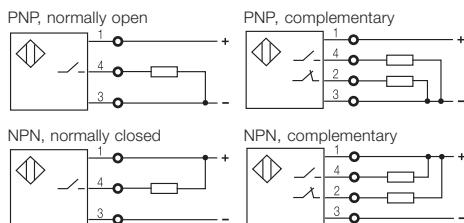


### Order code for replacement switch elements

PNP	NO Complementary	BES 517-312-Y		BES 517-110
NPN	NO Complementary		BES 517-311-Y	

Rated operational voltage $U_e$	24 V DC	24 V DC	24 V DC
Supply voltage $U_B$	10...30 V DC	10...30 V DC	10...60 V DC
Voltage drop $U_d$ at $I_e$ static	$\leq 3.5$ V	$\leq 3.5$ V	$\leq 1.5$ V
Rated insulation voltage $U_i$	75 V DC	75 V DC	75 V DC
Rated operational current $I_e$	130 mA	130 mA	200 mA
No-load current $I_0$ damped/undamped	$\leq 25$ mA $\leq 12$ mA	$\leq 25$ mA $\leq 12$ mA	$\leq 15$ mA $\leq 12$ mA
Off-state current $I$	$\leq 80$ $\mu$ A	$\leq 80$ $\mu$ A	$\leq 50$ $\mu$ A
Polarity reversal protected	yes	yes	yes
Short circuit protected	yes	yes	yes
Permissible load capacitance	$\leq 1$ $\mu$ F	$\leq 1$ $\mu$ F	$\leq 0.5$ $\mu$ F
Repeat accuracy R	$\leq 5$ %	$\leq 5$ %	$\leq 5$ %
Ambient temperature range $T_a$	-25...+70 °C	-25...+70 °C	-25...+70 °C
Switching frequency f	500 Hz	500 Hz	1500 Hz
Utilization category	DC 13	DC 13	DC 13
Function indicator	yes	yes	yes
Degree of protection per IEC 60529	IP 67	IP 67	IP 67
Housing material	PA 6.6	PA 6.6	PA 12
Material of sensing face	PVDF	PVDF	PA 12
Connection type	Screw terminals	Screw terminals	Screw terminals
max. conductor cross-section	up to 1 mm <sup>2</sup>	up to 1 mm <sup>2</sup>	up to 1.5 mm <sup>2</sup>

### Wiring diagrams

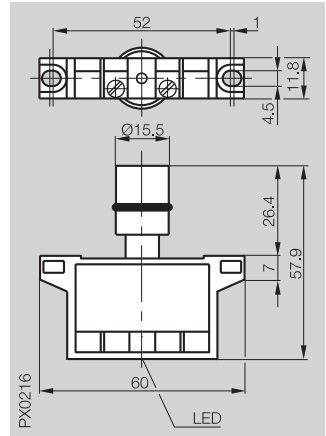
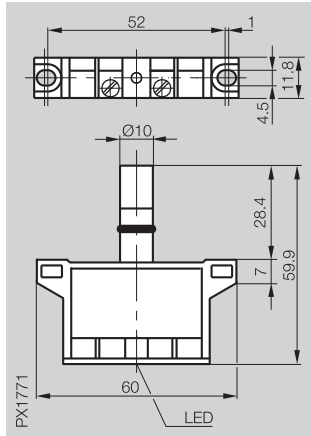
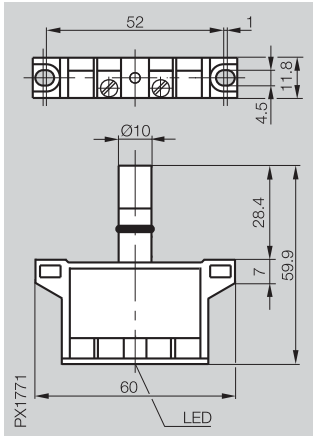


<b>NA</b> <b>2 mm</b> 0...1.6 mm 602, 610...613, 605	<b>THA</b> <b>5 mm</b> 0...4 mm 602, 611, 613, 605	<b>DH</b> <b>2, 2 mm</b> 0...1.8 mm 100, 62, 72, 61
	<p>BES 517-142-Y</p>	<p>BES 516-110-D</p>
<p>BES 517-108</p>		
<p>24 V DC                      10...60 V DC  <math>\leq 1.5 \text{ V}</math>                      75 V DC                      200 mA  <math>\leq 15 \text{ mA} / \leq 12 \text{ mA}</math>  <math>\leq 50 \mu\text{A}</math>                      yes                      yes  <math>\leq 0.5 \mu\text{F}</math>    <math>\leq 5 \%</math>                      -25...+70 °C                      1500 Hz                      DC 13                      yes</p>	<p>24 V DC                      10...30 V DC  <math>\leq 3.5 \text{ V}</math>                      75 V DC                      130 mA  <math>\leq 30 \text{ mA} / \leq 30 \text{ mA}</math>  <math>\leq 80 \mu\text{A}</math>                      yes                      yes  <math>\leq 1 \mu\text{F}</math>    <math>\leq 5 \%</math>                      -25...+70 °C                      500 Hz                      DC 13                      yes</p>	<p>24 V DC                      10...30 V DC  <math>\leq 1.2 \text{ V}</math>                      75 V DC                      400 mA  <math>\leq 30 \text{ mA} / \leq 30 \text{ mA}</math>  <math>\leq 100 \mu\text{A}</math>                      yes                      no  <math>\leq 1 \mu\text{F}</math>    <math>\leq 5 \%</math>                      -25...+70 °C                      1000 Hz                      DC 13                      yes</p>
<p>IP 67                      PA 12                      PA 12                      Screw terminals                      up to 1.5 mm<sup>2</sup></p>	<p>IP 67                      PA 12                      PBT                      Screw terminals                      up to 2.5 mm<sup>2</sup></p>	<p>IP 67                      PA 12                      PA 12                      Screw terminals                      up to 2.5 mm<sup>2</sup></p>

# Inductive switch elements

AC, DC 2-wire

Code for inductive switch elements	<b>WS</b> <b>2 mm</b>	<b>WO</b> <b>2 mm</b>	<b>EJA</b> <b>5 mm</b>
Rated operating distance $s_n$	0...1.6 mm	0...1.6 mm	0...4 mm
Assured operating distance $s_a$ for multiple position switches series	602, 610...613, 605	602, 610...613, 605	602, 611, 613, 605

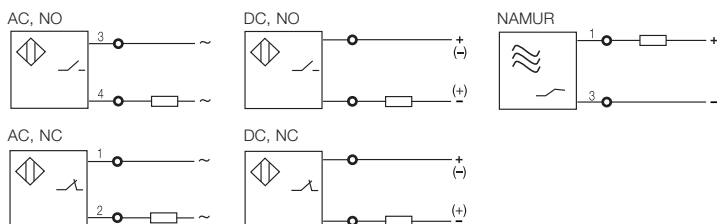


## Order code for replacement switch elements

AC	NO	BES 517-410	BES 517-421	BES 517-463
	NC			
DC	NO			
	NC			
	NAMUR			

Rated operational voltage $U_e$	110 V AC	110 V AC	220 V AC
Supply voltage $U_B$	35...250 V AC	35...250 V AC	90...250 V AC
Voltage drop $U_d$ at $I_e$ static	$\leq 8.5$ V	$\leq 8.5$ V	$\leq 8.5$ V
Rated insulation voltage $U_i$	250 V AC	250 V AC	250 V AC
Rated operational current $I_e$	100 mA	100 mA	100 mA
No-load current $I_0$ damped/undamped			
Off-state current $I$	$\leq 1700$ $\mu$ A	$\leq 1700$ $\mu$ A	$\leq 3000$ $\mu$ A
Polarity reversal protected	yes	yes	yes
Short circuit protected	no	no	no
Permissible load capacitance			
Repeat accuracy R	$\leq 5$ %	$\leq 5$ %	$\leq 5$ %
Ambient temperature range $T_a$	-25...+70 °C	-25...+70 °C	-25...+70 °C
Switching frequency f	10 Hz	10 Hz	15 Hz
Utilization category	AC 140	AC 140	AC 140
Function indicator	yes	yes	yes
Degree of protection per IEC 60529	IP 67	IP 67	IP 67
Housing material	PA	PA	PA
Material of sensing face	PA 12	PA 12	PA 12
Connection type	Screw terminals	Screw terminals	Screw terminals
max. conductor cross-section	up to 2.5 mm <sup>2</sup>	up to 2.5 mm <sup>2</sup>	up to 2.5 mm <sup>2</sup>
Approval	cULus	cULus	cULus
Output signal:			
Fully undamped			
Fully damped			
Permissible series resistance $R_v$			

## Wiring diagrams



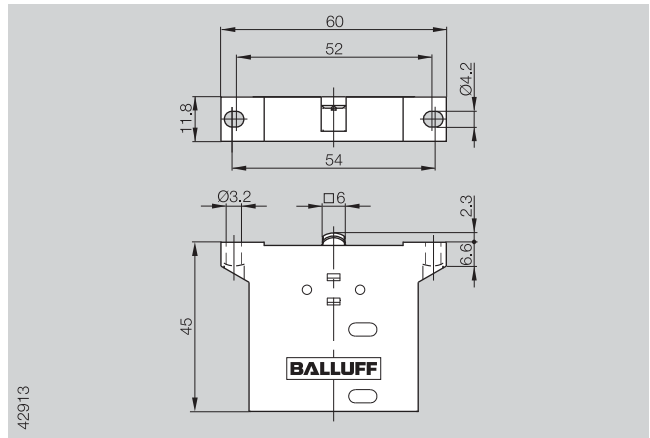
# Inductive switch elements

AC, DC 2-wire  
DC, 2-wire

AAA 5 mm 0...4 mm 602, 611, 613, 605	KHG 2 mm 0...1.6 mm 602, 610...613, 605	KHH 2 mm 0...1.6 mm 602, 610...613, 605	NG 2 mm 0...1.6 mm 602, 610...613, 605
BES 517-464	BES 517-560-H	BES 517-561-H	BES 516-314-N
220 V AC 90...250 V AC ≤ 8.5 V 250 V AC 100 mA	24 V DC 10...55 V DC ≤ 7 V DC 75 V DC 100 mA	24 V DC 10...55 V DC ≤ 7 V DC 75 V DC 100 mA	8.2 V DC 7.7...9 V DC 75 V DC
≤ 3000 µA yes no	≤ 1350 µA yes yes ≤ 0.5 µF	≤ 1350 µA yes yes ≤ 0.5 µF	yes no
≤ 5 % -25...+70 °C 15 Hz AC 140 yes	≤ 5 % -25...+70 °C 1000 Hz DC 13 yes	≤ 5 % -25...+70 °C 1000 Hz DC 13 yes	≤ 5 % -25...+70 °C 1000 Hz no
IP 67 PA PA 12 Screw terminals up to 2.5 mm <sup>2</sup> cULus	IP 67 PA 12 PA 12 Screw terminals up to 2.5 mm <sup>2</sup>	IP 67 PA 12 PA 12 Screw terminals up to 2.5 mm <sup>2</sup>	IP 67 PBT PBT Screw terminals up to 2.5 mm <sup>2</sup>
			Current change (no trigger response) ≥ 4 mA ≤ 1 mA 550...1100 Ohm

5.1

Type	Snap switch element BWT T1-185-01
for wireless position switches series	F 60



Ordering code for replacement element	BWT T1-185-01
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**Construction**

Switching principle	Snap switch
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**Mechanical data**

Switching actuation force on telescoping plunger	min. 20 N
Switching frequency	max. 60 operations/min
Housing material	Duroplast
Ambient temperature range T <sub>a</sub>	-5...+70 °C

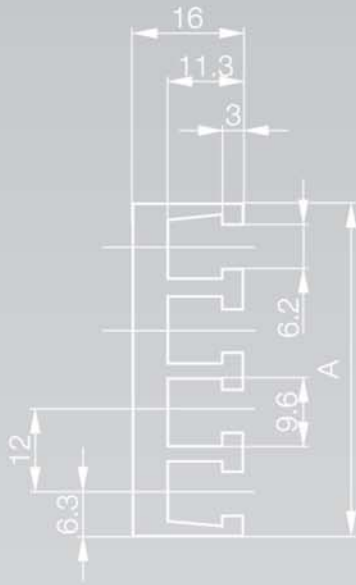
**Electrical data**

Supply voltage	Electrodynamic power generator
Transmitting frequency	868 MHz
Transmission power	max. 10 mW
Protocol	14 bytes
ID number	32 bits
Duty cycle	1 %

**Service life**

Mechanical data	> 0.25 mil. switching operations
Electrical	Depending on load, switching frequency and traverse speed

124 Cam trays  
 126 Cams for mechanical single and multiple position switches  
 128 Cams for inductive single and multiple position switches



**more added value**

- Optimized for your particular application
- Rugged and reliable
- Versatility through many possible combinations

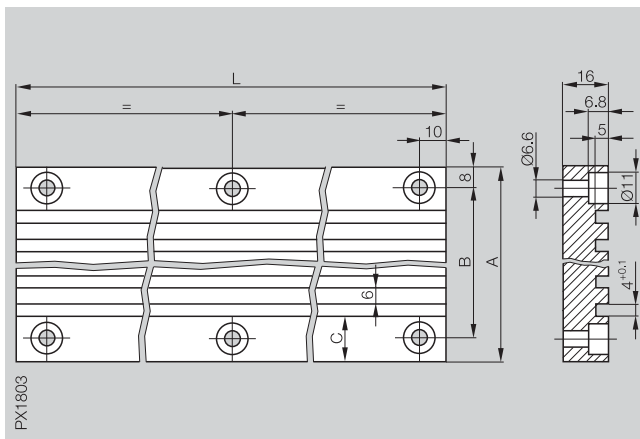
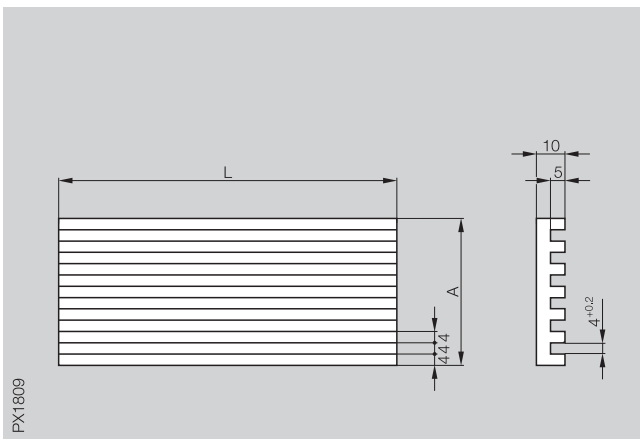




# Cam Trays and Cams

## Cam trays

Type	Aluminum cam trays with <b>8 mm</b> slot spacing for switches with switch position spacing <b>8 mm</b> for cams BNN 520-81-S-___ or BEN 516-19-___	Steel cam trays with <b>10 mm</b> slot spacing for switches with switch position spacing <b>10 mm</b> for cams BNN 520-81-S-___ or BEN 516-19-___
------	--	---



Order code	BNL 5304-080-___ without holes	BNL 5308-100-___ with holes	BNL 5306-100-___ without holes
------------	--------------------------------	-----------------------------	--------------------------------

Number of slots	Dimension A	Number of slots	Dimension A	Dimension B	Dimension C
02	20	02	46	30	16
03	28	03	56	40	16
04	36	04	68	52	17
06	52	05	76	60	16
08	68	06	87	71	16,5
10	84	08	108	92	17
		10	126	110	16
		12	148	132	17
		14	167	151	16,5
		16	188	172	17

Dimensions in mm L = Standard cam tray lengths: 1000, 1200, 1400, 1600, 1800, 2000 or 2500 mm.

L = Standard cam tray lengths: 200, 400, 600, 800, , 1000 or 1200 mm.

### Cam trays

Cam trays are used for holding cams. We offer these in standard lengths with or without standard holes.

### Installation note

Cam trays should be mounted on flat surfaces or machined members.

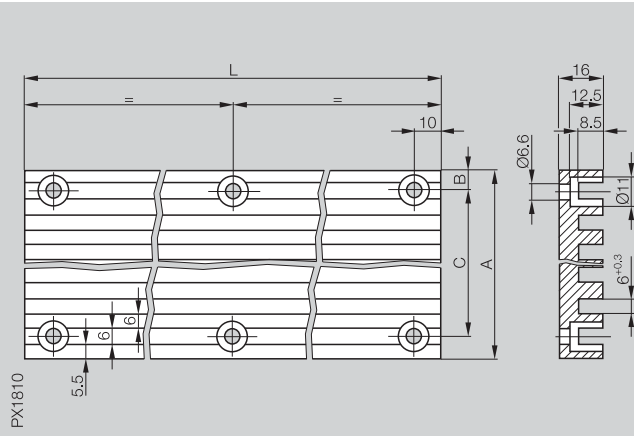
Ordering example:  
**BNL 5304-120-04-1000**

**BNL 53** - - - - -

Version	Slot spacing	Number of slots	Total length L
<b>04</b> Aluminum, no holes	<b>80</b> 8 mm	<b>02</b> 2 slots	(see standard lengths)
<b>07</b> Aluminum, with holes	<b>100</b> 10 mm	...	
<b>06</b> Steel, no holes	<b>120</b> 12 mm	(see table)	
<b>08</b> Steel, with holes	<b>160</b> 16 mm		
<b>10</b> Aluminum, no holes, T-slot			



Aluminum cam trays with **12 mm** slot spacing  
for switches with switch position spacing **12 mm**  
for cams BNN 520-UA/UB-\_\_\_\_ or BEN 516-14-\_\_\_\_  
**Form A per DIN 69638**

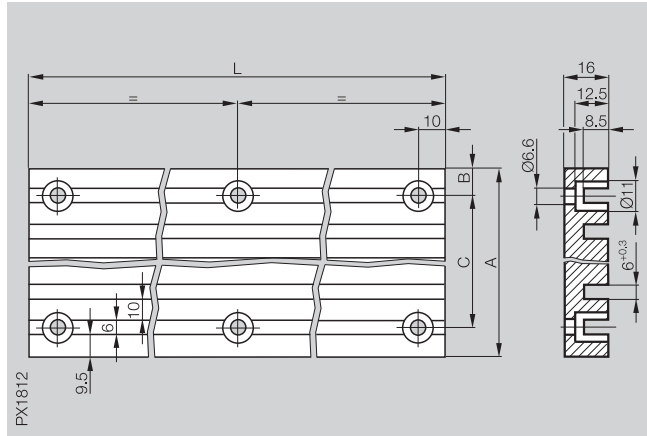


BNL 5307-120-\_\_\_\_ with holes  
BNL 5304-120-\_\_\_\_ no holes

Number of slots	Dimension A	Dimension B	Dimension C
02	29	14.5	
04	53	26.5	
06	77	8.5	60
08	101	8.5	84
10	125	8.5	108

L = Standard cam tray lengths:  
1000, 1200, 1400, 1600, 1800, 2000 or 2500 mm.

Aluminum cam trays with **16 mm** slot spacing  
for switches with switch position spacing **16 mm**  
for cams BNN 520-UA/UB-\_\_\_\_ or BEN 516-14-\_\_\_\_  
**Form A per DIN 69638**

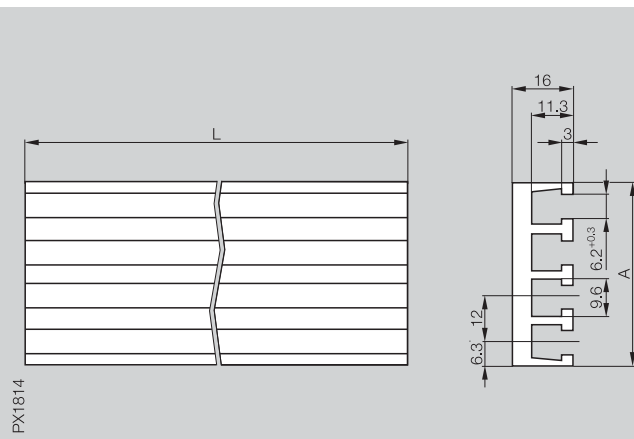


BNL 5307-160-\_\_\_\_ with holes  
BNL 5304-160-\_\_\_\_ no holes

Number of slots	Dimension A	Dimension B	Dimension C
02	41	20.5	
04	73	36.5	
06	105	12.5	80
08	137	12.5	112

L = Standard cam tray lengths:  
1000, 1200, 1400, 1600, 1800, 2000 or 2500 mm.

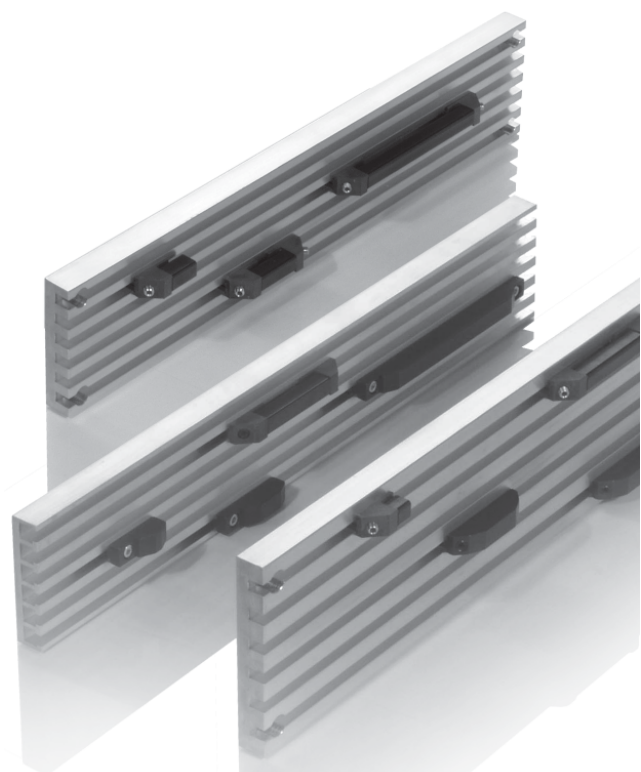
Type Aluminum cam trays with **12 mm** slot spacing  
for switches with switch position spacing **12 mm**  
for cams BNN 520-TA/TB-\_\_\_\_ and BEN 516-13-\_\_\_\_  
**Form B per DIN 69638**



Order code BNL 5310-120-\_\_\_\_ no holes

Number of slots	Dimension A
04	48.6
06	72.6

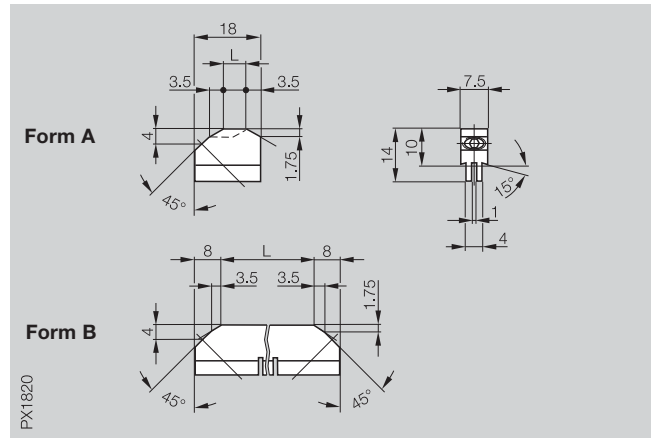
Dimensions in mm L = Standard cam tray lengths:  
200, 400, 600, 800, 1000, 1200, 1400, 1600, 1800, 2000 or 2500 mm.



## Cam Trays and Cams

Cams for mechanical single and multiple position switches

Type	<b>BNN 520-81-S-__</b>
	for switches with switch position spacing <b>8 mm</b> or <b>10 mm</b>
	For use with BNL 5304-080-... or
	BNL 5306/5308-100-...



Ordering code	Form A	L
	BNN 520-81-S-0	0
	BNN 520-81-S-6,5	6,5
Ordering code	Form B	L
	BNN 520-81-S-20	20
	BNN 520-81-S-40	40
	BNN 520-81-S-60	60
	BNN 520-81-S-80	80
	BNN 520-81-S-145	145

Dimensions in mm

L = Length of switching surface. Additional lengths on request.

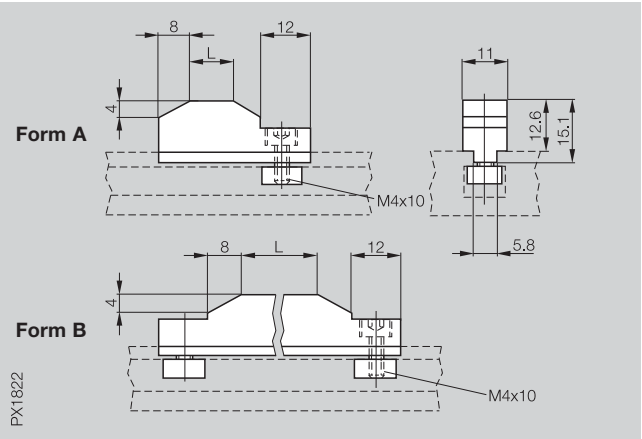
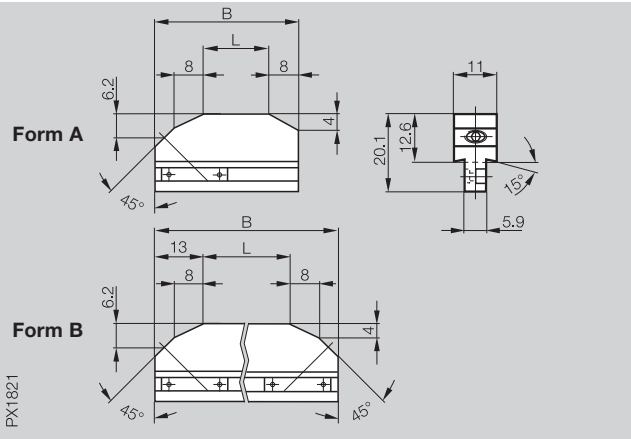
Material: Steel with hardened and burnished surface.

### Mounting possibilities for cams **Note!**

- BNN 520-UA/UB  
When a set screw is tightened, the cam is clamped firmly in the slot.
  - BNN 520-81-S  
When a set screw is tightened, the lower part of the cam is spread apart and the cam held firmly in place.
  - BNN 520-TA/TB  
When a clamping nut is tightened, the cam is clamped firmly in the T-slot.
- Cams for safety switch positions must be installed to fit.
- A tight connection such as is necessary for safety switch positions can be made by the customer with our cams using screws, pins or by welding.

**BNN 520-UA-\_\_ , BNN 520-UB-\_\_ per DIN 69639**  
for switches with switch position spacing **12 mm** and **16 mm**  
For use with BNL 5304/5307-120/160-...

**BNN 520-TA-\_\_ , BNN 520-TB-\_\_ per DIN 69639**  
for switches with switch position spacing **12 mm** and **16 mm**  
For use with BNL 5310-120-...

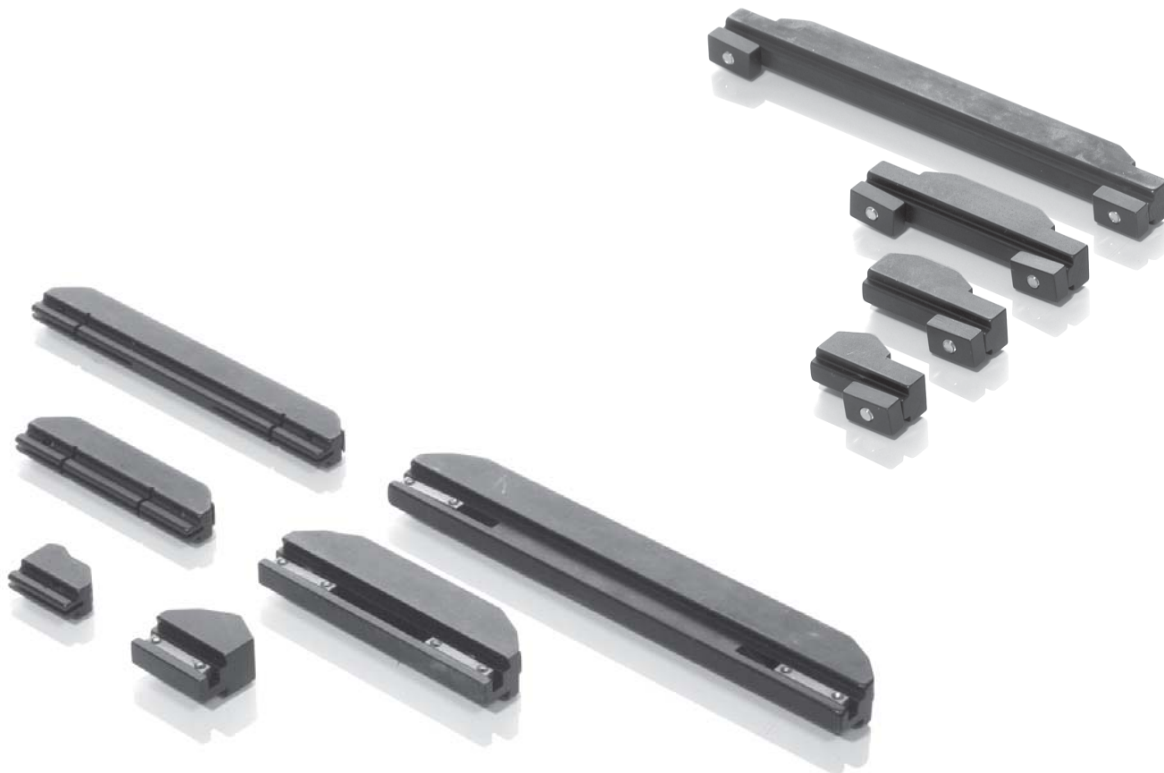


Form A	B	L
BNN 520-UA-0	21	0
BNN 520-UA-4	25	4
BNN 520-UA-10	31	10
BNN 520-UA-16	37	16

Form A	L
BNN 520-TA-0	0
BNN 520-TA-4	4
BNN 520-TA-10	10
BNN 520-TA-16	16

Form B	B	L
BNN 520-UB-25	51	25
BNN 520-UB-40	66	40
BNN 520-UB-63	89	63
BNN 520-UB-100	126	100
BNN 520-UB-120	146	120
BNN 520-UB-150	176	150
BNN 520-UB-200	226	200
BNN 520-UB-250	276	250
BNN 520-UB-300	326	300
BNN 520-UB-400	426	400

Form B	L
BNN 520-TB-25	25
BNN 520-TB-40	40
BNN 520-TB-63	63
BNN 520-TB-100	100



Type	

**Mounting possibilities for cams**

- BEN 516-13  
When a set screw is tightened, the cam is clamped firmly in a T-slot of the cam tray.
- BEN 516-14/19  
When a set screw is tightened, the cam is clamped firmly in a U-shaped slot of the cam tray.

**Note!**

Cams for safety switch positions must be installed to fit.

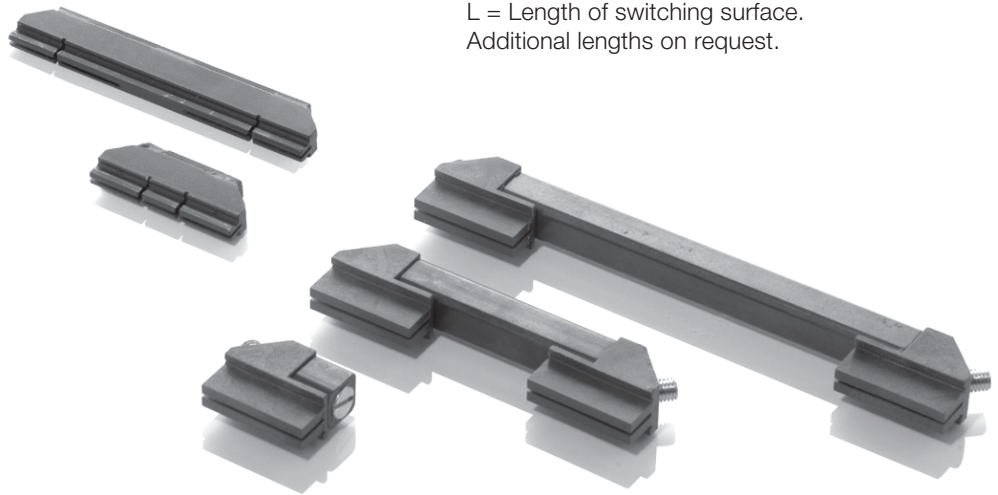
A tight connection such as is necessary for safety switch positions can be made by the customer with our cams using screws, pins or by welding.

Ordering code	
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Ordering code	
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Dimensions in mm

L = Length of switching surface.  
Additional lengths on request.

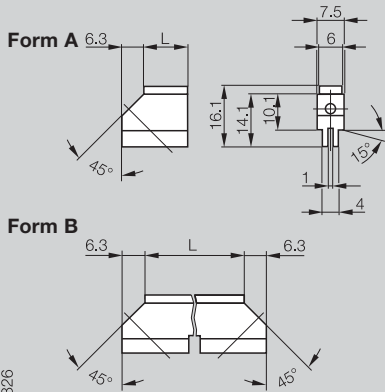


# Cam Trays and Cams

Cams for inductive single and multiple position switches

## BEN 516-19

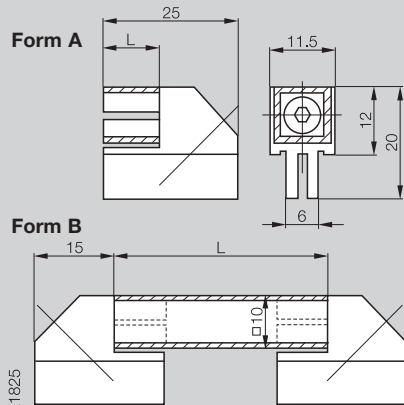
For switches with switch position spacing  
**8 mm and 10 mm**  
For use with BNL 5304-080-...



PX1826

## BEN 516-14

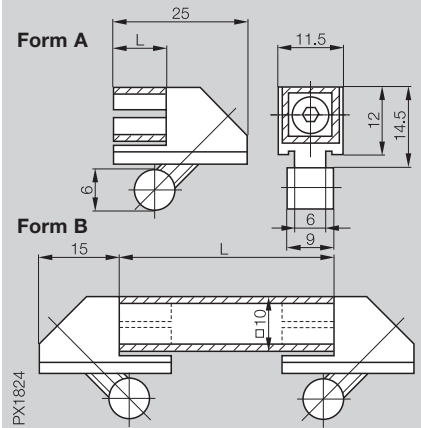
For switches with switch position spacing  
**12 mm and 16 mm**  
For use with BNL 5304/5307-120/160-...



PX1825

## BEN 516-13

For switches with switch position spacing  
**12 mm and 16 mm**  
For use with BNL 5310-120-...



PX1824

Form A	L
BEN 516-19-10	10
BEN 516-19-15	15

Form A	L
BEN 516-14-10	10
BEN 516-14-20	20

Form A	L
BEN 516-13-10	10
BEN 516-13-20	20

Form B	L
BEN 516-19-20	20
BEN 516-19-30	30
BEN 516-19-40	40
BEN 516-19-50	50
BEN 516-19-60	60
BEN 516-19-80	80
BEN 516-19-100	100
BEN 516-19-120	120

Form B	L
BEN 516-14-30	30
BEN 516-14-50	50
BEN 516-14-100	100
BEN 516-14-120	120
BEN 516-14-140	140
BEN 516-14-160	160
BEN 516-14-180	180
BEN 516-14-200	200

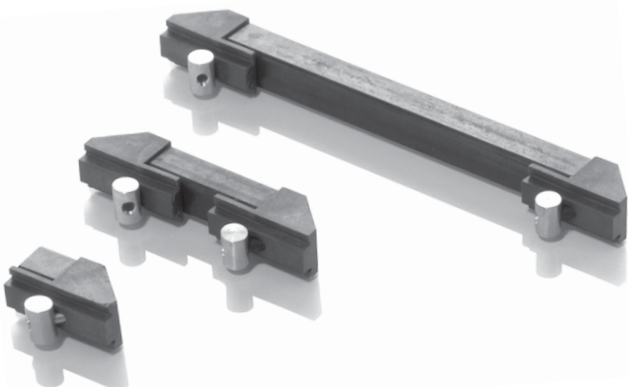
Form B	L
BEN 516-13-30	30
BEN 516-13-50	50
BEN 516-13-100	100
BEN 516-13-120	120
BEN 516-13-140	140
BEN 516-13-160	160
BEN 516-13-180	180
BEN 516-13-200	200

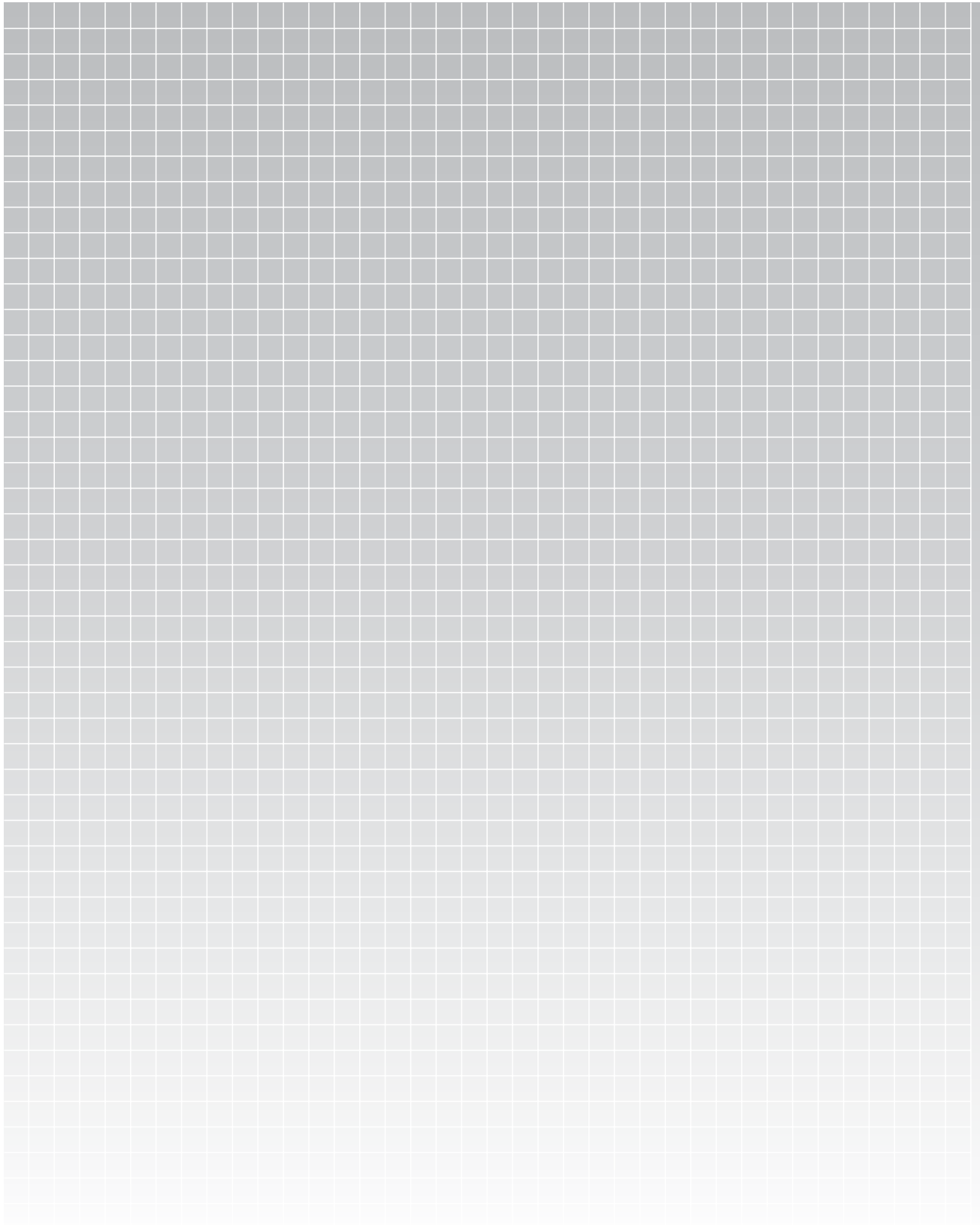
Material: Steel with burnished surface.

Material: Steel damping element with burnished surface and base made of PA 6.6.

Material: Steel damping element with burnished surface and base made of PA 6.6.

## 5.2







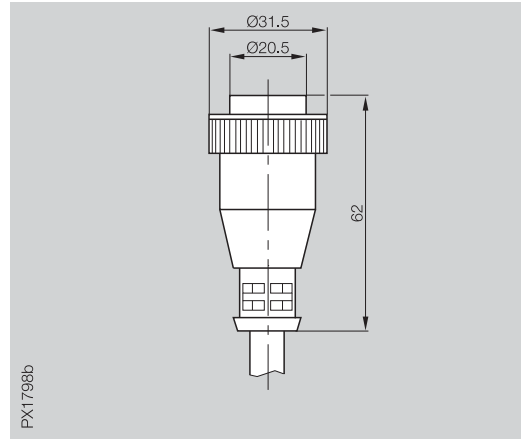
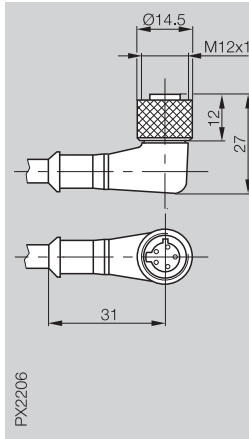
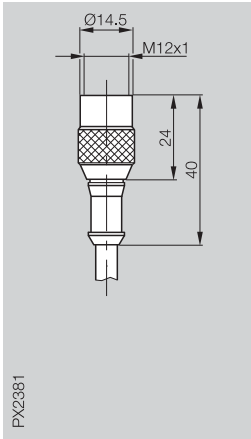
132 AC/DC connectors,  
DC connectors  
134 Function indicators  
FD, FE, FC

**more added value**

- Complete solutions from one source
- Sensors and accessories ideally matched



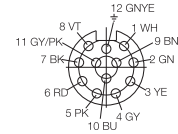
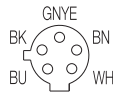
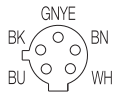
Connector	<b>BKS-S 80</b>	<b>BKS-S 80</b>	<b>BKS-S 90</b>
Version	Straight female	Right angle female	Straight female
Use	BNS ...-S80	BNS ...-S80	BNS ...-S90



12-pin			BKS-S 90-G-PU-__
5-pin	BKS-S 80-G-PU-05	BKS-S 80-W-PU-05	
4-pin			
3-pin			

Supply voltage U <sub>B</sub>	300 V AC/10...60 V DC	300 V AC/10...60 V DC	300 V AC/DC (max. 2 A)
Cable	5 m molded-on PUR	5 m molded-on PUR	6 m/15 m molded-on PUR
No. of wires × cross-section	5×0.5 mm <sup>2</sup>	5×0.5 mm <sup>2</sup>	12×0.5 mm <sup>2</sup>
Degree of protection per IEC 60529	IP 67	IP 68 per BWN Pr. 20	IP 67
Ambient temperature range T <sub>a</sub>	-25...+90 °C	-25...+90 °C	-25...+90 °C

View of female side



Please include cable length in ordering code!  
6 m = 06/15 m = 15

**Note!**

Standard configuration is normally open.  
Other pin assignments on request.

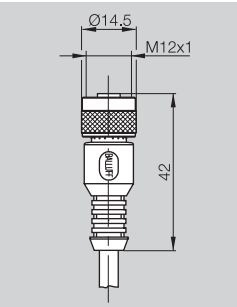
If there are multiple switch positions, multiple connectors or larger connectors with a larger number of pins are used.



# M12 Connectors

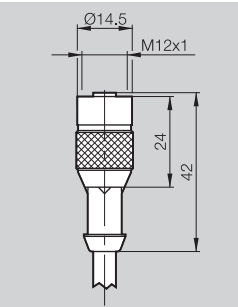
DC connectors

**BKS-B 19**  
Straight female  
BNS ...-S4\_-I (IO-Link)



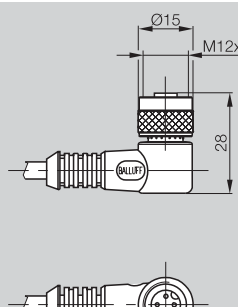
PX1927

**BKS-S 19**  
Straight female  
BNS ...-S4\_-I (IO-Link)



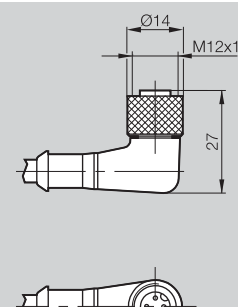
PX0037

**BKS-B 20**  
Right angle female  
BNS ...-S4\_-I (IO-Link)



PX1416

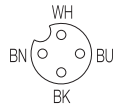
**BKS-S 20**  
Right angle female  
BNS ...-S4\_-I (IO-Link)



PX0095

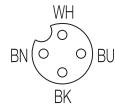
BKS-B 19-3-05  
BKS-B 19-1-03

10...30 V DC  
3 m/5 m molded-on PVC  
3x0.34 mm<sup>2</sup>/4x0.34 mm<sup>2</sup>  
IP 67  
-25...+85 °C



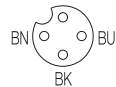
BKS-S 19-3-PU-03  
BKS-S 19-1-PU-03

10...30 V DC  
3 m molded PUR  
3x0.34 mm<sup>2</sup>/4x0.34 mm<sup>2</sup>  
IP 68 per BWN Pr. 20  
-25...+70 °C



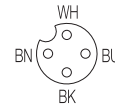
BKS-B 20-1-03

10...30 V DC  
3 m molded PVC  
3x0.34 mm<sup>2</sup>  
IP 67  
-25...+85 °C



BKS-S 20-3-PU-03  
BKS-S 20-1-PU-03

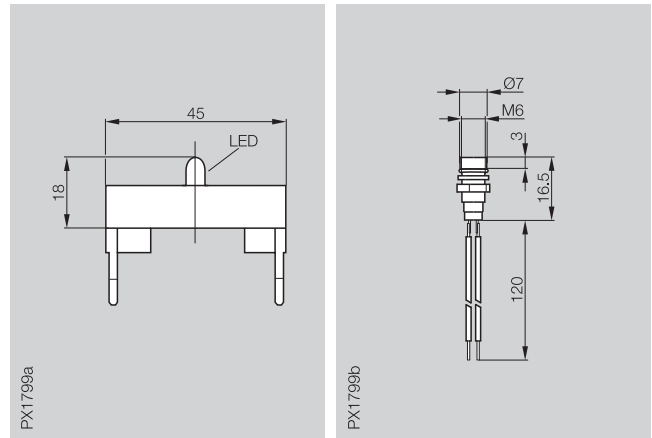
10...30 V DC  
3 m molded PUR  
3x0.34 mm<sup>2</sup>/4x0.34 mm<sup>2</sup>  
IP 68 per BWN Pr. 20  
-25...+70 °C



Other cable lengths on request.

5.3

Type	FD/FE	FC
Application with		
Multiple position switches <b>FD</b> 6...60 V DC/AC	510870	
Multiple position switches <b>FE</b> 90...250 V DC/AC	510880	
Multiple position switches <b>FD</b> 24...28 V DC/AC		149730
Function indicator	LED yellow	LED yellow
Material	PBT	PBT
Version	plug-in	universal



**Plug-in function indication**

For switches assembled with BSE 30.0 and BSE 61 switch elements we offer plug-in function indicators type FD/FE. For switches fitted with BSE 85 we offer the FC function indicator.

A yellow LED indicates the function of the switch position. The LED is visible through a plastic lens on the housing cover.

Three voltage ranges are available for multiple position switches with quick-change unit:

- 6...60 V AC/DC (FD)
- 90...250 V AC/DC (FE)
- 24...28 V DC (FC)

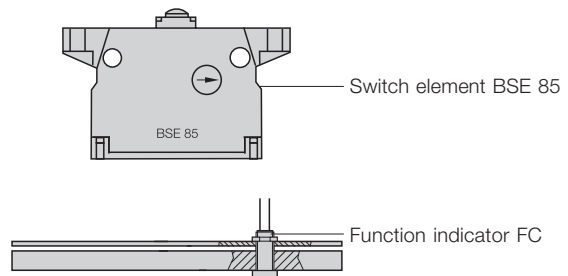
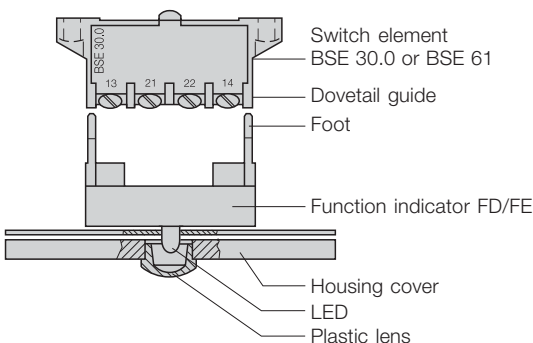


**Installation for FD/FE**

The foot of the function indicator is plugged into the dovetail guide of the snap switch.

**Installation for FC**

The FC function indicator is screwed directly into the cover.



# BALLUFF

sensors worldwide



**Object Detection**



**Linear Position Sensing**



**Industrial Identification**



**Industrial Networking and Connectivity**



**Mechanical Accessories**

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