Object Detection

Mechanical and Inductive Single and Multiple Position Switches

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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.
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Sales Germany

General Information

Principles of Mechanical and Inductive Single and Multiple Position Switches

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 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

Mechanical and Inductive Switch Elements

Cam Trays and Cams

Connectors and Function Indicators

Headquarters

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### 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 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 BW
- 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

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**Fax +49 7158 173-299**

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**

Please check and send fax!
In this section we cover the key concepts, technical details, conditions of use, standards, etc.

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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.

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
Mechanical and Inductive Single and Multiple Position Switches

Applications

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 Single and Multiple Position Switches**

**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

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**Diagram:**

- Slide bearing bush with PTFE coating
- Membrane
- Switch element
- Viton seal
- Plungers
- Housing
- Permanent part label
**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

**Snap switch element BSE 85**
Dual-changeover: 1. Dual-changeover (snap function), 2. Positive-opening (double-interruption), all galvanically isolated

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
Mechanical
Single and Multiple Position
Switches

Plunger styles

Chisel plunger for short actuation travel
- max. approach velocity 12 m/min
- Typical cam length 100 mm
- Defined approach direction
- Repeatability up to ±0.002 mm
- Recommended in conjunction with rigid plunger for safety applications
- Hardened, polished contact surface
- Angle of slope 30°
- 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 ±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 ±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 ±0.002 mm
- Not recommended in safety positions
- Hardened ball
- Hardness 58 HRC

Dimensions of Series
Roller and roller bearing plungers

<table>
<thead>
<tr>
<th>Series</th>
<th>Plunger diameter in mm</th>
<th>Roller diameter in mm</th>
<th>Roller width in mm</th>
<th>Roller bearing diameter in mm</th>
<th>Roller bearing width</th>
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<tbody>
<tr>
<td>46, 40, 99, 100</td>
<td>6</td>
<td>5</td>
<td>3.8</td>
<td>8</td>
<td>3.6</td>
</tr>
<tr>
<td>100, 62, 61, 72, F 60</td>
<td></td>
<td></td>
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<td></td>
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</tbody>
</table>

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

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.

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

<table>
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<th>Category</th>
<th>Typical load applications</th>
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<td>AC 12</td>
<td>Resistive and semiconductor loads, optocouplers</td>
</tr>
<tr>
<td>AC 140</td>
<td>Small electromagnetic load I ≤ 0.2 A; e. g. contactor relay</td>
</tr>
<tr>
<td>DC 12</td>
<td>Resistive and semiconductor loads, optocouplers</td>
</tr>
<tr>
<td>DC 13</td>
<td>Electromagnets</td>
</tr>
</tbody>
</table>

**Switching distances**

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

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

Inductive switch elements with extended switching distance available on request!
Inductive Single and Multiple Position Switches

**Function descriptions, Definitions**

**Supply voltage** $U_B$  
... is the permissible voltage range in which certain safe operation of the switch is guaranteed (including ripple $\sigma$).

**Voltage drop** $U_d$  
... is the voltage measured across the load of a closed (conducting) switch element at load current $I_e$.

**Rated operating current** $I_e$  
... is the permissible constant output current that may flow through the load $R_l$.

**Off-state current** $I_r$  
... is the residual current flowing through the load when a switch element is not conducting (open).

**Inrush capacity** $I_k$  
... in the case of alternating current indicates the current $I_k(A_{\text{eff}})$ which is permitted to flow during a given turn-on time $t_k (\text{ms})$ and at a given frequency (Hz).

**Minimum operating current** $I_m$  
... is the smallest load current required for function of the switch element when ON.

**Ambient temperature range** $T_a$  
... is the temperature range over which the function of the switch is guaranteed.

**Rated operating distance** $s_n$  
... is a theoretical value, which does not take into account manufacturing tolerances, operating temperatures, supply voltages, etc.

**Effective operating distance** $s_r$  
... is the switching distance of a single inductive switch element measured under the specified conditions (installation, voltage, temperature). $T_a = +23 \, ^\circ\text{C} \pm 5$  
$(0.9 \, s_n \leq s_r \leq 1.1 \, s_n)$

**Useful operating distance** $s_u$  
... is the permissible switching distance of an individual switch element within the specified voltage and temperature conditions. $(0.81 \, s_n \leq s_u \leq 1.21 \, s_n)$.

**Assured operating distance** $s_a$  
... is the switching distance at which assured operation of the switch element is guaranteed at specified voltage and temperature conditions. $(0 \leq s_a \leq 0.81 \, s_u)$.

**Hysteresis** $H$  
(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 $+23 \, ^\circ\text{C} \pm 5$ and at the rated operational voltage. It must be less than 20 % of the effective operating distance $(s_r)$. $H \leq 0.2 \, s_r$. 

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### Inductive Single and Multiple Position Switches

**Function descriptions, Definitions, Protection circuits**

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<th>.. refers to the maximum number of switching operations per second.</th>
</tr>
</thead>
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<tr>
<td><strong>Polarity reversal protected</strong></td>
<td>.. protected against any possible lead reversal for inductive switch elements with short circuit protection.</td>
</tr>
<tr>
<td><strong>Short circuit protected with maximum voltage 60 V DC</strong></td>
<td>.. is achieved for inductive switch elements with pulsing or thermal short circuit protection. The output stage is thereby protected against overload and short circuit.</td>
</tr>
<tr>
<td><strong>Short circuit/overload protected (for operating with AC or DC supply)</strong></td>
<td>.. 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 × 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.</td>
</tr>
<tr>
<td></td>
<td>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.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Damping</strong></th>
<th>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.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The rated value of the switching frequency is reached when</strong></td>
<td>- either the turn-on signal t_1 = 50 µs or the turn-off signal t_2 = 50 µs.</td>
</tr>
<tr>
<td><strong>A response (i.e. turn-off)</strong> 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.</td>
<td></td>
</tr>
</tbody>
</table>

- **Switching frequency f**
- **Polarity reversal protected**
- **Short circuit protected with maximum voltage 60 V DC**
- **Short circuit/overload protected (for operating with AC or DC supply)**

---

**Switching frequency f** refers to the maximum number of switching operations per second.

**Polarity reversal protected** refers to the maximum number of switching operations per second.

**Short circuit protected 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.

**Short circuit/overload protected (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 × 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.

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 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.

The rated value of the switching frequency is reached when:

- either the turn-on signal t_1 = 50 µs
- turn-off signal t_2 = 50 µs.

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 $t_r$ is the ready delay of a sensor $\times$ (number of sensors $n - 1$).

**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.

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.
### Switch
- 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

### Enclosure rating
- IP 67: EN 60529/IEC 60529

### EMC (electromagnetic compatibility) for switches with inductive switch elements
- 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

### Environmental simulation
- Vibration, sinusoidal:
  - Frequency range: 10...500 Hz
  - Amplitude: 3 mm rms/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
Mechanical and Inductive Single and Multiple Position Switches

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 Elétricos 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:

- 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.

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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.
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
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<th>Product overview</th>
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</thead>
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<tr>
<td>CE, CCC, CSA</td>
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<tr>
<td><strong>Mechanical single and multiple position switches with safety switch positions</strong></td>
</tr>
<tr>
<td>Series 100</td>
</tr>
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<tr>
<td>CE, CCC, CSA</td>
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<td>Series 61</td>
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<td>page 52</td>
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<tr>
<td>CE, CCC, CSA</td>
</tr>
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<td><strong>Mechanical single and multiple position switches with forced opening</strong></td>
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<tr>
<td>Series 100</td>
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<tr>
<td>CE</td>
</tr>
<tr>
<td><strong>Mechanical multiple position switches with quick-change plunger unit</strong></td>
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<td>Series 100</td>
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<tr>
<td>CE</td>
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<td><strong>Inductive single and multiple position switches</strong></td>
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<td>Series 602-11</td>
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<td><strong>Inductive multiple position switches with extended switching distance 4 mm</strong></td>
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<td>Series X603-...-602-11</td>
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<td><strong>Special form factors</strong></td>
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<td>Series 602-11</td>
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<td>CE, CCC</td>
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<td><strong>Wireless system</strong></td>
</tr>
<tr>
<td><strong>Mechanical and inductive switch elements</strong></td>
</tr>
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<td><strong>Cam trays and cams</strong></td>
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<td>page 132...</td>
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<tr>
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</tr>
<tr>
<td>Mounting and function dimensions per DIN 43697</td>
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<tr>
<td>IO-Link on request</td>
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<td></td>
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<tr>
<td>Series 72</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>page 36</td>
</tr>
<tr>
<td>CE, CCC, CSA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Series 72</th>
<th>Series 46</th>
<th>Series 40</th>
<th>Series F 60</th>
<th>Series 99/100</th>
</tr>
</thead>
<tbody>
<tr>
<td>page 54</td>
<td>page 60</td>
<td>page 62</td>
<td>page 56</td>
<td>page 64</td>
</tr>
<tr>
<td>CE, CCC, CSA</td>
<td>CE</td>
<td>CE</td>
<td>CE, CCC</td>
<td>CE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>page 84</td>
<td>page 86</td>
<td>page 88</td>
<td>page 90</td>
<td>page 90</td>
</tr>
<tr>
<td>CE, CCC</td>
<td>CE, CCC</td>
<td>CE, CCC</td>
<td>CE</td>
<td>CE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Series X603-...-605-11</th>
<th>Series 605-11</th>
<th>Series 603-11</th>
<th>Series 650-11</th>
<th>Series F 60</th>
</tr>
</thead>
<tbody>
<tr>
<td>page 99</td>
<td>page 102</td>
<td>page 103</td>
<td>page 103</td>
<td>page 110</td>
</tr>
<tr>
<td>CE, CCC</td>
<td>CE, CCC</td>
<td>CE, CCC</td>
<td>CE, CCC</td>
<td>CE</td>
</tr>
</tbody>
</table>

- 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.
Objekterkennung
Mechanical Single and Multiple Position Switches

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

more added value

– Long service life
– Rugged housing for extreme applications

Contents

5.1
5.2
5.3

Multiple position switches series
100
62
61
72
46
40

Single Position Switches Series
F 60
99
100

BallUFF
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).

Connection options

- Function indication for dual voltage range option

Multiple position switches with function indication

Available sizes

<table>
<thead>
<tr>
<th>Number of plungers</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimension l₁ = 12 mm</td>
<td>70</td>
<td>80</td>
<td>90</td>
<td>105</td>
<td>120</td>
<td>140</td>
<td>170</td>
<td>200</td>
</tr>
<tr>
<td>Dimension l₃</td>
<td>88</td>
<td>88</td>
<td>88</td>
<td>88</td>
<td>88</td>
<td>80</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>Dimension l₄</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Dimension l₂ = 16 mm</td>
<td>70</td>
<td>90</td>
<td>105</td>
<td>120</td>
<td>140</td>
<td>170</td>
<td>200</td>
<td>240</td>
</tr>
<tr>
<td>Dimension l₃</td>
<td>88</td>
<td>88</td>
<td>88</td>
<td>88</td>
<td>80</td>
<td>80</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>Dimension l₄</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

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
- S4 without FD (IO-Link) 1 1 1 1 1 1 1
- S4 with FD (IO-Link) 1 1 1 1 1 1 1

Ordering example:

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

BNS 819-D_ _-_ _ _-100-10-_ _-_ _ _ _

Dimensions in mm

| No. of plungers | 02 | 03 | 04 | ...
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Plunger type</td>
<td>D: Chisel</td>
<td>K: Ball</td>
<td>R: Roller</td>
<td>L: Roller bearing</td>
</tr>
<tr>
<td>Plunger spacing</td>
<td>12 mm</td>
<td>16 mm</td>
<td>12 mm</td>
<td>16 mm</td>
</tr>
</tbody>
</table>

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
- S4R-I 4-pin, right
- S4L-I 4-pin, left

only for IO-Link
**Mechanical**  
**Multiple Position Switches**

### Series 100  
per DIN 43697

### Multiple position switches  
**series**

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

---

**Type**

- Plunger spacing
- Mounting and function dimensions

**Multiple position switch**

- 12 mm or 18 mm
- per DIN 43697

---

**Plunger style**

Chisel (D), Ball (K), Roller (R), Roller bearing (L) or Chisel with wiper plate (E)

- Stainless steel, contact surfaces induction hardened
- Cast aluminum, corrosion-resistant, anodized finish

**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
- UL, CSA, CCC

**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 5.0.3 is especially critical.
Mechanical Multiple Position Switches

Series 62

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).

Available sizes

<table>
<thead>
<tr>
<th>Number of plungers</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>8</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions l₁ = 12 mm</td>
<td>64</td>
<td>72</td>
<td>84</td>
<td>96</td>
<td>112</td>
<td>130</td>
<td>160</td>
</tr>
<tr>
<td>Dimensions l₂ = 16 mm</td>
<td>64</td>
<td>84</td>
<td>96</td>
<td>112</td>
<td>130</td>
<td>160</td>
<td>192</td>
</tr>
<tr>
<td>Number of connectors</td>
<td>S80 without FD/FE</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>S80 with FD/FE</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>S90 without FD/FE</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>S90 with FD/FE</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>S4 without FD (IO-Link)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>S4 with FD (IO-Link)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Dimensions in mm

Ordering example:
BNS 819-D04-D12-62-10-FD-S80R

Function indication
- Function indication for dual voltage range option
Mechanical
Multiple Position Switches
Series 62

Multiple position switch
12 mm or 16 mm

Plunger style
Plunger material
Housing material
Connection type
Ambient temperature range
Degree of protection per IEC 60529
Function indicator

Chisel (D), Ball (K), Roller (R), Roller bearing (L) or Chisel with wiper plate (E) Stainless steel, contact surfaces induction hardened Cast aluminum, corrosion-resistant, anodized finish M20 x 1.5 for connector or cable gland

-5...+85 °C
IP 67
LED 6...60 V AC/DC (FD) or 90...250 V AC/DC (FE)

With switch element
Ordering code
BNS 819-D 62-10
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 5.13 is especially critical.
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).

Available sizes

<table>
<thead>
<tr>
<th>No. of plungers</th>
<th>Housing B</th>
<th>Housing B</th>
<th>Housing C</th>
<th>Number of connectors S80 without FD/FE</th>
<th>Number of connectors S80 with FD/FE</th>
<th>Number of connectors S90 without FD/FE</th>
<th>Number of connectors S90 with FD/FE</th>
<th>Number of connectors S4 without FD (IO-Link)</th>
<th>Number of connectors S4 with FD (IO-Link)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>12</td>
<td>36</td>
<td>24</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<tr>
<td>3</td>
<td>12</td>
<td>48</td>
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<td>5</td>
<td>12</td>
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<tr>
<td>6</td>
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<td>84</td>
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<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>16</td>
<td>48</td>
<td>30</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>16</td>
<td>72</td>
<td>30</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
<td>84</td>
<td>30</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Dimensions in mm

Ordering example:
BNS 819-B04-D12-61-12-10-FD-S80R

Multiple position switches with function indication

- Function indication for dual voltage range option

<table>
<thead>
<tr>
<th>Housing style</th>
<th>No. of plungers</th>
<th>Plunger type</th>
<th>Plunger spacing</th>
<th>Distance l1</th>
<th>optional Function indication</th>
<th>optional Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>2×</td>
<td>Chisel</td>
<td>12 mm</td>
<td>12 mm</td>
<td>FD 6...60</td>
<td>V AC/DC</td>
</tr>
<tr>
<td>B</td>
<td>3×</td>
<td>Ball</td>
<td>16 mm</td>
<td>16 mm</td>
<td>FE 90...250</td>
<td>V AC/DC</td>
</tr>
<tr>
<td>C</td>
<td>2×</td>
<td>Roller</td>
<td>12 mm</td>
<td>24 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>4×</td>
<td>Roller bearing</td>
<td>16 mm</td>
<td>30 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>2×</td>
<td>Chisel with wiper plate</td>
<td>16 mm</td>
<td>30 mm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Mechanical Multiple Position Switches**

Series 61

**Type**
- Multiple position switch

**Multiple position switch**
- 12 mm or 16 mm

**Chisel (D), Ball (K), Roller (R), Roller bearing (L) or Chisel with wiper plate (E)**
- Stainless steel, contact surfaces induction hardened
- Cast aluminum, corrosion-resistant, anodized finish
- M20×1.5 for connector or cable gland
- –5...+85 °C
- IP 67
- LED 6...60 V AC/DC (FD) or 90...250 V AC/DC (FE)

**Ordering code**
- BSE 30.0
- BNS 819-
- 61-10

**Switching function**
- Snap switch
- Dual changeover, one normally-open and one normally-closed, galvanically isolated

**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

To ensure switching function, the dimension S₀.₅ is especially critical.

**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

**Plunger style**
- Chisel plunger with wiper plate (E)

**Plunger material**
- Stainless steel, contact surfaces induction hardened
- Cast aluminum, corrosion-resistant, anodized finish

**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 S₀.₅ is especially critical.
Mechanical Multiple Position Switches

Series 72

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 l2 when l1 = 12 mm     84  84 100 116 132 164 180
Dimension l2 when l1 = 16 mm     84  84 100 116 132 164 180
Dimension l3 when l1 = 12 mm     66  66  82  98 114 146 162
Dimension l3 when l1 = 16 mm     66  66  82  98 114 146 162
Dimension l4 when l1 = 12 mm     54  54  68  84 100 132 148
Dimension l4 when l1 = 16 mm     54  54  68  84 100 132 148
Number of connectors
S80 without FD/FE                1  1  2  2
S80 with FD/FE                   1  2  2  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

Not for new applications.
Still available for replacements.
With switch element
Ordering code
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
Cam tray

Note!
To ensure switching function, the dimension 3.25 is especially critical.
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 ≥ 10 mA.

Available sizes

<table>
<thead>
<tr>
<th>Number of plungers</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>8</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimension (l_1) = 8 mm</td>
<td>49</td>
<td>59</td>
<td>64</td>
<td>72</td>
<td>80</td>
<td>96</td>
<td>112</td>
</tr>
<tr>
<td>Dimension (l_2) when (l_1) = 10 mm</td>
<td>49</td>
<td>59</td>
<td>72</td>
<td>80</td>
<td>89</td>
<td>112</td>
<td>129</td>
</tr>
<tr>
<td>Number of connectors</td>
<td>S80 without FC</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>S80 with FC</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S4 without FC (IO-Link)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>S4 with FC (IO-Link)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

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-_ _-_ _ _

No. of plungers
02 2×
03 3×
04 4×
...

Plunger style
D Chisel
K Ball
R Roller
E Chisel with wiper plate

Plunger spacing
08 8 mm
10 10 mm

Switch elements
0 BSE 69.1
1 BSE 70.1
2 BSE 73.1
3 BSE 74.1

optional

Function indication
FC 24...28 V DC

optional

Connector
S80R 5-pin, right
S80L 5-pin, left
S80S 5-pin, right and left
S4R-I 4-pin, right
only for IO-Link
S4L-I 4-pin, left
only for IO-Link

Only with BSE 69.1 or BSE 73.1.
### Mechanical Multiple Position Switches

**Series 46**

<table>
<thead>
<tr>
<th>Type</th>
<th>Multiple position switch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plunger spacing</td>
<td>8 mm or 10 mm</td>
</tr>
</tbody>
</table>

**Plunger style**
- Chisel (D), Ball (K), Roller (R)
- Chisel with wiper plate (E)

**Plunger material**
- Stainless steel, contact surfaces induction hardened
- Cast aluminum, corrosion-resistant, anodized finish

**Housing material**
- Stainless steel, contact surfaces induction hardened
- 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**

<table>
<thead>
<tr>
<th>BSE 69.1</th>
<th>BSE 73.1</th>
<th>BSE 70.1</th>
<th>BSE 74.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ordering code</td>
<td>BNS 819-...-46-10</td>
<td>BNS 819-...-46-12</td>
<td>BNS 819-...-46-11</td>
</tr>
</tbody>
</table>

**Wiring diagram, style**

<table>
<thead>
<tr>
<th>Switch diagram</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO</td>
</tr>
</tbody>
</table>

**Switch element**

<table>
<thead>
<tr>
<th>Contact material</th>
<th>Silver</th>
<th>Gold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switching principle</td>
<td>Snap switch</td>
<td>Single-pole changeover</td>
</tr>
<tr>
<td>Contact system</td>
<td>Solder connection</td>
<td>Single-pole changeover</td>
</tr>
<tr>
<td>Connection type</td>
<td>see page 117</td>
<td>see page 117</td>
</tr>
<tr>
<td>Approval</td>
<td>UL, CSA, CCC</td>
<td>UL, CSA, CCC</td>
</tr>
</tbody>
</table>

**Mechanical data**

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

---

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

---

**IO-Link**
For additional information see IO-Link brochure!
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).

Available sizes

<table>
<thead>
<tr>
<th>Number of plungers</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimension l₁</td>
<td>34</td>
<td>42</td>
<td>50</td>
<td>58</td>
<td>66</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of connectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>S80 without FC</td>
</tr>
<tr>
<td>S80 with FC</td>
</tr>
<tr>
<td>S4 without FC (IO-Link)</td>
</tr>
<tr>
<td>S4 with FC (IO-Link)</td>
</tr>
</tbody>
</table>

Dimensions in mm

Ordering example:
BNS 819-B04-D08-40-10-FC-S80R

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 ≥ 10 mA.

Switching elements for low-current applications

<table>
<thead>
<tr>
<th>Switching elements</th>
<th>S80R</th>
<th>S80L</th>
<th>S80S</th>
<th>S4R-I</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSE 69.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BSE 70.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BSE 73.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BSE 74.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Connection options

<table>
<thead>
<tr>
<th>Optional Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>S80R  5-pin, right</td>
</tr>
<tr>
<td>S80L  5-pin, left</td>
</tr>
<tr>
<td>S80S  5-pin, right and left</td>
</tr>
<tr>
<td>S4R-I 4-pin, right only for IO-Link</td>
</tr>
<tr>
<td>S4L-I 4-pin, left only for IO-Link</td>
</tr>
</tbody>
</table>

Only with BSE 69.1 or BSE 73.1.
Mechanical Position Switches

Series 40

<table>
<thead>
<tr>
<th>Type</th>
<th>Multiple position switch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plunger spacing</td>
<td>8 mm</td>
</tr>
</tbody>
</table>

Chisel plunger with wiper plate (E)

- **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

<table>
<thead>
<tr>
<th>Ordering code</th>
<th>BSE 69.1</th>
<th>BSE 73.1</th>
<th>BSE 70.1</th>
<th>BSE 74.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wiring diagram, style</td>
<td>BNS 819-...-40-10</td>
<td>BNS 819-...-40-12</td>
<td>BNS 819-...-40-11</td>
<td>BNS 819-...-40-13</td>
</tr>
</tbody>
</table>

Switch element

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

Mechanical data

- **Plunger point to reference surface**: 4 mm
- **Switchpoint to reference surface**: 3.5 mm
- **Maximum plunger travel**: min. 8 N
- **Switching actuating force on plunger**: max. 200/min
- **Switching frequency**: 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
- **Repeatability**: Plunger D, E ±0.02 mm, Plunger K ±0.03 mm, Plunger R ±0.05 mm

Note!
To ensure switching function, the dimension 2.8...3.5 mm is especially critical.

For additional information see IO-Link brochure!
Mechanical
Single Position Switches

Series F 60
per DIN 43693

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-

<table>
<thead>
<tr>
<th>Plunger style</th>
<th>Function indication</th>
<th>Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>D Chisel</td>
<td>FD 6...60 V AC/DC</td>
<td>S80R 5-pin, right</td>
</tr>
<tr>
<td>K Ball</td>
<td>FE 90...250 V AC/DC</td>
<td>S80L 5-pin, left</td>
</tr>
<tr>
<td>R Roller</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L Roller bearing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E Chisel with wiper plate</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

optional

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
Mechanical Single Position Switches

With switch element

Ordering code  BSE 30.0
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  7.5 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 \( s_{DC} \) is especially critical.
Series 99 and 100

**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

**Connection variants**
- Thread for cable gland M12×1.5 for series 99, M16×1.5 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.

**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 ≥ 10 mA.

**Ordering example:**
**BNS 819-100-E-12-FC-S80**

**BNS 819-**
- **Series:**
  - 99 Series 99
  - 100 Series 100
- **Plunger style:**
  - D Chisel
  - K Ball
  - R Roller
  - E Chisel with wiper plate
- **Switch elements:**
  - 0 BSE 69.1
  - 1 BSE 70.1
  - 2 BSE 73.1
  - 3 BSE 74.1
- **optional Function indication:**
  - FC 24...28 V DC
- **Connector:**
  - S80 5-pin

Only with BSE 69.1 or BSE 73.1.
Mechanical
Single Position Switches

Series 99 and 100

Type
Single position switch

<table>
<thead>
<tr>
<th>Type</th>
<th>Single position switch</th>
</tr>
</thead>
</table>

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 (M12×1.5 series 99, M16×1.5 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

Ordering code

Wiring diagram, style

Switch element

<table>
<thead>
<tr>
<th>Contact material</th>
<th>Silver</th>
<th>Gold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switching principle</td>
<td>Snap switch</td>
<td>Single-pole changeover</td>
</tr>
<tr>
<td>Connection type</td>
<td>Solder connection</td>
<td>Screw terminal</td>
</tr>
<tr>
<td>Electrical data</td>
<td>see page 117</td>
<td>see page 117</td>
</tr>
<tr>
<td>Approval</td>
<td>UL, CSA, CCC</td>
<td>UL, CSA, CCC</td>
</tr>
</tbody>
</table>

Mechanical data

| Plunger point to reference surface | 4 mm |
| Switchpoint to reference surface | 3.5 mm |
| Maximum plunger travel | 3.5 mm |
| Switching actuating force on plunger | min. 8 N |
| Switching frequency | 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 |
| Repeatability | Plunger D, E ±0.02 mm |
| | Plunger K ±0.03 mm |
| | Plunger R ±0.05 mm |

Installation

Note!
To ensure switching function, the dimension 2.8±0.5 is especially critical.
Objekterkennung
Mechanical Single and Multiple Position Switches with Safety Switch Positions

DIN EN 60204-1
VDE 0113

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

Mechanical multiple position switches with safety switch positions

56 Series F 60
per DIN 43693

Mechanical single position switches with safety switch position

5.1
5.2
5.3

more added value

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

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

<table>
<thead>
<tr>
<th>Number of plungers</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
</tr>
</thead>
</table>
| Dimension | Dimension l1 = 12 mm
| I1 when  | Dimension l2 = 88 |
| I2 | Dimension l3 = 14 |
| I3 | Dimension l4 = 88 |
| I4 | Dimension l5 = 70 |
| I5 | Dimension l6 = 88 |
| I6 | Dimension l7 = 88 |
| I7 | Dimension l8 = 80 |
| I8 | Dimension l9 = 80 |
| I9 | Dimension l10 = 80 |
| I10 | Dimension l11 = 80 |
| I11 | Dimension l12 = 80 |
| I12 | Number of connectors
| S80 without FD/FE | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
| S80 with FD/FE | 1  | 2  | 2  | 2  | 2  | 2  | 2  | 2  |
| S90 without FD/FE | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
| S90 with FD/FE | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |

Dimensions in mm
*Number of connectors BSE 85 on request.

Ordering example:
BNS 813-D04-D12-100-20-03-FE-S80R

<table>
<thead>
<tr>
<th>No. of plungers</th>
<th>02</th>
<th>03</th>
<th>04</th>
<th>...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plunger style</td>
<td>D</td>
<td>K</td>
<td>R</td>
<td>E</td>
</tr>
<tr>
<td>Plunger spacing</td>
<td>12</td>
<td>12</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Switch elements</td>
<td>10</td>
<td>12</td>
<td>20</td>
<td>22</td>
</tr>
</tbody>
</table>

Optional Connector
S8DR 5-pin, right
S80L 5-pin, left
S90S 5-pin, right and left
S90R 12-pin, right
S90L 12-pin, left
S90S 12-pin, right and left

Optional Function indication
FD 6...60 V AC/DC (for BSE 30.0 and BSE 61)
FE 90...250 V AC/DC (for BSE 30.0 and BSE 61)
FC 24...28 V DC (only for BSE 85)
### Mechanical

Multiple Position Switches with Safety Switch Positions

**Series 100 per DIN 43697**

<table>
<thead>
<tr>
<th>Type</th>
<th>Multiple position switch with positive-opening contacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plunger spacing</td>
<td>12 mm or 16 mm</td>
</tr>
<tr>
<td>Mounting and function dimensions</td>
<td>per DIN 43697</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Plunger style</th>
<th>Chisel (D), Ball (K), Roller (R), Roller bearing (L) or Chisel with wiper plate (E)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plunger material</td>
<td>Stainless steel, contact surfaces induction hardened</td>
</tr>
<tr>
<td>Housing material</td>
<td>Cast aluminum, corrosion-resistant, anodized finish</td>
</tr>
<tr>
<td>Connection type</td>
<td>M25×1.5 for connector or cable gland</td>
</tr>
<tr>
<td>Ambient temperature range</td>
<td>–5...+85 °C</td>
</tr>
<tr>
<td>Degree of protection per IEC 60529</td>
<td>IP 67</td>
</tr>
<tr>
<td>Function indicator</td>
<td>LED 6..60 V AC/DC (FD), 90..250 V AC/DC (FE) or 24...28 V DC (FC)</td>
</tr>
</tbody>
</table>

### With switch element

<table>
<thead>
<tr>
<th>Ordering code</th>
<th>BSE 61 per DIN EN 60204-1/VDE 0113</th>
<th>BSE 85 per DIN EN 60204-1/VDE 0113</th>
<th>BSE 30.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wiring diagram, style</td>
<td>BNS 813-D _-100-1</td>
<td>BNS 813-D _-100-2</td>
<td>BNS 813-D _-100-0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Switch element</th>
<th>Contact material</th>
<th>Switching principle</th>
<th>Contact system</th>
<th>Electrical data</th>
<th>Approval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Silver</td>
<td>Creep switch, Positive-opening</td>
<td>Normally-closed, double interruption</td>
<td>see page 116</td>
<td>CSA, CCC</td>
</tr>
<tr>
<td></td>
<td>Silver</td>
<td>Snap switch, positive opening</td>
<td>normally-closed</td>
<td>see page 116</td>
<td>cULus, CSA, CCC</td>
</tr>
<tr>
<td></td>
<td>Silver</td>
<td>Snap switch</td>
<td>dual changeover, one normally-open and one normally-closed,</td>
<td>see page 116</td>
<td>UL, CSA, CCC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mechanical data</th>
<th>Plunger point to reference surface</th>
<th>Switchpoint to reference surface</th>
<th>Maximum plunger travel</th>
<th>Assured opening after plunger travel</th>
<th>Switching actuating force on plunger</th>
<th>Switching frequency</th>
<th>Approach speed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8 mm</td>
<td>7 mm</td>
<td>4 mm</td>
<td>2.5 mm</td>
<td>min. 15 N</td>
<td>max. 300/min</td>
<td>Plunger D</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>40 m/min</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Plunger E</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>30 m/min</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Plunger K</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10 m/min</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Plunger R</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>60 m/min</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Plunger L</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>120 m/min</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>± 0.002 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>± 0.01 mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Installation</th>
<th>Note!</th>
</tr>
</thead>
<tbody>
<tr>
<td>To ensure switching function, the dimension 5.05 is especially critical.</td>
<td></td>
</tr>
</tbody>
</table>

www.balluff.com
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

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

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

Multiple position switches with wiper plate

- Function indication for selectable three voltage ranges

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

<table>
<thead>
<tr>
<th>Number of plungers</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>8</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimension l₁ = 12 mm</td>
<td>64</td>
<td>72</td>
<td>84</td>
<td>96</td>
<td>112</td>
<td>130</td>
<td>160</td>
</tr>
<tr>
<td>l₂ when l₁ = 16 mm</td>
<td>64</td>
<td>84</td>
<td>96</td>
<td>112</td>
<td>130</td>
<td>160</td>
<td>192</td>
</tr>
<tr>
<td>Number of S80 without FD/FE</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S80 with FD/FE</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S90 without FD/FE</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>S90 with FD/FE</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

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-_ _-_ _-_ _ -_ _ _

optional

Connection options

optional

Connector

FD 6...60 V AC/DC (for BSE 30.0 and BSE 61)
FE 90...250 V AC/DC (for BSE 30.0 and BSE 61)
FC 24...28 V DC (only for BSE 85)

S0R 5-pin, right
S0L 5-pin, left
S0S 5-pin, right and left
S9R 12-pin, right
S9L 12-pin, left
S9S 12-pin, right and left
Mechanical
Multiple Position Switches with Safety Switch Positions

Series 62

Plunger style
Plunger material
Housing material
Connection type
Ambient temperature range
Degree of protection per IEC 60529

With switch element
Ordering code
Wiring diagram, style

Switch element
Contact material
Switching principle
Contact system

Electrical data
Approval

Mechanical data
Plunger point to reference surface
Switchpoint to reference surface
Maximum plunger travel
Assured opening after plunger travel
Switching actuating force on plunger
Switching frequency
Approach speed
Repeatability

Note!
To ensure switching function, the dimension $S_{2,3}$ is especially critical.

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**Mechanical Multiple Position Switches with Safety Switch Positions**

**Series 61**

- **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

**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

**Available sizes**

<table>
<thead>
<tr>
<th>No. of plungers</th>
<th>Plunger spacing</th>
<th>Housing B Standard Dimension</th>
<th>Housing B Dimension</th>
<th>Housing C Dimension</th>
<th>Number of connectors S80 without FD/FE</th>
<th>Number of connectors S80 with FD/FE</th>
<th>Number of connectors S90 without FD/FE</th>
<th>Number of connectors S90 with FD/FE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>12</td>
<td>36 b 12 60</td>
<td>12 b 24</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
<td>48 b 12 60</td>
<td>24 b 24</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>12</td>
<td>60 b 12 24</td>
<td>24 b 24</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>12</td>
<td>72 b 12 24</td>
<td>24 b 24</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>12</td>
<td>84 b 12 24</td>
<td>24 b 24</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Dimensions in mm

*No. of connectors BSE 85 on request.

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

**Connection options**
- Thread for cable gland M20 x 1.5 on side and in flange (seals and plugs included)
- Connector (note permissible operating voltage for the connectors, see page 132).
Series 61

Mechanical Multiple Position Switches with Safety Switch Positions

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

Chisel (D), Ball (K), Roller (R), Roller bearing (L) or Chisel with wiper plate (E)

Stainless steel, contact surfaces induction hardened
Cast aluminum, corrosion-resistant, anodized finish

M20x1.5 for connector or cable gland

–5...+85 °C

IP 67

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

With switch element

<table>
<thead>
<tr>
<th>Type</th>
<th>Plunger spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chisel plunger with wiper plate (E)</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Stationary cabinet</th>
<th>5.1</th>
<th>5.2</th>
<th>5.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function indicator FC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Function indicator FD/FE</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Plunger point to reference surface | 8 mm |
| Switchpoint to reference surface | 7 mm |
| Maximum plunger travel | 4 mm |
| Assured opening after plunger travel | 2.5 mm |
| Switching actuating force on plunger (min.) | 15 N |
| Switching frequency | max. 160/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 | ± 0.002 mm |
| | ± 0.002 mm |

Note!

To ensure switching function, the dimension 5.5 is especially critical.
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

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

<table>
<thead>
<tr>
<th>Number of plungers</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>8</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimension l when l₁ = 12 mm</td>
<td>84</td>
<td>84</td>
<td>100</td>
<td>116</td>
<td>132</td>
<td>164</td>
<td>180</td>
</tr>
<tr>
<td>Dimension l when l₁ = 12 mm</td>
<td>66</td>
<td>66</td>
<td>82</td>
<td>98</td>
<td>114</td>
<td>146</td>
<td>162</td>
</tr>
<tr>
<td>Dimension l when l₁ = 12 mm</td>
<td>54</td>
<td>54</td>
<td>68</td>
<td>84</td>
<td>100</td>
<td>132</td>
<td>148</td>
</tr>
<tr>
<td>Dimension l when l₁ = 16 mm</td>
<td>84</td>
<td>100</td>
<td>116</td>
<td>132</td>
<td>148</td>
<td>180</td>
<td>212</td>
</tr>
<tr>
<td>Dimension l when l₁ = 16 mm</td>
<td>66</td>
<td>82</td>
<td>98</td>
<td>114</td>
<td>130</td>
<td>162</td>
<td>194</td>
</tr>
<tr>
<td>Dimension l when l₁ = 16 mm</td>
<td>54</td>
<td>68</td>
<td>84</td>
<td>100</td>
<td>116</td>
<td>148</td>
<td>180</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of Connector*</th>
<th>S80 without FD/FE</th>
<th>1</th>
<th>1</th>
<th>2</th>
<th>2</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>S80 with FD/FE</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>S90 without FD/FE</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>S90 with FD/FE</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

Dimensions in mm
*Number of connectors BSE 85 on request.

Ordering example:
BNS 813-B04-R12-72-10-FD-S80R

Not for new applications.
Still available for replacements.
Multiple Position Switches with Safety Switch Positions

Series 72

Multiple position switch with positive-opening contacts
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

With switch element

Ordering code
BSE 61 per DIN EN 60204-1/VDE 0113
BSE 85 per DIN EN 60204-1/VDE 0113
BSE 30.0

Wiring diagram, style

Switch element

Contact material: Silver

Switching principle: Creep switch, positive-opening

Contact system: Normally-closed, double interruption

Electrical data
Approval: CSA, CCC

Mechanical data

Plunger point to reference surface:
- 6 mm

Switchpoint to reference surface:
- 5 mm

Maximum plunger travel:
- 4 mm

Assured opening after plunger travel:
- 2.5 mm

Switching actuating force on plunger:
- min. 15 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.
### 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

### 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 M16×1.5 (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**

<table>
<thead>
<tr>
<th>Plunger style</th>
<th>Switch elements</th>
<th>Function indication</th>
<th>Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>D Chisel</td>
<td>BSE 61</td>
<td>FD 6...60 V AC/DC</td>
<td>S80R 5-pin, right</td>
</tr>
<tr>
<td>K Ball</td>
<td>BSE 61</td>
<td>FE 90...250 V AC/DC</td>
<td>S80L 5-pin, left</td>
</tr>
<tr>
<td>R Roller</td>
<td>BSE 61</td>
<td>FC 24...28 V DC</td>
<td></td>
</tr>
<tr>
<td>L Roller bearing</td>
<td>BSE 85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E Chisel with wiper plate</td>
<td>BSE 85</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Approach direction longitudinal, parallel to mounting surface
- Approach direction lateral, 90° to mounting surface

---

**Mechanical Single Position Switches with Safety Switch Positions**

Series F 60 per DIN 43693

**VDE 0113**

**DIN EN 60204-1**
### Series F 60 per DIN 43693

**Mechanical Single Position Switches with Safety Switch Positions**

- Single position switch with positive-opening contacts 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

#### Connection Type
- M16 x 1.5 for cable gland or connector

#### Ambient Temperature Range
- \(-5\ldots+85\, ^\circ C\)

#### 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

<table>
<thead>
<tr>
<th>With Switch Element</th>
</tr>
</thead>
<tbody>
<tr>
<td>21-22</td>
</tr>
</tbody>
</table>

#### Switch Element

<table>
<thead>
<tr>
<th>Switch Element</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact Material</td>
</tr>
<tr>
<td>Switching Principle</td>
</tr>
<tr>
<td>Contact System</td>
</tr>
</tbody>
</table>

#### Electrical Data
- see page 116

#### Approval
- CSA, CCC

#### Mechanical Data

<table>
<thead>
<tr>
<th>Mechanical Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plunger point to reference surface</td>
</tr>
<tr>
<td>Switchpoint to reference surface</td>
</tr>
<tr>
<td>Maximum plunger travel</td>
</tr>
<tr>
<td>Assured opening after plunger travel</td>
</tr>
<tr>
<td>Switching actuating force on plunger</td>
</tr>
<tr>
<td>Switching frequency</td>
</tr>
<tr>
<td>Approach speed</td>
</tr>
<tr>
<td>Plunger D</td>
</tr>
<tr>
<td>Plunger E</td>
</tr>
<tr>
<td>Plunger K</td>
</tr>
<tr>
<td>Plunger R</td>
</tr>
<tr>
<td>Plunger L</td>
</tr>
<tr>
<td>Repeatability</td>
</tr>
<tr>
<td>Plunger D, E, K</td>
</tr>
<tr>
<td>Plunger R, L</td>
</tr>
</tbody>
</table>

#### Installation

- To ensure switching function, the dimension \(5 \pm 0.5\) is especially critical.

---

www.balluff.com
Objekterkennung
Mechanical Single and Multiple Position Switches with Forced Opening

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

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

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

Available sizes

<table>
<thead>
<tr>
<th>Number of plungers</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>8</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimension l₂ when l₁ = 8 mm</td>
<td>49</td>
<td>59</td>
<td>64</td>
<td>72</td>
<td>80</td>
<td>96</td>
<td>112</td>
</tr>
<tr>
<td>l₁ = 10 mm</td>
<td>49</td>
<td>59</td>
<td>72</td>
<td>80</td>
<td>89</td>
<td>112</td>
<td>129</td>
</tr>
<tr>
<td>Number of S80 without FC</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>S80 with FC</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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-_ _-_ _-_ _-_ _ _ _

<table>
<thead>
<tr>
<th>No. of plungers</th>
<th>Plunger style</th>
<th>Plunger spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td>D Chisel</td>
<td>08 8 mm</td>
</tr>
<tr>
<td>03</td>
<td>K Ball</td>
<td>10 10 mm</td>
</tr>
<tr>
<td>04</td>
<td>R Roller</td>
<td></td>
</tr>
<tr>
<td>...</td>
<td>E Chisel with wiper plate</td>
<td></td>
</tr>
</tbody>
</table>

Switch elements

<table>
<thead>
<tr>
<th>Switch elements</th>
<th>No. from flange</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSE 63</td>
<td></td>
</tr>
<tr>
<td>BSE 64</td>
<td></td>
</tr>
<tr>
<td>BSE 69.1</td>
<td></td>
</tr>
<tr>
<td>BSE 70.1</td>
<td></td>
</tr>
<tr>
<td>BSE 73.1</td>
<td></td>
</tr>
</tbody>
</table>

Switch elements with forced opening

<table>
<thead>
<tr>
<th>Optional Function indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>FC 24...28 V DC</td>
</tr>
</tbody>
</table>

Optional Connector

| Connector       | |
|-----------------| |
| S80R            | 5-pin, right |
| S80L            | 5-pin, left  |
| S80S            | 5-pin, right and left |

Only with BSE 60.1, BSE 73.1 or BSE 63.
### Mechanical
**Multiple Position Switches with Forced Opening**

**Series 46**

<table>
<thead>
<tr>
<th>Type</th>
<th>Multiple position switch with forced opening contacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plunger spacing</td>
<td>8 mm or 10 mm</td>
</tr>
</tbody>
</table>

#### 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
- M16×1.5 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

<table>
<thead>
<tr>
<th>BSE 63</th>
<th>BSE 64</th>
</tr>
</thead>
<tbody>
<tr>
<td>BNS 813..., 46-3...</td>
<td>BNS 813..., 46-4...</td>
</tr>
</tbody>
</table>

#### Wiring diagram, style

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

#### Mechanical data

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

#### Note!
To ensure switching function, the dimension 2.8, 8, 3 is especially critical.

www.balluff.com
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

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

Available sizes

<table>
<thead>
<tr>
<th>No. of plungers</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimension l₁</td>
<td>34</td>
<td>42</td>
<td>50</td>
<td>58</td>
<td>66</td>
</tr>
<tr>
<td>S₈₀ without FC</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>S₈₀ with FC</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dimensions in mm

Ordering example:
BNS 813-B04-D08-40-01-FC-S₈₀R

Available sizes

<table>
<thead>
<tr>
<th>No. of plungers</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions l₁</td>
<td>34</td>
<td>42</td>
<td>50</td>
<td>58</td>
<td>66</td>
</tr>
<tr>
<td>S₈₀ without FC</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>S₈₀ with FC</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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).

Connection options

Optional Connector
S₈₀R 5-pin, right
S₈₀L 5-pin, left
S₈₀S 5-pin, right and left

Only with BSE 69.1, BSE 73.1 or BSE 63.
**Mechanical Multiple Position Switches with Forced Opening**

**Series 40**

<table>
<thead>
<tr>
<th>Type</th>
<th>Multiple position switch with forced opening contacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plunger spacing</td>
<td>8 mm</td>
</tr>
</tbody>
</table>

**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 | M16×1.5 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**

<table>
<thead>
<tr>
<th>Ordering code</th>
<th>BSE 63</th>
<th>BSE 64</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wiring diagram, style</td>
<td>BNS 813...-40-3_</td>
<td>BNS 813...-40-4_</td>
</tr>
</tbody>
</table>

**Switch element**

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

**Mechanical data**

| Plunger point to reference surface | 4 mm |
| Switchpoint to reference surface | 3.5 mm |
| Maximum plunger travel | 2.1 mm |
| Assured separation after plunger travel | 1 mm |
| Switching actuating force on plunger | min. 8 N |
| Switching frequency | 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 |
| Repeatability | Plunger D, E ±0.02 mm |
| | Plunger K ±0.03 mm |
| | Plunger R ±0.05 mm |

**Installation**

| www.balluff.com |

**Note!**

To ensure switching function, the dimension 2.8-0.3 is especially critical.
Mechanical
Single Position Switches with Forc ed Opening

Series 99 and 100

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 M12x1.5 for Series 99, M16x1.5 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

Series
99 Series 99
100 Series 100

Plunger style
D Chisel
K Ball
R Roller
E Chisel with wiper plate

Switch elements
38 BSE 63
- Approach direction lateral, 90° to mounting surface
39 BSE 63
- Approach direction longitudinal, parallel to mounting surface
48 BSE 64
- Approach direction lateral, 90° to mounting surface
49 BSE 64
- Approach direction longitudinal, parallel to mounting surface

optional Function indicator
FC 24...28 V DC

optional Connector
S80 5-pin

Only with BSE 63.
Series 99 and 100

Mechanical Single Position Switches with Forced Opening

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 (M12×1.5 series 99, M16×1.5 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

BSE 63
BNS 813-99/100-3

BSE 64
BNS 813-99/100-4

Switch diagram, style

Switch element

Contact material
Silver

Switching principle
Snap switch

Contact system
Single-pole change-over, NO with snap function, NC with forced opening

Connection type
Solder connection

Electrical data
see page 117

Approval
UL, CSA, CCC

Mechanical data

Plunger point to reference surface
4 mm

Switchpoint to reference surface
3.5 mm

Maximum plunger travel
2.1 mm

Assured separation after plunger travel
1 mm

Switching actuating force on plunger
min. 8 N

Switching frequency
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

Repeatability
Plunger D, E ± 0.02 mm
Plunger K ± 0.03 mm
Plunger R ± 0.05 mm

Installation

Note!
To ensure switching function, the dimension 2.8...3 is especially critical.

www.balluff.com
### Mechanical Multiple Position Switches with Quick-Change Plunger Unit

<table>
<thead>
<tr>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical multiple position switches with quick-change plunger unit</td>
</tr>
<tr>
<td>68 Series 100 per DIN 43697</td>
</tr>
<tr>
<td>70 Series 100 per DIN EN 60204-1/ VDE 0113</td>
</tr>
<tr>
<td>72 Series 61</td>
</tr>
<tr>
<td>74 Series 61 per DIN EN 60204-1/ VDE 0113</td>
</tr>
<tr>
<td>76 Quick-change block for series 100</td>
</tr>
<tr>
<td>77 Quick-change block for series 61</td>
</tr>
</tbody>
</table>

#### more added value
- For the most extreme applications
- Long service life
- Quick-change plunger unit for short service time
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 M25x1.5 on side and in flange (Gaskets and plugs included)
- Connector (note permissible operating voltage for the connectors, see page 132).

Available sizes

<table>
<thead>
<tr>
<th>No. of plungers</th>
<th>Dimension l₁ = 12 mm</th>
<th>Dimension l₂ = 16 mm</th>
<th>Number of Connector S80 without FD/FE</th>
<th>Number of Connector S80 with FD/FE</th>
<th>Number of Connector S90 without FD/FE</th>
<th>Number of Connector S90 with FD/FE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>70</td>
<td>70</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>80</td>
<td>90</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>90</td>
<td>105</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>105</td>
<td>120</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Dimensions in mm

Ordering example:
BNS 829-D02-D16-100-10-FE-S80R

BNS 829-D _____-100-10-____

- No. of plungers
  - 02 2x
  - ... (for 02 to 06)
  - 06 6x

- Plunger style
  - D Chisel
  - K Ball
  - R Roller
  - L Roller bearing

- Plunger spacing
  - 12 mm
  - 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 Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plunger point to reference surface</td>
<td>8 mm</td>
</tr>
<tr>
<td>Switchpoint to reference surface</td>
<td>6 mm</td>
</tr>
<tr>
<td>Maximum plunger travel</td>
<td>5.5 mm</td>
</tr>
<tr>
<td>Switching actuating force on plunger</td>
<td>min. 20 N</td>
</tr>
<tr>
<td>Switching frequency</td>
<td>max. 300/min</td>
</tr>
<tr>
<td>Approach speed Plunger D</td>
<td>40 m/min</td>
</tr>
<tr>
<td>Approach speed Plunger K</td>
<td>10 m/min</td>
</tr>
<tr>
<td>Approach speed Plunger R</td>
<td>60 m/min</td>
</tr>
<tr>
<td>Approach speed Plunger L</td>
<td>120 m/min</td>
</tr>
<tr>
<td>Repeatability Plunger D, K</td>
<td>± 0.002 mm</td>
</tr>
<tr>
<td>Repeatability Plunger R, L</td>
<td>± 0.01 mm</td>
</tr>
</tbody>
</table>

### Note!

To ensure switching function, the dimension 5.05 is especially critical.

---

**For additional information see IO-Link brochure!**
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 60240-1/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).

Available sizes

<table>
<thead>
<tr>
<th>No. of plungers</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>12 mm</td>
<td>70</td>
<td>80</td>
<td>90</td>
<td>105</td>
</tr>
<tr>
<td>2nd</td>
<td>16 mm</td>
<td>70</td>
<td>90</td>
<td>105</td>
<td>120</td>
</tr>
<tr>
<td>Number of Connector*</td>
<td>S80 without FD/FE</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>S80 with FD/FE</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>S90 without FD/FE</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>S90 with FD/FE</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

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-_ _ _ _- _ _ _

<table>
<thead>
<tr>
<th>No. of plungers</th>
<th>Plunger style</th>
<th>Plunger spacing</th>
<th>Switch elements</th>
<th>Safety switch elements</th>
<th>Function indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td>2×</td>
<td>D Chisel</td>
<td>12</td>
<td>BSE 61 Remaining switch positions</td>
<td>FD 6...60 V AC/DC (for BSE 30,0 and BSE 61)</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>K Ball</td>
<td>16</td>
<td>only BSE 61 BSE 85</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>R Roller</td>
<td>16 mm</td>
<td>Remaining switch positions BSE 30,0 only BSE 85</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td></td>
<td>L Roller bearing</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

optional Connector

<table>
<thead>
<tr>
<th>Connector</th>
<th>5-pin, right</th>
</tr>
</thead>
<tbody>
<tr>
<td>S80R</td>
<td>S80L</td>
</tr>
<tr>
<td>S80S</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Connector</th>
<th>5-pin, left</th>
</tr>
</thead>
<tbody>
<tr>
<td>S90R</td>
<td>S90L</td>
</tr>
<tr>
<td>S90S</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Connector</th>
<th>12-pin, right</th>
</tr>
</thead>
<tbody>
<tr>
<td>S90R</td>
<td>S90L</td>
</tr>
<tr>
<td>S90S</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Connector</th>
<th>12-pin, left</th>
</tr>
</thead>
<tbody>
<tr>
<td>S90R</td>
<td>S90L</td>
</tr>
<tr>
<td>S90S</td>
<td></td>
</tr>
</tbody>
</table>
Multiple position switches with forced-opening contacts

12 mm or 16 mm per DIN 43697

Chisel (D), Ball (K), Roller (R) or Roller Bearing (L)
Stainless steel, contact surfaces induction hardened
Cast aluminum, corrosion-resistant, anodized finish

M25×1.5 for connector or cable gland
–5...+85 °C
IP 67

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

Multiple Position Switches with Quick-Change Plunger Unit

Series 100 per DIN 43697

Type
Plunger spacing
Mounting and function dimensions

With switch element
DIN EN 60204-1/VDE 0113
DIN EN 60204-1/VDE 0113
DIN EN 60204-1/VDE 0113

Ordering code
Wiring diagram, style

Switch element
Contact material
Switching principle
Contact system
Electrical data
Approval
Mechanical data
Switchpoint to reference surface
Maximum plunger travel
Assured opening after plunger travel
Switching actuating force on plunger
Switching frequency
Approach speed
Repeatability

Approach speed
Plunger D
Plunger K
Plunger R
Plunger L

Repeatability
Plunger D, K
Plunger R, L

Plunger point to reference surface
Switchpoint to reference surface

8 mm
7 mm
8 mm
6.5 mm
4 mm
2.5 mm
15 N

8 mm
6 mm
5.5 mm
30 N
8 mm
6 mm
12 mm
10 N
20 mm

± 0.002 mm
± 0.001 mm
± 0.02 mm
± 0.02 mm
± 0.002 mm
± 0.01 mm

Silver, creep switch, forced-opening
Silver, snap switch, forced-opening (normally-closed)
Silver, gold plated, snap switch

DIN EN 60204-1/VDE 0113
DIN EN 60204-1/VDE 0113
DIN EN 60204-1/VDE 0113

8 mm
6.5 mm
4 mm
2.5 mm

± 0.02 mm
± 0.02 mm

8 mm
6 mm
5.5 mm

30 N
160/min
40 m/min
40 m/min

± 0.02 mm
± 0.02 mm
± 0.002 mm
± 0.01 mm

www.balluff.com

Note!
To ensure switching function, the dimension 5.0C is especially critical.

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**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**

<table>
<thead>
<tr>
<th>No. of plungers</th>
<th>Plunger spacing Dimension</th>
<th>Housing B Standard Dimension</th>
<th>Housing B Dimension</th>
<th>Housing C Dimension</th>
<th>Number of connectors S80 without FD/FE</th>
<th>Number of connectors S80 with FD/FE</th>
<th>Number of connectors S90 without FD/FE</th>
<th>Number of connectors S90 with FD/FE</th>
<th>Number of connectors S4 without FD (IO-Link)</th>
<th>Number of connectors S4 with FD (IO-Link)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>12</td>
<td>48</td>
<td>24</td>
<td>30</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
<td>48</td>
<td>24</td>
<td>30</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>12</td>
<td>60</td>
<td>12</td>
<td>24</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>12</td>
<td>60</td>
<td>12</td>
<td>24</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>12</td>
<td>60</td>
<td>12</td>
<td>24</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

Dimensions in mm

**Ordering example:**

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

**Housing style**
- B Standard
- C 2x M20x1.5 on side and cable entry in flange

**No. of plungers**
- 2x
- 3x
- 4x

**Plunger style**
- D Chisel
- K Ball
- R Roller

**Plunger spacing**
- 12 mm
- 16 mm
- 24 mm
- 30 mm

**Distance l3**
- 6...60 V AC/DC
- 60...250 V AC/DC

**Function indicator**
- FE 90...200 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 61

<table>
<thead>
<tr>
<th>Type</th>
<th>Multiple position switch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plunger spacing</td>
<td>12 mm or 16 mm</td>
</tr>
</tbody>
</table>

#### Plunger style
- Chisel (D), Ball (K), Roller (R), Roller Bearing (L)

#### Plunger material
- Stainless steel, contact surfaces induction hardened
- Cast aluminum, corrosion-resistant, anodized finish

#### Housing material
- M20x1.5 for connector or cable gland

#### Connection type
- –5...+85 °C

#### Ambient temperature range
- LED 6...60 V AC/DC (FD) or 90...250 V AC/DC (FE)

#### Degree of protection per IEC 60529
- IP 67

#### Function indicator
- Silver, gold plated
- Snap switch
- Dual changeover, one normally-open and one normally-closed, galvanically isolated

#### With switch element
- BSE 30.0
- BNS 829-61-10

#### Switching principle
- UL, CSA, CCC

#### Electrical data
- see page 116

#### Approval
- see page 116

#### 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 5.0/5.5 is especially critical.
Multiple position switches with safety switch positions per DIN EN 60204-1/VDE 0113 and 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 M20×1.5 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

<table>
<thead>
<tr>
<th>No. of plungers</th>
<th>Plunger spacing dimension</th>
<th>Housing standard dimension</th>
<th>Housing standard dimension</th>
<th>Number of connectors with FD/FE</th>
<th>Number of connectors without FD/FE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

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-
**Multiple Position Switches with Quick-Change Plunger Unit**

### Series 61

**Type**  
Multiple position switch with forced-opening contacts  
12 mm or 16 mm

**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

<table>
<thead>
<tr>
<th>Type</th>
<th>Plunger spacing</th>
<th>Housing material</th>
<th>Connection type</th>
<th>Ambient temperature range</th>
<th>Degree of protection per IEC 60529</th>
<th>Function indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSE 61 per DIN EN 60204-1/VDE 0113</td>
<td>8 mm</td>
<td>Stainless steel, contact surfaces induction hardened</td>
<td>M20x1.5 for connector or cable gland</td>
<td>-5...+85 °C</td>
<td>IP 67</td>
<td>LED 6...60 V AC/DC (FD), 90...250 V AC/DC (FE) or 24...28 V DC (FC)</td>
</tr>
<tr>
<td>BSE 85 per DIN EN 60204-1/VDE 0113</td>
<td>8 mm</td>
<td>Stainless steel, contact surfaces induction hardened</td>
<td>M20x1.5 for connector or cable gland</td>
<td>-5...+85 °C</td>
<td>IP 67</td>
<td>LED 6...60 V AC/DC (FD), 90...250 V AC/DC (FE) or 24...28 V DC (FC)</td>
</tr>
<tr>
<td>BSE 30.0</td>
<td>8 mm</td>
<td>Stainless steel, contact surfaces induction hardened</td>
<td>M20x1.5 for connector or cable gland</td>
<td>-5...+85 °C</td>
<td>IP 67</td>
<td>LED 6...60 V AC/DC (FD), 90...250 V AC/DC (FE) or 24...28 V DC (FC)</td>
</tr>
</tbody>
</table>

**With switch element**

<table>
<thead>
<tr>
<th>Ordering code</th>
<th>Wiring diagram, style</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSE 61 per DIN EN 60204-1/VDE 0113</td>
<td>BSE 85 per DIN EN 60204-1/VDE 0113</td>
</tr>
</tbody>
</table>

**Switch element**

<table>
<thead>
<tr>
<th>Contact material</th>
<th>Contact system</th>
<th>Switching principle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creep switch, positive-opening</td>
<td>Normally-closed, double interruption</td>
<td>Snap switch, forced-opening (normally-closed)</td>
</tr>
<tr>
<td>Snap switch</td>
<td>Dual-changeover: 1. NO (snap function), 2. Forced-opening (double-interruption), all galvanically isolated</td>
<td>Dual changeover, one normally-open and one normally-closed, galvanically isolated</td>
</tr>
</tbody>
</table>

**Electrical data**

<table>
<thead>
<tr>
<th>Approval</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSA, CCC</td>
</tr>
</tbody>
</table>

**Mechanical data**

<table>
<thead>
<tr>
<th>Plunger point to reference surface</th>
<th>Switchpoint to reference surface</th>
<th>Maximum plunger travel</th>
<th>Assured opening after plunger travel</th>
<th>Switching actuating force on plunger</th>
<th>Switching frequency</th>
<th>Approach speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 mm</td>
<td>7 mm</td>
<td>4 mm</td>
<td>2.5 mm</td>
<td>min. 15 N</td>
<td>max. 160/min</td>
<td>Plunger D</td>
</tr>
<tr>
<td>8 mm</td>
<td>6.5 mm</td>
<td>4 mm</td>
<td>2.5 mm</td>
<td>min. 30 N</td>
<td>max. 160/min</td>
<td>Plunger K</td>
</tr>
<tr>
<td>8 mm</td>
<td>6.5 mm</td>
<td>4 mm</td>
<td>2.5 mm</td>
<td>min. 30 N</td>
<td>max. 160/min</td>
<td>Plunger R</td>
</tr>
<tr>
<td>8 mm</td>
<td>6.5 mm</td>
<td>4 mm</td>
<td>2.5 mm</td>
<td>min. 30 N</td>
<td>max. 160/min</td>
<td>Plunger L</td>
</tr>
<tr>
<td>8 mm</td>
<td>6.5 mm</td>
<td>4 mm</td>
<td>2.5 mm</td>
<td>min. 30 N</td>
<td>max. 160/min</td>
<td>Plunger D, K</td>
</tr>
<tr>
<td>8 mm</td>
<td>6.5 mm</td>
<td>4 mm</td>
<td>2.5 mm</td>
<td>min. 30 N</td>
<td>max. 160/min</td>
<td>Plunger R, L</td>
</tr>
<tr>
<td>8 mm</td>
<td>6.5 mm</td>
<td>4 mm</td>
<td>2.5 mm</td>
<td>min. 30 N</td>
<td>max. 160/min</td>
<td>Plunger D, K</td>
</tr>
<tr>
<td>8 mm</td>
<td>6.5 mm</td>
<td>4 mm</td>
<td>2.5 mm</td>
<td>min. 30 N</td>
<td>max. 160/min</td>
<td>Plunger R, L</td>
</tr>
</tbody>
</table>

**Approach speed**

<table>
<thead>
<tr>
<th>Approach speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plunger D</td>
</tr>
<tr>
<td>Plunger K</td>
</tr>
<tr>
<td>Plunger R</td>
</tr>
<tr>
<td>Plunger L</td>
</tr>
<tr>
<td>Plunger D, K</td>
</tr>
<tr>
<td>Plunger R, L</td>
</tr>
</tbody>
</table>

**Repeatability**

<table>
<thead>
<tr>
<th>Repeatability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plunger D, K</td>
</tr>
<tr>
<td>Plunger R, L</td>
</tr>
</tbody>
</table>

**Installation**

Note!  
To ensure switching function, the dimension 5.0 is especially critical.
Quick-change block
for Series 100

<table>
<thead>
<tr>
<th>Type</th>
<th>BNP quick-change block/Plunger</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plunger spacing</td>
<td>12 mm or 16 mm</td>
</tr>
</tbody>
</table>

Ordering code

Plunger style
Chisel (D), Ball (K), Roller (R) or Roller Bearing (L)

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

<table>
<thead>
<tr>
<th>No. of plungers</th>
<th>Plunger style</th>
<th>Plunger spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td>D</td>
<td>12 mm</td>
</tr>
<tr>
<td>...</td>
<td>K</td>
<td>16 mm</td>
</tr>
<tr>
<td>06</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td></td>
<td>L</td>
<td></td>
</tr>
</tbody>
</table>

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

BNP 23- - - -100-

<table>
<thead>
<tr>
<th>No. of plungers</th>
<th>Plunger style</th>
<th>Plunger spacing</th>
<th>Safety switch elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td>D</td>
<td>12 mm</td>
<td>No. from flange</td>
</tr>
<tr>
<td>...</td>
<td>K</td>
<td>16 mm</td>
<td></td>
</tr>
<tr>
<td>06</td>
<td>R</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>L</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note!
Safety switch positions to DIN EN 60204-1/ VDE 0113 may only be operated with a rigid plunger.
### Quick-change block for Series 61

<table>
<thead>
<tr>
<th>Type</th>
<th>BNP quick-change block/Plunger</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plunger spacing</td>
<td>12 mm or 16 mm</td>
</tr>
</tbody>
</table>

#### Ordering code

- **Type**
- **Plunger spacing**
- **Ordering code**
- **Plunger style**
- **Plunger material**
- **Cam tray material**

#### Quick-change block for Series 100

<table>
<thead>
<tr>
<th>No. of plungers</th>
<th>Plunger style</th>
<th>Plunger spacing</th>
<th>Distance I₃</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td>D Chisel</td>
<td>12 mm</td>
<td>12 mm</td>
</tr>
<tr>
<td>06</td>
<td>K Ball</td>
<td>16 mm</td>
<td>16 mm</td>
</tr>
<tr>
<td></td>
<td>R Roller</td>
<td>12 mm</td>
<td>16 mm</td>
</tr>
<tr>
<td></td>
<td>L Roller bearing</td>
<td>24 mm</td>
<td>24 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30 mm</td>
<td>30 mm</td>
</tr>
</tbody>
</table>

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

#### Note!
Objekterkennung
Inductive single and multiple position switches

2.1 Inductive multiple position switches

- Series 602-11 per DIN 43697
- Series 610-11
- Series 611-11
- Series 612-11
- Series 613-11
- Series 605-11
- Series 603-11
- Series 650-11

2.1 Inductive single position switches

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

More added value:
- Long service life
- Non-contacting, wear-free,
- Compatible with mechanical switches
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

<table>
<thead>
<tr>
<th>Number of switch positions</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimension l₁ = 12 mm</td>
<td>70</td>
<td>80</td>
<td>90</td>
<td>105</td>
<td>120</td>
<td>140</td>
<td>170</td>
<td>200</td>
</tr>
<tr>
<td>Dimension l₄</td>
<td>88</td>
<td>88</td>
<td>88</td>
<td>88</td>
<td>88</td>
<td>80</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>Dimension l₅</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Dimension l₁ = 16 mm</td>
<td>70</td>
<td>90</td>
<td>105</td>
<td>120</td>
<td>140</td>
<td>170</td>
<td>200</td>
<td>240</td>
</tr>
<tr>
<td>Dimension l₄</td>
<td>88</td>
<td>88</td>
<td>88</td>
<td>88</td>
<td>80</td>
<td>80</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>Dimension l₅</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

Number of connectors

- S80: on request
- S90: on request

Dimension l₃: 4 mm for inductive switch elements with sensing head Ø 10 mm
2 mm for inductive switch elements with sensing head Ø 15.5 mm

Dimensions in mm

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>80</th>
</tr>
</thead>
</table>

Ordering example:

BNS 816-B12-THA-16-602-11-S80R
# Multiple Position Switches

## Series 602-11

### per DIN 43697

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

### Ordering code

| Housing material | Cast aluminum, corrosion-resistant, anodized finish
| Connection type | M25×1.5 for connector or cable gland
| Ambient temperature range | –25...+70 °C
| Degree of protection per IEC 60529 | IP 67
| Function indicator | LED

### Inductive

#### Multiple Position Switches

**Ordering code for replace-**

| Code | BNS 816-B...
|------|-------------------

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

<table>
<thead>
<tr>
<th>Code</th>
<th>PA</th>
<th>NA</th>
<th>WS</th>
<th>WO</th>
<th>KHG</th>
<th>KHH</th>
<th>NG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated operating distance</td>
<td>2 mm</td>
<td>2 mm</td>
<td>2 mm</td>
<td>2 mm</td>
<td>2 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assured operating distance</td>
<td>0...1.6 mm</td>
<td>0...1.6 mm</td>
<td>0...1.6 mm</td>
<td>0...1.6 mm</td>
<td>0...1.6 mm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Code</th>
<th>THA</th>
<th>EJA</th>
<th>AAA</th>
</tr>
</thead>
<tbody>
<tr>
<td>BES code</td>
<td>517-142-Y</td>
<td>517-463</td>
<td>517-464</td>
</tr>
<tr>
<td>Rated operating distance</td>
<td>5 mm</td>
<td>5 mm</td>
<td>5 mm</td>
</tr>
<tr>
<td>Assured operating distance</td>
<td>0...4 mm</td>
<td>0...4 mm</td>
<td>0...4 mm</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Code</th>
<th>DH</th>
</tr>
</thead>
<tbody>
<tr>
<td>BES code</td>
<td>516-110-D</td>
</tr>
<tr>
<td>Additional information on request!</td>
<td>Additional information on request!</td>
</tr>
</tbody>
</table>

For additional electrical data see pages 118 to 121.

---

**Note!**

To ensure switching function, \( s_a \) must be in a range of \( 0 < s_a \leq 0.81 \ s_n \).
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

<table>
<thead>
<tr>
<th>No. of Switch positions</th>
<th>No. of connectors S80/S90</th>
<th>Switch position spacing</th>
<th>Series 610</th>
<th>Series 611</th>
<th>Series 612</th>
<th>Series 612</th>
<th>Series 613</th>
<th>Series 613</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Housing B</td>
<td>Housing B</td>
<td>Housing B</td>
<td>Housing B</td>
<td>Housing C</td>
<td>Housing C</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Standard</td>
<td>Standard</td>
<td>Standard</td>
<td>Standard</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td>12</td>
<td>36</td>
<td>48</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td>12</td>
<td>48</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td>12</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td>12</td>
<td>72</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td>12</td>
<td>84</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
</tbody>
</table>

Dimensions in mm

Dimension l4 = 4 mm for inductive switch elements with sensing head Ø 10 mm
Dimension l4 = 2 mm for inductive switch elements with sensing head Ø 15.5 mm

Ordering example:
BNS 816-B04-KHG-12-610-11-S80R

---

Dimensions in mm

- l3 = 4 mm for inductive switch elements with sensing head Ø 10 mm
- l2 = 2 mm for inductive switch elements with sensing head Ø 15.5 mm

---

BNS 816-

<table>
<thead>
<tr>
<th>Housing style</th>
<th>No. of switch positions</th>
<th>Code for switch elements</th>
<th>Plunger spacing</th>
<th>Distance l4</th>
<th>optional Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>B Standard</td>
<td>2x M20×1.5 on side</td>
<td>(see table at right)</td>
<td>12 12 mm</td>
<td>610 12 mm</td>
<td>S80R 5-pin, right</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>16 16 mm</td>
<td>611 16 mm</td>
<td>S80L 5-pin, left</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>612 24 mm</td>
<td>S80S 5-pin, right</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>613 30 mm</td>
<td>S90R 12-pin, right</td>
</tr>
<tr>
<td>B 3x M20×1.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>S90L 12-pin, left</td>
</tr>
<tr>
<td>on side and</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>S90S 12-pin, right</td>
</tr>
<tr>
<td>in flange</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C 2x M20×1.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>on side and</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cable entry</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>in flange</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Inductive Multiple Position Switches**

**Type**

- Switch position spacing
  - 12 mm or 16 mm

<table>
<thead>
<tr>
<th>Housing material</th>
<th>Cast aluminum, corrosion-resistant, anodized finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection type</td>
<td>M20x1.5 for connector or cable gland</td>
</tr>
<tr>
<td>Ambient temperature range</td>
<td>–25...+70 °C</td>
</tr>
<tr>
<td>Degree of protection per IEC 60529</td>
<td>IP 67</td>
</tr>
<tr>
<td>Function indicator</td>
<td>LED</td>
</tr>
</tbody>
</table>

**Ordering code**

- BNS 816-B__-__-__-610/611/612/613-11-__

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

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

**Inductive switch elements with sensing head ∅ 15.5 mm, for use with switch position spacing 16 mm**

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

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

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

For additional electrical data see pages 118 to 121.
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

<table>
<thead>
<tr>
<th>Number of switch positions</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>10</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimension l₁ for l₂ = 12 mm</td>
<td>84</td>
<td>84</td>
<td>100</td>
<td>116</td>
<td>132</td>
<td>148</td>
<td>164</td>
<td>180</td>
<td></td>
</tr>
<tr>
<td>Dimension l₂ for l₁ = 12 mm</td>
<td>66</td>
<td>66</td>
<td>82</td>
<td>98</td>
<td>114</td>
<td>130</td>
<td>146</td>
<td>162</td>
<td></td>
</tr>
<tr>
<td>Dimension l₃ for l₁ = 12 mm</td>
<td>54</td>
<td>54</td>
<td>68</td>
<td>84</td>
<td>100</td>
<td>116</td>
<td>132</td>
<td>148</td>
<td></td>
</tr>
<tr>
<td>Dimension l₄ for l₁ = 16 mm</td>
<td>84</td>
<td>100</td>
<td>116</td>
<td>132</td>
<td>148</td>
<td>164</td>
<td>180</td>
<td>212</td>
<td></td>
</tr>
<tr>
<td>Dimension l₅ for l₁ = 16 mm</td>
<td>66</td>
<td>82</td>
<td>98</td>
<td>114</td>
<td>130</td>
<td>146</td>
<td>162</td>
<td>194</td>
<td></td>
</tr>
<tr>
<td>Dimension l₆ for l₁ = 16 mm</td>
<td>54</td>
<td>68</td>
<td>84</td>
<td>100</td>
<td>116</td>
<td>132</td>
<td>148</td>
<td>180</td>
<td></td>
</tr>
<tr>
<td>Number of connectors</td>
<td>S80 on request</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S90 on request</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

| Dimension l₁ | 1.0 mm |
| Dimension l₂ | 40 mm |
| Dimension l₃ | 43.5 mm |

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

| Dimension l₁ | 8 mm |
| Dimension l₂ | 38 mm |
| Dimension l₃ | 41.5 mm |

Dimensions in mm

Ordering example:

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

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

<table>
<thead>
<tr>
<th>No. of switch positions</th>
<th>Code for switch elements</th>
<th>Plunger spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td>2x</td>
<td>12 12 mm</td>
</tr>
<tr>
<td>03</td>
<td>3x</td>
<td>12 12 mm</td>
</tr>
<tr>
<td>04</td>
<td>4x</td>
<td>16 16 mm</td>
</tr>
<tr>
<td>...</td>
<td>(see table at right)</td>
<td></td>
</tr>
</tbody>
</table>

**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.*
Inductive Multiple Position Switches

Series 605-11

Type

Multiple position switch

Switch position spacing

12 mm or 16 mm

Housing material

Cast aluminum, corrosion-resistant, anodized finish

Connection type

M25×1.5 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 ∅ 10 mm, for use with switch position spacing 12 and 16 mm

<table>
<thead>
<tr>
<th>Code</th>
<th>Ordering code for replacement switch elements</th>
<th>Electrical version</th>
<th>Rated operating distance s₀</th>
<th>Assured operating distance sₘ</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA</td>
<td>BES 517-110</td>
<td>PNP, complementary, 10...60 V DC, short circuit protected</td>
<td>2 mm</td>
<td>0...1.6 mm</td>
</tr>
<tr>
<td>NA</td>
<td>BES 517-108</td>
<td>NPN, complementary, 10...60 V DC, short circuit protected</td>
<td>2 mm</td>
<td>0...1.6 mm</td>
</tr>
<tr>
<td>WS</td>
<td>BES 517-410</td>
<td>NO, up to 250 V AC</td>
<td>2 mm</td>
<td>0...1.6 mm</td>
</tr>
<tr>
<td>WO</td>
<td>BES 517-421</td>
<td>NC, up to 250 V AC</td>
<td>2 mm</td>
<td>0...1.6 mm</td>
</tr>
<tr>
<td>KHG</td>
<td>BES 517-560-H</td>
<td>2-wire, NO, 10...55 V DC, short circuit protected</td>
<td>2 mm</td>
<td>0...1.6 mm</td>
</tr>
<tr>
<td>KHH</td>
<td>BES 517-561-H</td>
<td>2-wire, NC, 10...55 V DC, short circuit protected</td>
<td>2 mm</td>
<td>0...1.6 mm</td>
</tr>
<tr>
<td>NG</td>
<td>BES 516-314-N</td>
<td>2-wire, NAMUR, 7.7...9 V DC</td>
<td>2 mm</td>
<td>0...1.6 mm</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Code</th>
<th>Ordering code for replacement switch elements</th>
<th>Electrical version</th>
<th>Rated operating distance s₀</th>
<th>Assured operating distance sₘ</th>
</tr>
</thead>
<tbody>
<tr>
<td>THA</td>
<td>BES 517-142-Y</td>
<td>PNP, complementary, 10...30 V DC, short circuit protected</td>
<td>5 mm</td>
<td>0...4 mm</td>
</tr>
<tr>
<td>EJA</td>
<td>BES 517-465</td>
<td>NO, up to 250 V AC</td>
<td>5 mm</td>
<td>0...4 mm</td>
</tr>
<tr>
<td>AAA</td>
<td>BES 517-464</td>
<td>NC, up to 250 V AC</td>
<td>5 mm</td>
<td>0...4 mm</td>
</tr>
</tbody>
</table>

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

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

For additional electrical data see pages 118 to 121.
**Inductive Multiple Position Switches**

**Series 603-11**

**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**

<table>
<thead>
<tr>
<th>Number of switch positions</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>8</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimension l1 for l2 8 mm</td>
<td>49</td>
<td>59</td>
<td>64</td>
<td>72</td>
<td>80</td>
<td>96</td>
<td>112</td>
</tr>
<tr>
<td>Number of connectors S80</td>
<td>49</td>
<td>59</td>
<td>72</td>
<td>80</td>
<td>89</td>
<td>112</td>
<td>129</td>
</tr>
</tbody>
</table>

**Ordering example:**

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

**BNS 816-B_ _-_ _ _-_ _-603-11-_ _ _ _**

- **No. of switch positions**
  - 02 2x
  - 03 3x
  - 04 4x
  - ...
- **Code for switch elements**
  - (see table at right)
- **Plunger spacing**
  - 08 8 mm
  - 10 10 mm
- **optional Connector**
  - S80R 5-pin, right
  - S80L 5-pin, left
  - S80S 5-pin, right and left

---

**Dimensions in mm**

Size 12x with 8 mm spacing on request.
Multiple position switches
Series 603-11

Type
Switch position spacing

Multiple position switch
8 mm or 10 mm

Ordering code
BNS 816-B-__-__-603-11-__

Housing material
Cast aluminum, corrosion-resistant, anodized finish

Connection type
M16×1.5 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
TOB
TNB

Ordering code for replacement switch elements
BES 517-312-Y
BES 517-311-Y

Electrical version
PNP, NO, 10...30 V DC, short circuit protected
NPN, NO, 10...30 V DC, short circuit protected

Rated operating distance sn
1.1 mm
1.1 mm

Assured operating distance sa
0...0.9 mm
0...0.9 mm

For additional electrical data see page 118

Installation

Note!
To ensure switching function sa must be in a range of 0 < sa < 0.81 sn.

www.balluff.com
Inductive Multiple Position Switches

Series 650-11

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

<table>
<thead>
<tr>
<th>Number of switch positions</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimension l₁</td>
<td>34</td>
<td>42</td>
<td>50</td>
<td>58</td>
<td>66</td>
</tr>
<tr>
<td>Number of connectors S80</td>
<td>on request</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dimensions in mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Ordering example:
BNS 816-B04-TNB-08-650-11-S80R

BNS 816-B 650-11-

No. of switch positions
- 02: 2× (see table at right)
- 03: 3×
- 04: 4×
- ...

Code for switch elements
- 08: 8 mm

Plunger spacing

optional Connector
- S80R: 5-pin, right
- S80L: 5-pin, left
- S80S: 5-pin, right and left

Available sizes

Number of switch positions 2 3 4 5 6
Dimension l₁ 34 42 50 58 66
Number of connectors S80 on request
Dimensions in mm

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

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<th>Number of switch positions</th>
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Ordering example:
BNS 816-B04-TNB-08-650-11-S80R

BNS 816-B 650-11-

No. of switch positions
- 02: 2× (see table at right)
- 03: 3×
- 04: 4×
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Code for switch elements
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Plunger spacing

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Available sizes

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Ordering example:
BNS 816-B04-TNB-08-650-11-S80R

BNS 816-B 650-11-

No. of switch positions
- 02: 2× (see table at right)
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- ...

Code for switch elements
- 08: 8 mm

Plunger spacing

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No. of switch positions
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<td></td>
<td></td>
</tr>
</tbody>
</table>
### Inductive Multiple Position Switches

**Series 650-11**

<table>
<thead>
<tr>
<th>Type</th>
<th>Multiple position switch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switch position spacing</td>
<td>8 mm</td>
</tr>
</tbody>
</table>

#### Ordering code

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

For additional electrical data see page 118

#### Housing material

Cast aluminum, corrosion-resistant, anodized finish

#### Connection type

M16×1.5 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

| Note! | To ensure switching function \( s_n \) must be in a range of \( 0 < s_n < 0.8 \)  |

**Installation**

![Diagram](image)
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**

<table>
<thead>
<tr>
<th>PNP</th>
<th>NO</th>
<th>NC</th>
<th>Complementary</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="" alt="Wiring Diagram PNP NO" /></td>
<td><img src="" alt="Wiring Diagram PNP NC" /></td>
<td><img src="" alt="Wiring Diagram PNP Complementary" /></td>
<td></td>
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</tbody>
</table>

**Supply voltage** $U_s$
**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

**Connector orientation**
### Inductive Single Position Switches

**Series H2 and H3**

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Dimensions</th>
<th>Voltage</th>
<th>Current</th>
<th>Resistance</th>
<th>Humidity</th>
<th>Temperature</th>
<th>Frequency</th>
<th>Connector Type</th>
<th>Material</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>BES 516-346-H2-Y-S4</td>
<td>42×48×22 mm Flush</td>
<td>10...30 V DC</td>
<td>≤ 3.5 V</td>
<td>130 mA</td>
<td>≤ 25 mA</td>
<td>≤ 5 %</td>
<td>–25...+70 °C</td>
<td>500 Hz</td>
<td>DC 13</td>
<td>IP 67</td>
<td>Anodized GD-Al</td>
</tr>
<tr>
<td>BES 516-346-H2-Y-S49</td>
<td>42×48×22 mm Flush</td>
<td>10...30 V DC</td>
<td>≤ 3.5 V</td>
<td>130 mA</td>
<td>≤ 25 mA</td>
<td>≤ 5 %</td>
<td>–25...+70 °C</td>
<td>500 Hz</td>
<td>DC 13</td>
<td>IP 67</td>
<td>Anodized GD-Al</td>
</tr>
<tr>
<td>BES 516-346-H2-Y</td>
<td>42×48×22 mm Flush</td>
<td>10...30 V DC</td>
<td>≤ 3.5 V</td>
<td>130 mA</td>
<td>≤ 25 mA</td>
<td>≤ 5 %</td>
<td>–25...+70 °C</td>
<td>500 Hz</td>
<td>DC 13</td>
<td>IP 67</td>
<td>Anodized GD-Al</td>
</tr>
<tr>
<td>BES 516-161-H3-L</td>
<td>74×60.5×28 mm Flush</td>
<td>10...30 V DC</td>
<td>≤ 1.5 V</td>
<td>400 mA</td>
<td>≤ 30 mA</td>
<td>≤ 5 %</td>
<td>–25...+70 °C</td>
<td>300 Hz</td>
<td>DC 13</td>
<td>IP 67</td>
<td>Anodized GD-Al</td>
</tr>
</tbody>
</table>

*www.balluff.com*
### Inductive Single Position Switches

**DC connectors**  
**M12 connection (S4)**  
**for Series H2**

<table>
<thead>
<tr>
<th>Connector</th>
<th>BKS-B 19</th>
<th>BKS-S 19</th>
<th>BKS-B 20</th>
<th>BKS-S 20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Version</td>
<td>Straight female</td>
<td>Straight female</td>
<td>Right angle female</td>
<td>Right angle female</td>
</tr>
<tr>
<td>Use</td>
<td>Position switch S4</td>
<td>Position switch S4</td>
<td>Position switch S4</td>
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</tr>
<tr>
<td></td>
<td><img src="PX-387" alt="Diagram" /></td>
<td><img src="PX-387" alt="Diagram" /></td>
<td><img src="PX-416" alt="Diagram" /></td>
<td><img src="PX-405" alt="Diagram" /></td>
</tr>
</tbody>
</table>

### Connector Version Use
- no LED, NO
- no LED, NC
- no LED, NC or NO
- with 2 LED's, NO PNP
- with 2 LED's, NC PNP
- with LED, NC or NO PNP

<table>
<thead>
<tr>
<th>Connector</th>
<th>BKS-B 19</th>
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</tbody>
</table>

### Other details:
- Supply voltage $U_B$: 10...30 V DC
- Cable: 3 m/5 m molded PVC
- No. of wires × cross-section: 3×0.34 mm²
- Degree of protection per IEC 60529: IP 67
- Ambient temperature range $T_a$: -25...+85 °C

Other cable lengths and qualities on request.
## Inductive Single Position Switches

<table>
<thead>
<tr>
<th>Model</th>
<th>Type</th>
<th>Position Switch</th>
<th>Dimensions</th>
<th>Operating Temperature</th>
<th>Insulation Material</th>
<th>Connector Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>BKS-B 48</td>
<td>Straight female</td>
<td>S49</td>
<td>10...30 V DC</td>
<td>3 m molded PVC</td>
<td>3×0.25 mm²</td>
<td>IP 67</td>
</tr>
<tr>
<td>BKS-S 48</td>
<td>Straight female</td>
<td>S49</td>
<td>10...30 V DC</td>
<td>3 m molded PVC</td>
<td>3×0.34 mm²</td>
<td>IP 67</td>
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<tr>
<td>BKS-B 49</td>
<td>Right angle female</td>
<td>S49</td>
<td>10...30 V DC</td>
<td>3 m molded PVC</td>
<td>3×0.25 mm²</td>
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<tr>
<td>BKS-S 49</td>
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<td>S49</td>
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<td>3 m molded PUR</td>
<td>3×0.34 mm²</td>
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### DC Connectors

- M8 connection (S49)
  - Series H2
  - Multiple position switches: 602-11, 610-11, 611-11, 612-11, 613-11, 605-11, 603-11, 650-11
- Single position switches: H2 and H3
Objekterkennung
Inductive Multiple Position Switches with Extended Switching Distance 4 mm

**Contents**

- Principles
- Series 602-11 per DIN 43697
- Series 610-11
- Series 605-11

**more added value**

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

Multiple position switch
12 mm
per DIN 43697

<table>
<thead>
<tr>
<th>Type</th>
<th>Switch position spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inductive Multiple Position Switches with Extended Switching Distance 4 mm</td>
<td>12 mm</td>
</tr>
</tbody>
</table>

Ordering code: BNS 816-X603-B_ _-00-12-602-11

Housing material: Cast aluminum, corrosion-resistant, anodized finish

Connection type: M25×1.5 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

<table>
<thead>
<tr>
<th>Inductive switch elements</th>
<th>Electrical version</th>
<th>Rated operating distance $s_a$</th>
<th>Assured operating distance $s_n$</th>
</tr>
</thead>
<tbody>
<tr>
<td>BES 517-100-S42, ...-S43, ...-S44</td>
<td>PNP, complementary, 10...60 V DC, short circuit protected</td>
<td>4 mm</td>
<td>0...3.2 mm</td>
</tr>
</tbody>
</table>

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 $0 < s_a \leq 0.81 s_n$.

www.balluff.com
Inductive Multiple Position Switches with Extended Switching Distance 4 mm

Series 610-11

<table>
<thead>
<tr>
<th>Type</th>
<th>Multiple position switch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switch position spacing</td>
<td>12 mm</td>
</tr>
</tbody>
</table>

Ordering example:
BNS 816-X603-B__-00-12-610-11

<table>
<thead>
<tr>
<th>Housing material</th>
<th>Cast aluminum, corrosion-resistant, anodized finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection type</td>
<td>M20×1.5 for connector or cable gland</td>
</tr>
<tr>
<td>Ambient temperature range</td>
<td>–25...+70 °C</td>
</tr>
<tr>
<td>Degree of protection per IEC 60529</td>
<td>IP 67</td>
</tr>
<tr>
<td>Function indicator</td>
<td>LED</td>
</tr>
</tbody>
</table>

Inductive switch elements with head Ø 10 mm

<table>
<thead>
<tr>
<th>Inductive switch elements</th>
<th>Electrical version</th>
<th>Rated operating distance $s_n$</th>
<th>Assured operating distance $s_a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>BES 517-100-S42, ...-S44</td>
<td>PNP, complementary, 10...60 V DC, short circuit protected</td>
<td>4 mm</td>
<td>0...3.2 mm</td>
</tr>
</tbody>
</table>

Ordering example:
BNS 816-X603-B04-00-12-610-11

<table>
<thead>
<tr>
<th>No. of switch positions</th>
</tr>
</thead>
<tbody>
<tr>
<td>02 2x</td>
</tr>
<tr>
<td>03 3x</td>
</tr>
<tr>
<td>04 4x</td>
</tr>
<tr>
<td>05 5x</td>
</tr>
<tr>
<td>06 6x</td>
</tr>
</tbody>
</table>

Other sizes and connectors on request.

Installation

Caution! To ensure switching function $s_a$, must be in a range of $0 < s_a \leq 0.81 \text{ s}_n$. 

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

### Series 605-11

<table>
<thead>
<tr>
<th>Type</th>
<th>Multiple position switch</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Switch position spacing</th>
<th>12 mm</th>
</tr>
</thead>
</table>

### Ordering code

| BNS 816-X603-B__-00-12-605-11 |

### Housing material

- Cast aluminum, corrosion-resistant, anodized finish

### Connection type

- M25×1.5 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 ∅ 10 mm

<table>
<thead>
<tr>
<th>Inductive switch elements</th>
<th>Electrical version</th>
<th>Rated operating distance sa</th>
<th>Assured operating distance sn</th>
</tr>
</thead>
<tbody>
<tr>
<td>BES 517-100-S42, ...-S43, ...-S44</td>
<td>PNP, complementary, 10...60 V DC, short circuit protected</td>
<td>4 mm</td>
<td>0...3.2 mm</td>
</tr>
</tbody>
</table>

### Ordering example:

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

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

<table>
<thead>
<tr>
<th>No. of switch positions</th>
<th>02</th>
<th>03</th>
<th>04</th>
<th>05</th>
<th>06</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2x</td>
<td>3x</td>
<td>4x</td>
<td>5x</td>
<td>6x</td>
</tr>
</tbody>
</table>

Inquire for connectors.

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

### Installation

![Diagram of installation](image)

**Caution!**

To ensure switching function sa must be in a range of 0 < sa ≤ 0.81 sn.
Objekterkennung
Special Form Factors

Contents

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
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

Switch position 3
Switch position 2
Switch position 1
Flange

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
**Special Form Factors**

**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

*Section 5.1*
Mechanical and Inductive Switch Elements

---

**Example for Series 40**

**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
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
Customer-specific products

Special Form Factors

Customer-specific connectors Cam trays in flexible lengths
Objekterkennung
Wireless System

Contents

Wireless System

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

Wireless system

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

Principles
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
Wireless System

Wireless position switches
Series F 60
per DIN 43693

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

<table>
<thead>
<tr>
<th>Plunger style</th>
<th>Approach direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>D Chisel</td>
<td>3 longitudinal, parallel to mounting surface</td>
</tr>
<tr>
<td>K Ball</td>
<td>5 lateral, 90° to mounting surface</td>
</tr>
<tr>
<td>R Roller</td>
<td></td>
</tr>
<tr>
<td>L Roller bearing</td>
<td></td>
</tr>
<tr>
<td>E Chisel with wiper plate</td>
<td></td>
</tr>
</tbody>
</table>
### Wireless Position Switches

#### Series F 60 per DIN 43693

- **Type**
- **Mounting and function dimensions**

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

#### With switch element

**Ordering code**

| BWT T1-185-01 | BNS 819-F_._-60-W1_ |

#### Switch element

- **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

#### Mechanical data

| 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 |
| min. 2 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.
Wireless receiver box
BWT R1-4R1D-10_-T

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

Photo credit: MCM
## Electrical data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>BWT R1-4R1D-101-T</th>
<th>BWT R1-4R1D-102-T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated operational voltage $U_e$</td>
<td>24 V DC</td>
<td></td>
</tr>
<tr>
<td>Supply voltage $U_B$</td>
<td>20.4…28.8 V DC</td>
<td></td>
</tr>
<tr>
<td>Ripple</td>
<td>$\leq 5% \text{ of } U_e$</td>
<td>$20 \text{ mA}$</td>
</tr>
<tr>
<td>No-load supply current $I_0$ max.</td>
<td>20 mA</td>
<td></td>
</tr>
<tr>
<td>Current consumption</td>
<td>1.5 W</td>
<td></td>
</tr>
<tr>
<td>Max. load</td>
<td>2 A/30 V DC</td>
<td>$2 \times 10^5$</td>
</tr>
<tr>
<td>Min. relay switching frequency (1 A, 30 V DC, resistive load)</td>
<td>$2 \times 10^5$</td>
<td></td>
</tr>
</tbody>
</table>

## Mechanical data

<table>
<thead>
<tr>
<th>Parameter</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing material</td>
<td>PC</td>
</tr>
<tr>
<td>Connection type</td>
<td>Clamping terminal</td>
</tr>
<tr>
<td>Degree of protection per IEC 60529</td>
<td>IP 20</td>
</tr>
<tr>
<td>Contamination class</td>
<td>2</td>
</tr>
</tbody>
</table>

## Ambient data

<table>
<thead>
<tr>
<th>Parameter</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. range</td>
<td>30 m</td>
</tr>
<tr>
<td>Range reduction during the programming procedure</td>
<td>0.5 m</td>
</tr>
<tr>
<td>Receive frequency</td>
<td>868 MHz</td>
</tr>
<tr>
<td>Ambient temperature range $T_a$</td>
<td>+5…+65 °C</td>
</tr>
<tr>
<td>Utilization category</td>
<td>DC 13</td>
</tr>
</tbody>
</table>

## Antenna

- **BWT A4-01-50R-SMB-02,5**
  - please order separately!
more added value

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

Contents

5.1

- Mechanical and inductive switch elements
  - 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
<table>
<thead>
<tr>
<th>Type</th>
<th>Snap switch element</th>
<th>Creep switch element</th>
<th>Snap switch element</th>
</tr>
</thead>
<tbody>
<tr>
<td>for multiple position switches series</td>
<td>BSE 30.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>for single position switches series</td>
<td>BSE 61 to DIN EN 60204-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>for single position switches series</td>
<td>BSE 65 to DIN EN 60204-1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact material</td>
</tr>
<tr>
<td>Switching principle</td>
</tr>
<tr>
<td>Contact system</td>
</tr>
<tr>
<td>Contact arrangement</td>
</tr>
<tr>
<td>Wire cross-section (with end ferrule)</td>
</tr>
<tr>
<td>Connection type</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mechanical data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switching actuation force on telescoping plunger</td>
</tr>
<tr>
<td>Switching actuation force on rigid plunger</td>
</tr>
<tr>
<td>Bounce time</td>
</tr>
<tr>
<td>Switchover time</td>
</tr>
<tr>
<td>Switching frequency</td>
</tr>
<tr>
<td>Housing material</td>
</tr>
<tr>
<td>Tightening torque max.</td>
</tr>
<tr>
<td>Ambient temperature range T_a</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Electrical data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolation</td>
</tr>
<tr>
<td>Nominal voltage</td>
</tr>
<tr>
<td>Constant current</td>
</tr>
<tr>
<td>Contact resistance</td>
</tr>
<tr>
<td>Contact resistance</td>
</tr>
<tr>
<td>Contact resistance</td>
</tr>
<tr>
<td>Contact resistance</td>
</tr>
<tr>
<td>Contact resistance</td>
</tr>
<tr>
<td>Switching capacity</td>
</tr>
<tr>
<td>Switching capacity</td>
</tr>
<tr>
<td>Switching capacity</td>
</tr>
<tr>
<td>Switching capacity</td>
</tr>
<tr>
<td>Switching capacity</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Service life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical data</td>
</tr>
<tr>
<td>Electrical data</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Approval</th>
</tr>
</thead>
<tbody>
<tr>
<td>UL, CSA, CCC</td>
</tr>
</tbody>
</table>
### Mechanical switch elements

#### Snap switch elements BSE

<table>
<thead>
<tr>
<th>Model</th>
<th>Material</th>
<th>Type</th>
<th>Contact Configuration</th>
<th>Current Rating</th>
<th>Contact Resistance</th>
<th>Temperature Range</th>
<th>Group</th>
<th>UL, CSA, CCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSE 69.1</td>
<td>Silver, Gold</td>
<td>Snap switch</td>
<td>Single-pole changeover</td>
<td>NO C + NO, NC C + NC</td>
<td>0.75 mm²</td>
<td>max. 2 ms</td>
<td>200 operations/min, Thermoplastic, 0.12 Nm, –5...+85 °C</td>
<td>C</td>
</tr>
<tr>
<td>BSE 70.1</td>
<td>Silver, Gold</td>
<td>Snap switch</td>
<td>Single-pole changeover</td>
<td>NO C + NO, NC C + NC</td>
<td>0.75 mm²</td>
<td>max. 2 ms</td>
<td>200 operations/min, Thermoplastic, 0.12 Nm, –5...+85 °C</td>
<td>C</td>
</tr>
<tr>
<td>BSE 73.1</td>
<td>Silver, Gold</td>
<td>Snap switch</td>
<td>Single-pole changeover</td>
<td>NO C + NO, NC C + NC</td>
<td>0.75 mm²</td>
<td>max. 2 ms</td>
<td>200 operations/min, Thermoplastic, 0.12 Nm, –5...+85 °C</td>
<td>C</td>
</tr>
<tr>
<td>BSE 74.1</td>
<td>Silver, Gold</td>
<td>Snap switch</td>
<td>Single-pole changeover</td>
<td>NO C + NO, NC C + NC</td>
<td>0.75 mm²</td>
<td>max. 2 ms</td>
<td>200 operations/min, Thermoplastic, 0.12 Nm, –5...+85 °C</td>
<td>C</td>
</tr>
</tbody>
</table>

**Notes:**
- Depending on load, switching frequency, and traverse speed
- 2 A, cos ϕ = 0.8
- 5 A, L/R = 10 ms
- > 10 mil. switching operations (VDE 0660)

- www.balluff.com
- VDE 0110
- 250 V AC, 30 V DC
- ≥ 20 mA
- ≥ 10 mA
- < 240 mA
- 2 A, cos ϕ = 0.8
- 5 A, L/R = 10 ms
- > 10 mil. switching operations (VDE 0660)

**Contact Resistance:**
- 2 A, cos ϕ = 0.8
- 5 A, L/R = 10 ms
- > 10 mil. switching operations (VDE 0660)
### Inductive switch elements

<table>
<thead>
<tr>
<th>Code for inductive switch elements</th>
<th>TOB</th>
<th>TNB</th>
<th>PA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated operating distance $s_{op}$</td>
<td>1.1 mm</td>
<td>1.1 mm</td>
<td>2 mm</td>
</tr>
<tr>
<td>Assured operating distance $s_a$</td>
<td>0...0.9 mm</td>
<td>0...0.9 mm</td>
<td>0...1.6 mm</td>
</tr>
<tr>
<td>for multiple position switches series</td>
<td>603, 650</td>
<td>603, 650</td>
<td>602, 610...613, 605</td>
</tr>
</tbody>
</table>

#### Order code

<table>
<thead>
<tr>
<th>PNP</th>
<th>NPN</th>
<th>BES 517-312-Y</th>
<th>BES 517-311-Y</th>
<th>BES 517-110</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO</td>
<td>NO</td>
<td>Complementary</td>
<td>Complementary</td>
<td></td>
</tr>
</tbody>
</table>

#### Rated operational voltage $U_e$
- 24 V DC
- 10...30 V DC
- 75 V DC
- 130 mA
- ≤ 25 mA
- ≤ 80 µA
- ≤ 1 µF
- ≤ 5 %
- ≤ 5 %

#### Supply voltage $U_b$
- 24 V DC
- 10...30 V DC
- 75 V DC
- 130 mA
- ≤ 25 mA
- ≤ 80 µA
- ≤ 1 µF
- ≤ 5 %

#### Voltage drop $U_d$ at $I_e$ static
- ≤ 3.5 V
- ≤ 3.5 V
- ≤ 1.5 V

#### Rated insulation voltage $U_i$
- 75 V DC
- 200 mA
- ≤ 50 µA
- ≤ 0.5 µF

#### Rated operational current $I_e$
- ≤ 25 mA
- ≤ 12 mA
- ≤ 25 mA
- ≤ 12 mA
- ≤ 15 mA
- ≤ 12 mA

#### No-load current $I_0$
- ≤ 80 µA
- ≤ 80 µA
- ≤ 50 µA

#### Off-state current $I_r$
- ≤ 1 µF
- ≤ 1 µF
- ≤ 0.5 µF

#### Repeat accuracy $R$
- ≤ 5 %
- ≤ 5 %

#### Ambient temperature range $T_a$
- -25...+70 °C
- -25...+70 °C
- -25...+70 °C

#### 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 mm²
- up to 1 mm²
- up to 1.5 mm²

### Wiring diagrams

- PNP, normally open
- PNP, complementary
- NPN, normally closed
- NPN, complementary
### Inductive Switch Elements

**DC 3-/4-wire**

<table>
<thead>
<tr>
<th>NA</th>
<th>2 mm</th>
<th>THA</th>
<th>5 mm</th>
<th>DH</th>
<th>2, 2 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>0...1.6 mm</td>
<td>602, 610...613, 605</td>
<td>0...4 mm</td>
<td>602, 611, 613, 605</td>
<td>0...1.8 mm</td>
<td>100, 62, 72, 61</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specifications</th>
<th>NA</th>
<th>THA</th>
<th>DH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage Range</td>
<td>24 V DC</td>
<td>24 V DC</td>
<td>24 V DC</td>
</tr>
<tr>
<td>- 10...30 V DC</td>
<td>- 10...30 V DC</td>
<td>- 10...30 V DC</td>
<td></td>
</tr>
<tr>
<td>- 24 V DC</td>
<td>- 10...30 V DC</td>
<td>- 24 V DC</td>
<td></td>
</tr>
<tr>
<td>- 10 V DC</td>
<td>- 10 V DC</td>
<td>- 10 V DC</td>
<td></td>
</tr>
<tr>
<td>Current Range</td>
<td>200 mA</td>
<td>100 mA</td>
<td>30 mA</td>
</tr>
<tr>
<td>- 15 mA</td>
<td>- 30 mA</td>
<td>- 30 mA</td>
<td></td>
</tr>
<tr>
<td>- 50 µA</td>
<td>- 30 mA</td>
<td>- 30 mA</td>
<td></td>
</tr>
<tr>
<td>Input Resistance</td>
<td>≤ 1.5 V</td>
<td>≤ 3.5 V</td>
<td>≤ 3.5 V</td>
</tr>
<tr>
<td>- 75 V DC</td>
<td>- 75 V DC</td>
<td>- 75 V DC</td>
<td></td>
</tr>
<tr>
<td>- 200 mA</td>
<td>- 100 mA</td>
<td>- 100 mA</td>
<td></td>
</tr>
<tr>
<td>- 12 mA</td>
<td>- 50 µA</td>
<td>- 50 µA</td>
<td></td>
</tr>
<tr>
<td>Output</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>- 1 µF</td>
<td>≤ 5 %</td>
<td>≤ 5 %</td>
<td></td>
</tr>
<tr>
<td>- 5%</td>
<td>≤ 5%</td>
<td>≤ 5%</td>
<td></td>
</tr>
<tr>
<td>- 500 Hz</td>
<td>- 1000 Hz</td>
<td>- 1000 Hz</td>
<td></td>
</tr>
<tr>
<td>- DC 13</td>
<td>- DC 13</td>
<td>- DC 13</td>
<td></td>
</tr>
<tr>
<td>- yes</td>
<td>- yes</td>
<td>- yes</td>
<td></td>
</tr>
<tr>
<td>- Screw terminals</td>
<td>- Screw terminals</td>
<td>- Screw terminals</td>
<td></td>
</tr>
<tr>
<td>- up to 2.5 mm²</td>
<td>- up to 2.5 mm²</td>
<td>- up to 2.5 mm²</td>
<td></td>
</tr>
</tbody>
</table>

**BES 517-108**

**BES 517-142-Y**

**BES 516-110-D**
### Inductive switch elements

**AC, DC 2-wire**

<table>
<thead>
<tr>
<th>Code for inductive switch elements</th>
<th>Rated operating distance s&lt;sub&gt;n&lt;/sub&gt;</th>
<th>Assured operating distance s&lt;sub&gt;a&lt;/sub&gt;</th>
<th>for multiple position switches series</th>
</tr>
</thead>
<tbody>
<tr>
<td>WS 2 mm</td>
<td>0...1.6 mm</td>
<td>602, 610...613, 605</td>
<td></td>
</tr>
<tr>
<td>WO 2 mm</td>
<td>0...1.6 mm</td>
<td>602, 610...613, 605</td>
<td></td>
</tr>
<tr>
<td>EJA 5 mm</td>
<td>0...4 mm</td>
<td>602, 611, 613, 605</td>
<td></td>
</tr>
</tbody>
</table>

#### Order code for replacement switch elements

<table>
<thead>
<tr>
<th>AC</th>
<th>NC</th>
<th>DC</th>
<th>NO</th>
<th>NC</th>
<th>NAMUR</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>AC</th>
<th>NO</th>
<th>NC</th>
</tr>
</thead>
<tbody>
<tr>
<td>BES 517-410</td>
<td>BES 517-421</td>
<td>BES 517-463</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DC</th>
<th>NO</th>
<th>NC</th>
<th>NAMUR</th>
</tr>
</thead>
</table>

- **Rated operational voltage U<sub>e</sub>**
  - AC: 110 V AC
  - DC: 110 V DC
  - EJA: 220 V AC

- **Supply voltage U<sub>s</sub>**
  - AC: 35...250 V AC
  - DC: 35...250 V DC
  - EJA: 90...250 V AC

- **Voltage drop U<sub>d</sub> at I<sub>e</sub> static**
  - ≤ 8.5 V

- **Rated insulation voltage U<sub>i</sub>**
  - AC: 250 V AC
  - DC: 250 V DC
  - EJA: 250 V AC

- **Rated operational current I<sub>e</sub>**
  - AC: 100 mA
  - DC: 100 mA

- **No-load current I<sub>n</sub> damped/undamped**
  - ≤ 1700 µA

- **Off-state current I<sub>r</sub>**
  - ≤ 3000 µA

- **Polarity reversal protected**
  - yes

- **Short circuit protected**
  - yes

- **Permissible load capacitance**
  - ≤ 5 %

- **Repeat accuracy R**
  - ≤ 5 %

- **Ambient temperature range T<sub>a</sub>**
  - –25...+70 °C

- **Switching frequency f**
  - 10 Hz

- **Utilization category**
  - AC 140

- **Function indicator**
  - yes

- **Degree of protection per IEC 60529**
  - IP 67

- **Housing material**
  - PA

- **Material of sensing face**
  - PA 12

- **Connection type**
  - Screw terminals

- **max. conductor cross-section**
  - up to 2.5 mm²

- **Approval**
  - cULus

#### Wiring diagrams

- AC, NO
- DC, NO
- DC, NC
- NAMUR
### Inductive switch elements

**AAA 5 mm**
- 0...4 mm
- 602, 611, 613, 605
- BES 517-464
- 220 V AC
- 90...250 V AC
  - ≤ 8.5 V
  - 250 V AC
  - 100 mA
  - ≤ 3000 µA
    - yes
    - no
- ≤ 5 %
- -25...+70 °C
- 15 Hz
- AC 140
- yes
- IP 67
- PA
- PA 12
- Screw terminals
  - up to 2.5 mm²
  - cULus

**KHG 2 mm**
- 0...1.6 mm
- 602, 610...613, 605
- BES 517-560-H
- 24 V DC
- 10...55 V DC
  - ≤ 7 V DC
  - 75 V DC
  - 100 mA
  - ≤ 1350 µA
  - ≤ 0.5 µF
- ≤ 5 %
- -25...+70 °C
- DC 13
- yes
- IP 67
- PA 12
- Screw terminals
  - up to 2.5 mm²

**KHH 2 mm**
- 0...1.6 mm
- 602, 610...613, 605
- BES 517-561-H
- 24 V DC
- 10...55 V DC
  - ≤ 7 V DC
  - 75 V DC
  - 100 mA
  - ≤ 1350 µA
  - ≤ 0.5 µF
- ≤ 5 %
- -25...+70 °C
- DC 13
- yes
- IP 67
- PA 12
- Screw terminals
  - up to 2.5 mm²

**NG 2 mm**
- 0...1.6 mm
- 602, 610...613, 605
- BES 516-314-N
- 8.2 V DC
- 7.7...9 V DC
- 75 V DC
- yes
- no
- ≤ 5 %
- -25...+70 °C
- 1000 Hz
- AC 140
- yes
- IP 67
- PBT
- Screw terminals
  - up to 2.5 mm²

Current change (no trigger response)
- ≥ 4 mA
- ≤ 1 mA
- 550...1100 Ohm

---

www.balluff.com
**Snap switch element BWT**

for wireless position switch F 60

| Type | Snap switch element  
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BWT T1-185-01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ordering code for replacement element</th>
<th>BWT T1-185-01</th>
</tr>
</thead>
</table>

**Construction**

Switching principle

Snap switch

**Mechanical data**

- Switching actuation force on telescoping plunger: min. 20 N
- Switching frequency: max. 60 operations/min
- Housing material: Duroplast
- Ambient temperature range $T_a$: -5...+70 °C

**Electrical data**

- Supply voltage
- 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
Cam Trays and Cams

Contents

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

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 04 120 04 100

Version

04 Aluminum, no holes
07 Aluminum, with holes
06 Steel, no holes
08 Steel, with holes
10 Aluminum, T-slot

Slot spacing

80 8 mm
100 10 mm
120 12 mm
160 16 mm

Number of slots

02 2 slots
...

Total length L

(see standard lengths)

Dimensions

L = Standard cam tray lengths:

1000, 1200, 1400, 1600, 1800, 2000 or 2500 mm.

www.balluff.com 124
### 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**

<table>
<thead>
<tr>
<th>Number of slots</th>
<th>Dimension A</th>
<th>Dimension B</th>
<th>Dimension C</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td>29</td>
<td>14.5</td>
<td></td>
</tr>
<tr>
<td>04</td>
<td>53</td>
<td>26.5</td>
<td></td>
</tr>
<tr>
<td>06</td>
<td>77</td>
<td>8.5</td>
<td>60</td>
</tr>
<tr>
<td>08</td>
<td>101</td>
<td>8.5</td>
<td>84</td>
</tr>
<tr>
<td>10</td>
<td>125</td>
<td>8.5</td>
<td>108</td>
</tr>
</tbody>
</table>

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**

<table>
<thead>
<tr>
<th>Number of slots</th>
<th>Dimension A</th>
<th>Dimension B</th>
<th>Dimension C</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td>41</td>
<td>20.5</td>
<td></td>
</tr>
<tr>
<td>04</td>
<td>73</td>
<td>36.5</td>
<td></td>
</tr>
<tr>
<td>06</td>
<td>105</td>
<td>12.5</td>
<td>80</td>
</tr>
<tr>
<td>08</td>
<td>137</td>
<td>12.5</td>
<td>112</td>
</tr>
</tbody>
</table>

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

---

### 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**

<table>
<thead>
<tr>
<th>Number of slots</th>
<th>Dimension A</th>
</tr>
</thead>
<tbody>
<tr>
<td>04</td>
<td>48.6</td>
</tr>
<tr>
<td>06</td>
<td>72.6</td>
</tr>
</tbody>
</table>

L = Standard cam tray lengths:
200, 400, 600, 800, 1000, 1200, 1400, 1600, 1800, 2000 or 2500 mm. 
## Cam Trays and Cams

### Cam Trays and Cams

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Ordering code</th>
<th>Dimensions in mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BNN 520-81-S-0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>BNN 520-81-S-6,5</td>
<td>6,5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Form A</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>BNN 520-81-S-0</td>
<td>0</td>
</tr>
<tr>
<td>BNN 520-81-S-6,5</td>
<td>6,5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Form B</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>BNN 520-81-S-0</td>
<td>0</td>
</tr>
<tr>
<td>BNN 520-81-S-6,5</td>
<td>6,5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cam Trays and Cams</th>
</tr>
</thead>
<tbody>
<tr>
<td>L = Length of switching surface. Additional lengths on request.</td>
</tr>
<tr>
<td>Material: Steel with hardened and burnished surface.</td>
</tr>
</tbody>
</table>

### Mounting possibilities for cams

- **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/TA**
  When a clamping nut is tightened, the cam is clamped firmly in the T-slot.

### 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.
### Cam Trays and Cams

#### Cam Trays and Cams per DIN 69639

<table>
<thead>
<tr>
<th>Form A</th>
<th>BNN 520-UA-0</th>
<th>BNN 520-UA-4</th>
<th>BNN 520-UA-10</th>
<th>BNN 520-UA-16</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>21</td>
<td>25</td>
<td>31</td>
<td>37</td>
</tr>
<tr>
<td>L</td>
<td>0</td>
<td>4</td>
<td>10</td>
<td>16</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Form A</th>
<th>BNN 520-TA-0</th>
<th>BNN 520-TA-4</th>
<th>BNN 520-TA-10</th>
<th>BNN 520-TA-16</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>0</td>
<td>4</td>
<td>10</td>
<td>16</td>
</tr>
</tbody>
</table>

#### Cams for mechanical single and multiple position switches

For use with BNL 5304/5307-120/160-...

For use with BNL 5310-120-...

#### Cams for mechanical single and multiple position switches

For switches with switch position spacing **12 mm and 16 mm**

For switches with switch position spacing **12 mm and 16 mm**
Cam Trays and Cams

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

Dimensions in mm

L = Length of switching surface.
Additional lengths on request.
Material: Steel damping element with burnished surface and base made of PA 6.6.

Form A

BEN 516-19-10 | L | 10
BEN 516-19-15 | 15

Form B

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

Material: Steel with burnished surface.

Form A

BEN 516-14-10 | 10
BEN 516-14-20 | 20

Form B

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 A

BEN 516-13-10 | 10
BEN 516-13-20 | 20

Form B

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

For switches with switch position spacing 8 mm and 10 mm

For use with BNL 5304-080-...

For switches with switch position spacing 12 mm and 16 mm

For use with BNL 5304/5307-120/160-...

For switches with switch position spacing 12 mm and 16 mm

For use with BNL 5310-120-...
Connectors and Function Indicators

Contents

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

5.3
## Connectors

**AC/DC connectors**

<table>
<thead>
<tr>
<th>Connector</th>
<th>Version</th>
<th>Use</th>
<th>12-pin</th>
<th>BKS-S 80</th>
<th>BKS-S 90</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>5-pin</td>
<td>BKS-S 80</td>
<td>BKS-S 90</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4-pin</td>
<td>BKS-S 80</td>
<td>BKS-S 90</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3-pin</td>
<td>BKS-S 80</td>
<td>BKS-S 90</td>
</tr>
</tbody>
</table>

### Connector Details:

- **Supply voltage** $U_{sb}$
- **Cable**
- **No. of wires × cross-section**
- **Degree of protection per IEC 60529**
- **Ambient temperature range** $T_a$
- **View of female side**

#### BKS-S 80 - Straight female
- **No. of wires × cross-section**: 5×0.5 mm²
- **Degree of protection**: IP 67
- **Ambient temperature range**: –25…+90 °C

#### BKS-S 80 - Right angle female
- **No. of wires × cross-section**: 5×0.5 mm²
- **Degree of protection**: IP 68 per BWN Pr. 20
- **Ambient temperature range**: –25…+90 °C

#### BKS-S 90 - Straight female
- **No. of wires × cross-section**: 12×0.5 mm²
- **Degree of protection**: IP 67
- **Ambient temperature range**: –25…+90 °C

---

### 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.

Please include cable length in ordering code!

6 m = 06/15 m = 15
<table>
<thead>
<tr>
<th>Model</th>
<th>Type</th>
<th>Length</th>
<th>Voltage</th>
<th>Insulation</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>BKS-B 19</td>
<td>Straight female</td>
<td>3 m</td>
<td>10...30 V DC</td>
<td>PVC, PUR</td>
<td>-25...+85 °C</td>
</tr>
<tr>
<td>BKS-B 20</td>
<td>Right angle female</td>
<td>3 m</td>
<td>10...30 V DC</td>
<td>PVC</td>
<td>-25...+85 °C</td>
</tr>
<tr>
<td>BKS-S 19</td>
<td>Straight female</td>
<td>3 m</td>
<td>10...30 V DC</td>
<td>PVC, PUR</td>
<td>-25...+70 °C</td>
</tr>
<tr>
<td>BKS-S 20</td>
<td>Right angle female</td>
<td>3 m</td>
<td>10...30 V DC</td>
<td>PVC, PUR</td>
<td>-25...+70 °C</td>
</tr>
</tbody>
</table>

Other cable lengths on request.
Function Indicators

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.
Object Detection – Mechanical and Inductive Single and Multiple Position Switches

Mechanical and Inductive Single and Multiple Position Switches

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