

Object Detection

Mechanical and inductive single and multiple position switches



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Mechanical Switches

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Mechanical Switches

Introduction

Balluff North America



Florence, Kentucky USA

Enjoying one of the highest growth rates in the automation industry, Balluff's Florence, Kentucky United States headquarters is located just south of Cincinnati, Ohio. Our customers are in industries such as automotive, machine tool, robotics, injection molding, packaging, material handling, and more.

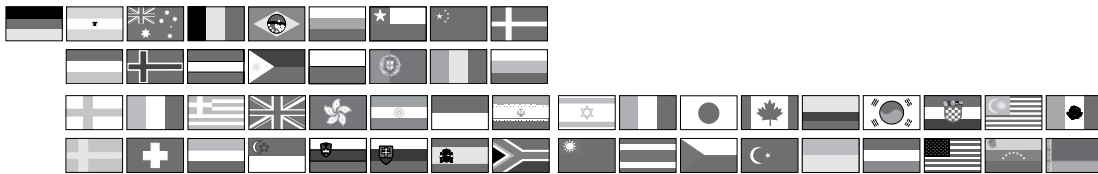
In addition to sales, marketing, and logistic functions, this facility manufactures regionally focused inductive proximity sensors and Micropulse® magnetostrictive linear position sensors.

The Balluff Global Network

Balluff spans the globe with representation in 49 countries.



For a complete global listing visit www.balluff.com/global



Argentina	Canada	France	Iran	Netherlands	Russia	Switzerland
Australia	China	Great Britain	Israel	Norway	Singapore	Thailand
Austria	Columbia	Greece	Italy	Pakistan	Slovakia	Taiwan
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Belgium	Czech Republic	Hungary	Korea	Poland	South Africa	USA
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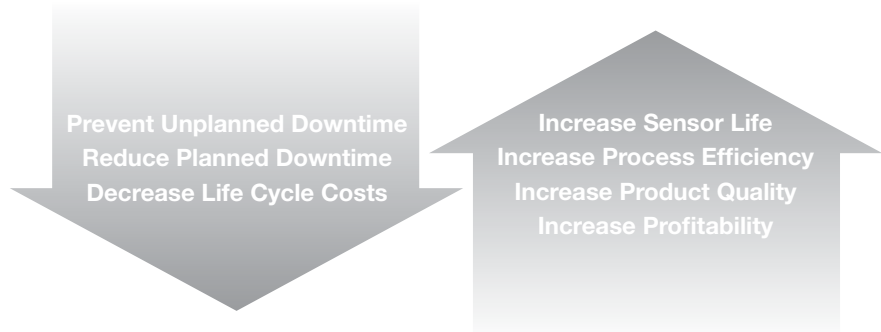
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Applications

Balluff control solutions are found wherever products are being produced, controlling key functions in virtually every type of production cycle. Balluff provides thousands of different sensors, but it also provides something else—a unique understanding of how best to apply them for maximum positive impact.

Balluff Application Expertise Can:



Service

- **24 hour on-call service.**
- **Complete in-house technical support.**
- **Comprehensive product selection, cross reference, and application assistance.**
- **Fast, friendly experienced service – guaranteed!**

The best customer service team in the industry is ready to solve your automation challenges. We'll make finding the right sensor easier and faster.

1-800-543-8390
Give us a call.

Balluff's enthusiastic and knowledgeable staff help us stand out from the competition. When you call, you'll be instantly connected with experienced customer service, technical support, and application engineers. We know your industry, and we know how to make your job easier, and we'll go out of our way to make sure you are satisfied with our products and services.

Warranty

Balluff products are guaranteed to be free from defects in material and workmanship as follows:

Standard lifetime warranty for inductive sensors and magnetically operated sensors sold to the original user.

Standard 2-year warranty from the date of shipment for photoelectric, capacitive sensors, read-write ID systems, magnetostrictive transducers*, connectors and cables, electromechanical limit and rotary switches, and all products with electromechanical relays sold to the original user.

Balluff will repair or replace at our discretion, without charge, any unit which fails because of defective workmanship or material, during this guarantee period and

which is returned to Balluff transportation prepaid. This guarantee will not apply if, in the judgement of Balluff, damage or failure has resulted from accident, alteration, misuse, abuse, or operation on an incorrect power supply. This guarantee expressly does not include any other costs such as the cost of removal of the defective part, installation, labor or consequential damages of any kind. Balluff assumes no responsibility for selection and installation of its products. The foregoing is in lieu of all other guarantees expressed, implied or statutory and Balluff neither assumes nor

authorizes any person to assume for it any other obligation or liability in connection with said products.

Mechanical Switches

Applications

Single and multiple position cam 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 ensure lasting quality and reliability.

Mechanical switch systems consist of two basic components:

1. A rugged single or multiple position switch assembly with a wide variety of switch elements (see sections 1-10).
2. Linear or rotary cams and associated cam trays or drums (see sections 11-14).

Actuation and switching systems

You can choose from three actuation and output switching systems.

- **Mechanical/mechanical**
A mechanical cam trips a mechanical plunger, which actuates an electro-mechanical switch element through a sealed membrane. Best for highest level of switchpoint stability and repeatability.
- **Mechanical/electronic**
A mechanical cam trips a mechanical plunger. The metallic plunger is sensed internally by an inductive sensor and the output signal is switched electronically. Perfect for extremely low DC current switching in heavy metallic chip areas that would false trip an inductive sensor.
- **Inductive/electronic**
Metallic cam is sensed by an inductive sensor element, which changes state electronically to activate the output signal. Non-contact operation for wear-free service in areas without metallic chips.

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.

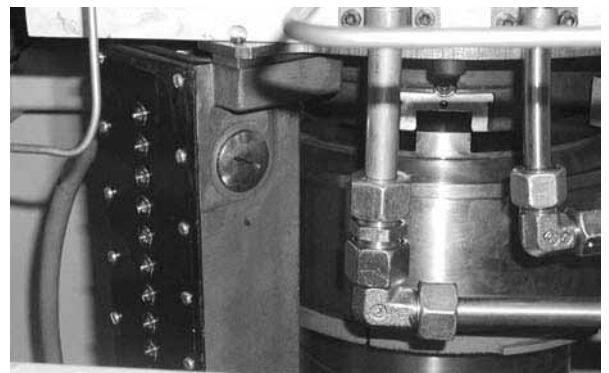
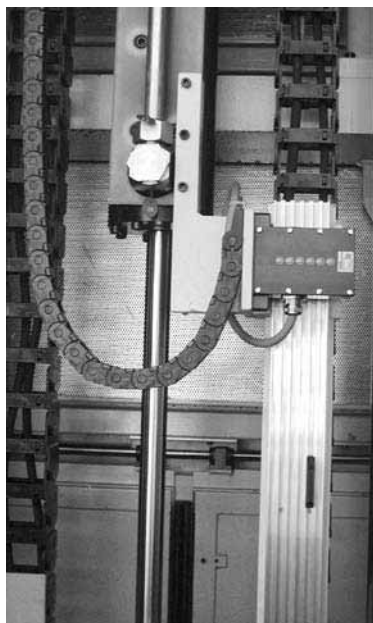
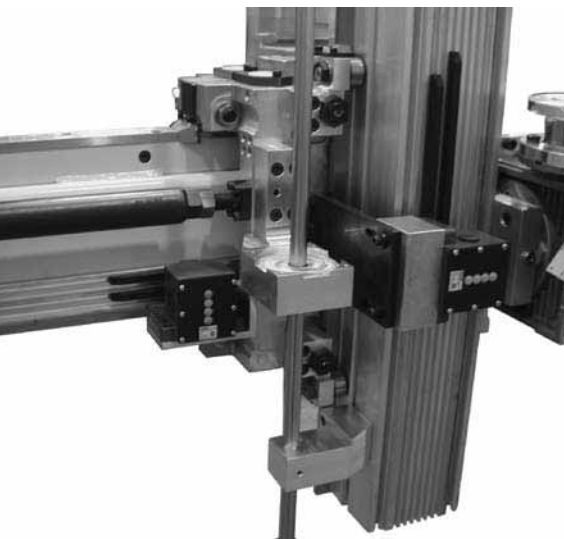
Switching cams are available in multiple variations:

- Straight for linear applications
- Radial for rotary applications in multiple radii and swept angles
- Surface-hardened solid steel for long life with mechanical switches
- Mild steel tubular cams for non-contact inductive switching
- U-channel for drop-in installation or T-slot for drop-in captive installation

Cam tray variations include:

- Straight for linear applications with various slot types and profiles
- Machined aluminum drums for rotary applications in multiple diameters and profiles
- Extruded aluminum semi-circles with T-slots and various radii

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



For standard applications

Mechanical single and multiple position switches

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

Features

- Maintenance-free, self-lubricating slide bearing bushing constructed of three layers: Steel back, bronze and PTFE coating
- Low coefficient of friction
- Can be continuously used without lubrication
- Plunger will not stick after production is stopped even when aggressive coolants are used
- Optional LED indicators
- Optional inductive switch elements
- Pre-wired connectors for rapid installation on new equipment and replacement in event of failure during production

For safety applications:

Such as E-stop or end-of travel restriction

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.

Balluff multiple position switches are ideal for robot dynamic safety zone control. Positive break switches coupled with high switching element density, rugged construction, and long life expectancy, combine to prove a perfect match for safe and reliable human-robot interface.

Features

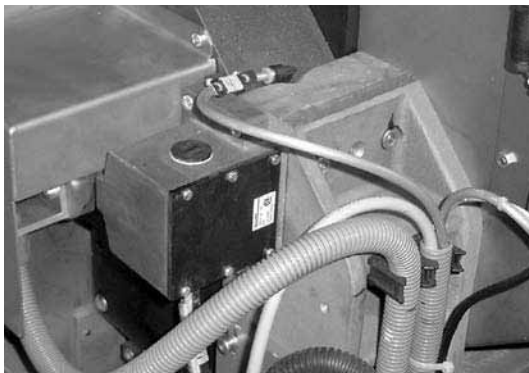
- Housing styles and sizes for a variety of applications
- Various plunger spacings
- Up to 12 switch positions
- Rigid chisel plungers for reliable switching
- Creep or snap switch elements with positive opening in accordance with DIN EN 60204-1/VDE 0113 for the greatest possible safety
- Maintenance-free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

Custom products include mixed assemblies combining snap, safety, and inductive elements, pre-wired and factory tested micro or mini style connectors. Custom configurations receive unique part numbers with documentation (refer to section 10).



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

Mechanical Switches

Standard Form Factors

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.

Highly elastic, wear-free **membrane** made of Viton is used for hermetic sealing between the plunger mechanism and switch chamber. This dual chamber design ensures an IP 67 rating. Viton offers improved resistance to aggressive media over a large temperature range and under pressure.

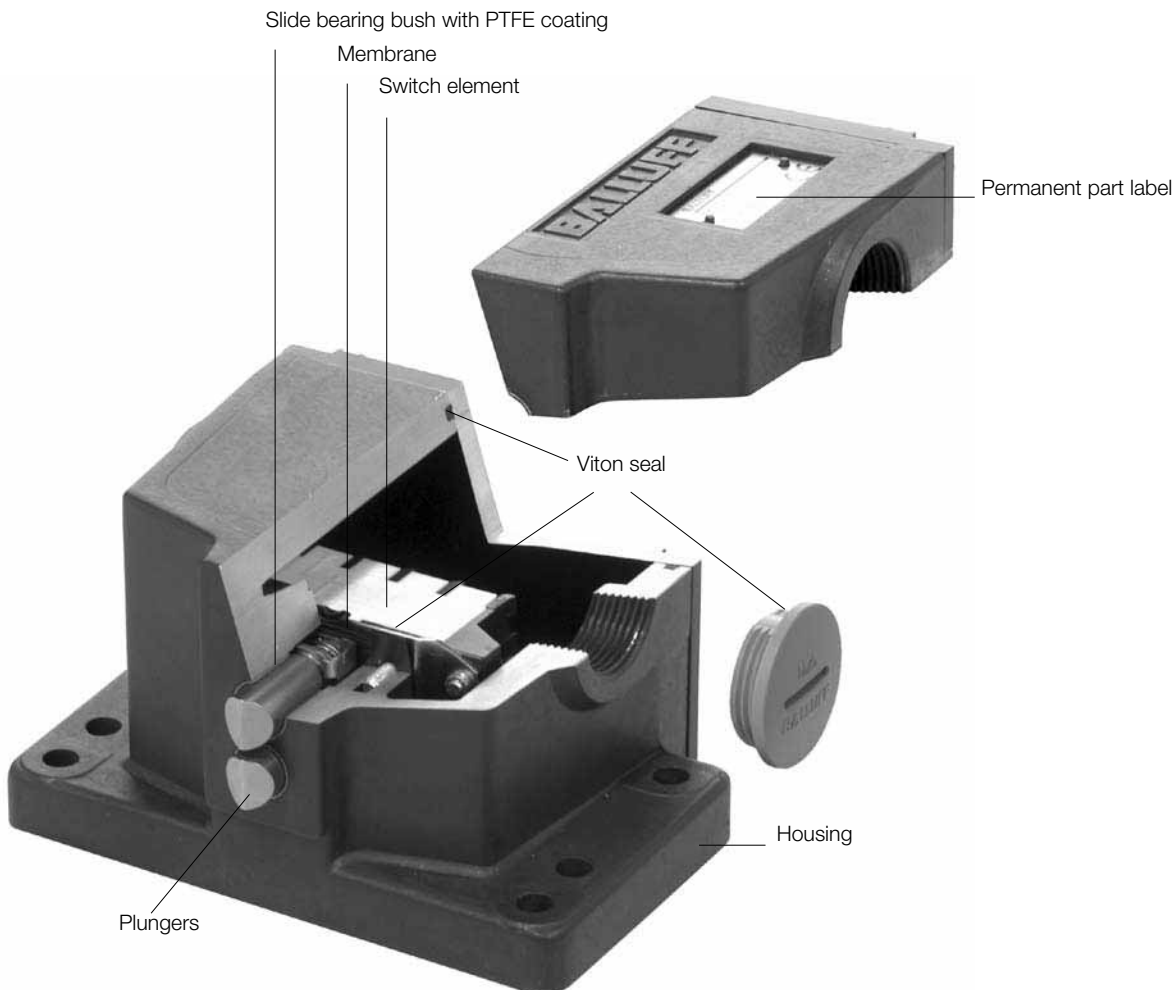
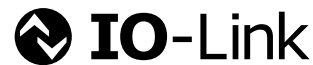
Snap and creep switch elements are available as changeover contacts with self-cleaning effect. A variety of switch elements can be used.

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 LEDs is optional on mechanical versions. LEDs are standard on inductive switch assemblies.

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)
- Standard with S4 (M12) connector
- Available for all standard form factors
- Not available on safety style switches



Mechanical Switches

Models with Safety Switch Positions

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
- For optimum safety we recommend chisel plungers

Available series

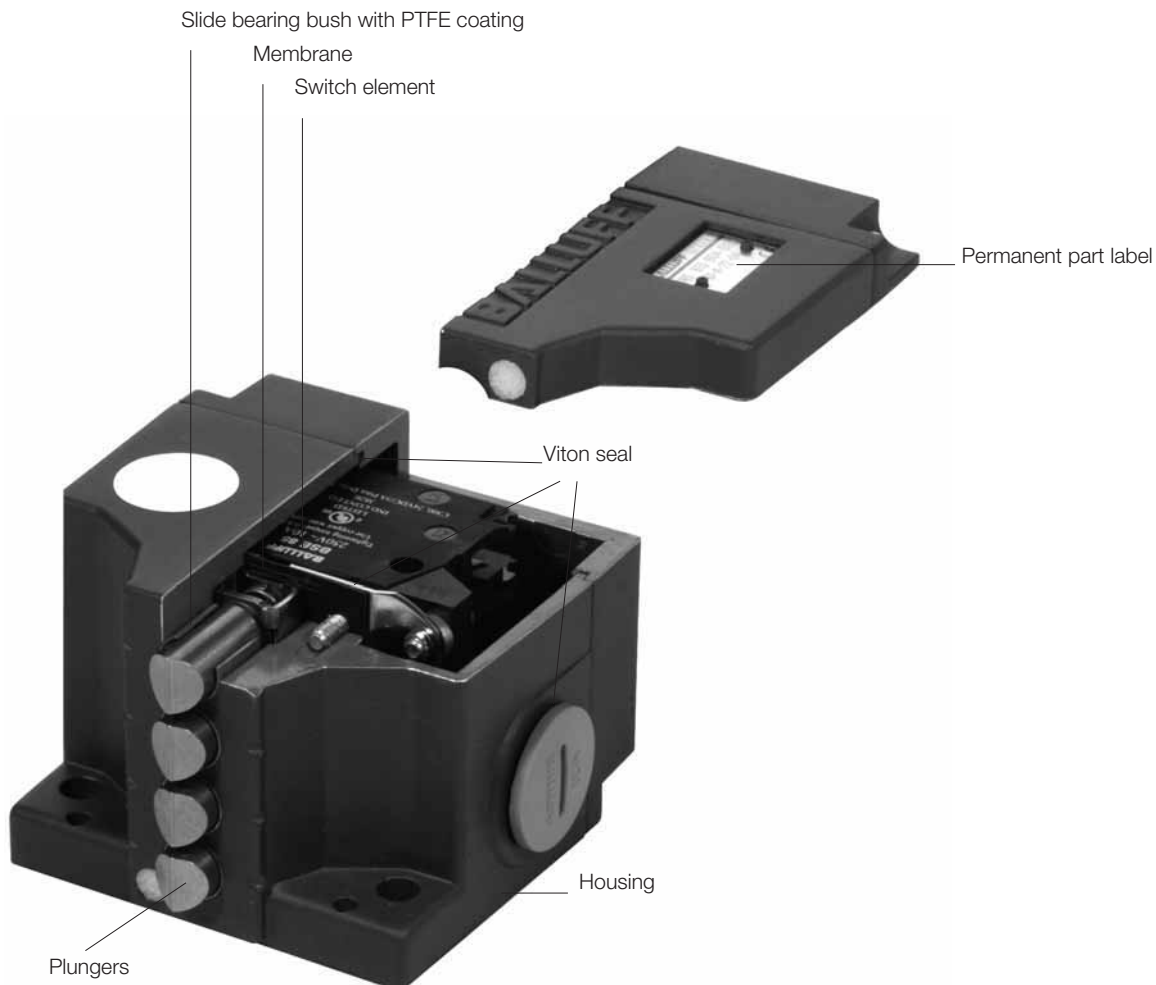
Safety switch positions can be installed in Series 100, 99/100, 62, 61, 72, F 60, 46 and 40 single and multiple position switches.

Switch position combinations

Switches with safety switch positions can be assembled using both mechanical elements and inductive elements. Such mixed assemblies can be provided on request. Refer also to Section 10.

Note!

Cams for safety switch positions must be permanently secured.



Mechanical Switches

Form Factors with Quick-Change Plunger Block

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 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
- Aggressive 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:

- 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.

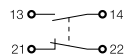


Switch elements for standard applications

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

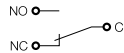
Snap switch element BSE 30.0

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



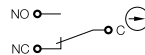
Snap switch elements BSE 73.1 or BSE 74.1 have specially formed gold contacts making them suitable for low currents from 10...100 mA.

Switch element with positive opening

Were developed for miniature series 99/100, 46 and 40 switches. Typical applications include end-of-travel sensing. Available are:

Snap switch element BSE 64, BSE 63

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

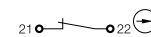


Switch elements with safety functions

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

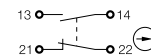
Creep switch element BSE 61

NC, double-interrupting, positive-opening.



Snap switch element BSE 85

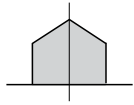
Dual-changeover:
1. Dual-changeover (snap function), 2. Positive-opening (double-interruption), all galvanically isolated



Mechanical Switches

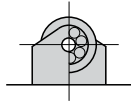
Plunger Styles

Chisel plunger
for short actuation
travel at low speeds with
highly repeatable switch
points.



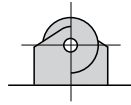
- max. approach velocity
40 m/min
- Typical cam length
100 mm
- Defined approach direction
- Repeatability
up to ± 0.002 mm
- Recommended in conjunction
with rigid plunger for safety
applications
- Hardened, polished contact
surface
- Angle of slope 30°
- Hardness 58 HRC

Roller bearing plunger
for long actuation
travel at maximum speeds



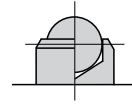
- max. approach velocity
120 m/min
- Typical cam length
1000 mm
- Defined approach direction
- Repeatability
up to ± 0.01 mm
- Not recommended in safety
positions
- Low-noise
- Hardness 58 HRC

Roller plunger
for medium actuation travel



- max. approach velocity
60 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 roller and roller bearing plungers

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

The specified approach speeds for all plunger styles
apply only in combination with
Balluff mechanical cams (see page 13.1)



Mechanical Switches

Plunger Systems

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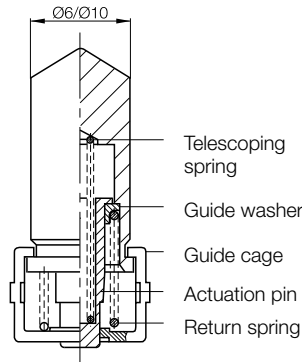
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Telescoping plungers

For standard switch positions. 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.

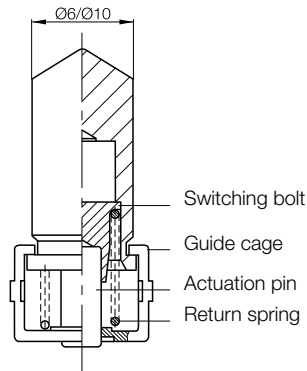
- Maintenance-free, self-lubricating slide bearing bushing with coating (PTFE)
- Can be dry-run in continuous operation with no lubrication
- Lowest coefficient of friction
- Resistant to chemical effects



Rigid plunger

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

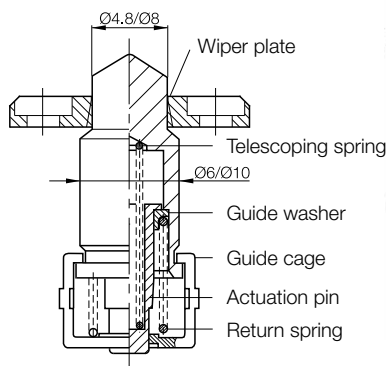
- Reliable opening of the switching circuit even when overload causes contact welding
- Telescoping plunger



Telescoping plunger Chisel with wiper plate

Encapsulated version for extreme applications. 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.

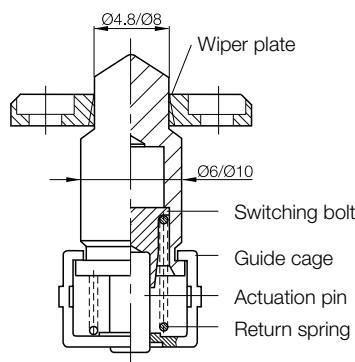
- One-piece, easily replaceable plastic plate with wiper edge
- Protection against effects of coolants and lubricants which form resins
- Breaks up adhering, hardened coolants and lubricant deposits
- Slide bearing bushing is kept clean
- Ideal for use in processing cast materials



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



Mechanical Switches

Inductive Single and Multiple Position Switches

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

Machine-compatible **housing** per DIN 43697 made of a special cast aluminum.

Sensing face, material PA 12, resistant to aggressive coolants.

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

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.

Connectors
The threads on factory installed connectors are sealed.

Switching distances

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

- 0... 1.1 mm
- 0... 2 mm
- 0... 4 mm
- 0... 5 mm

Inductive switch elements with extended switching distance available on request!

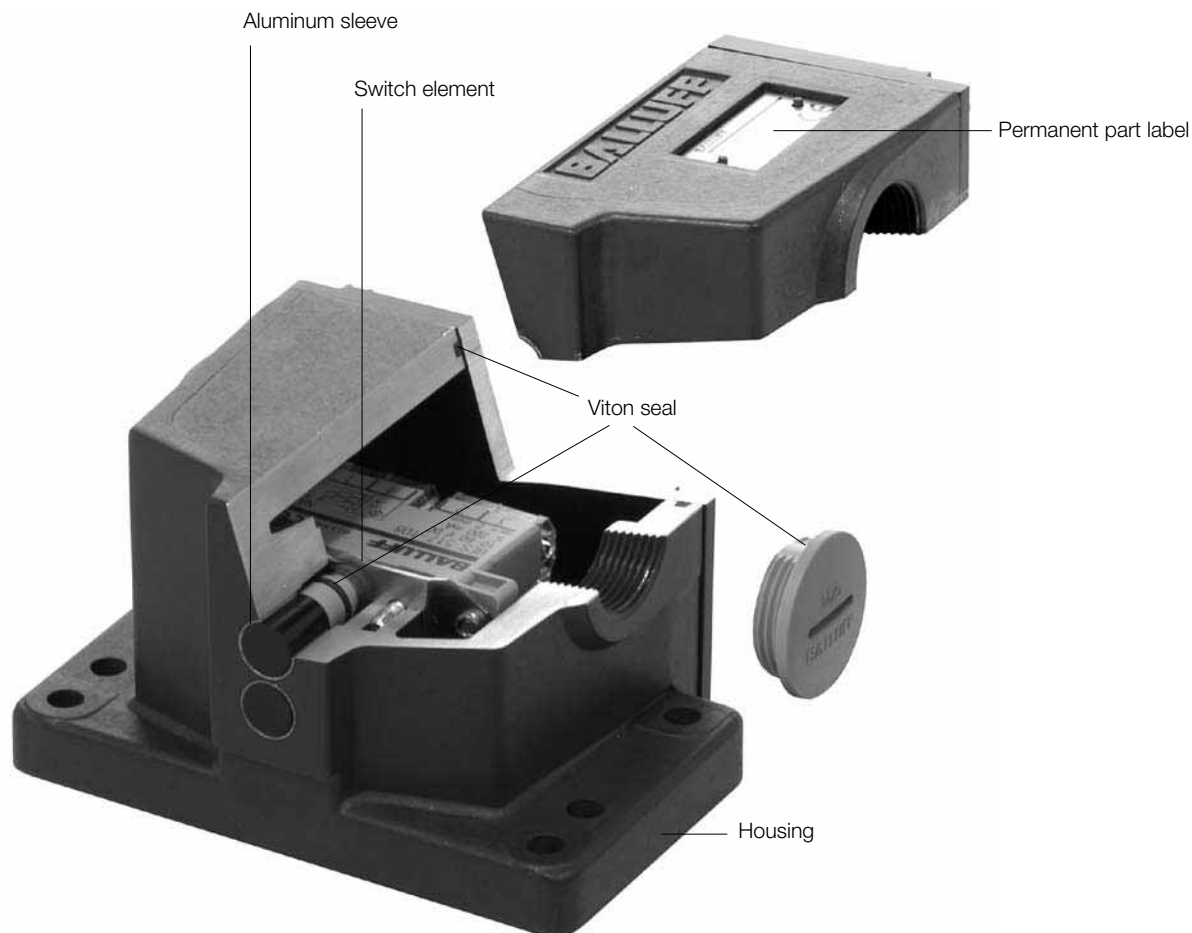
Utilization categories
per EN 60947-5-2/
IEC 60947-5-2

Category

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

Typical load applications

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



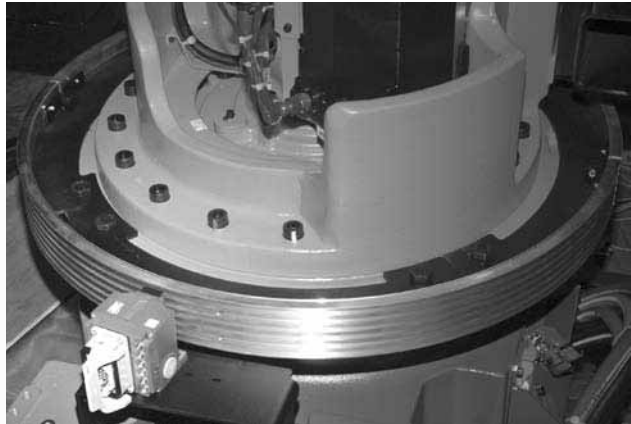
Mechanical Switches

Robot Zone Limit Systems

Balluff's Robot Zone Limit System

No compromise on safety or productivity

Wherever a human operator must share workspace with a robot, there's no question that safety is the highest priority. When a person enters a robotic work cell, the robot must be safely idled. But this idle time results in a loss of the robot's productivity. Enter Balluff's robot zone limit systems. These pre-engineered hardware kits let you recapture that lost productivity, while maintaining complete operator safety. Finally, you don't have to sacrifice productivity to keep your floor team safe.



The Finest and Most Reliable ANSI/RIA Dynamic Limiting System Available Anywhere

Balluff zone limit systems are hardware kits that provide diverse, complementary, and redundant position monitoring for up to three robot axes. Designed to interface with a user-supplied safety monitoring relay or safety PLC, Balluff zone limit systems include all mounting hardware, complementary redundant cams, and the proven Balluff multiple position limit switch, available in either mechanical or non-contact inductive configurations. These robust systems install easily and provide the flexibility to adjust zone angles and zone location, while providing a control-reliable means to mute personnel sensing devices when the robot is safely out of the way.

Control Reliability is defined by ANSI/RIA R15.06-1999 –Section 4.54 as ...any single component failure shall not prevent the stopping action of the robot. When properly installed and monitored, the Balluff system is single point fault tolerant and prevents the robot from entering a zone if the following conditions are present:

- Broken, missing, or stuck switch actuators
- Missing cams
- Cams that may have slipped out of position
- Open or short circuits
- Switch contacts welded together
- Broken internal switch spring
- Switch disconnected
- Switch actuator not touching cams



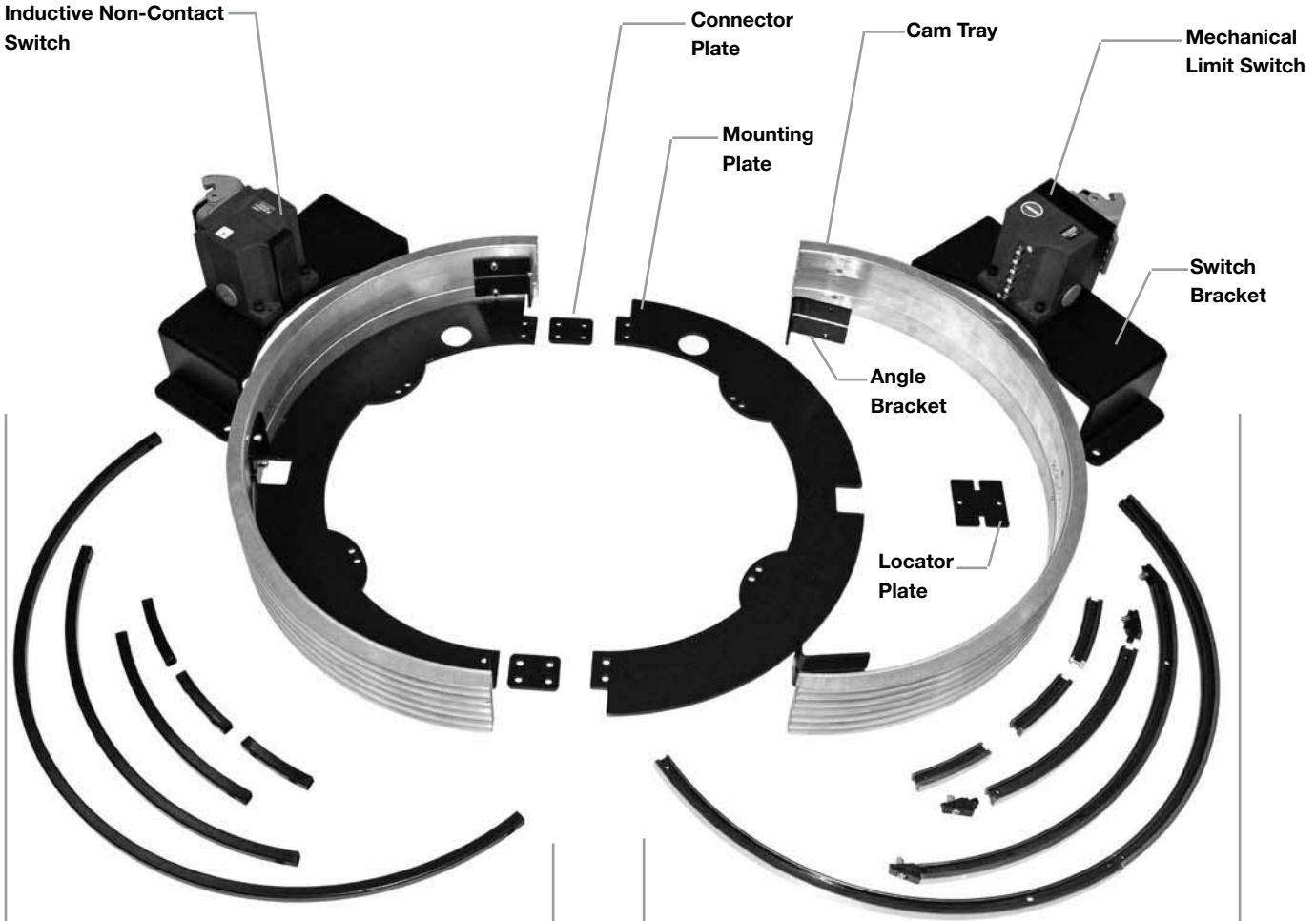
Mechanical Switches

Robot Zone Limit Systems

Balluff Zone Limit System Components

Designed for safety, durability, and long operational life

All mounting hardware is included in the kit. Mounting hardware can consist of: cam tray, mounting plates, switch bracket, connector plates, angle brackets, and hubs or spacers as required, including all nuts, bolts, screws and washers.



Non-Contact Cams for Inductive Sensors

Non-Contact rotary trip cams are made from tubular mild steel. They mount to the T-slot cam ring with a cleverly-designed speed T-nut for easy installation. Tamper resistant spanner screws are included to semi-permanently fix the cams to the ring for additional installation integrity.

Mechanical Cams for Mechanical Limit Switches

Mechanical rotary trip cams are made from hardened steel with a burnished and hard-chromed surface for extra long life. The cams mount with either friction wedges for U-slots or T-nuts for T-slots. Self-tapping screws are also provided to semi-permanently fix the cams to the ring to guard against slippage or inadvertent re-positioning.



Cam Sets

Segmented cam sets (one set required per zone) are supplied with everything needed to create complimentary angles totaling 360°. The cam set typically includes one 180° segment, one 90° degree segment, one 45° degree segment, and three 15° segments. By attaching different combinations of cam angles together, two complementary cam sets can be created – for example 90° and 270°, in minimum increments of 15°. The cams that are supplied for axis 2 and 3 are typically two 180° segments that are positioned around the cam ring to set the boom back or flip over switch point.

Balluff Zone Limit Systems

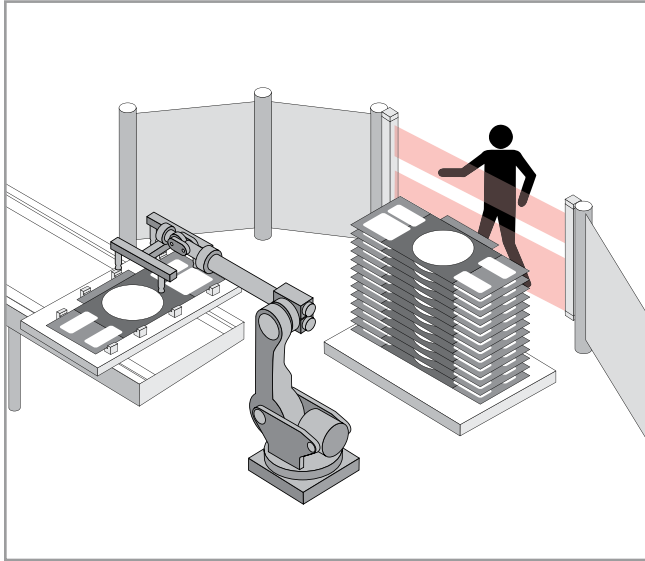
How they work

Two Channels Per Zone

Balluff zone limit systems consist of a multi-channel ring that holds switch-actuating cams. Each zone is monitored by two adjacent yet complementary cams. The differential status of two separate switches must be confirmed to prove that the robot is safely out of the operator-occupied zone, before muting of the presence-sensing device is allowed. For example, an Axis 1

system with six channels and six switches allows up to three independent zones to be monitored with diverse, complementary redundancy. Segmented cams allow configuration of the angular size of the zones in 15° increments from 15° to 345°. Each zone can be independently and infinitely located 360° around the circumference of the cam ring.

Before

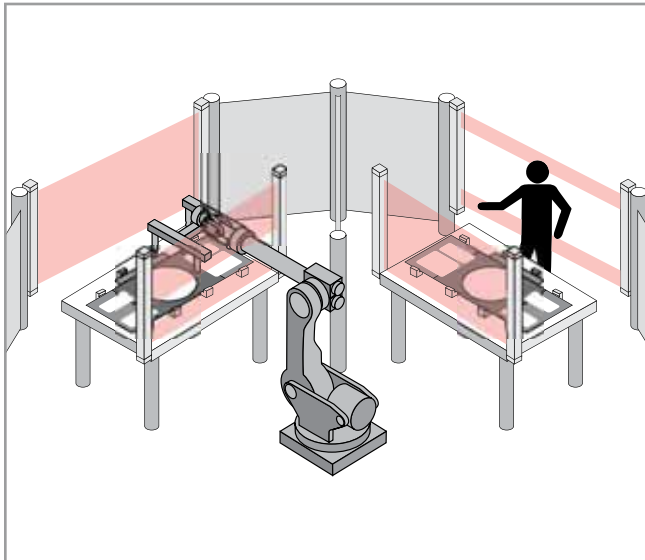


Typical Robotic Work Cell (Without Robot Zone Limit System)

In the first example, when the operator breaks the light curtain, the robot immediately stops working – no matter where it is positioned in the cell. Robot productivity is lost as long as the operator is present.

See next page for improved configuration →

Before



Typical Robotic Work Cell (Without Robot Zone Limit System)

The second example shows a typical light curtain robot limiting application. Two extra sets of robot-detecting light curtains are employed. As long as the robot does not break the light curtain at the station where an operator is present, the robot can continue working elsewhere in the cell.

Although this method delivers some improvement in robot productivity, the space occupied by the additional light curtains restricts the robot motion and may cause interference with transport of large parts or sizable end-of-arm tooling. The additional robot moves required to remain clear of hitting the light curtains add to increased cycle time, which steals back some of the productivity gains resulting from adding the light curtains in the first place.

See next page for improved configuration →

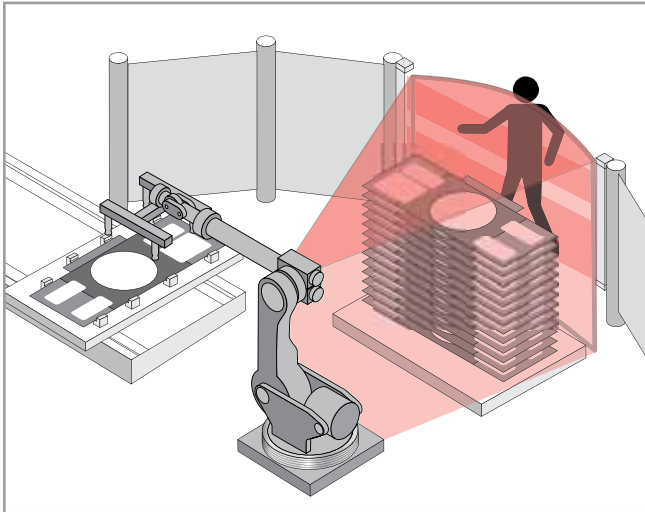
Mechanical Switches

Robot Zone Limit Systems

Balluff Zone Limit Systems

Designed to increase productivity

After

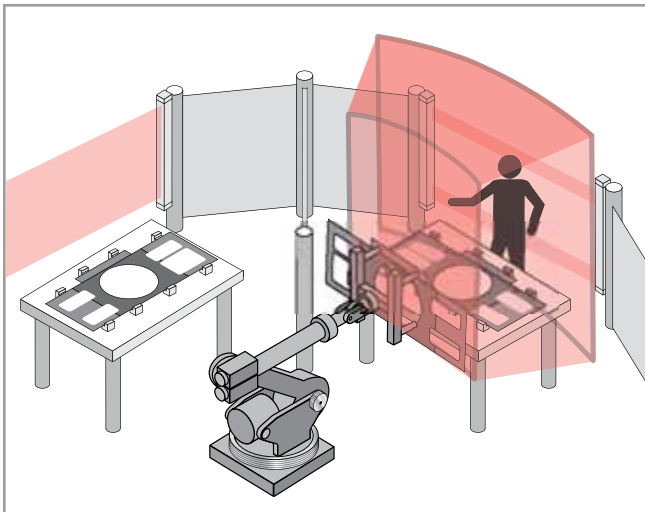


Balluff Axis 1 Zone Limit System

In the third example, the Axis 1 position of the robot is directly detected by the Balluff zone limit system. As long as the robot is safely away from the operator-occupied area of the cell, the safety light curtain is muted and the robot remains operational.

The operator can enter the work cell to load or unload parts into a fixture, replenish raw materials, or perform other tasks – without stopping the robot. However, if the robot finishes its task and tries to enter the operators zone before the operator leaves the area, the zone limit system detects the intrusion. The safety light curtains are instantly reactivated and the robot is stopped.

After

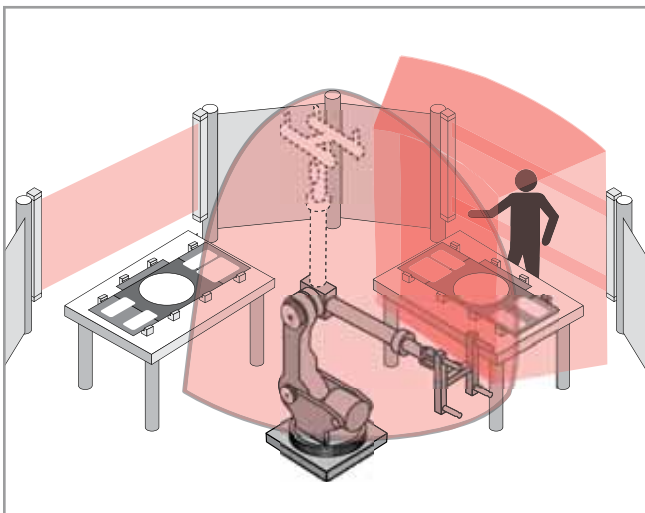


Balluff Axis 2 Zone Limit System

Some applications may require the robot arm to traverse past an operator to go to another area of the cell. By implementing a zone limit system on Axis 2 (commonly called boom back), the robot can pass in front of the operator with the arm safely retracted without shutting down the robot, even though the operator is present. If the robot should unexpectedly come off of the boom back switch while the operator is present in the station, the safety light curtains are re-enabled, stopping the robot.

Another application for an Axis 2 zone limit system is to prevent a gantry (or track) robot from reaching back under itself, or to ensure that the robot arm is safely retracted before the robot is allowed to traverse the length of the gantry.

After



Balluff Axis 3 Zone Limit System

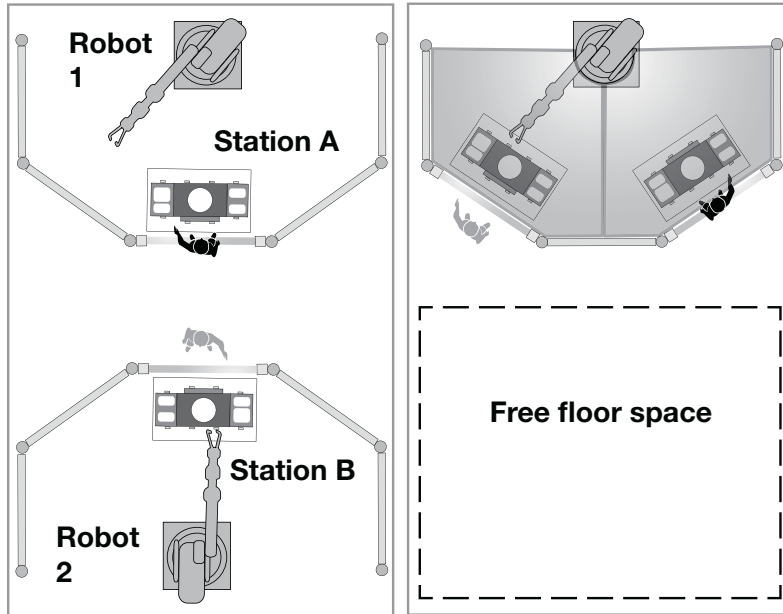
Axis 3 zone limit systems are sometimes referred to as flip over switches. Some robots have the capability to reach backwards. In these cases, an Axis 1 zone limit system is not sufficient to determine the actual position of the robot arm.

In this example, if an operator is working on the right and the robot suddenly tries to flip the upper arm over into that zone, the safety light curtains are re-enabled and the robot is stopped.

Mechanical Switches

Robot Zone Limit Systems

Two Stations/Two Cells



Rather than single workstations in two robot cells working without zone limits, a single robot/dual workstation setup using a Balluff robot zone limit system can reduce the number of robots and floorspace needed by half.

Work cell size reduction is another big benefit. Since the size of the area guarding must be larger than the maximum operational envelope of the robot and its payload, a Balluff robot zone limit system can be used to dynamically restrict the operating envelope of the robot, allowing a much smaller area to be guarded. The reduced guarded area also saves a substantial amount of money by reducing the amount of perimeter guard fencing per work cell.

The enhanced productivity of several robot cells may free up enough capacity to eliminate the need for additional robotic work cells, saving significant capital investment costs.

Linear Zone Limit Systems



RTU Systems

Robot Transfer Units, floor-mounted tracks that convey robots between multiple work stations, can benefit from linear zone limit system implementation.

A multi-channel linear zone limit system can eliminate multiple sets of robot-detecting light curtains while increasing zoning flexibility. This cuts initial cost, simplifies work cell design, speeds workflow changes, and reduces clutter on the factory floor.



Linear Toppers (Track or Gantry Robots)

Gantry-mounted robots travel back and forth delivering parts and products. Balluff linear zone limit systems can provide up to four independent zones along the full length of robot travel.

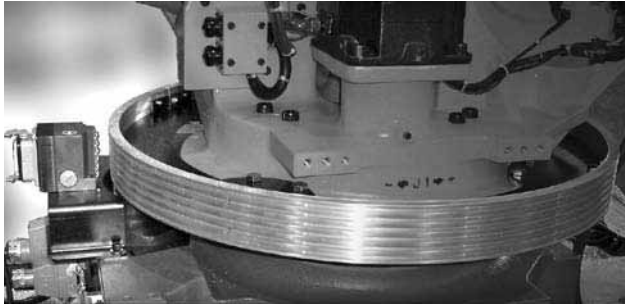
When used in conjunction with an Axis 2 system, linear zone limit systems ensure that the robot can be safely interlocked with automatic machine doors, gates, operator-occupied areas, and other robots mounted on the same track or working within the same physical envelope.

Mechanical Switches

Robot Zone Limit Systems

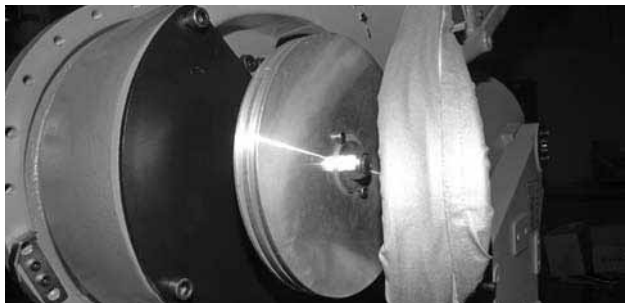
Easy to Install, Easy to Maintain, and Totally Effective

- **Flexible**
Zones can be easily changed by maintenance or trade personnel.
- **Reliable**
Proven ganged mechanical switches or wear-free inductive sensors.
- **Productive**
Robot doesn't need to wait for operator to load or unload components.
- **Space-Saving**
Reduces area guarding requirements.
- **Cost-Saving**
Reduces capital costs for unnecessary robots and perimeter guarding.
- **User-Friendly**
Provides direct visual indication of zone sizes and locations.
- **Convenient**
Fully pre-engineered, kitted hardware solutions eliminate guesswork.
- **Specified**
Meets automotive manufacturers requirements.
- **Safe**
Hardware conforms to ANSI recommended practices.



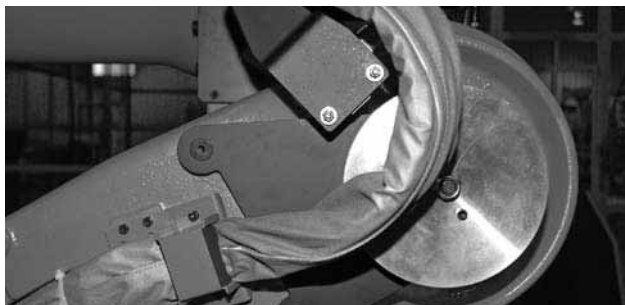
Axis 1

The main rotational axis (Axis 1) system can monitor up to three fully independent diverse complimentary redundant zones. Each zone can be infinitely located 360° around the axis of rotation. The angular zone can be configured in 15° increments from 15° to 345°, or the cams can be user-modified to create smaller increments.



Axis 2

The boom forward/back (Axis 2) switch monitors a single zone using two channels with two 180° cams. Some available systems can monitor up to three zones with six channels. This axis is used to ensure boom is retracted, allowing the robot more freedom to move safely past operator-occupied areas.



Axis 3

Similar to an Axis 2 system, the flip over (Axis 3) switch monitors a single zone using two channels with two 180° cams. An Axis 3 system provides protection against the robot flipping over 180°, without the need to restrict the robots motion with permanent hard stops that might interfere with required program movements.

SAFETY NOTICE:

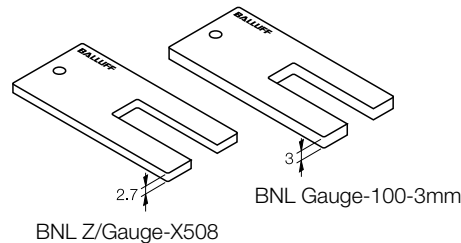
The components supplied with Balluff Zone Limit Systems are suitable for use in personnel safety applications only when installed and used in compliance with all applicable provisions of American National Standards Institute / Robotics Industries Association American National Standard for Industrial Robots and Robot System – Safety Requirements ANSI/RIA R15.06-1999 or subsequent editions thereof, and all other relevant industrial and governmental standards and requirements.

Mechanical Switches

Adjusting the Switchpoint

Setting the correct distance between the limit switch and the cam is critical to the proper operation of the switch. If the distance is too large, the switch contacts may not open. If the distance is too small, the maximum allowable overtravel on the switch plungers will be exceeded and the switches will be damaged or have their life expectancy reduced. Excessive overtravel can also damage the internal sealing membrane between the plunger and the switch operator, resulting in entry of dirt and fluids into the sealed contact chamber.

To set dimension "A", set up gauges can be used.



The pre-travel adjustment of Balluff cam switches has been carefully set by the Balluff factory. Do not tamper with the pre-travel adjustment screw for the following reasons:

1. If the pre-travel is increased beyond factory specifications, the switch will fail to reliably function.
2. If the pre-travel is reduced below factory specifications, excessive overtravel will lead to premature switch failure due to return spring fatigue.

Excessive overtravel will also cause premature failure of the sealing membrane, allowing fluid leaks into the housing.

Multiple Position Switches

Series		100	62	61	72	46	40
A	cam setting	5 ^{-0.5}	5 ^{-0.5}	5 ^{-0.5}	3 ^{-0.5}	2.8 ^{-0.5}	2.8 ^{-0.5}
B	plunger point to reference surface (basic setting)	(d) 8	(d) 8	(d) 8	(d) 6	(d) 4	(d) 4
B minus C	switchpoint to reference surface	(a) 6 (b) 6.5 (c) 7	(a) 6 (b) 6.5 (c) 7	(a) 6 (b) 6.5 (c) 7	(a) 4 (b) 4.5 (c) 5	(d) 3.5	(d) 3.5
C	switchpoint of switch element	(a) 2 (b) 1.5 (c) 1	(a) 2 (b) 1.5 (c) 1	(a) 2 (b) 1.5 (c) 1	(a) 2 (b) 1.5 (c) 1	(d) 0.5	(d) 0.5
D	max. travel plunger	(a) 5.5 (b), (c) 4	(a) 5.5 (b), (c) 4	(a) 5.5 (b), (c) 4	(a) 5.5 (b), (c) 4	(d) 3.5	(d) 3.5

Single Position Switches

Series		F60	99	100
A	cam setting	5 ^{-0.5}	2.8 ^{-0.5}	2.8 ^{-0.5}
B	plunger point to reference surface (basic setting)	(d) 8	(d) 4	(d) 4
B minus C	switchpoint to reference surface	(a) 4 (b) 4.5 (c) 5	(d) 3.5	(d) 3.5
C	switchpoint of switch element	(a) 2 (b) 1.5 (c) 1	(d) 0.5	(d) 0.5
D	max. travel plunger	(a) 7.5 (b), (c) 4	(d) 3.5	(d) 3.5

Dimensions in mm

When replacing snap switches in the field, every effort should be made to ensure proper pre-travel adjustment according to the following:

Switch Type	Pre-Travel Specification
BSE-30	2.0 mm ± 0.1mm
BSE-61	1.0 mm ± 0.1mm
BSE-85	1.5 mm ± 0.1mm
Miniature	0.5 mm ± 0.25mm

Mechanical Switches

Function Descriptions, Definitions - Electronic Elements

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

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_r ... 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 $I_k (A_{eff})$ which is permitted to flow during a given turn-on time t_k (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.

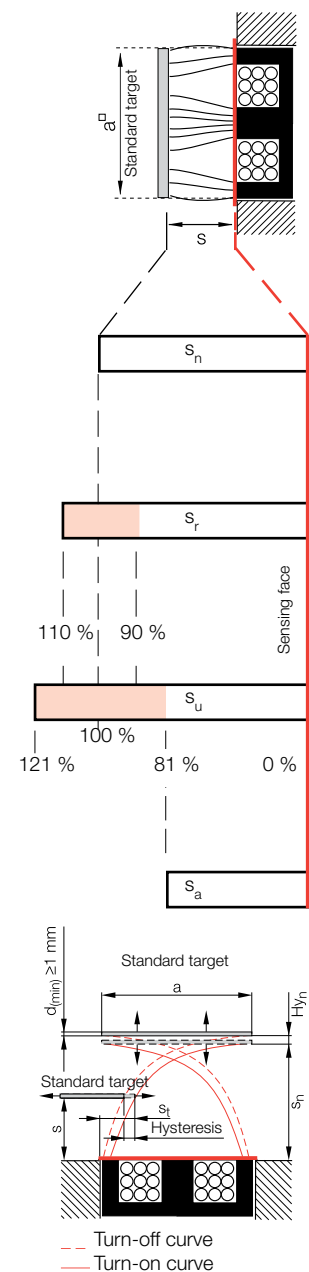
Rated operating distance s_n ... is a theoretical value, which does not take into account manufacturing tolerances, operating temperatures, supply voltages, etc.

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

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.
 $(0 \leq s_a \leq 0.81 s_r)$.

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



Mechanical Switches

Function Descriptions, Definitions

Switching frequency f

.. refers to the maximum number of switching operations per second.

Damping is per EN 60947-5-2 with standard targets on a rotating, non-conducting disk. The surface area ratio of iron to non-conductor must be 1 : 2.

The rated value of the switching frequency is reached when

- either the turn-on signal $t_1 = 50 \mu s$ or the
- turn-off signal $t_2 = 50 \mu s$.

Polarity reversal protected

... protected against any possible lead reversal for inductive switch elements with short circuit protection.

... against reversal of plus/minus leads for inductive switch elements without short circuit protection.

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. The trigger current

for the short circuit protection is higher than the rated operating current I_o . 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.

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 ($6...10 \times$ rated current) when they are first energized as compared with their static operation due to the fact that the core is still open. The static value of the load (current) is not reached until several milliseconds later. Not until the magnetic field is closed does the max. permissible rated operating current I_o flow through the sensor. This means that the threshold value for a short circuit condition

in these switch elements must lie significantly higher and would, if for example the contactor is prevented for mechanical or electrical reasons from fully closing, result in an overload on the switch elements. This is where the overload protection comes into play. It is designed as slow-acting (time-delayed). Its trigger threshold lies only slightly above the maximum permissible I_o . 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.

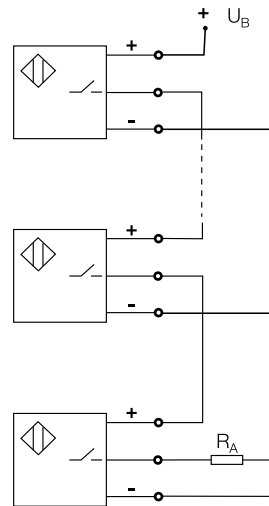
Mechanical Switches

Function Descriptions, Definitions

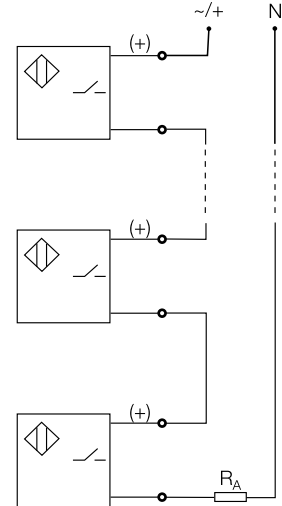
Series connection

... 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_{0j}). In the case of 2-wire sensors it is limited by the addition of the minimum supply voltages. For 3-wire switches, the load capacity of the output stage represents a further limitation, since the current consumption I_0 of all switches is added to the rated current I_e . The ready delay time t_v is the ready delay of a sensor $\times$ (number of sensors $n-1$).

3-wire DC switch elements



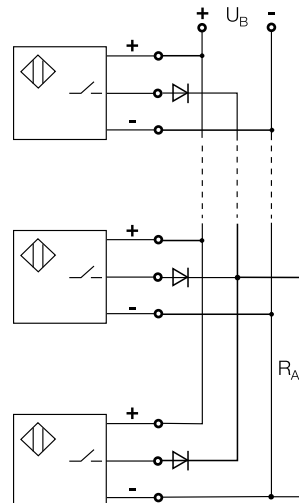
2-wire DC switch elements (AC/DC)



For parallel connection

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

3-wire DC switch elements



2-wire DC switch elements

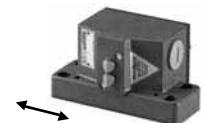
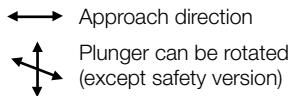
Parallel wiring of 2-wire switch elements is not recommended, since missed pulses can be caused by the ready delay while the oscillation is built up.

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 _{p-p} /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 Switches

BNS Precision Switches



Series	BNS 100	BNS 72	BNS 62	
Housing Type				
Full Size Housing - Multiple Position	■	■		
Full Size Housing / Reduced Mounting Flange - Multiple Position			■	
Compact Housing Smaller Wiring Compartment - Multiple Position				
Miniature - Multiple Position				
Compact - Single Position Limit				
Miniature - Single Position Limit				
Actuation/Switching Means				
Mechanical / Mechanical	■	■	■	
Mechanical / I/O Link	■		■	
Non-Contact / Inductive	602-11	605-11		
Plunger Spacing				
8 mm				
10 mm				
12 mm	■	■	■	
16 mm	■	■	■	
Plunger Type				
Chisel - D	■	■	■	
Chisel with Wiper - E	■	■	■	
Low Speed Bushing Roller - R	■	■	■	
High Speed Sealed Ball Bearing Roller - L	■	■	■	
Multi-Directional Ball Tip - K	■	■	■	
Plunger/Switch Style				
Standard - 819	■	■	■	
Safety - 813	■	■	■	
Standard Quick Change Plunger Block - 829	■			
Safety Quick Change Plunger Block - 823	■			
Hardened Aluminum Guides - X512	■	■	■	
Switch Elements				
BSE-30 Snap Action - 250 Vac - NO & NC	■	■	■	
BSE61 Safety Forced Opening - 250 Vac - NC	■	■	■	
BSE 85 Safety Snap Action - 250 Vac -NO & NC	■	■	■	
BSE 69.1 (solder), BSE 70.1 (screw) Snap Action - 250 Vac - Form C				
BSE 73.1 (solder), BSE 74.1 (screw) Snap Action - 30 Vdc - Form C				
KHG Inductive - 10...55 Vdc - DC 2-wire - NO	■	■		
KHH Inductive - 10...55 Vdc - DC 2-wire - NC	■	■		
PA Inductive - 10...60 Vdc - PNP - NO & NC	■	■		
NA Inductive - 10...60 Vdc - NPN - NO & NC	■	■		
TOB Inductive - 10...30 Vdc - PNP -NC				
TNB Inductive - 10...30 Vdc - NPN - NO				
WO Inductive - 35...250 Vac - NC	■	■		
WS Inductive - 35...250 Vac - NO	■	■		
LED - Function Indication				
FC - 24 Vdc	w/BSE 85 switch	w/BSE 85 switch		
FD - 6...60 Vdc	■	■	■	
FE - 90...250 Vac	■	■	■	
Attributes				
Short Circuit Protection - Inductive Version Only	■	■		
Reverse Polarity Protection - Inductive Version Only - Except AC Version	■	■		
Temperature Range up to 70 °C	Inductive	Inductive		
Temperature Range up to 85 °C	Mechanical	Mechanical	Mechanical	
Metric Conduit Opening	■	■	■	
Optional Factory Pre-Wired Connector	■	■	■	
CE	■	■	■	



BNS 61

BNS F. 60

BNS 46

BNS 40

BNS 99/100

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

603-11

650-11

BES 516

BES...346
BES...346

w/BSE 85 switch

w/BSE 85 switch

Inductive
Mechanical

Inductive
Mechanical

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Intro

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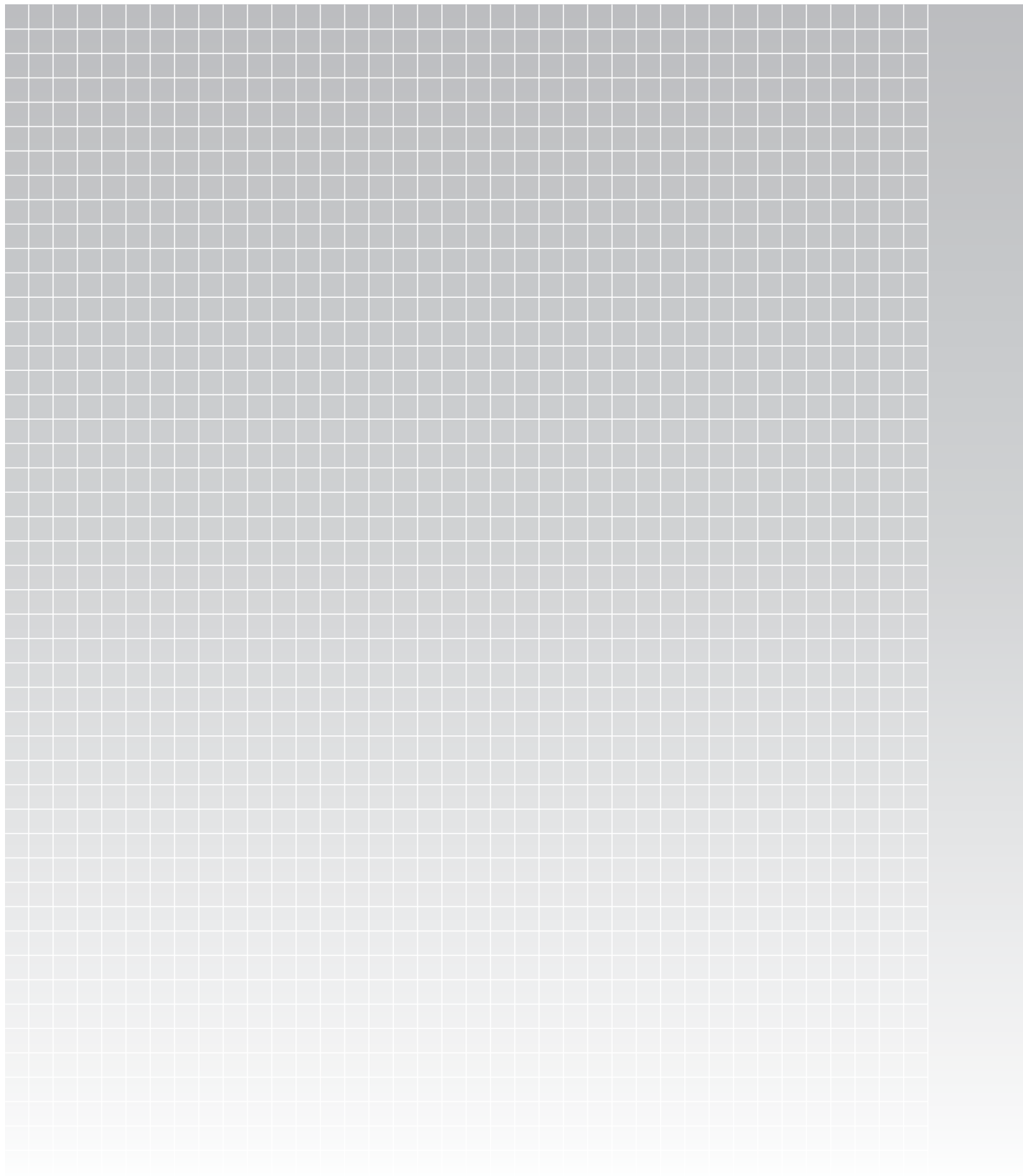
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Mechanical Switches

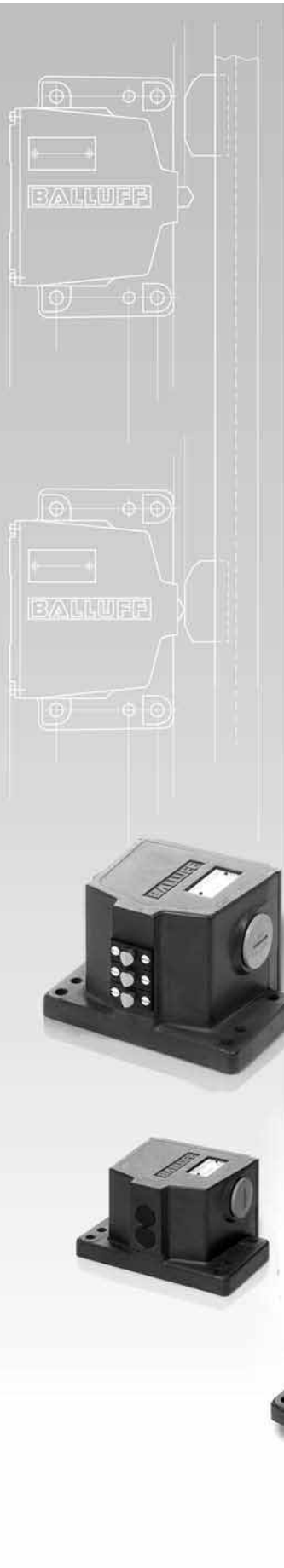
Contents

Series 100 Multiple Position Switches

- Full size housing
- Full size switch elements
- DIN 43697
- Up to 12 positions
- IO-Link
- Quick change plunger block
- Inductive
- Inductive with extended range
- 12 or 16 mm spacing

- 1.2 Standard 819
- 1.4 Safety 813
- 1.6 Standard and quick change block 829
- 1.8 Safety with quick change block 823
- 1.10 Inductive 602-11
- 1.12 Inductive with extended 4 mm range 602-11

Series 100
1



Mechanical Switches

Series 100 per DIN 43697

Multiple Position

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

- Available with chisel plunger only
- Use in wet areas with adhering media
- Use in dry areas with small chip presence
- Prevents plunger from sticking in the guide

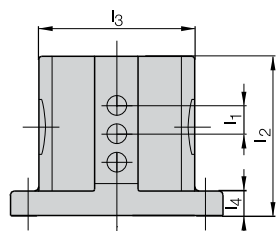
Connection options

- Thread for cable gland M25×1.5 on sides and in flange (Gasketed plugs included)
- Connector (note permissible operating voltage for the connectors, see page 15.16).

Multiple position switches with function indication

- Optional function indication for two voltage ranges

Available sizes



Number of plungers		2	3	4	5	6	8	10	12
Dimension l ₂ when	Dimension l ₁ = 12 mm	70	80	90	105	120	140	170	200
	Dimension l ₃	88	88	88	88	88	80	80	80
	Dimension l ₄	14	14	14	14	14	20	20	20
	Dimension l ₁ = 16 mm	70	90	105	120	140	170	200	240
	Dimension l ₃	88	88	88	88	80	80	80	80
Dimension l ₄		14	14	14	14	20	20	20	20

Dimensions in mm

Ordering example:

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

BNS 819-X####-D - -100-10- - - -

No. of plungers	Plunger type	Plunger spacing	optional Function indication	optional Connector
02 2x	D Chisel	12 12 mm	FD 6...60 V AC/DC	S80R 5-pin, dual keyway right
03 3x	K Ball	16 16 mm	FE 90...250 V AC/DC	S80L 5-pin, dual keyway left
04 4x	R Roller			S80S 5-pin, right and left
...	L Roller bearing			S90R 12-pin, right
	E Chisel with wiper plate			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

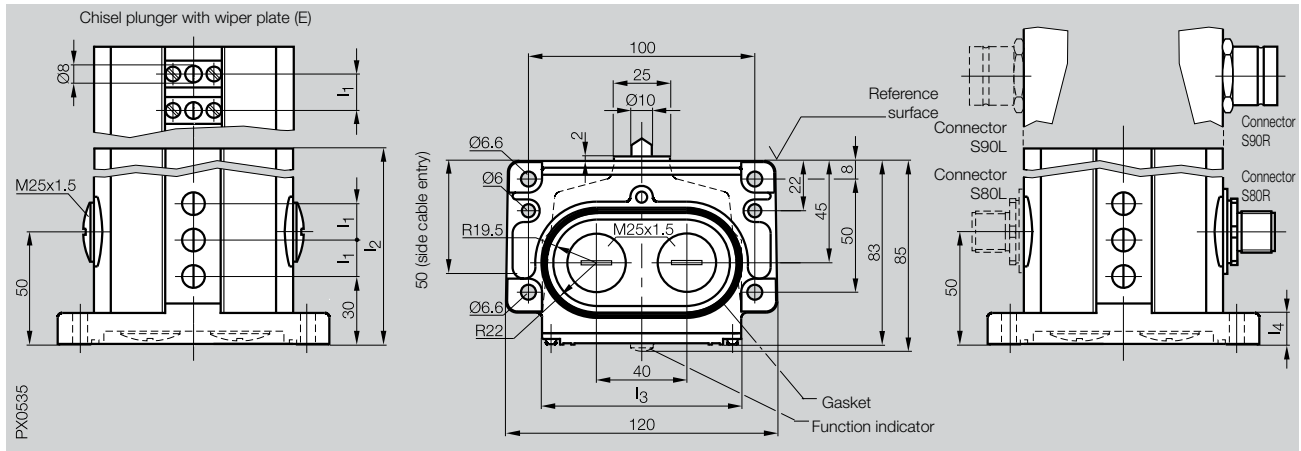
See page 15.14 for connector options

X#### Unique number to indicate special configuration, such as custom pre-wired connector (blank = standard assembly)

X512 Hardened aluminum bushings



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



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



IO-Link

For additional information, visit
www.balluff.com/iolink

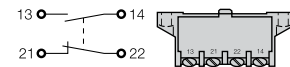
With switch element

BSE 30.0

Part number

BNS 819-D - -100-10- -

Wiring diagram



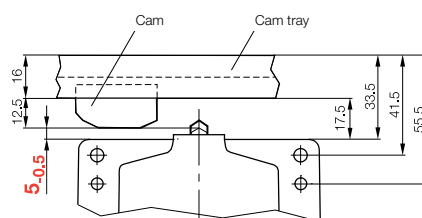
Switch element

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 15.2

Mechanical data

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

Installation



Note!

To ensure switching function, the dimension 5-0.5 is especially critical to front edge of mounting base. Dimension is 3-0.05 to the face of the switch housing (the area around the plungers).



Mechanical Switches

Series 100 per DIN 43697

Safety Multiple Position

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

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

Multiple position switches with function indicator

- Optional function indication for three voltage ranges

Multiple position switches with wiper plate

- Available with chisel plunger only
- Use in wet areas with adhering media
- Use in dry areas with small chip presence
- Prevents plunger from sticking in the guide

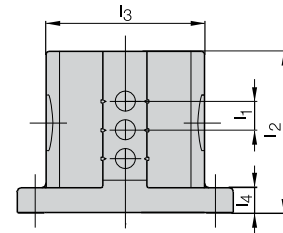
Connection options

- Thread for cable gland M25×1.5 on sides and in flange (Gasketed plugs included)
- Connector (note permissible operating voltage for the connectors, see page 15.16).

Available sizes

Number of plungers		2	3	4	5	6	8	10	12
Dimension	Dimension $l_1 = 12$ mm	70	80	90	105	120	140	170	200
l_2 when	Dimension l_3	88	88	88	88	88	80	80	80
	Dimension l_4	14	14	14	14	14	20	20	20
	Dimension $l_1 = 16$ mm	70	90	105	120	140	170	200	240
	Dimension l_3	88	88	88	88	80	80	80	80
	Dimension l_4	14	14	14	14	20	20	20	20

Dimensions in mm



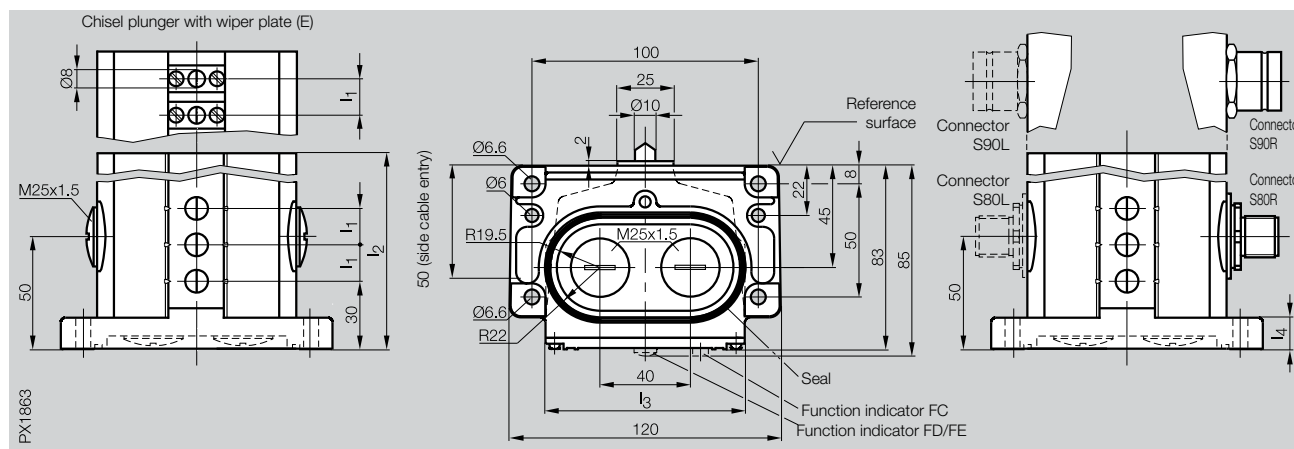
Ordering example:

BNS 813-D04-D12-100-03-FE-S80S

BNS 813-X####-D - - -100- - - - -

X#### Unique number to indicate special configuration, such as custom pre-wired connector (blank = standard assembly) X512 Hardened aluminum bushings	No. of plungers 02 2× 03 3× 04 4× ...	Plunger style D Chisel K Ball R Roller L Roller bearing E Chisel with wiper plate	Plunger spacing 12 12 mm 16 16 mm	Switch elements 10 BSE 61 Remaining switch positions BSE 30.0 12 Only BSE 61 20 BSE 85 Remaining switch positions BSE 30.0 22 Only BSE 85	Safety switch elements No. from flange	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)	See page 15.14 for connector options optional Connector S80R 5-pin, dual keyway right S80L 5-pin, dual keyway left S80S 5-pin, dual keyway right and left S90R 12-pin, right S90L 12-pin, left S90S 12-pin, right and left

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



Plunger style	Chisel (D), Ball (K), Roller (R), Roller bearing (L) or Chisel with wiper plate (E)		
Plunger material	Stainless steel, contact surfaces induction hardened		
Housing material	Cast aluminum, corrosion-resistant, anodized finish		
Connection type	M25x1.5 for connector or cable gland		
Ambient temperature range	-5...+85 °C		
Degree of protection per IEC 60529	IP 67		
Function indicator	LED 6...60 V AC/DC (FD), 90...250 V AC/DC (FE) or 24...28 V DC (FC)		
With switch element			
	BSE 61 per	BSE 85 per	BSE 30.0
	DIN EN 60204-1/VDE 0113	DIN EN 60204-1/VDE 0113	
Part number	BNS 813-D - -100-1 - -	BNS 813-D - -100-2 - -	BNS 813-D - -100-0 - -
Wiring diagram			
Switch element			
Contact material	Silver	Silver	Silver, gold plated
Switching principle	Creep switch, Positive-opening	Snap switch, positive opening (normally-closed)	Snap switch
Contact system	Normally-closed, double interruption	Dual-changeover: 1. NO (snap function), 2. Positive-opening (double-interruption), all galvanically isolated	Dual changeover, one normally-open and one normally-closed, galvanically isolated
Electrical data	see page 15.2	see page 15.2	see page 15.2
Mechanical data			
Plunger point to reference surface	8 mm	8 mm	8 mm
Switchpoint to reference surface	7 mm	6.5 mm	6 mm
Maximum plunger travel	4 mm	4 mm	5.5 mm
Assured opening after plunger travel	2.5 mm	2.5 mm	
Switching actuating force on plunger	min. 15 N	min. 30 N	min. 20 N
Switching frequency	max. 300/min	max. 160/min	max. 300/min
Approach speed	Plunger D 40 m/min Plunger E 30 m/min Plunger K 10 m/min Plunger R 60 m/min Plunger L 120 m/min	40 m/min 30 m/min 10 m/min 60 m/min 80 m/min	40 m/min 30 m/min 10 m/min 60 m/min 120 m/min
Repeatability	Plunger D, E, K ± 0.002 mm Plunger R, L ± 0.01 mm	± 0.02 mm ± 0.02 mm	± 0.002 mm ± 0.01 mm

For installation and notes, see page 1.3

Mechanical Switches

Series 100 per DIN 43697

Quick Change Plunger Block Multiple Position

Multiple position switches per DIN 43697 for standard ap- plications 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

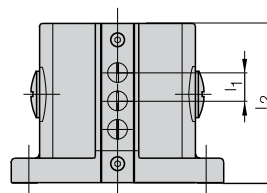
- Thread for cable gland M25×1.5 on sides and in flange (Gasketed plugs included)
- Connector (note permissible operating voltage for the connectors, see page 15.16)

Multiple position switches with function indication

- Optional function indication for two voltage ranges

Available sizes

No. of plungers		2	3	4	5	6
Dimension $l_1 = 12 \text{ mm}$		70	80	90	105	120
l_2 when $l_1 = 16 \text{ mm}$		70	90	105	120	
Dimensions in mm						



Ordering example:

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

BNS 829-X####-D - - -100-10- - - -

No. of plungers

02 2×
...
06 6×
(12mm only)

Plunger style

D Chisel
K Ball
R Roller
L Roller bearing

Plunger spacing

12 12 mm
16 16 mm

optional Function indicator

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

optional Connector

S80R 5-pin, dual keyway right
S80L 5-pin, dual keyway left
S80S 5-pin, dual keyway 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

See page 15.14 for connector options

X####

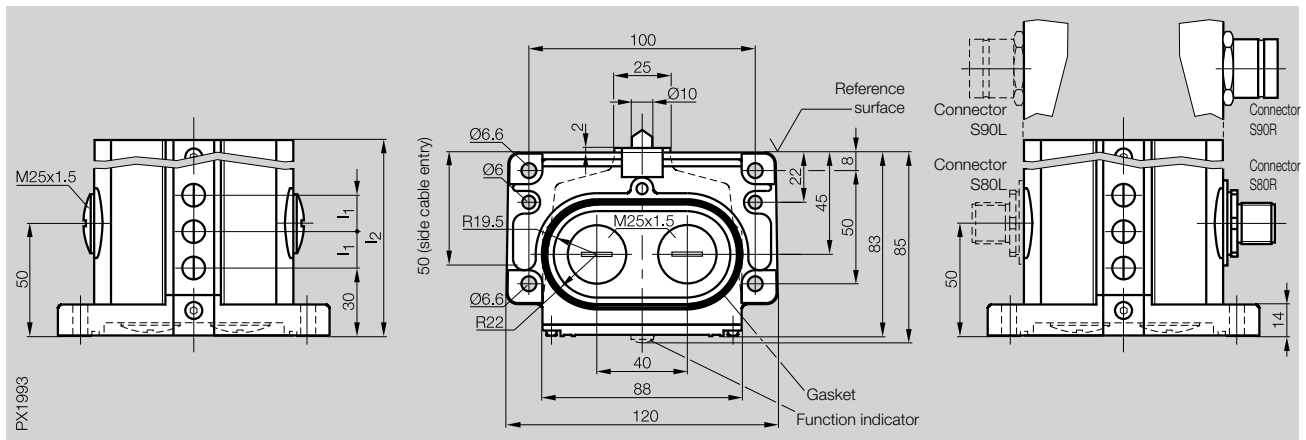
Unique number to indicate special configuration, such as custom pre-wired connector (blank = standard assembly)



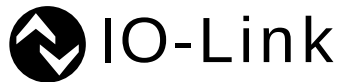
Note!

See accessory section for replacement plunger blocks and plungers.

Type	Multiple position switch with quick change plunger block
Plunger spacing	12 mm or 16 mm
Mounting and function dimensions	per DIN 43697



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



For additional information, visit
www.balluff.com/iolink

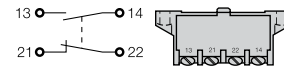
With switch element

BSE 30.0

Part number

BNS 829-D - -100-10- -

Wiring diagram



Switch element

Contact material	Silver, gold plated
Switching principle	Snap switch
Contact system	Dual changeover, one normally-open and one normally-closed, galvanically isolated

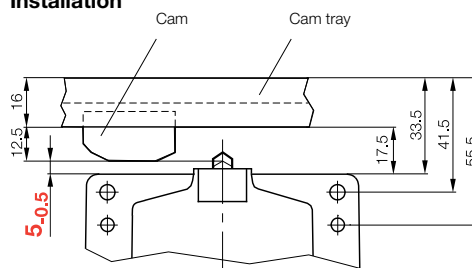
Electrical data

see page 15.2

Mechanical data

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

Installation



Note!

To ensure switching function, the dimension 5-0.5 is especially critical. Dimension is 3-0.05 to the face of the switch housing (the area around the plungers)

Mechanical Switches

Series 100 per DIN 43697

Safety Quick Change Plunger Block Multiple Position

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

- Forced-opening contacts and rigid plungers for additional security per DIN EN 60204-1/VDE 0113
- Dual-chamber system with IP

67 protection: wear-free membrane with hermetic sealing from plunger mechanism and switch chamber

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

Connection options

- Thread for cable gland M25×1.5 on side and in flange (Gasketed plugs included)
- Connector (note permissible operating voltage for the connectors, see page 15.16)

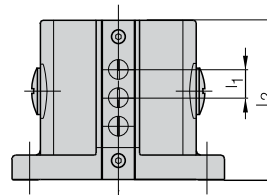
Multiple position switches with function indication

- Optional function indication for three voltage ranges

Available sizes

No. of plungers		2	3	4	5	6
Dimension $l_1 = 12$ mm		70	80	90	105	120
l_2 when $l_1 = 16$ mm		70	90	105	120	

Dimensions in mm



Ordering example:

BNS 823-D02-D12-100-10-03-FE-S80R

BNS 823-X####-D - - -100- - - -

X####

Unique number to indicate special configuration, such as custom pre-wired connector (blank = standard assembly)

No. of plungers	Plunger style	Plunger spacing	Switch elements	Safety switch elements	optional Function indication
02 2×	D Chisel	12 12 mm	10 BSE 61	No. from flange	FD 6...60 V AC/DC (for BSE 30.0 and BSE 61)
...	K Ball	16 16 mm	Remaining switch positions BSE 30.0		FE 90...250 V AC/DC (for BSE 30.0 and BSE 61)
06 6×	R Roller		12 Only BSE 61		FC 24...28 V DC (only for BSE 85)
(12 mm only)	L Roller bearing		20 BSE 85		
			Remaining switch positions BSE 30.0		
			22 Only BSE 85		

See page 15.14 for connector options

optional Connector

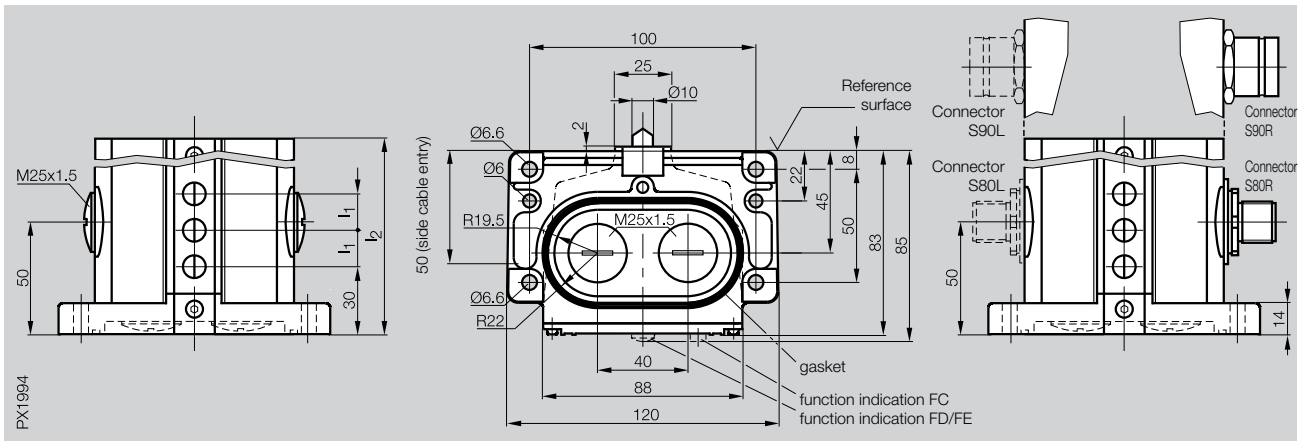
- S80R** 5-pin, dual keyway right
- S80L** 5-pin, dual keyway left
- S80S** 5-pin, dual keyway right and left
- S90R** 12-pin, right
- S90L** 12-pin, left
- S90S** 12-pin, right and left

Note!

See accessory section for replacement plunger blocks and plungers.



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



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

	BSE 61 per DIN EN 60204-1/VDE 0113	BSE 85 per DIN EN 60204-1/VDE 0113	BSE 30.0
Part number	BNS 823-D - -100-1 - -	BNS 823-D - -100-2 - -	BNS 823-D - -100-0 - -
Wiring diagram			

Switch element			
Contact material	Silver	Silver	Silver, gold plated
Switching principle	Creep switch, forced-opening	Snap switch, forced-opening (normally-closed)	Snap switch
Contact system	Normally-closed, double interruption	Dual-changeover: 1. NO (snap function), 2. Positive-opening (double-interruption), all galvanically isolated	Dual changeover, one normally-open and one normally-closed, galvanically isolated
Electrical data	see page 15.2	see page 15.2	see page 15.2

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

For installation and notes, see page 1.7

Mechanical Switches

Series 602-11 per DIN 43697

Inductive Multiple Position

Multiple position switches per DIN 43697 for standard applications

- Can be used under extreme conditions such as shock, temperature fluctuations, coolant flooding, high speed, and abrasive applications
- 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.

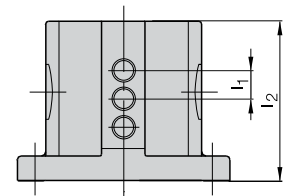
Connection options

- Thread for cable gland M25×1.5 on sides and in flange (Gasketed plugs included)
- Connector (note permissible operating voltage for the connectors, see page 15.16)

Available sizes

Number of switch positions		2	3	4	5	6	8	10	12
Dimension	Dimension $l_1 = 12$ mm	70	80	90	105	120	140	170	200
l_2 when	Dimension l_4	88	88	88	88	88	80	80	80
	Dimension l_5	14	14	14	14	14	20	20	20
	Dimension $l_1 = 16$ mm	70	90	105	120	140	170	200	240
	Dimension l_4	88	88	88	88	80	80	80	80
	Dimension l_5	14	14	14	14	20	20	20	20
Dimension l_3	4 mm for inductive switch elements with sensing head $\varnothing 10$ mm								
	2 mm for inductive switch elements with sensing head $\varnothing 15.5$ mm								

Dimensions in mm



Ordering example:

BNS 816-B06-THA-16-602-11-S90R

BNS 816-X####-B - - - -602-11-

No. of switch positions	Code for switch elements	Plunger spacing	optional Connector
02 2×	(see table at right)	12 12 mm	See page 15.14 for connector options
03 3×		16 16 mm	
04 4×			
...			

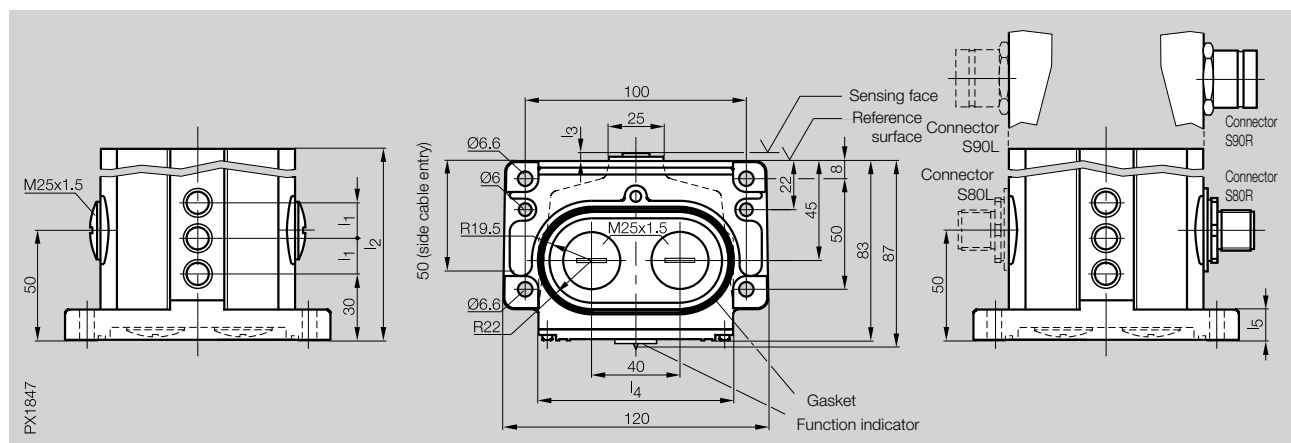
X####

Unique number to indicate special configuration, such as custom pre-wired connector (blank = standard assembly)





Type	Multiple position switch with inductive sensors
Switch position spacing	12 mm or 16 mm
Mounting and function dimensions	per DIN 43697



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

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

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

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

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

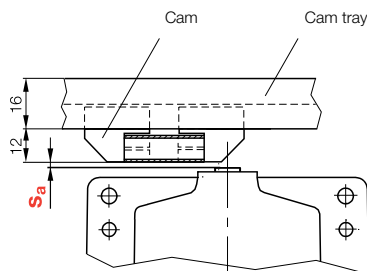
Hybrid switch element with sensing head 15.5 mm, for use with switch position spacing 16 mm

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

For additional electrical data see pages 15.4-15.7.



Installation



Note!

To ensure switching function s_a must be in a range of
 $0 < s_a \leq 1.6$ @ 12mm spacing
 $0 < s_a \leq 4$ @ 16mm spacing

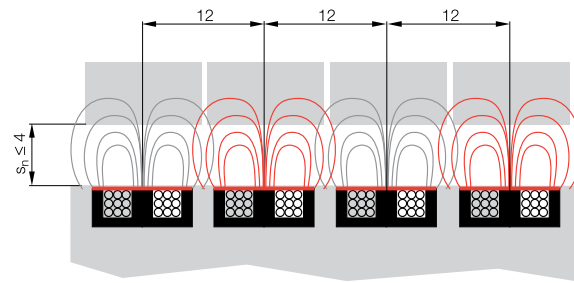
Mechanical Switches

Series 602-11 per DIN 43697

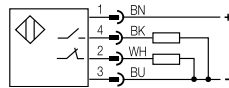
Inductive sensors from Balluff are characterized by a compact housing and generous switching distances. The result is a non-contacting, wear-free sensor.

The tuned sensing coil oscillator frequencies of the inductive sensors allow them to be installed very close to each other. Mutual interference is precluded at 12 mm spacing and 4 mm switching distance.

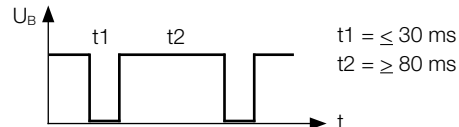
Extended Range Inductive Multiple Position



Complementary electronic switching elements allow the sensor to be used either as normally open or normally closed.



Sensor compatible with pulsed power supply.



Robot Zone Limits

Two diverse, complementary, redundant channels are required for control reliable operation of each zone.

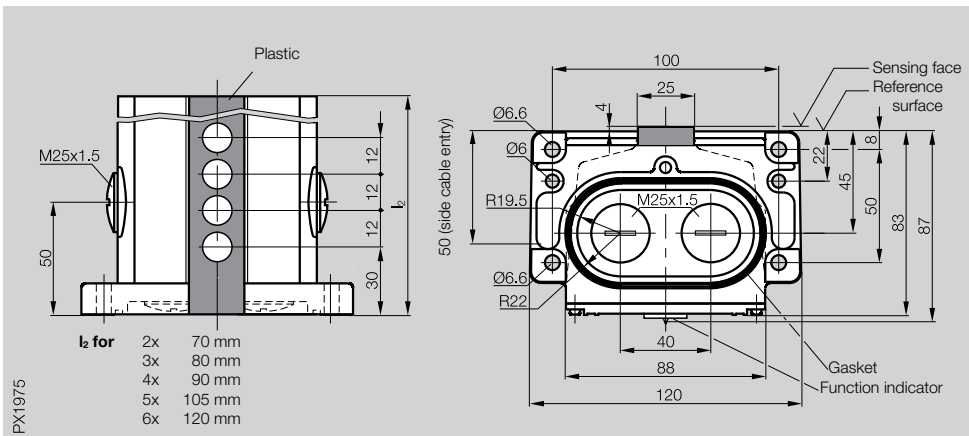
In case of error (short circuit, mis-wiring, ...) both signals are identical and are recognized by the controller as a fault condition. Monitoring must be implemented with a safety PLC or with a safety relay.

Safety Notice

The components supplied with Balluff's Zone Limit Systems are suitable for use in personnel safety applications only when installed and used in compliance with all applicable provisions of American National Standards Institute / Robotic Industries Association American National Standard for Industrial Robots and Robot Systems - Safety Requirements ANSI/RIA R15.06-1999 or subsequent editions thereof, and all other relevant industrial and governmental standards and requirements.



Type	Multiple position switch with extended range inductive sensors
Switch position spacing	12 mm
Mounting and function dimensions	per DIN 43697



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

Inductive switch elements with head Ø 10 mm

Inductive switch elements	Electrical version	Rated operating distance s_n	Assured operating distance s_a
Not Field Replaceable	PNP, complementary, 10...60 V DC, short circuit protected, 200mA	4 mm	0...3.2 mm

Ordering example:
BNS 816-X603-B04-00-12-602-11

BNS 816-X####-B_-00-12-602-11

No. of switch positions

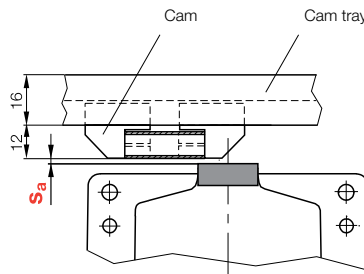
- 02** 2x
- 03** 3x
- 04** 4x
- 05** 5x
- 06** 6x

Note: See page 15.14 for connector options

X####

Unique number to indicate special configuration, such as custom pre-wired connector (blank = standard assembly) standard switches without special wiring or connectors
X580 = 2 position
X603 = 4 and 6 positions

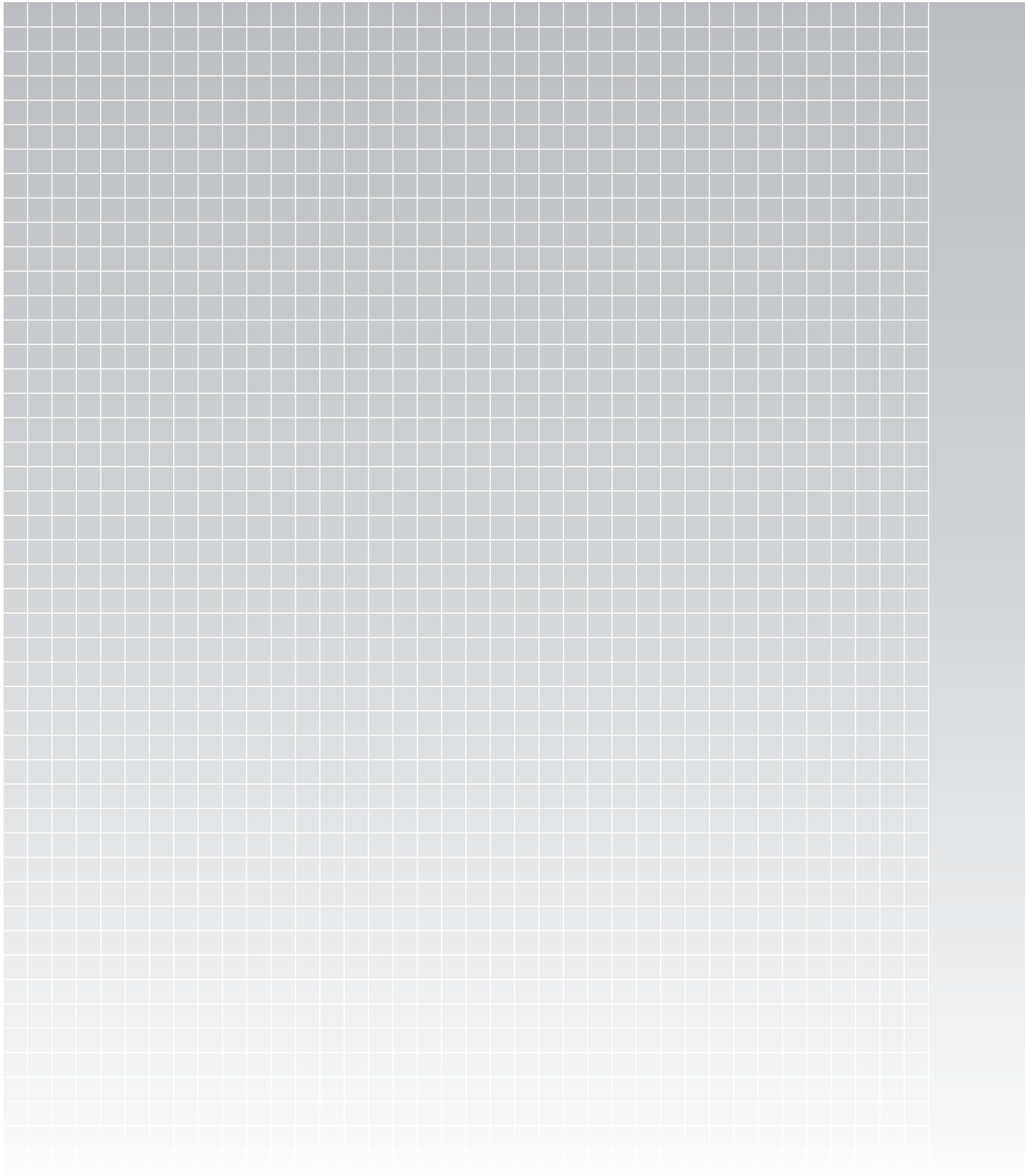
Installation



Caution!

To ensure switching function s_a must be in a range of $0 < s_a \leq 3.2$





Mechanical Switches

Contents

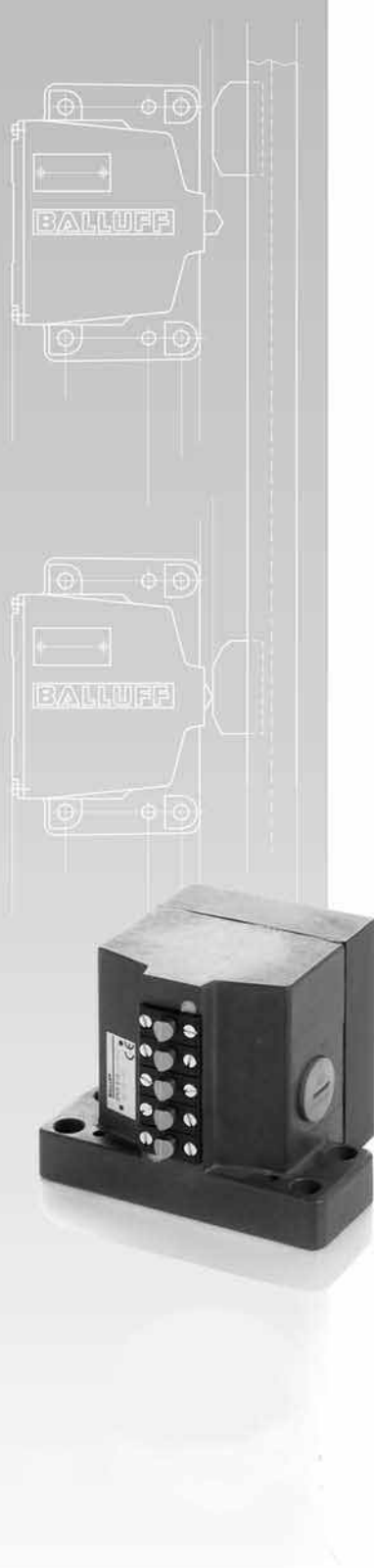
Series 62 Multiple Position Switches

- Smaller flange dimensions compared to 100 series
- Smaller wiring chamber
- Up to 10 positions
- I/O Link
- Full size switch elements
- 12 or 16 mm spacing

- 2.2 Standard 819
- 2.4 Safety 813

Series 62

2



Mechanical Switches

Series 62

Multiple Position

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

- Available with chisel plunger only
- Use in wet areas with adhering media
- Use in dry areas with small chip presence
- Prevents plunger from sticking in the guide

Connection options

- Thread for cable gland M20×1.5 on sides and in flange (Gasketed plugs included)
- Connector (note permissible operating voltage for the connectors, see page 15.16)

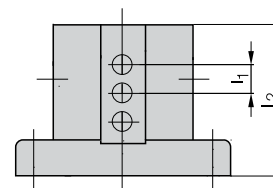
Multiple position switches with function indication

- Optional function indication for two voltage ranges

Available sizes

Number of plungers		2	3	4	5	6	8	10
Dimension $l_1 = 12$ mm		64	72	84	96	112	130	160
l_2 when $l_1 = 16$ mm		64	84	96	112	130	160	192

Dimensions in mm



Ordering example:

BNS 819-D04-D12-62-10-FD-S80S

BNS 819-X####-D - -62-10- - - -

X####

Unique number to indicate special configuration, such as custom pre-wired connector (blank = standard assembly)

X512

Hardened aluminum bushing

No. of plungers

02 2×
03 3×
04 4×
...

Plunger type

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

Plunger spacing

12 12 mm
16 16 mm

optional Function indication

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

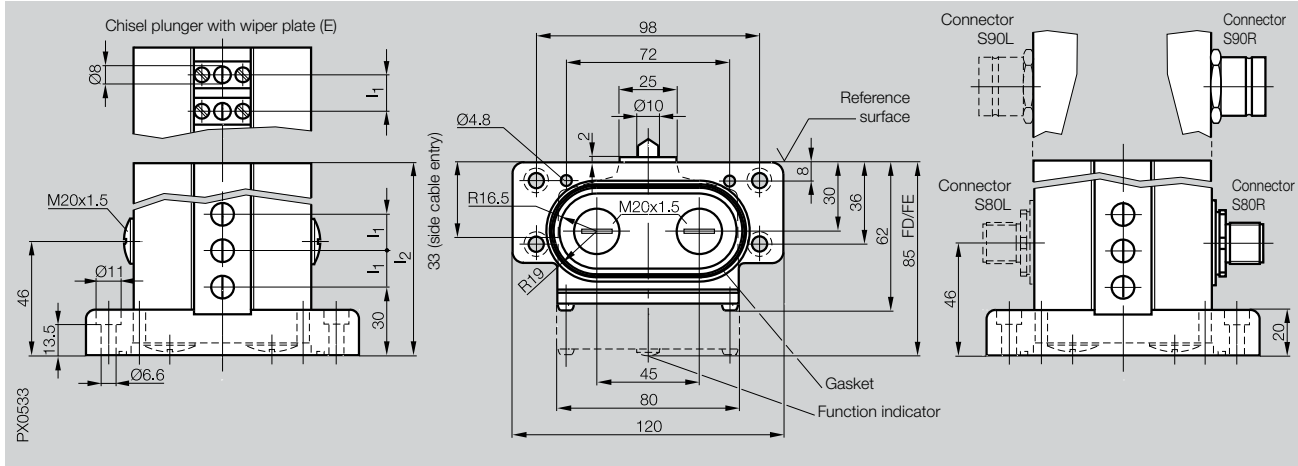
See page 15.14 for connector options

optional Connector

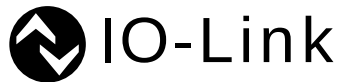
S80R 5-pin, dual keyway right
S80L 5-pin, dual keyway left
S80S 5-pin, dual keyway right and left
S90R 12-pin, right
S90L 12-pin, left
S90S 12-pin, right and left
S4R-I 4-pin, right only for IO-Link
S4L-I 4-pin, left only for IO-Link



Type	Multiple position switch
Plunger spacing	12 mm or 16 mm



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



For additional information, visit
www.balluff.com/iolink



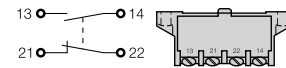
With switch element

BSE 30.0

Part number

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

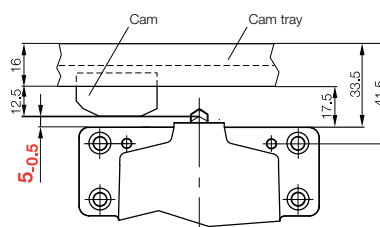
Electrical data

see page 15.2

Mechanical data

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

Installation



Note!

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

Dimension is 3-0.5 to the face of the switch housing (the area around the plungers)

Mechanical Switches

Series 62

Safety Multiple Position

Multiple position switches with safety switch positions per

DIN EN 60204-1/VDE 0113

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

Multiple position switches with function indicator

- Optional function indication for three voltage ranges

Multiple position switches with wiper plate

- Available with chisel plunger only
- Use in wet areas with adhering media
- Use in dry areas with small chip presence
- Prevents plunger from sticking in the guide

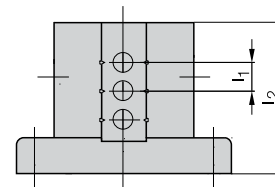
Connection options

- Thread for cable gland M20×1.5 on side and in flange (gasketed plugs included)
- Connector (note permissible operating voltage for the connectors, see page 15.6)

Available sizes

Number of plungers		2	3	4	5	6	8	10
Dimension $l_1 = 12$ mm		64	72	84	96	112	130	160
l_2 when $l_1 = 16$ mm		64	84	96	112	130	160	192

Dimensions in mm



Ordering example:

BNS 813-D04-R12-62-10-02-FD-S80S

BNS 813-X####-D - -62- - - -

See page 15.14 for connector options													
No. of plungers		Plunger style		Plunger spacing		Switch elements		Safety switch elements		optional Function indication	optional Connector		
02	2×	D	Chisel	12	12 mm	10	BSE 61	No. from flange	FD	6...60	S80R	5-pin, dual keyway right	
03	3×	K	Ball	16	16 mm		Remaining switch positions BSE 30.0				V AC/DC (for BSE 30.0 and BSE 61)	S80L	5-pin, dual keyway left
04	4×	R	Roller bearing			12	Only BSE 61		FE	90...250		S80S	5-pin, dual keyway right and left
...		L	Roller bearing			20	BSE 85				V AC/DC (for BSE 30.0 and BSE 61)		S90R
		E	Chisel with wiper plate			22	Remaining switch positions BSE 30.0		FC	24...28	S90L	12-pin, left	
							Only BSE 85			V DC (only for BSE 85)	S90S	12-pin, right and left	

X####

Unique number to indicate special configuration, such as custom pre-wired connector (blank = standard assembly)

X512

Hardened aluminum bushings

X####

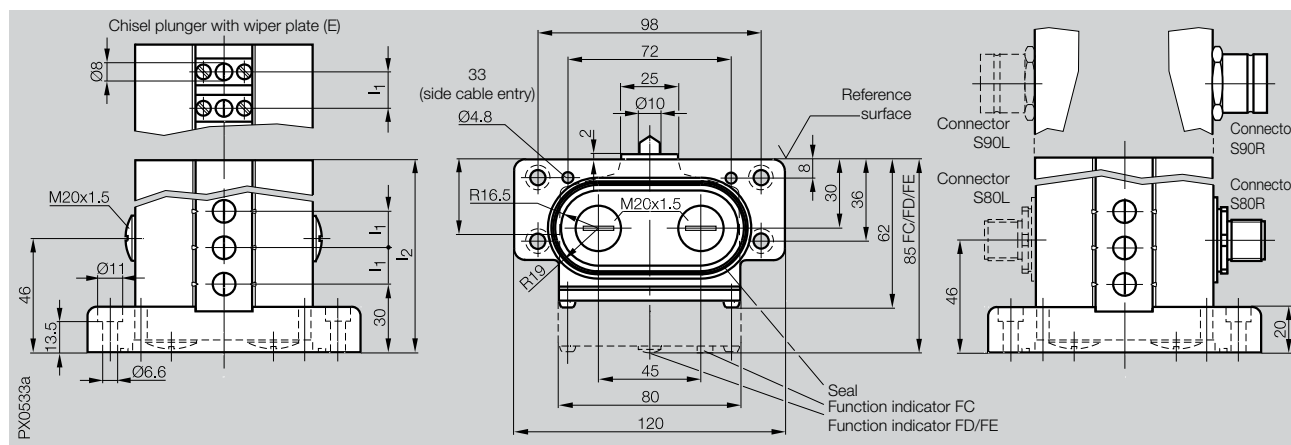
Unique number to indicate special configuration, such as custom pre-wired connector (blank = standard assembly)

X512

Hardened aluminum bushings

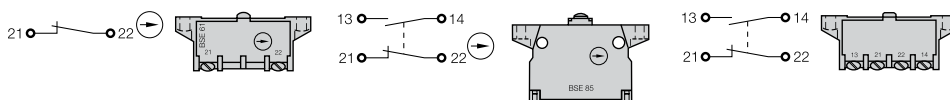
See page 15.14 for connector options

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



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

	BSE 61 per DIN EN 60204-1/VDE 0113	BSE 85 per DIN EN 60204-1/VDE 0113	BSE 30.0
Part number	BNS 813-D - -62-1 - -	BNS 813-D - -62-2 - -	BNS 813-D - -62-0 - -
Wiring diagram, style			

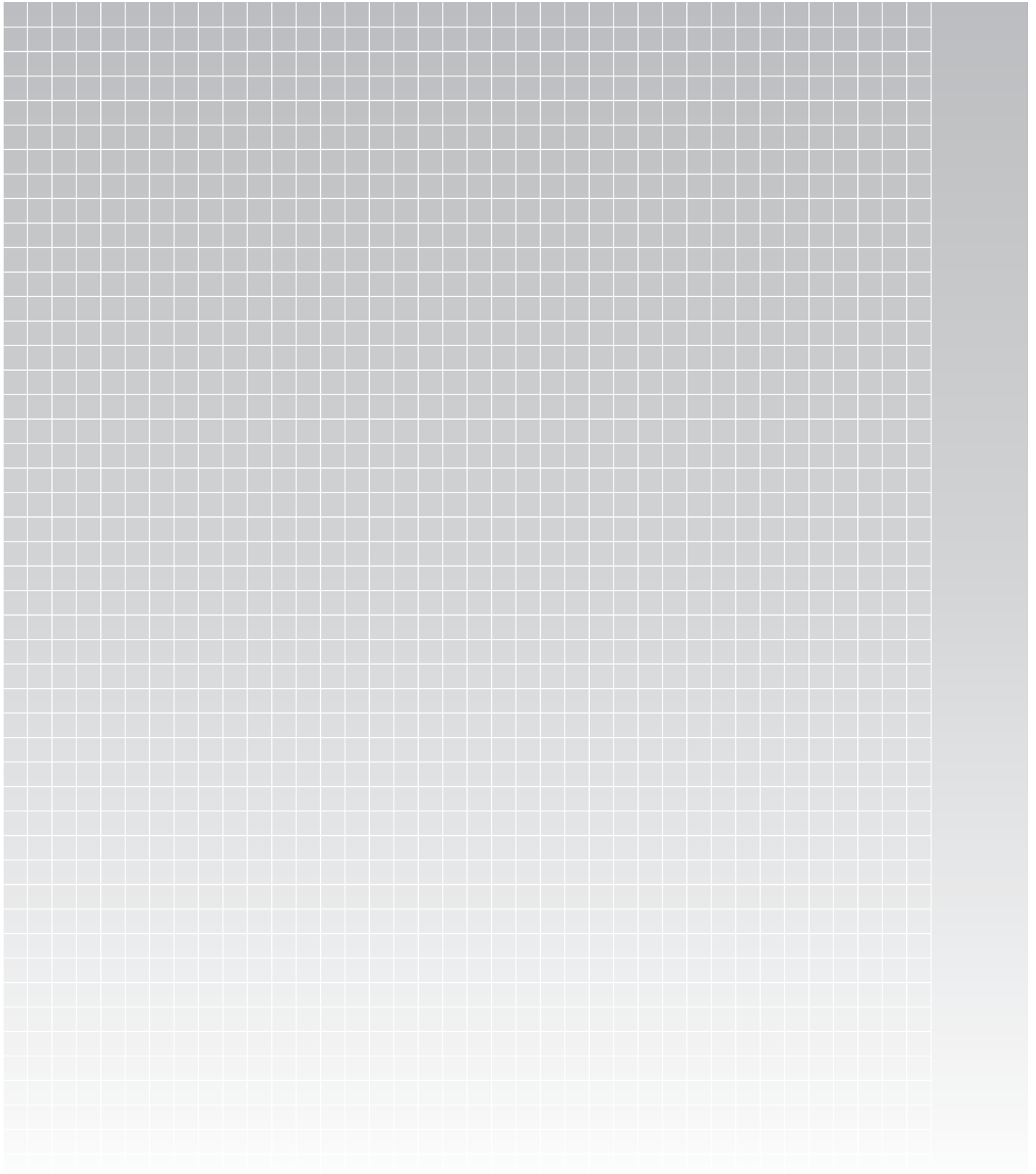


Switch element			
Contact material	Silver	Silver	Silver, gold plated
Switching principle	Creep switch, positive-opening	Snap switch, positive opening (normally-closed)	Snap switch
Contact system	Normally-closed, double interruption	Dual-changeover: 1. NO (snap function), 2. Positive-opening (double-interruption), all galvanically isolated	Dual changeover, one normally-open and one normally-closed, galvanically isolated
Electrical data	see page 15.2	see page 15.2	see page 15.2
Mechanical data			
Plunger point to reference surface	8 mm	8 mm	8 mm
Switchpoint to reference surface	7 mm	6.5 mm	6 mm
Maximum plunger travel	4 mm	4 mm	5.5 mm
Assured opening after plunger travel	2.5 mm	2.5 mm	
Switching actuating force on plunger	min. 15 N	min. 30 N	min. 20 N
Switching frequency	max. 300/min	max. 160/min	max. 300/min
Approach speed	Plunger D: 40 m/min Plunger E: 30 m/min Plunger K: 10 m/min Plunger R: 60 m/min Plunger L: 120 m/min	40 m/min 30 m/min 10 m/min 60 m/min 80 m/min	40 m/min 30 m/min 10 m/min 60 m/min 120 m/min
Repeatability	Plunger D, E, K: ± 0.002 mm Plunger R, L: ± 0.01 mm	± 0.02 mm ± 0.02 mm	± 0.002 mm ± 0.01 mm

For installation and notes, see page 2.3



Mechanical Switches



Mechanical Switches

Contents

Series 61 Multiple Position Switches

- Compact housing with smaller wiring chamber
- Full size switch elements
- Up to 6 positions
- IO-Link
- Quick change plunger block
- Inductive
- Inductive with extended range
- 12 or 16 mm spacing

3.2	Standard 819
3.4	Safety 813
3.6	Standard with quick change block 829
3.8	Safety with quick change block 823
3.10	Inductive 610-11, 611-11, 612-11, 613-11
3.12	Inductive with extended 4 mm range 610-11

Series 61

3



Mechanical Switches

Series 61

Multiple Position

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

- Available with chisel plunger only
- Use in wet areas with adhering media
- Use in dry areas with small chip presence
- Prevents plunger from sticking in the guide

Connection options

- Thread for cable gland M20×1.5 on sides and in flange (Gasketed plugs included)
- Connector (note permissible operating voltage for the connectors, see page 15.16)

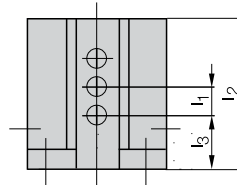
Multiple position switches with function indication

- Optional function indication for two voltage ranges

Available sizes

No. of plungers	Plunger spacing	Housing B Standard		Housing B		Housing C	
	Dimension	Dimension	Dimension	Dimension	Dimension	Dimension	Dimension
	l_1	l_2	l_3	l_2	l_3	l_2	l_3
2	12	36	12	60	30	48	24
						60	30
3	12	48	12	60	24	60	24
4	12	60	12				
5	12	72	12				
6	12	84	12				
2	16	48	16	60	30	60	30
3	16	72	16				
4	16	84	16				

Dimensions in mm



Ordering example:

BNS 819-B04-D12-61-12-10-FD-S80S

BNS 819-X####- - -61- -10- - -

See page 15.14 for connector options

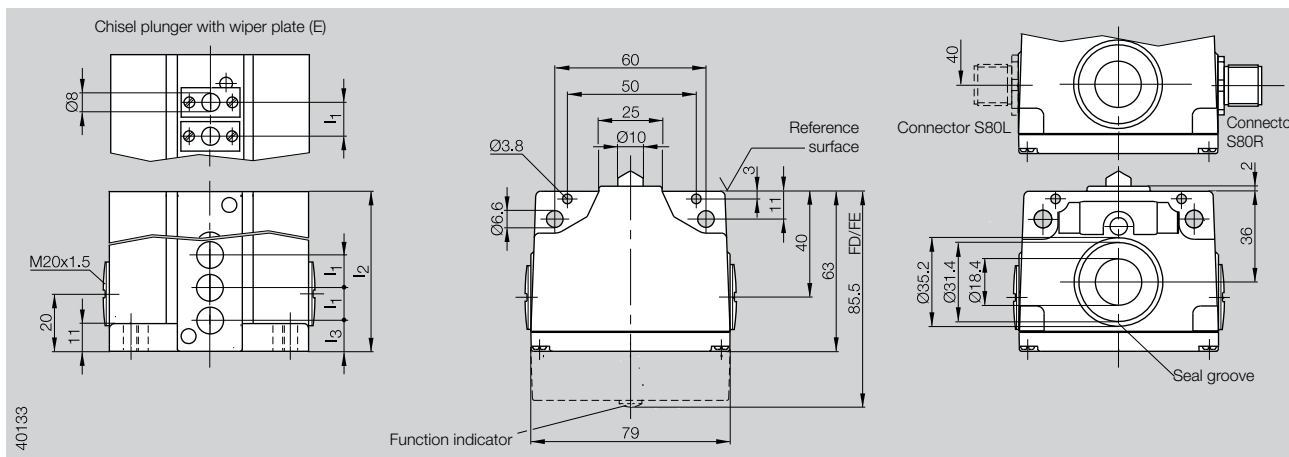
X####
Unique number to indicate special configuration, such as custom pre-wired connector (blank = standard assembly)

X512
Hardened aluminum bushings

Housing style	No. of plungers	Plunger type	Plunger spacing	Distance l_3	optional Function indication	optional Connector
B Standard	02 2×	D Chisel	12 12 mm	12 12 mm	FD 6...60 V AC/DC	S80R 5-pin, dual keyway right
	03 3×	K Ball	16 16 mm	16 16 mm		S80L 5-pin, dual keyway left
	04 4×	R Roller		24 24 mm	FE 90...250 V AC/DC	S80S 5-pin, dual keyway right and left
B 3× M20×1.5 on side and in flange	...	L Roller bearing		30 30 mm		S90R 12-pin, right
C 2× M20×1.5 on side and cable entry in flange		E Chisel with wiper plate				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



Type	Multiple position switch
Plunger spacing	12 mm or 16 mm



Plunger style	Chisel (D) , Ball (K) , Roller (R) , Roller bearing (L) or Chisel with wiper plate (E)
Plunger material	Stainless steel, contact surfaces induction hardened
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	M20×1.5 for connector or cable gland
Ambient temperature range	–5...+85 °C
Degree of protection per IEC 60529	IP 67
Function indicator	LED 6...60 V AC/DC (FD) or 90...250 V AC/DC (FE)



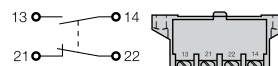
IO-Link

For additional information, visit
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With switch element	BSE 30.0				
Part number	BNS 819-	-	-61-	-10-	-

Wiring diagram, style



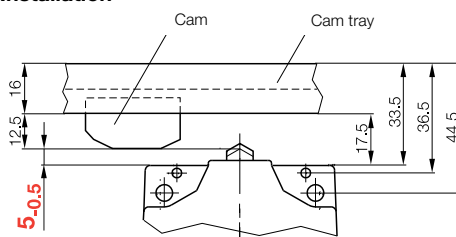
Switch element	
Contact material	Silver, gold plated
Switching principle	Snap switch
Contact system	Dual changeover, one normally-open and one normally-closed, galvanically isolated
Electrical data	see page 15.2

Electrical data	see page 15.2
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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!

Note:
To ensure switching function,
the dimension
5-0.5 is especially critical.
*Dimension is 3-.05 to the
face of the switch housing
(the area around the plungers)*

Mechanical Switches

Series 61

Safety Multiple Position

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

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

Multiple position switches with function indicator

- Optional function indication for three voltage ranges

Multiple position switches with wiper plate

- Available with chisel plunger only
- Use in wet areas with adhering media
- Use in dry areas with small chip presence
- Prevents plunger from sticking in the guide

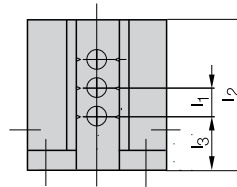
Connection options

- Thread for cable gland M20×1.5 on side and in flange (gasketed plugs included)
- Connector (note permissible operating voltage for the connectors, see page 15.16)

Available sizes

No. of Plungers	Plunger spacing Dimension	Housing B Standard		Housing B		Housing C	
	l_1	l_2	l_3	l_2	l_3	l_2	l_3
2	12	36	12	60	30	48	24
						60	30
3	12	48	12	60	24	60	24
4	12	60	12				
5	12	72	12				
6	12	84	12				
2	16	48	16	60	30	60	30
3	16	72	16				
4	16	84	16				

Dimensions in mm



Ordering example:

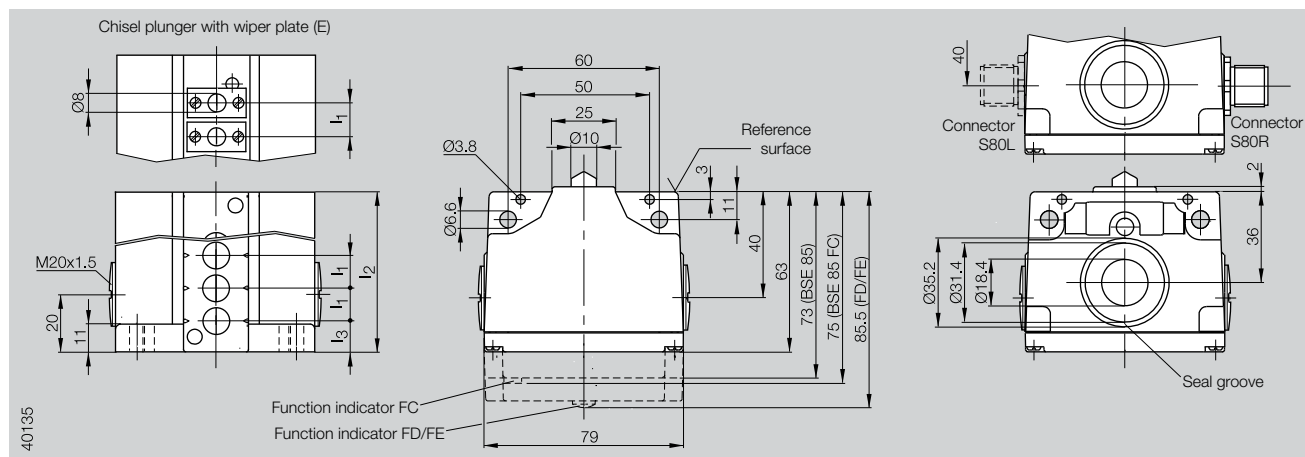
BNS 813-B06-L12-61-A-12-02-FE-S90R

BNS 813-X####- - - -61- - - - -

X####	Housing style	No. of plungers	Plunger style	Plunger spacing	Switching elements	Safety switch elements	optional Function indication	optional Connector
Unique number to indicate special configuration, such as custom pre-wired connector (blank = standard assembly) X512 Hardened aluminum bushings	B Standard	02 2×	D Chisel	12 12 mm	10 BSE 61	No. from flange	FD 6...60 V AC/DC (for BSE 30.0 and BSE 61)	S80R 5-pin, dual keyway right
	2× M20×1.5 on side	03 3×	K Ball	16 16 mm	Remaining switch positions BSE 30.0			S80L 5-pin, dual keyway link
	B 3× M20×1.5 on side and in flange	04 4×	R Roller	Distance l_3	12 Only BSE 61		FE 90...250 V AC/DC (for BSE 30.0 and BSE 61)	S80S 5-pin, dual keyway right and left
	C 2× M20×1.5 on side and cable entry in flange	...	L Roller bearing		20 BSE 85		FC 24...28 V DC (only for BSE 85)	S90R 12-pin, right
			E Chisel with wiper plate	A 12 mm	Remaining switch positions BSE 30.0			S90L 12-pin, left
				B 16 mm	22 Only BSE 85			S90S 12-pin, right and left
				C 24 mm				
				D 30 mm				

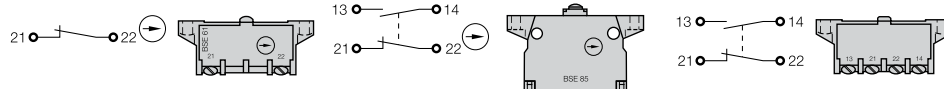
See page 15.14 for connector options

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



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

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



Switch element			
Contact material	Silver	Silver	Silver, gold plated
Switching principle	Creep switch, positive-opening	Snap switch, positive opening (normally-closed)	Snap switch
Contact system	Normally-closed, double interruption	Dual-changeover: 1. NO (snap function), 2. Positive-opening (double-interruption), all galvanically isolated	Dual changeover, one normally-open and one normally-closed, galvanically isolated

Electrical data	see page 15.2	see page 15.2	see page 15.2
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Mechanical data			
Plunger point to reference surface	8 mm	8 mm	8 mm
Switchpoint to reference surface	7 mm	6.5 mm	6 mm
Maximum plunger travel	4 mm	4 mm	5.5 mm
Assured opening after plunger travel	2.5 mm	2.5 mm	
Switching actuating force on plunger	min. 15 N	min. 30 N	min. 20 N
Switching frequency	max. 300/min	max. 160/min	max. 300/min
Approach speed	Plunger D 40 m/min Plunger E 30 m/min Plunger K 10 m/min Plunger R 60 m/min Plunger L 120 m/min	40 m/min 30 m/min 10 m/min 60 m/min 80 m/min	40 m/min 30 m/min 10 m/min 60 m/min 120 m/min
Repeatability	Plunger D, E, K ± 0.002 mm Plunger R, L ± 0.01 mm	± 0.02 mm ± 0.02 mm	± 0.002 mm ± 0.01 mm

For installation and notes, see page 3.3

Mechanical Switches

Series 61

Quick Change Plunger Block Multiple Position

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 M20×1.5 on sides and in flange (gasketed plugs included)
- Connector (note permissible operating voltage for the connectors, see page 15.16)

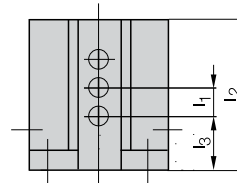
Multiple position switches with function indication

- Function indication for two voltage ranges

Available sizes

No. of plungers	Plunger spacing	Housing B Standard		Housing B		Housing C	
	Dimension	Dimension	Dimension	Dimension	Dimension	Dimension	Dimension
	l_1	l_2	l_3	l_2	l_3	l_2	l_3
2	12	36	12	60	30	48	24
						60	30
3	12	48	12	60	24	60	24
4	12	60	12				
5	12	72	12				
6	12	84	12				
2	16	48	16	60	30	60	30
3	16	72	16				
4	16	84	16				

Dimensions in mm



Ordering example:

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

BNS 829-X####- - -61- -10- - -

See page 15.14 for connector options

optional Connector

- S80R** 5-pin, dual keyway right
- S80L** 5-pin, dual keyway left
- S80S** 5-pin, dual keyway 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

optional Function indicator

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

X####
Unique number to indicate special configuration, such as custom pre-wired connector (blank = standard assembly)

Housing style

- B** Standard 2× M20×1.5 on side
- B** 3× M20×1.5 on side and in flange
- C** 2× M20×1.5 on side a cable ent in flange

No. of plungers

- 02** 2×
- 03** 3×
- 04** 4×
- ...**

Plunger style

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

Plunger spacing

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

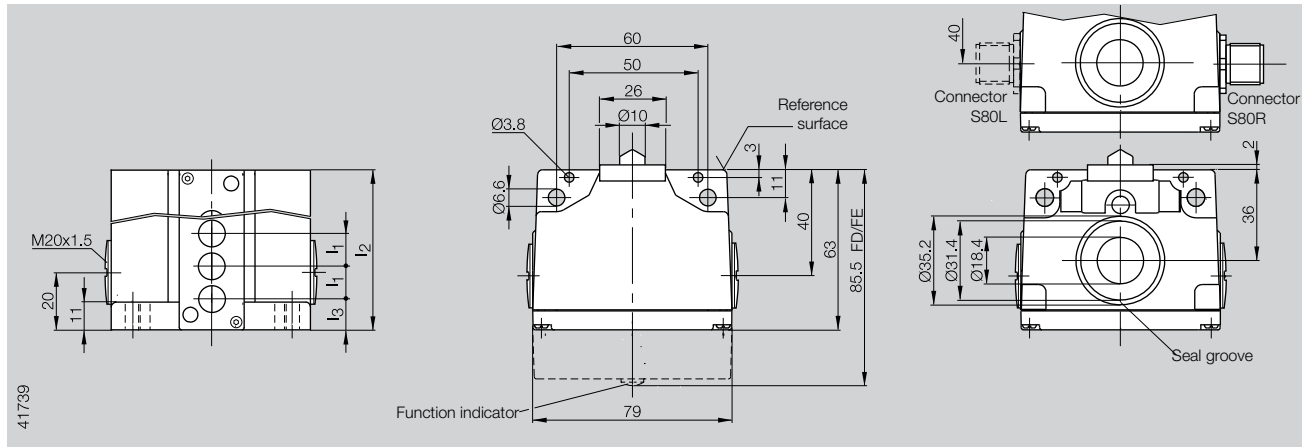
Distance l_3

- 12** 12 mm
- 16** 16 mm
- 24** 24 mm
- 30** 30 mm



Note! See accessory section for replacement plunger block and plungers.

Type	Multiple position switch with quick change plunger block
Plunger spacing	12 mm or 16 mm



Plunger style	Chisel (D) , Ball (K) , Roller (R) Roller Bearing (L)
Plunger material	Stainless steel, contact surfaces induction hardened
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	M20×1.5 for connector or cable gland
Ambient temperature range	–5...+85 °C
Degree of protection per IEC 60529	IP 67
Function indicator	LED 6...60 V AC/DC (FD) or 90...250 V AC/DC (FE)

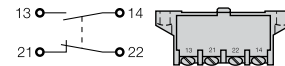


For additional information, visit
www.balluff.com/iolink

With switch element

Part number	BNS 829- - -61- - 10 - - -
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Wiring diagram, style



Switch element

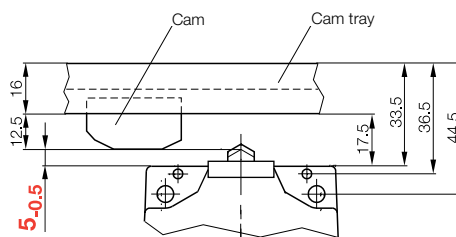
Contact material	Silver, gold plated
Switching principle	Snap switch
Contact system	Dual changeover, one normally-open and one normally-closed, galvanically isolated

Electrical data	see page 15.2
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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
Repeata- bility	Plunger D, K	± 0.002 mm
	Plunger R, L	± 0.01 mm

Installation



Note!

Note:
To ensure switching function,
the dimension
5-0.5 is especially critical.
*Dimension is 3-0.5 to the face
of the switch housing (the area
around the plungers)*

Mechanical Switches

Series 61

Safety Quick Change Plunger Block Multiple Position

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

- 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 mem-

- brane 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 sides and in flange (gasketed plugs included)
- Connector (note permissible operating voltage for the connectors, see page 15.16)

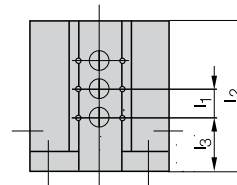
Multiple position switches with function indication

- Optional function indication for three voltage ranges

Available sizes

No. of plungers	Plunger spacing dimension	Housing B standard dimension		Housing B dimension		Housing C dimension	
	l_1	l_2	l_3	l_2	l_3	l_2	l_3
2	12	36	12	60	30	48	24
						60	30
3	12	48	12	60	24	60	24
4	12	60	12				
5	12	72	12				
6	12	84	12				
2	16	48	16	60	30	60	30
3	16	72	16				
4	16	84	16				

Dimensions in mm



Ordering example:

BNS 823-B02-L12-61-A-12-02-FE-S80R

BNS 823-X#### - - -61- - - - -

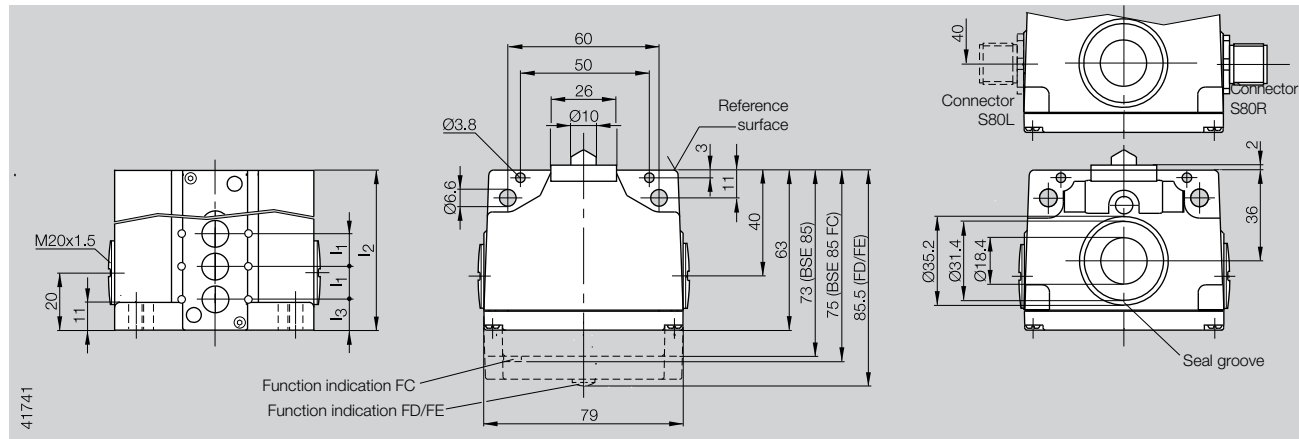
Housing style	No. of plungers	Plunger style	Plunger spacing	Distance l_3	Switch elements	Safety switch elements	optional Connector
B Standard	02 2×	D Chisel	12 12 mm	A 12 mm	10 BSE 61	No. from flange	S80R 5-pin, dual keyway right
2 × M20×1.5 on side	03 3×	K Ball	16 16 mm	B 16 mm	Remaining switch positions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

X####
Unique number to indicate special configuration, such as custom pre-wired connector (blank = standard assembly)

Note! See accessory section for replacement plunger block and plungers.

See page 15.14 for connector options

Type	Multiple position switch with forced-opening contacts and quick change plunger block
Plunger spacing	12 mm or 16 mm



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

	BSE 61 per DIN EN 60204-1/VDE 0113	BSE 85 per DIN EN 60204-1/VDE 0113	BSE 30.0
Part number	BNS 823- - -61-1 - -	BNS 823- - -61-2 - -	BNS 823- - -61-0 - -
Wiring diagram, style			

Switch element			
Contact material	Silver	Silver	Silver, gold plated
Switching principle	Creep switch, positive-opening	Snap switch, forced-opening (normally-closed)	Snap switch
Contact system	Normally-closed, double interruption	Dual-changeover: 1. NO (snap function), 2. Forced-opening (double-interruption), all galvanically isolated	Dual changeover, one normally-open and one normally-closed, galvanically isolated
Electrical data	see page 15.2	see page 15.2	see page 15.2

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

For installation and notes, see page 3.7

Mechanical Switches

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

Inductive Multiple Position

Multiple position switches for standard applications

- Can be used under extreme conditions such as shock, temperature fluctuations, coolant flooding, high speed and abrasive applications
- 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

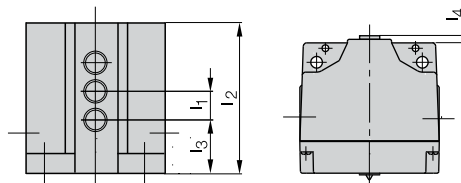
- Thread for cable gland M20×1.5 on sides and in flange (Gasketed plugs included)
- Connector (note permissible operating voltage for the connectors, see page 15.16)

Available sizes

No. of Switch positions	Switch position spacing Dimension	Series 610 Housing B Standard Dimension	Series 611 Housing B Standard Dimension	Series 612 Housing B Dimension	Series 612 housing C Dimension	Series 613 Housing B Dimension	Series 613 housing C Dimension
	l_1	l_2 l_3	l_2 l_3	l_2 l_3	l_2 l_3	l_2 l_3	l_2 l_3
2	12	36 12			48 24	60 30	60 30
3	12	48 12		60 24	60 24		
4	12	60 12					
5	12	72 12					
6	12	84 12					
2	16		48 16			60 30	60 30
3	16		72 16				
4	16		84 16				

Dimensions in mm

Dimension l_4 = 4 mm for inductive switch elements with sensing head $\varnothing$ 10 mm
 Dimension l_4 = 2 mm for inductive switch elements with sensing head $\varnothing$ 15.5 mm



Ordering example:

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

BNS 816-X####- - - - -11- - - -

Housing style	No. of switch positions	Code for switch elements	Plunger spacing	Distance l_3
B Standard 2× M20×1.5 on side	02 2× 03 3× 04 4×	(see table at right)	12 12 mm 16 16 mm	610 12 mm 611 16 mm 612 24 mm 613 30 mm
B 3× M20×1.5 on side and in flange	...			
C 2× M20×1.5 on side and cable entry in flange				

See page 15.14 for connector options

optional Connector

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

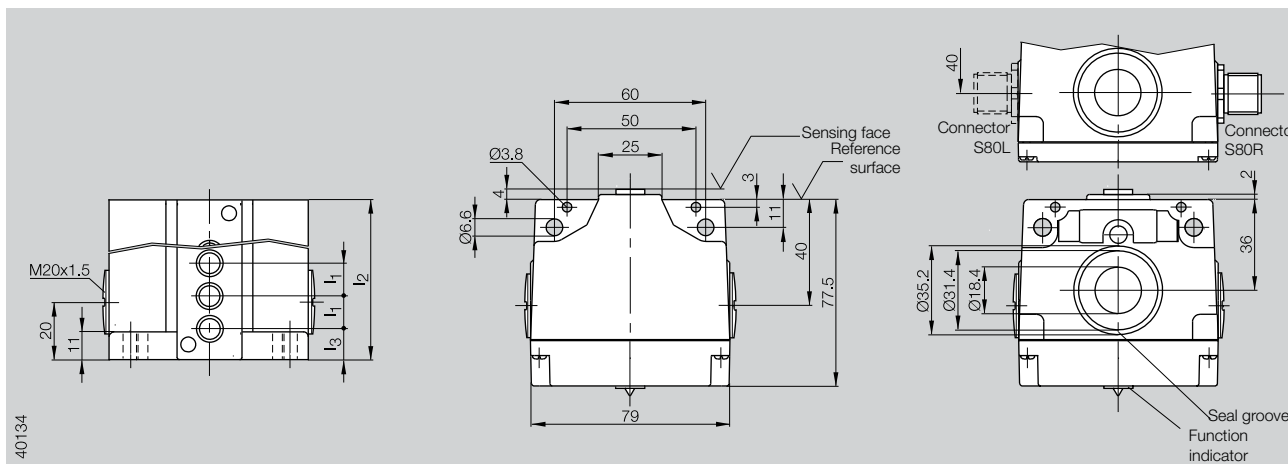
X####

Unique number to indicate special configuration, such as custom pre-wired connector (blank = standard assembly)



CE

Type	Multiple position switch with inductive sensors
Switch position spacing	12 mm or 16 mm



Part number	BNS 816-B _ _ _ _ _ -610/611/612/613-11- _ _ _
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	M20×1.5 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 $\varnothing$ 10 mm, for use with switch position spacing 12 and 16 mm

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

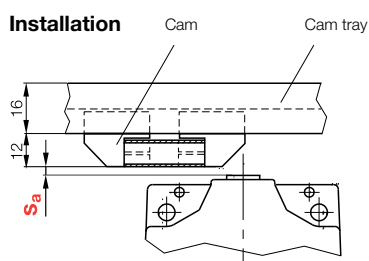
Inductive switch elements with sensing head $\varnothing$ 15.5 mm, for use with switch position spacing 16 mm

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

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

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

For additional electrical data, see pages 15.4-15.7



Note!

To ensure switching function s_a must be in a range of
 $0 < s_a \leq 1.6 \text{ mm}$ @ 12mm spacing s_n .
 $0 < s_a \leq 4$ @ 16mm spacing s_n .

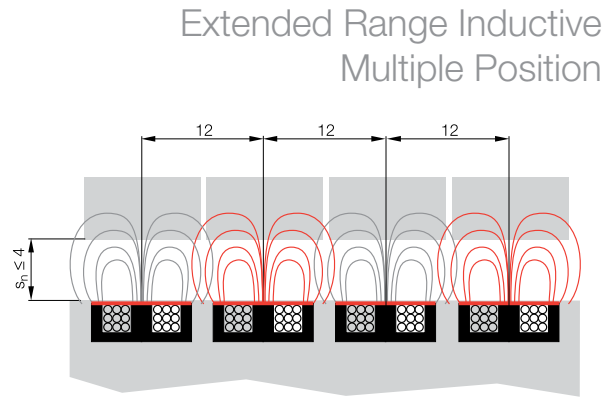


Mechanical Switches

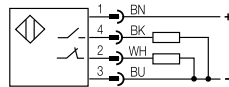
Series 610-11

Inductive sensors from Balluff are characterized by a compact housing and generous switching distances. The result is a non-contacting, wear-free sensor.

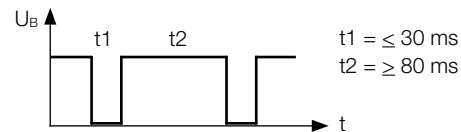
The tuned sensing coil oscillator frequencies of the inductive sensors allow them to be installed very close to each other. Mutual interference is precluded at 12 mm spacing and 4 mm switching distance.



Complementary electronic switching elements allow the sensor to be used either as normally open or normally closed.



Sensor compatible with pulsed power supply.



Robot Zone Limits

Two diverse, complementary, redundant channels are required for control reliable operation of each zone.

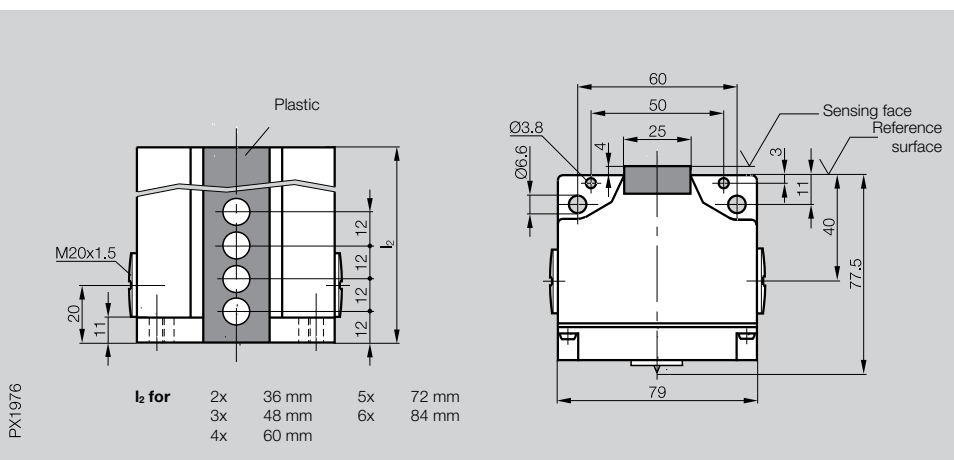
In case of error (short circuit, mis-wiring, ...) both signals are identical and are recognized by the controller as a fault condition. Monitoring must be implemented with a safety PLC or with a safety relay.

Safety Notice

The components supplied with Balluff's Zone Limit Systems are suitable for use in personnel safety applications only when installed and used in compliance with all applicable provisions of American National Standards Institute / Robotic Industries Association American National Standard for Industrial Robots and Robot Systems - Safety Requirements ANSI/RIA R15.06-1999 or subsequent editions thereof, and all other relevant industrial and governmental standards and requirements.



Type	Multiple position switch with extended range inductive sensors
Switch position spacing	12 mm



Part number	BNS 816-X603-B _ _ -00-12-610-11
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	M20×1.5 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 $\varnothing$ 10 mm

Inductive switch elements	Electrical version	Rated operating	Assured operating
		distance s_n	distance s_a
Not Field Replaceable	PNP, complementary, 10...60 V DC, short circuit protected, 200mA	4 mm	0...3.2 mm

Ordering example:

BNS 816-X603-B04-00-12-610-11

BNS 816-X####-B -00-12-610-11

X####

Unique number to indicate special configuration, such as custom pre-wired connector
(blank = standard assembly)

No. of
switch positions

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

Standard switch without special wiring or connector

X580 = 2 Position

X709 = 3 Position

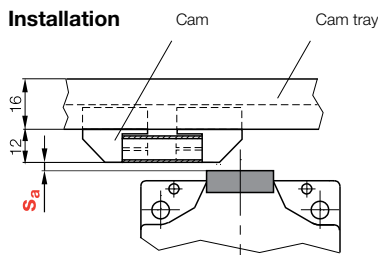
X594 = 4 Position

X603 = 6 Position

Note:

See page 15.14 for connector options

Installation



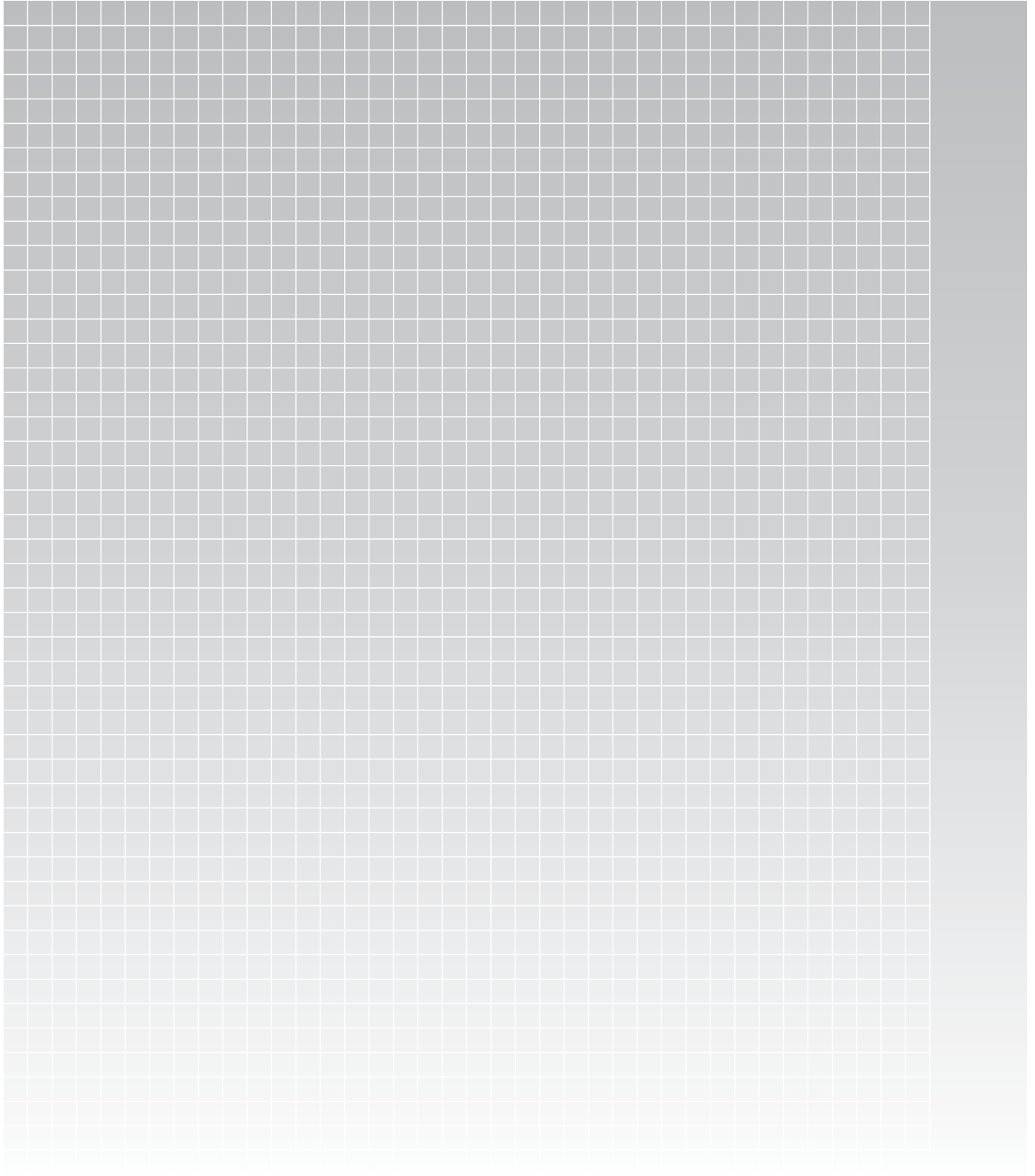
Caution!

To ensure switching function s_a must be in a range of $0 < s_a \leq 3.2$





Mechanical Switches



Mechanical Switches

Contents

Series 72 Multiple Position Switches

- Horizontal plungers for perpendicular cam approach
- Compact housing
- Full size switch elements
- Up to 10 positions
- Inductive
- Inductive with extended range
- 12 or 16 mm spacing

4.2	Standard 819
4.4	Safety 813
4.6	Inductive 605-11
4.8	Inductive with extended 4 mm range 605-11

Series 72

4



Mechanical Switches

Series 72

Multiple Position

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

- Available with chisel plunger only
- Use in wet areas with adhering media
- Use in dry areas with small chip presence
- Prevents plunger from sticking in guide

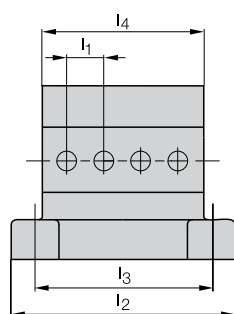
Connection options

- Thread for cable gland M25×1.5 on sides and in flange (Gasketed plugs included)
- Connector (note permissible operating voltage for the connectors, see page 15.16)

Multiple position switches with function indication

- Optional function indication for two voltage ranges

Available sizes



Number of plungers	2	3	4	5	6	8	10
Dimension l ₂ when l ₁ = 12 mm	84	84	100	116	132	164	180
Dimension l ₃ when l ₁ = 12 mm	66	66	82	98	114	146	162
Dimension l ₄ when l ₁ = 12 mm	54	54	68	84	100	132	148
Dimension l ₂ when l ₁ = 16 mm	84	100	116	132	148	180	212
Dimension l ₃ when l ₁ = 16 mm	66	82	98	114	130	162	194
Dimension l ₄ when l ₁ = 16 mm	54	68	84	100	116	148	180

Dimensions in mm

Ordering example:

BNS 819-B04-D12-72-10-FD-S80S

BNS 819-X####-B - - -72-10- - - -

X####

Unique number to indicate special configuration, such as custom pre-wired connector (blank = standard assembly)

X512

Hardened aluminum bushings

No. of plungers

02 2×
03 3×
04 4×
...

Plunger style

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

Plunger spacing

12 12 mm
16 16 mm

optional Function indication

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

See page 15.14 for connector options

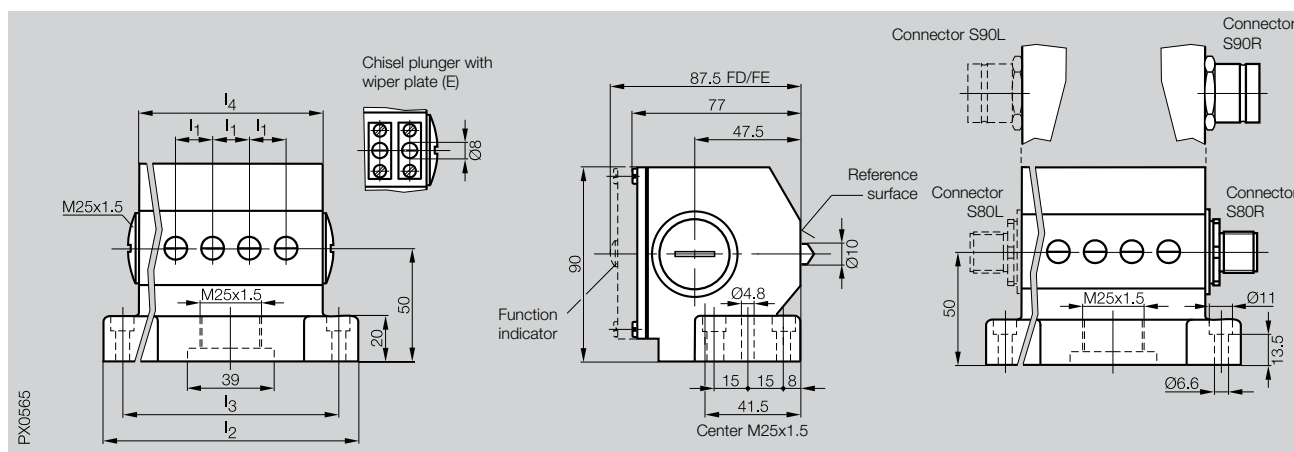
optional Connector

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





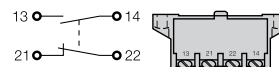
Type	Multiple position switch
Plunger spacing	12 mm or 16 mm



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

With switch element	BSE 30.0			
Part number	BNS 819-B	-	-72-10-	-

Wiring diagram, style



Switch element

Contact material	Silver, gold plated
Switching principle	Snap switch
Contact system	Dual changeover, one normally-open and one normally-closed, galvanically isolated

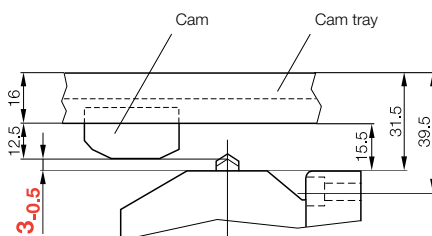
Electrical data

see page 15.2

Mechanical data

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

Installation



Note!

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



Mechanical Switches

Series 72

Safety Multiple Position

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

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

Multiple position switches with function indicator

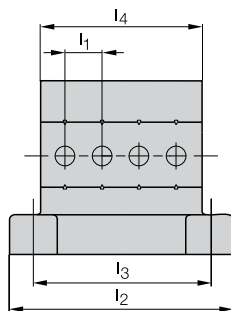
- Function indication for three voltage ranges

Multiple position switches with wiper plate

- Available with chisel plunger only
- Use in wet areas with adhering media
- Use in dry areas with small chip presence
- Prevents plunger from sticking in the guide

Connection options

- Thread for cable gland M25×1.5 on sides and in flange (Gasketed plugs included)
- Connector (note permissible operating voltage for the connectors, see page 15.16)



Available sizes

Number of plungers	2	3	4	5	6	8	10
Dimension I ₂ when I ₁ = 12 mm	84	84	100	116	132	164	180
Dimension I ₃ when I ₁ = 12 mm	66	66	82	98	114	146	162
Dimension I ₄ when I ₁ = 12 mm	54	54	68	84	100	132	148
Dimension I ₂ when I ₁ = 16 mm	84	100	116	132	148	180	212
Dimension I ₃ when I ₁ = 16 mm	66	82	98	114	130	162	194
Dimension I ₄ when I ₁ = 16 mm	54	68	84	100	116	148	180

Dimensions in mm

Ordering example:

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

BNS 813-X####-B - - -72- - - -

X####

Unique number to indicate special configuration, such as custom pre-wired connector (blank = standard assembly)

X512

Hardened aluminum bushing

No. of plungers

02 2×
03 3×
04 4×
...

Plunger style

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

Plunger spacing

12 12 mm
16 16 mm

Switch elements

10 BSE 61
Remaining switch positions
BSE 30.0
12 Only BSE 61
20 BSE 85
Remaining switch positions
BSE 30.0
22 Only BSE 85

Safety switch elements

No. from left to right facing plungers

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)

optional Connector

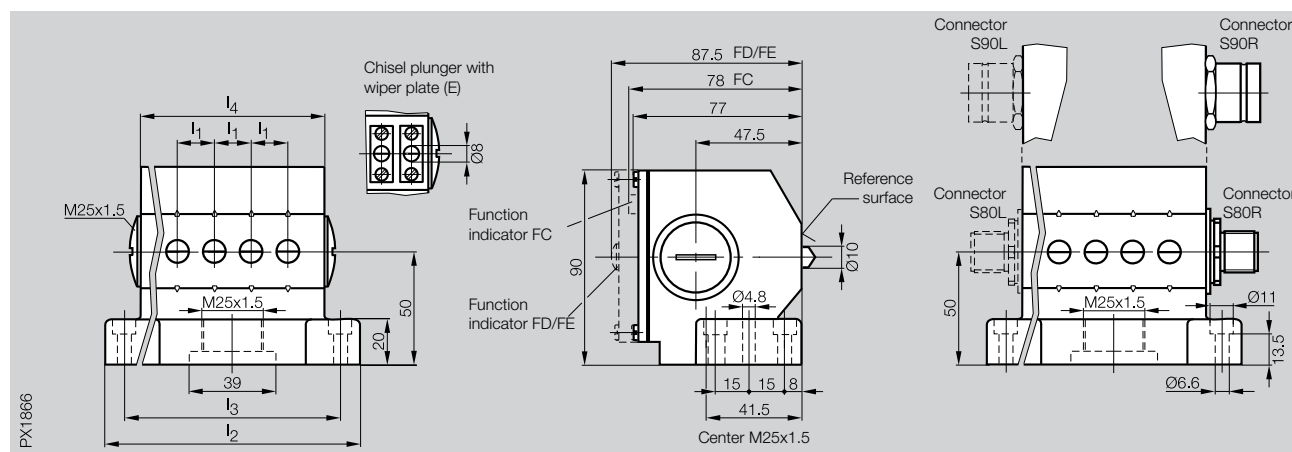
S80R 5-pin, dual keyway right
S80L 5-pin, dual keyway left
S80S 5-pin, dual keyway right and left
S90R 12-pin, right
S90L 12-pin, left
S90S 12-pin, right and left

See page 15.14 for connector options



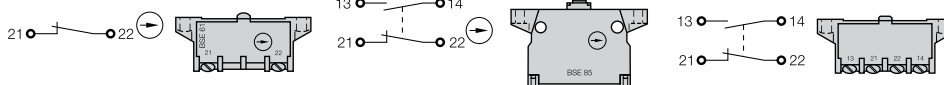


Type	Multiple position switch with positive-opening contacts
Plunger spacing	12 mm or 16 mm



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

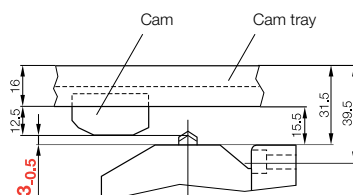
With switch element	BSE 61 per DIN EN 60204-1/VDE 0113	BSE 85 per DIN EN 60204-1/VDE 0113	BSE 30.0
Part number	BNS 813-B _ _ -72- 1 _ _	BNS 813-B _ _ -72- 2 _ _	BNS 813-B _ _ -72- 0 _ _
Wiring diagram, style		13  14 	



Switch element			
Contact material	Silver	Silver	Silver, gold plated
Switching principle	Creep switch, positive-opening	Snap switch, positive opening (normally-closed)	Snap switch
Contact system	Normally-closed, double interruption	Dual-changeover: 1. NO (snap function), 2. Positive-opening (double-interruption), all galvanically isolated	Dual changeover, one normally-open and one normally-closed, galvanically isolated
Electrical data	see page 15.2	see page 15.2	see page 15.2

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

Installation



Note!

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

Mechanical Switches

Series 605-11

Inductive Multiple Position

Multiple position switches for standard applications

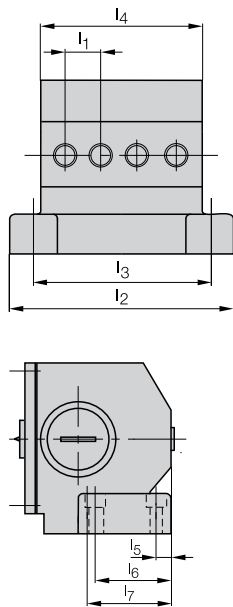
- Can be used under extreme conditions such as shock, temperature fluctuations, coolant flooding, high speed and abrasive applications
- Reliability comparable with inductive sensors

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 sides and in flange (Gasketed plugs included)
- Connector (note permissible operating voltage for the connectors, see page 15.16)



Available sizes

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

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

Dimension l₅ 10 mm

Dimension l₆ 40 mm

Dimension l₇ 43.5 mm

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

Dimension l₅ 8 mm

Dimension l₆ 38 mm

Dimension l₇ 41.5 mm

Dimensions in mm

Ordering example:

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

BNS 816-X####-B - - -605-11-

No. of switch positions

02 2x
03 3x
04 4x

Code for switch elements

(see table at right)

Plunger spacing

12 12 mm
16 16 mm

See page 15.14 for connector options

optional Connector

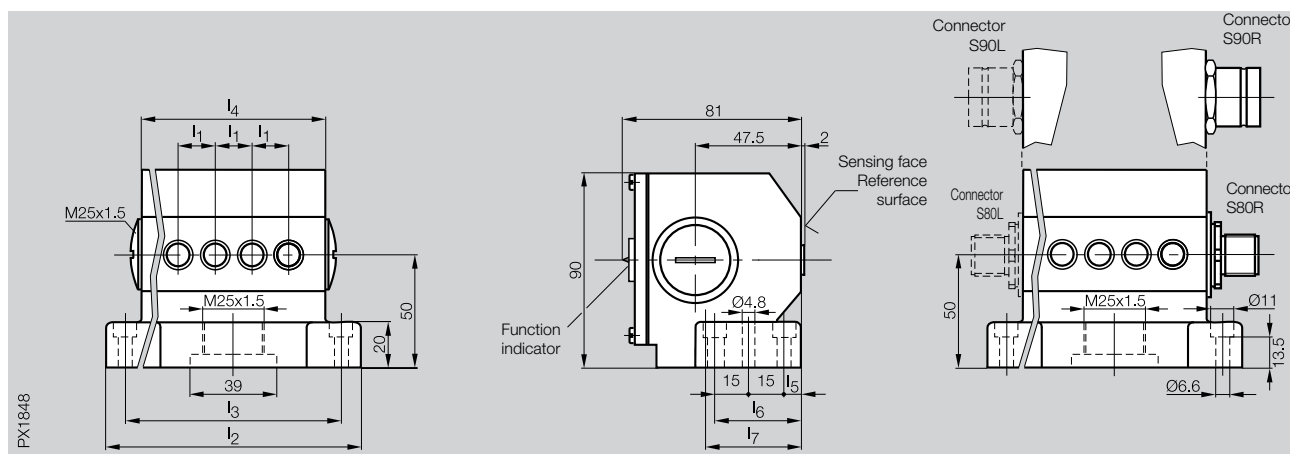
S80R 5-pin, dual keyway right
S80L 5-pin, dual keyway left
S80S 5-pin, dual keyway right and left
S90R 12-pin, right
S90L 12-pin, left
S90S 12-pin, right and left

X####

Unique number to indicate special configuration, such as custom pre-wired connector (blank = standard assembly)



Type	Multiple position switch with inductive sensors
Switch position spacing	12 mm or 16 mm



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

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

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

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

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

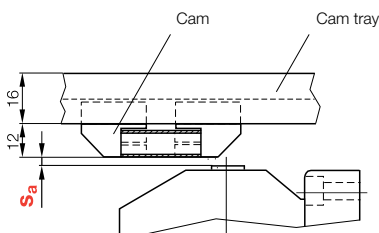
Hybrid switch element with sensing head 15.5 mm, for use with switch position spacing 16 mm

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

For additional electrical data see pages 15.4-15.7



Installation



Note!

To ensure switching function s_a must be in a range of
 $0 < s_a \leq 1.6$ @ 12 mm spacing s_n .
 $0 < s_a \leq 4$ @ 16 mm spacing s_n .

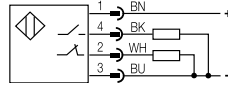
Mechanical Switches

Series 605-11

Inductive sensors from Balluff are characterized by a compact housing and generous switching distances. The result is a non-contacting, wear-free sensor.

The tuned sensing coil oscillator frequencies of the inductive sensors allow them to be installed very close to each other. Mutual interference is precluded at 12 mm spacing and 4 mm switching distance.

Complementary electronic switching elements allow the sensor to be used either as normally open or normally closed.



Robot Zone Limits

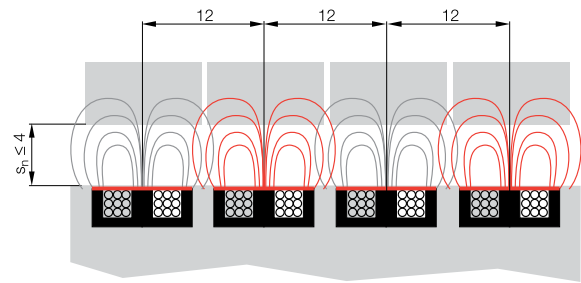
Two diverse, complementary, redundant channels are required for control reliable operation of each zone.

In case of error (short circuit, mis-wiring, ...) both signals are identical and are recognized by the controller as a fault condition. Monitoring must be implemented with a safety PLC or with a safety relay.

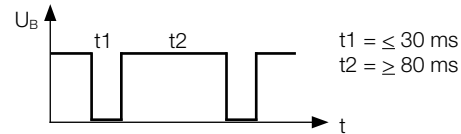
Safety Notice

The components supplied with Balluff's Zone Limit Systems are suitable for use in personnel safety applications only when installed and used in compliance with all applicable provisions of American National Standards Institute / Robotic Industries Association American National Standard for Industrial Robots and Robot Systems - Safety Requirements ANSI/RIA R15.06-1999 or subsequent editions thereof, and all other relevant industrial and governmental standards and requirements.

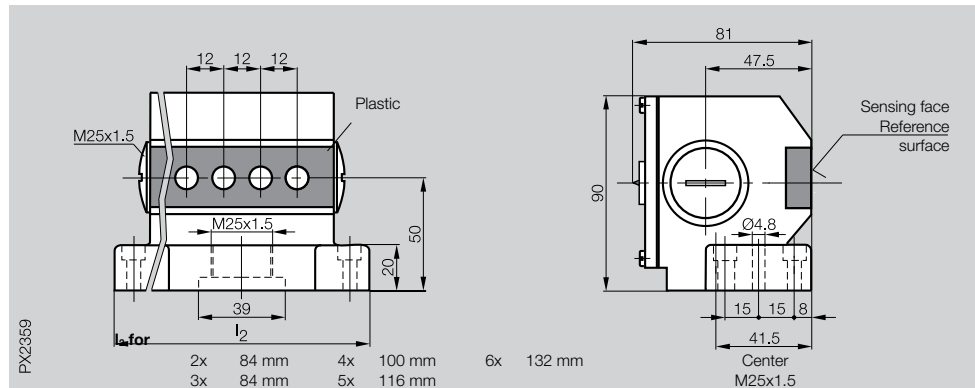
Extended Range Inductive Multiple Position



Sensor compatible with pulsed power supply.



Type	Multiple position switch with extended range inductive sensors
Switch position spacing	12 mm



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

Inductive switch elements with head Ø 10 mm

Inductive switch elements	Electrical version	Rated operating distance s_n	Assured operating distance s_a
Not field replaceable	PNP, complementary, 10...60 V DC, short circuit protected, 200 mA	4 mm	0...3.2 mm

Ordering example:

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

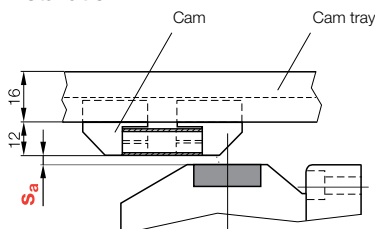
BNS 816-X603-B_-00-12-605-11

No. of switch positions

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

Note: See page 15.14 for
connector options

Installation

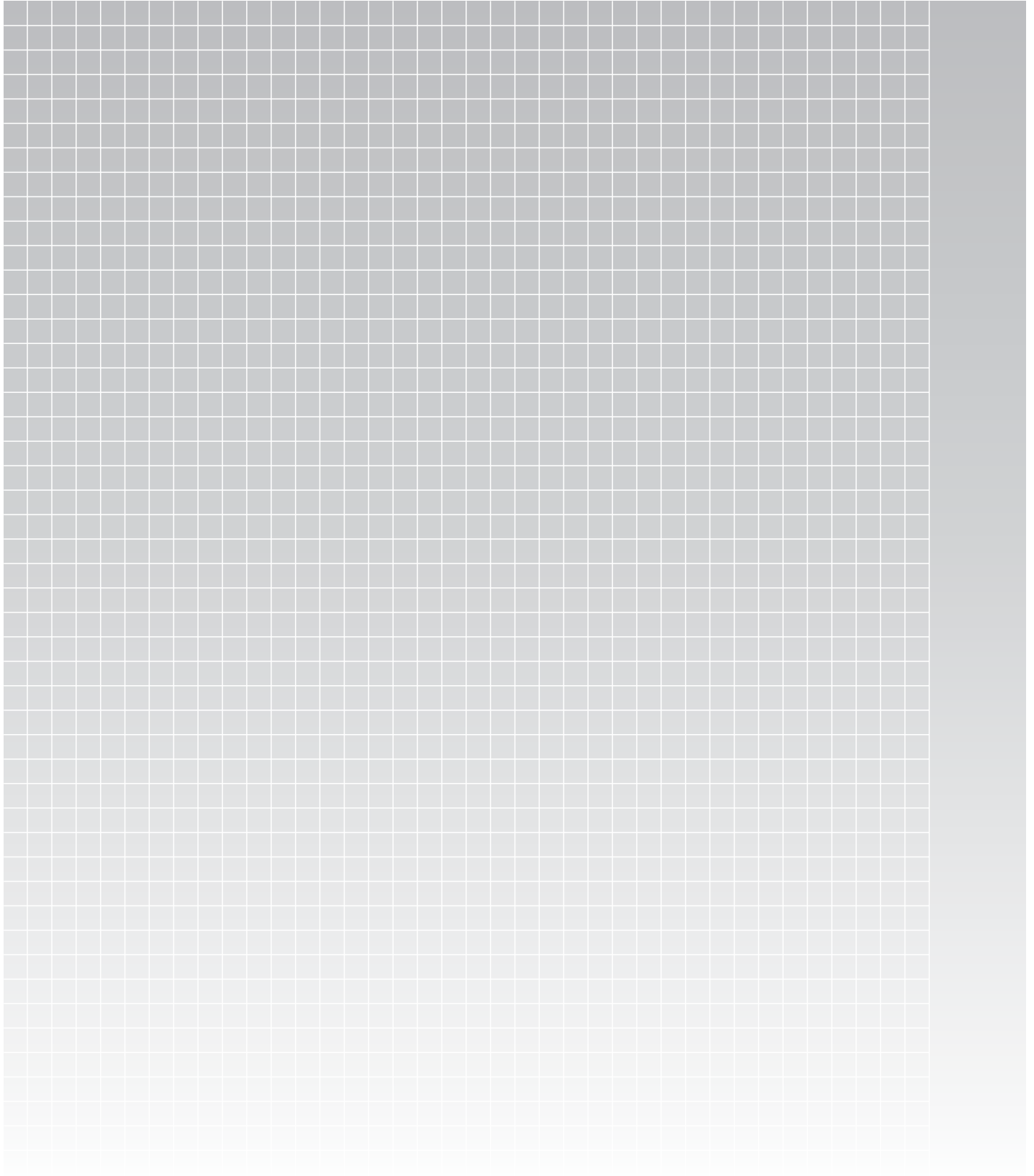


Caution!
To ensure switching
function s_a must
be in a range of
 $0 < s_a \leq 3.2$





Mechanical Switches



Mechanical Switches

Contents

Series 46 Multiple Position Switches

- Miniature housing with mounting flange
- Miniature switch elements
- Up to 10 positions
- IO-Link
- Inductive
- 8 or 10 mm spacing
- Switch elements for low current applications

- 5.2 Standard 819
- 5.4 Safety 813
- 5.6 Inductive 603-11

Series 46

5



Mechanical Switches

Series 46

Multiple Position

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

- Available with chisel plunger only
- Use in wet areas with adhering media
- Use in dry areas with small chip presence
- Prevents plunger from sticking in the guide

Connection options

- Thread for cable gland M16x1.5 on sides and in flange (Gasketed plugs included)
- Connector (note permissible operating voltage for the connectors, see page 15.16)

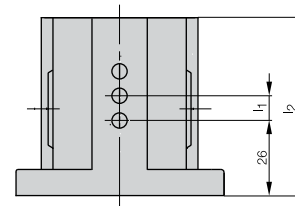
Switching elements for low-current applications

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

Number of plungers	2	3	4	5	6	8	10
Dimension $l_1 = 8$ mm	49	59	64	72	80	96	112
l_2 when $l_1 = 10$ mm	49	59	72	80	89	112	129

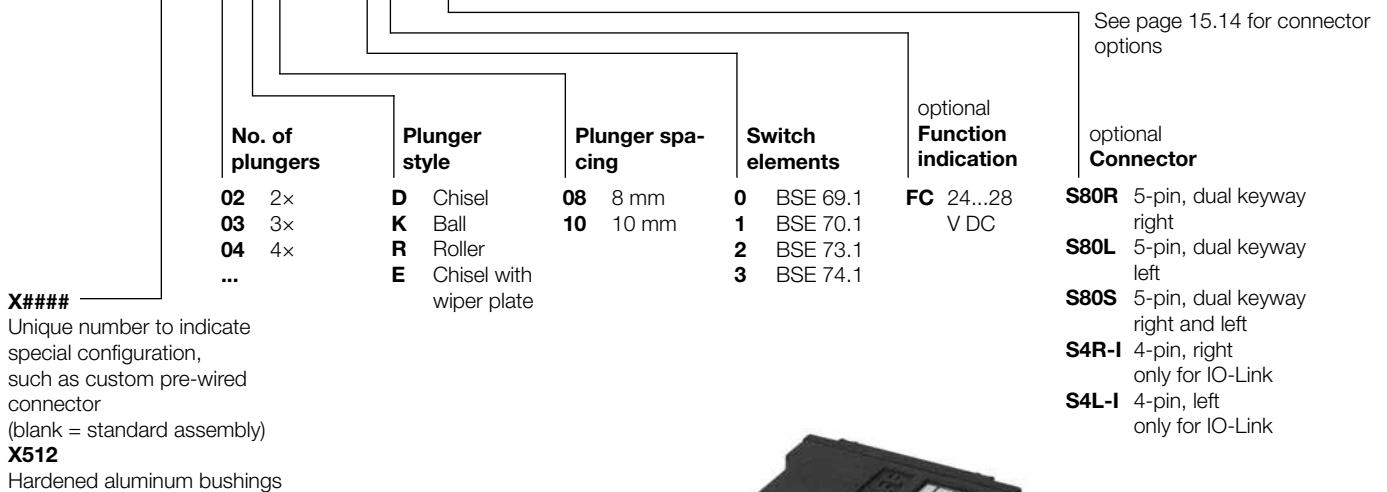
Dimensions in mm



Ordering example:

BNS 819-B04-D08-46-11-FC-S80S

BNS 819-X####-B - - -46-1 - - -



X####

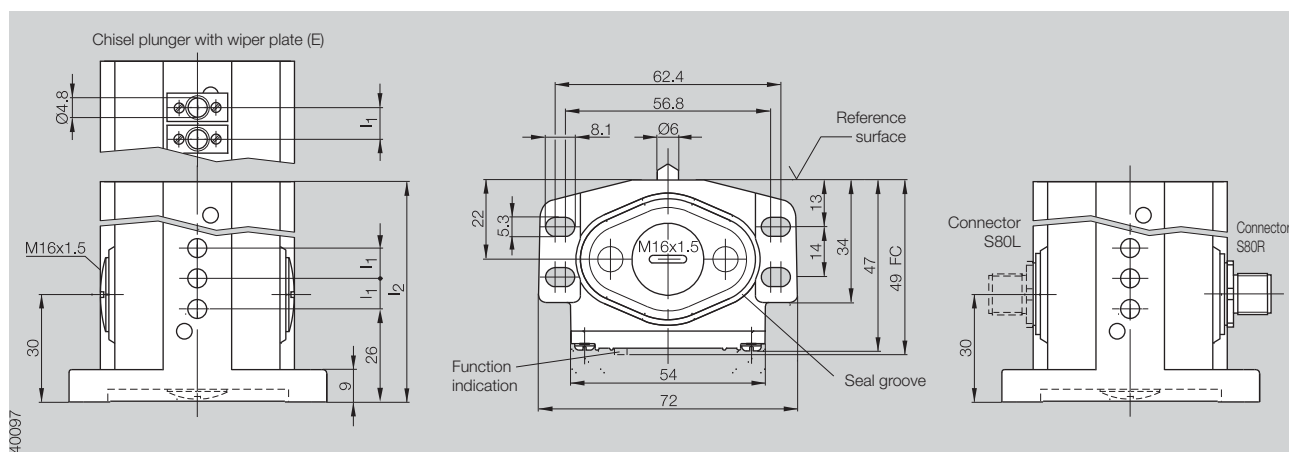
Unique number to indicate special configuration, such as custom pre-wired connector (blank = standard assembly)

X512

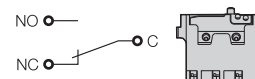
Hardened aluminum bushings



Type	Multiple position switch
Plunger spacing	8 mm or 10 mm

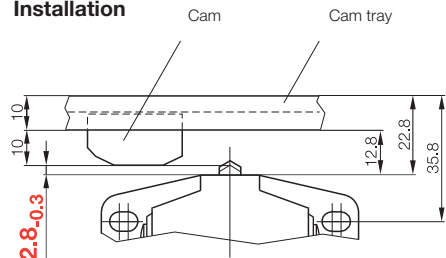


Plunger style	Chisel (D), Ball (K), Roller (R) or Chisel with wiper plate (E)
Plunger material	Stainless steel, contact surfaces induction hardened
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	M16x1.5 for cable gland or connector
Ambient temperature range	-5...+85 °C
Degree of protection per IEC 60529	IP 67
Function indicator	LED 24...28 V DC (FC)
With switch element	
Part number	BSE 69.1 BNS 819-...-46-10 BSE 73.1 BNS 819-...-46-12 BSE 70.1 BNS 819-...-46-11 BSE 74.1 BNS 819-...-46-13
Wiring diagram, style	



Switch element			
Contact material	Silver	Gold	
Switching principle	Snap switch		
Contact system	Single-pole changeover		
Connection type	Solder connection		
Electrical data	see page 15.3		
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.



For additional information, visit
www.balluff.com/iolink

Mechanical Switches

Series 46

Safety Multiple Position

Multiple position switches with forced opening

- Smallest plunger spacing for mechanical multiple position switches (8 or 10 mm)
- Switch element with forced opening with rigid plungers
- 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

- Available with chisel plunger only
- Use in wet areas with adhering media
- Use in dry areas with small chip presence
- Prevents plunger from sticking in the guide

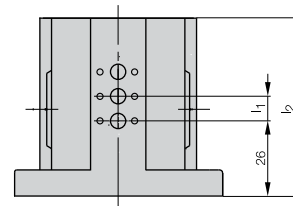
Connection options

- Thread for cable gland M16×1.5 on side and in flange (Gasketed plugs included)
- Connector (note permissible operating voltage for the connectors, see page 15.16)

Available sizes

Number of plungers		2	3	4	5	6	8	10
Dimension l_2 when $l_1 = 8 \text{ mm}$		49	59	64	72	80	96	112
	$l_1 = 10 \text{ mm}$	49	59	72	80	89	112	129

Dimensions in mm



Ordering example:

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

BNS 813-X####-B - - - -46- - - -

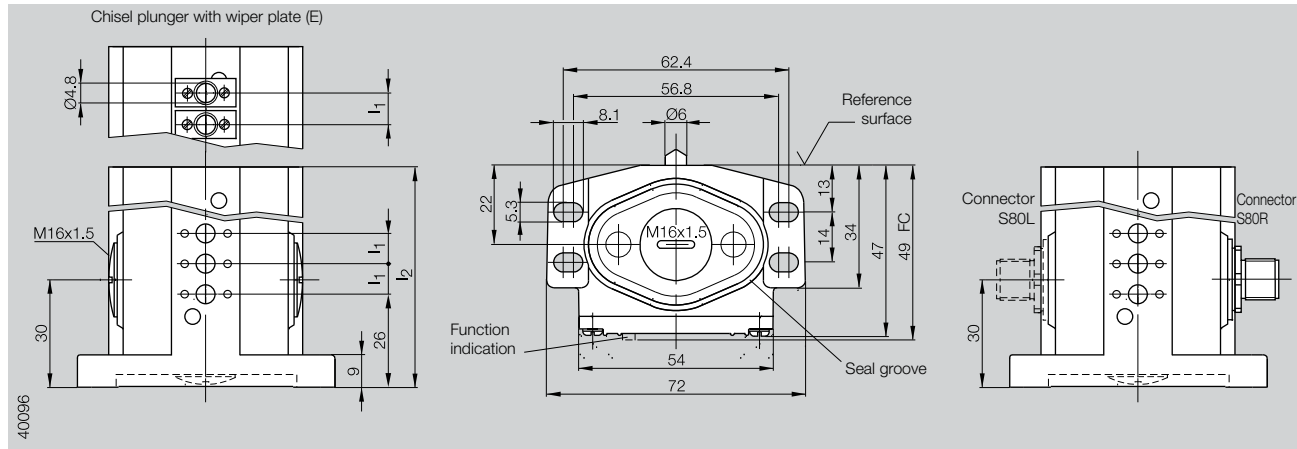
No. of plungers	Plunger style	Plunger spacing	Switch elements	Switch elements with forced opening	optional Connector
02 2×	D Chisel	08 8 mm	30 BSE 63, remaining switch positions BSE 69.1	No. from flange	S4R 4-pin, right
03 3×	K Ball	10 10 mm	32 BSE 63, remaining switch positions BSE 73.1	optional Function indication	S4L 4-pin, left
04 4×	R Roller		39 all BSE 63	FC 24...28 V DC	S4S 4-pin, right and left
...	E Chisel with wiper plate		41 BSE 64, remaining switch positions BSE 70.1		S80R 5-pin, dual keyway right
			43 BSE 64, remaining switch positions BSE 74.1		S80L 5-pin, dual keyway left
			49 all BSE 64		S80S 5-pin, dual keyway right and left

X####
Unique number to indicate special configuration, such as custom pre-wired connector (blank = standard assembly)

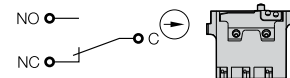
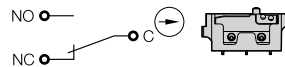
X512
Hardened aluminum bushings

See page 15.14 for connector options

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

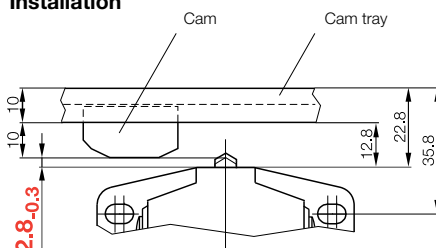


Plunger style	Chisel (D), Ball (K), Roller (R), or Chisel with wiper plate (E)
Plunger material	Stainless steel, contact surfaces induction hardened
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	M16x1.5 for cable gland or connector
Ambient temperature range	-5...+85 °C
Degree of protection per IEC 60529	IP 67
Function indicator	LED 24...28 V DC (FC)
With switch element	
Part number	BSE 63 BNS 813-...-46-3_
Wiring diagram, style	BSE 64 BNS 813-...-46-4_



Switch element			
Contact material		Silver	Silver
Switching principle		Snap switch	Snap switch
Contact system		Single-pole change-over, NO with snap function, NC with forced opening	Single-pole change-over, NO with snap function, NC with forced opening
Connection type		Solder connection	Screw terminal
Electrical data		see page 15.3	see page 15.3
Mechanical data			
Plunger point to reference surface		4 mm	4 mm
Switchpoint to reference surface		3.5 mm	3.5 mm
Maximum plunger travel		2.1 mm	2.1 mm
Assured separation after plunger travel		1 mm	1 mm
Switching actuating force on plunger		min. 8 N	min. 8 N
Switching frequency		max. 200/min	max. 200/min
Approach speed	Plunger D	20 m/min	20 m/min
	Plunger E	10 m/min	10 m/min
	Plunger K	9 m/min	9 m/min
	Plunger R	60 m/min	60 m/min
Repeatability	Plunger D, E	± 0.02 mm	± 0.02 mm
	Plunger K	± 0.03 mm	± 0.03 mm
	Plunger R	± 0.05 mm	± 0.05 mm

Installation



Note!

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

Mechanical Switches

Series 603-11

Inductive Multiple Position

Multiple position switches for standard applications

- Smallest sensor spacing for inductive multiple position switches (8 mm or 10 mm)
- Can be used under extreme conditions such as shock, temperature fluctuations, coolant flooding, high speed and abrasive applications
- 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.

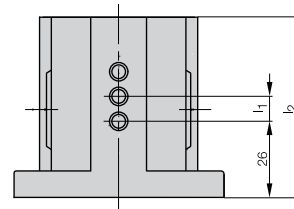
Connection options

- Thread for cable gland M16×1.5 on side and in flange (gasketed plugs included)
- Connector (note permissible operating voltage for the connectors, see page 15.16)

Available sizes

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

Dimensions in mm



Ordering example:

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

BNS 816-X####-B - - -603-11-

No. of switch positions

02 2×
03 3×
04 4×
...

Code for switch elements

(see table at right)

Plunger spacing

08 8 mm
10 10 mm

See page 15.14 for connector options

optional Connector

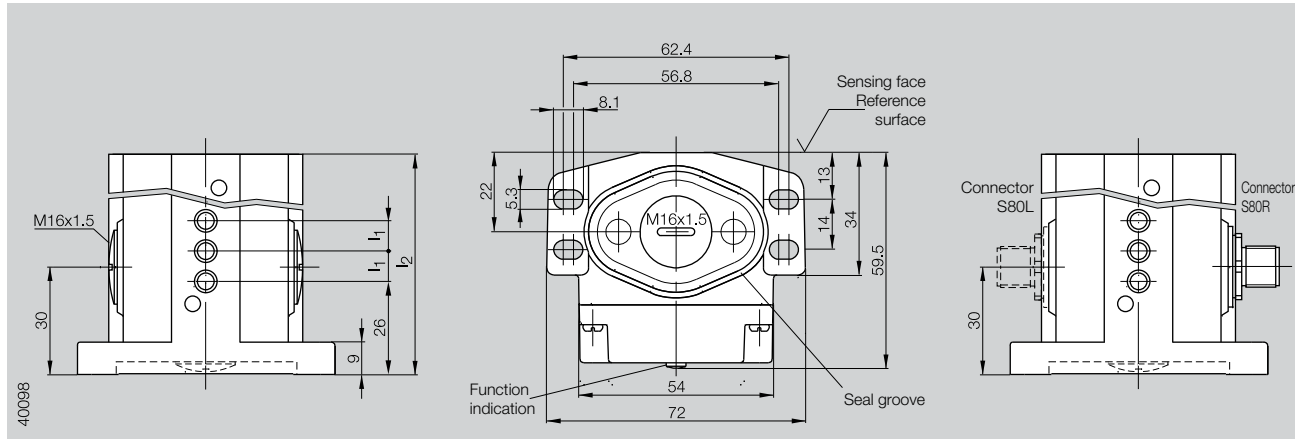
S4R 4-pin, right
S4L 4-pin, left
S4S 4-pin, right and left
S80R 5-pin, right
S80L 5-pin, left
S80S 5-pin, right and left

X####

Unique number to indicate special configuration, such as custom pre-wired connector (blank = standard assembly)



Type	Multiple position switch with inductive sensors
Switch position spacing	8 mm or 10 mm



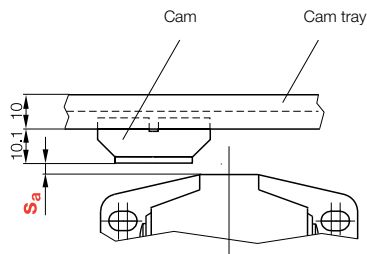
Part number	BNS 816-B - - -603-11-
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	M16x1.5 for cable gland or connector
Ambient temperature range	-25...+70 °C
Degree of protection per IEC 60529	IP 67
Function indicator	LED

Inductive switch elements

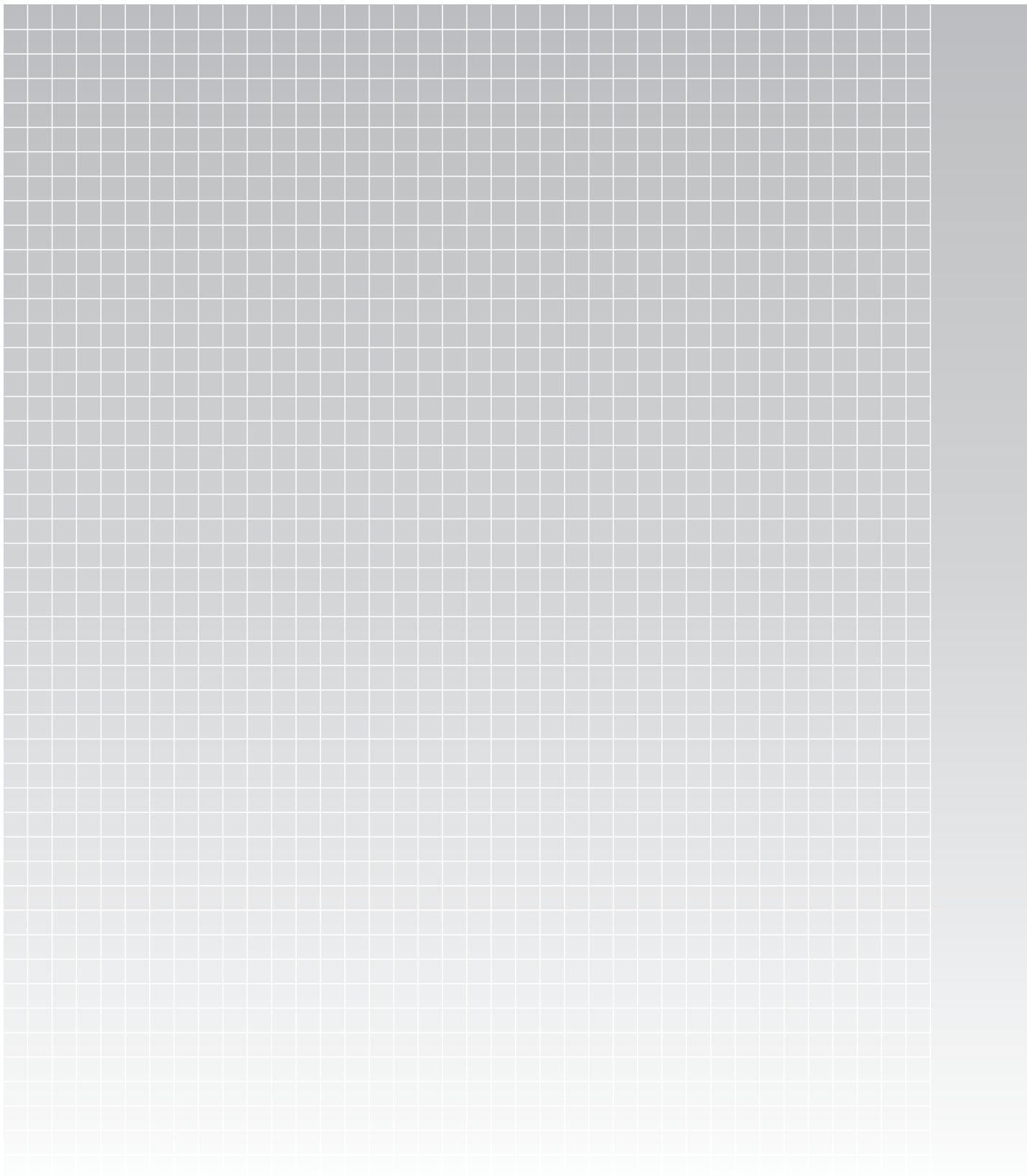
Code	Ordering code for replacement switch elements	Electrical version	Rated operating distance s_n	Assured operating distance s_a
TOB	BES 517-312-Y-RK	PNP, NO, 10...30 V DC, short circuit protected	1.1 mm	0...0.9 mm
TNB	BES 517-311-Y-RK	NPN, NO, 10...30 V DC, short circuit protected	1.1 mm	0...0.9 mm

5

For additional electrical data, see page 15.4.

Installation**Note!**

To ensure switching function
 s_a must
 be in a range of
 $0 < s_a \leq .9$



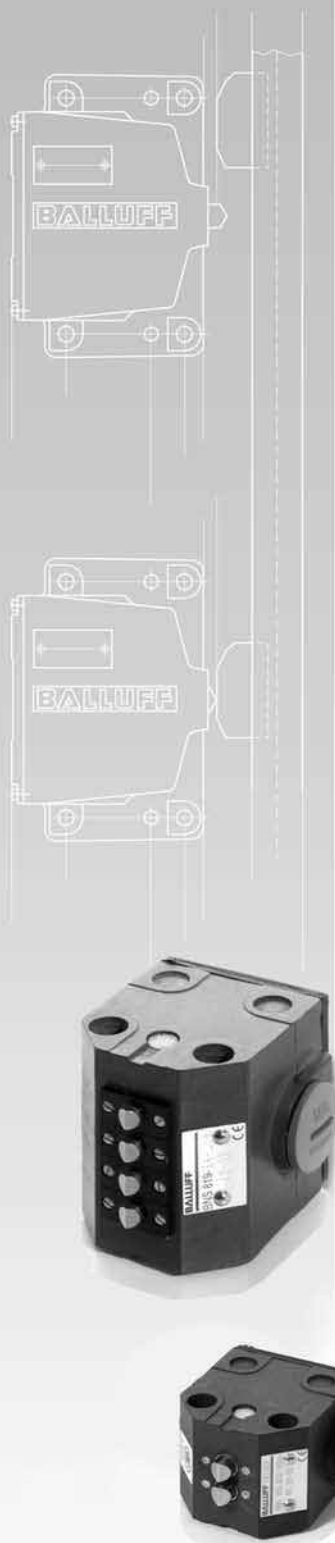
Mechanical Switches

Contents

Series 40 Multiple Position Switches

- Miniature housing with minimum footprint
- Miniature switch elements
- Up to 6 positions
- IO-Link
- Inductive
- 8 mm spacing
- Switch elements for low current applications

6.2	Standard 819
6.4	Safety 813
6.6	Inductive 650-11



Mechanical Switches

Series 40

Multiple Position

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

- Available with chisel plunger only
- Use in wet areas with adhering media
- Use in dry areas with small chip presence
- Prevents plunger from sticking in the guide

Connection options

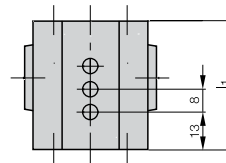
- Thread for cable gland M16×1.5 on sides (Gasketed plugs included)
- Connector (note permissible operating voltage for the connectors, see page 15.16)

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

Number of plungers	2	3	4	5	6
Dimension I_1	34	42	50	58	66
Dimensions in mm					



Ordering example:

BNS 819-B04-D08-40-10-FC-S80S

BNS 819-X####-B - - 08-40-1 - - - -

No. of plungers

02 2×
03 3×
04 4×

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

See page 15.14 for connector options

optional Connector

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

X####

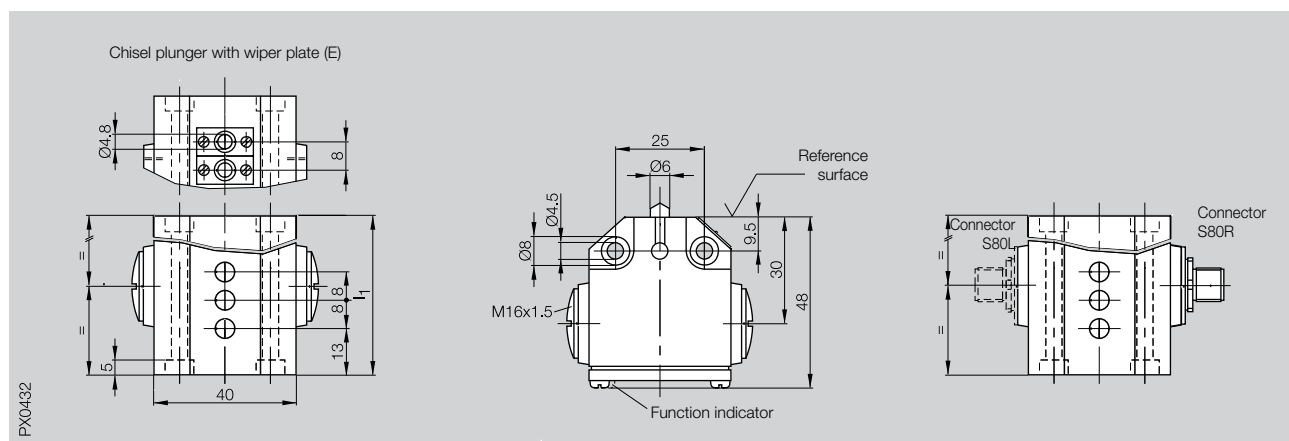
Unique number to indicate special configuration, such as custom pre-wired connector (blank = standard assembly)

X512

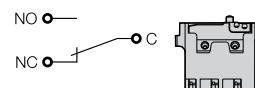
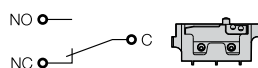
Hardened aluminum bushing



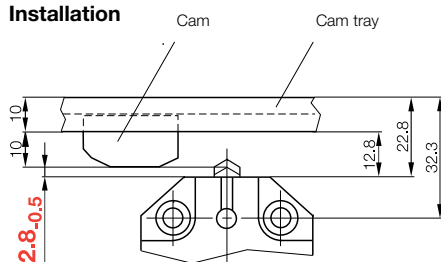
Type	Multiple position switch
Plunger spacing	8 mm



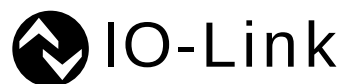
Plunger style	Chisel (D), Ball (K), Roller (R) or Chisel with wiper plate (E)
Plunger material	Stainless steel, contact surfaces induction hardened
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	M16x1.5 for cable gland or connector
Ambient temperature range	-5...+85 °C
Degree of protection per IEC 60529	IP 67
Function indicator	LED 24...28 V DC (FC)
With switch element	
Part number	BSE 69.1 BNS 819-...-40-10 BSE 73.1 BNS 819-...-40-12 BSE 70.1 BNS 819-...-40-11 BSE 74.1 BNS 819-...-40-13
Wiring diagram, style	



Switch element					
Contact material		Silver	Gold	Silver	Gold
Switching principle		Snap switch		Snap switch	
Contact system		Single-pole changeover		Single-pole changeover	
Connection type		Solder connection		Screw terminal	
Electrical data		see page 15.3		see page 15.3	
Mechanical data					
Plunger point to reference surface		4 mm		4 mm	
Switchpoint to reference surface		3.5 mm		3.5 mm	
Maximum plunger travel		3.5 mm		3.5 mm	
Switching actuating force on plunger		min. 8 N		min. 8 N	
Switching frequency		max. 200/min		max. 200/min	
Approach speed	Plunger D	20 m/min		20 m/min	
	Plunger E	10 m/min		10 m/min	
	Plunger K	9 m/min		9 m/min	
	Plunger R	60 m/min		60 m/min	
Repeatability	Plunger D, E	± 0.02 mm		± 0.02 mm	
	Plunger K	± 0.03 mm		± 0.03 mm	
	Plunger R	± 0.05 mm		± 0.05 mm	

Installation**Note!**

To ensure switching function, the dimension 2.8_{-0.5} is especially critical.



For additional information, visit
www.balluff.com/iolink

Mechanical Switches

Series 40

Safety Multiple Position

Multiple position switches with forced opening

- Smallest plunger spacing for mechanical multiple position switches (8 mm)
- Switch element with forced opening with rigid plungers
- 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

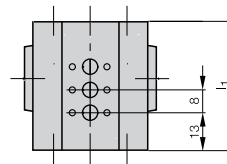
- Available with chisel plunger only
- Use in wet areas with adhering media
- Use in dry areas with small chip presence
- Prevents plunger from sticking in the guide

Connection options

- Thread for cable gland M16×1.5 on sides (Gasketed plugs included)
- Connector (note permissible operating voltage for the connectors, see page 15.16)

Available sizes

No. of plungers	2	3	4	5	6
Dimension I ₁	34	42	50	58	66
Dimensions in mm					



Ordering example:

BNS 813-B04-D08-40-01-FC-S80S

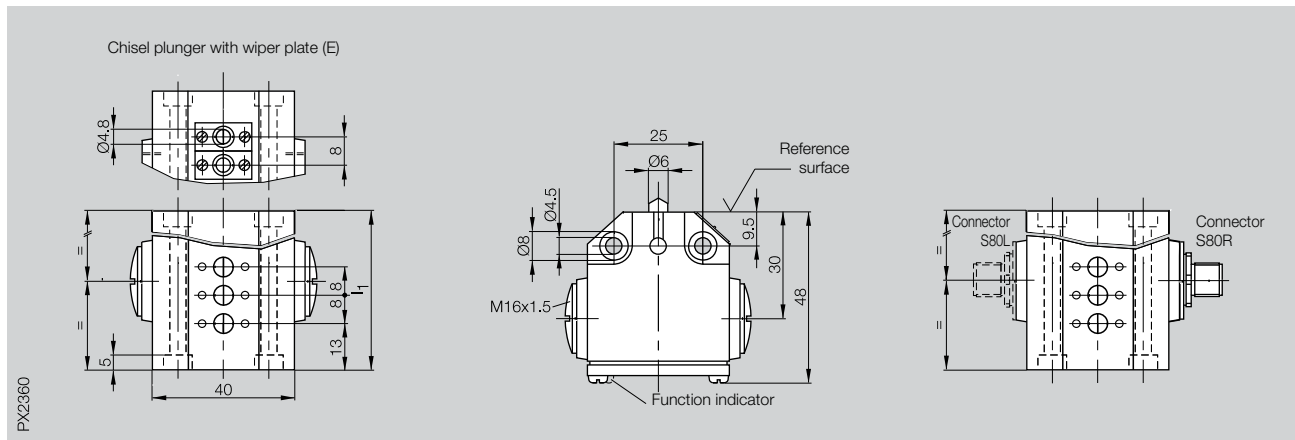
BNS 813-X####-B - - 08-40- - - - -

	No. of plungers	Plunger style	Switch elements	Switch elements with forced opening	optional Function indication	optional Connector
02	2×	D Chisel	30 BSE 63, remaining switch positions BSE 69.1	No. from flange	FC 24...28 V DC	S4R 4-pin, right
03	3×	K Ball	32 BSE 63, remaining switch positions BSE 73.1			S4L 4-pin, left
04	4×	R Roller	39 all BSE 63			S4S 4-pin, right and left
...		E Chisel with wiper plate	41 BSE 64, remaining switch positions BSE 70.1			S80R 5-pin, dual keyway right
X####			43 BSE 64, remaining switch positions BSE 74.1			S80L 5-pin, dual keyway left
Unique number to indicate special configuration, such as custom pre-wired connector (blank = standard assembly)			49 all BSE 64			S80S 5-pin, dual keyway right and left
X512 Hardened aluminum bushing						

See page 15.14 for connector options



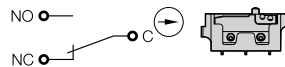
Type	Multiple position switch with forced opening contacts
Plunger spacing	8 mm



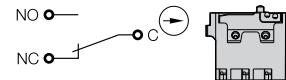
Plunger style	Chisel (D), Ball (K), Roller (R), or Chisel with wiper plate (E)
Plunger material	Stainless steel, contact surfaces induction hardened
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	M16x1.5 for cable gland or connector
Ambient temperature range	-5...+85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

BSE 63

BNS 813-...-40-3_

**BSE 64**

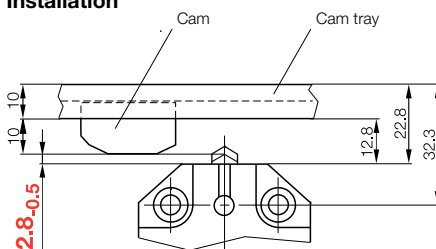
BNS 813-...-40-4_

**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 15.3

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_{±0.5} is especially critical.

Mechanical Switches

Series 650-11

Inductive Multiple Position

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, coolant flooding, high speed and abrasive applications
- Reliability comparable with inductive sensors

Multiple position switches with function indicator

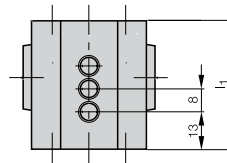
- The inductive switch elements are equipped standard with an LED. The light is highly visible on the housing cover.

Connection options

- Thread for cable gland M16×1.5 on side (Gasketed plugs included)
- Connector (note permissible operating voltage for the connectors, see page 15.16)

Available sizes

Number of switch positions	2	3	4	5	6
Dimension I ₁	34	42	50	58	66
Dimensions in mm					



Ordering example:

BNS 816-B04-TNB-08-650-11-S80S

BNS 816-X####-B - -08-650-11-

No. of switch positions

02 2×
03 3×
04 4×
...

Code for switch elements

(see table at right)

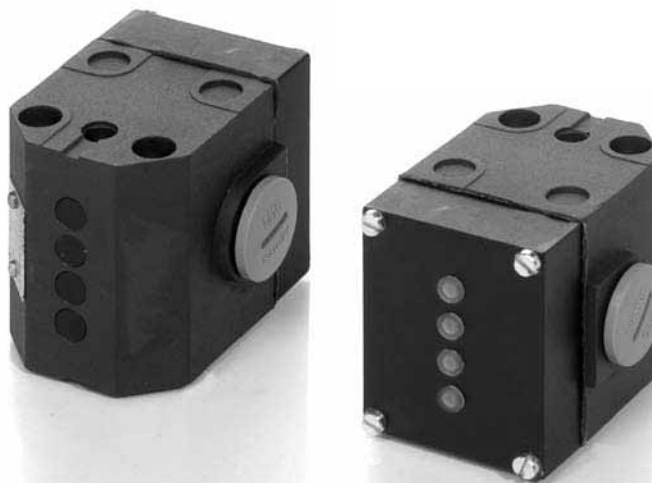
See page 15.14 for connector options

optional
Connector

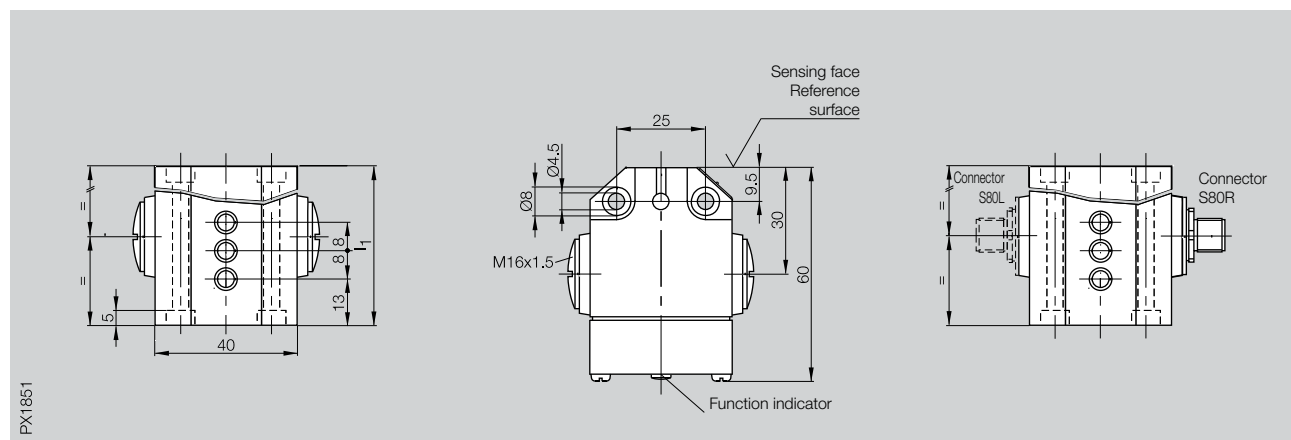
S4R 4-pin, right
S4L 4-pin, left
S4S 4-pin, right and left
S80R 5-pin, dual keyway right
S80L 5-pin, dual keyway left
S80S 5-pin, dual keyway right and left

X####

Unique number to indicate special configuration, such as custom pre-wired connector (blank = standard assembly)



Type	Multiple position switch with inductive sensors
Switch position spacing	8 mm



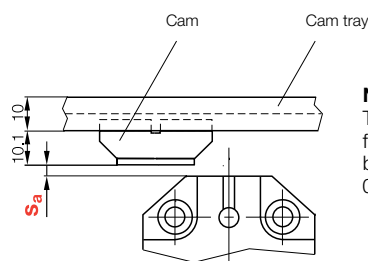
Part number	BNS 816-B - - -650-11-
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	M16x1.5 for cable gland or connector
Ambient temperature range	-25...+70 °C
Degree of protection per IEC 60529	IP 67
Function indicator	LED

Inductive switch elements

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

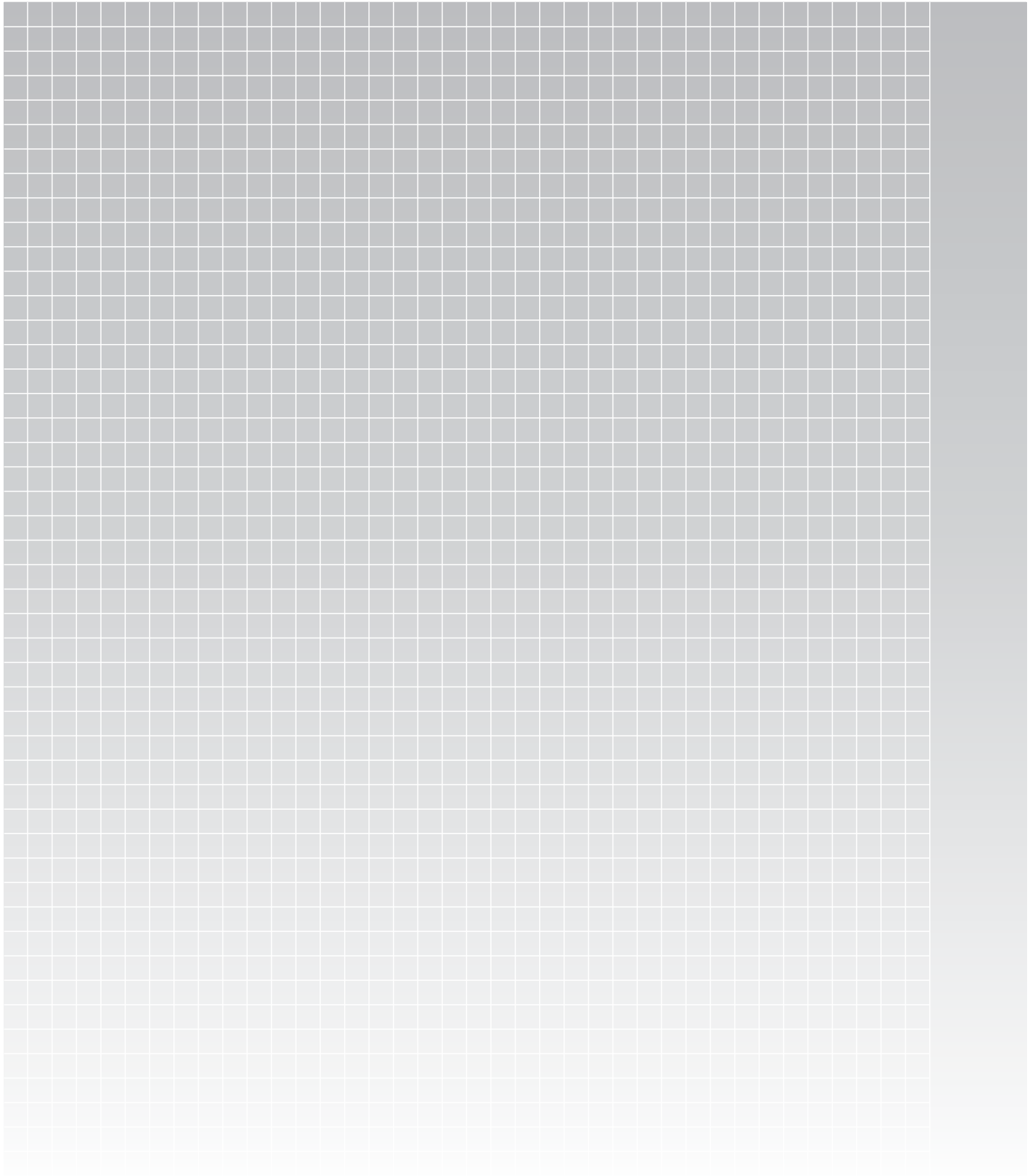
For additional electrical data see page 15.4.

Installation



Note!

To ensure switching function s_a must be in a range of $0 < s_a \leq .9$



Mechanical Switches

Contents

Series F60 Single Position Switches

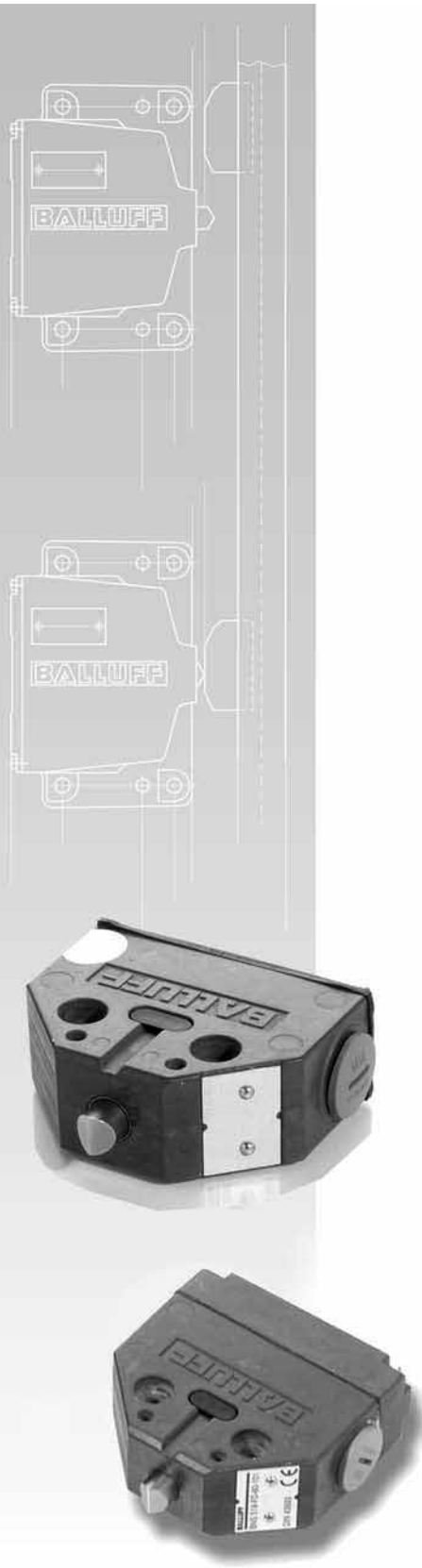
- Compact single position switch
- Full size switch element
- DIN 43693
- Selectable approach axis

7.2 Standard 819

7.4 Safety 813

Series F 60

7



Mechanical Switches

Series F 60 per DIN 43693

Single Position

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
- Available with chisel plungers only

Connection options

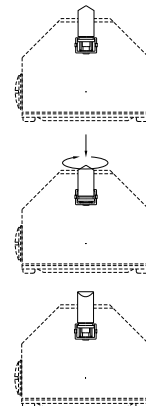
- Thread for cable gland M16x1.5 (Gasketed plugs included)
- Connector (note permissible operating voltage for the connectors, see page 15.16)

Single position switch with function indicator

- Function indication for two voltage ranges

Approach from two directions possible (parallel or perpendicular)

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



Ordering example:

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

BNS 819-X####-F_-60-101-_-_-_-_-

Plunger style

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

optional Function indication

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

See page 15.14 for connector options

optional Connector

S4R 4-pin, right
S80R 5-pin, dual keyway right

X####

Unique number to indicate special configuration, such as custom pre-wired connector (blank = standard assembly)

X512

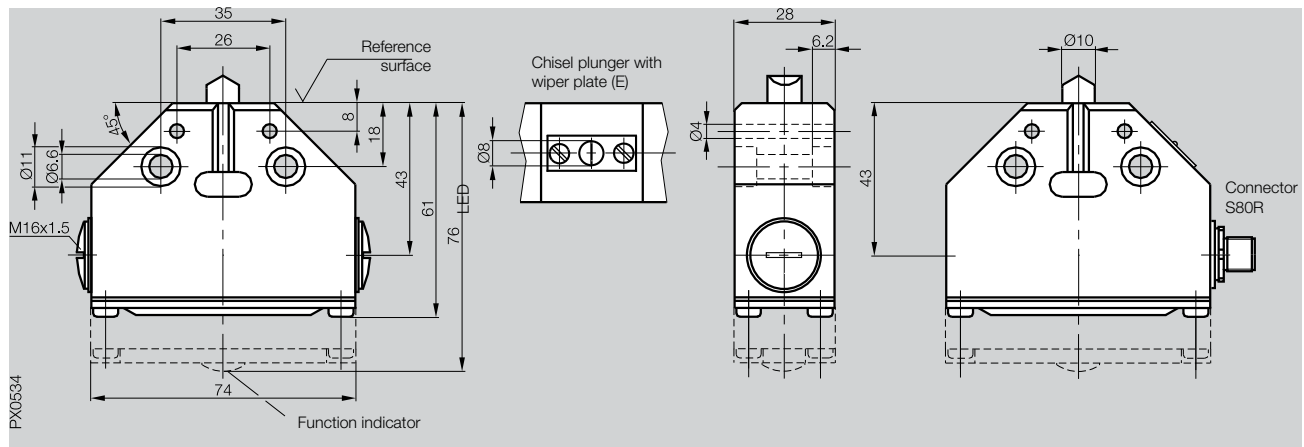
Hardened aluminum bushing

Note:
Flip switch over for connector on left side.



Type	Single position switch
Mounting and function dimensions	per DIN 43693

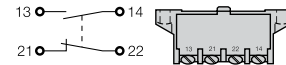
Single position switch
per DIN 43693



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	M16x1.5 for cable gland or connector
Ambient temperature range	-5...+85 °C
Degree of protection per IEC 60529	IP 67
Function indicator	LED 6...60 V AC/DC (FD) or 90...250 V AC/DC (FE)

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
M16x1.5 for cable gland or connector
-5...+85 °C
IP 67
LED 6...60 V AC/DC (FD) or 90...250 V AC/DC (FE)

With switch element	BSE 30.0
Part number	BNS 819-F-60-101- - - - -
Wiring diagram, style	

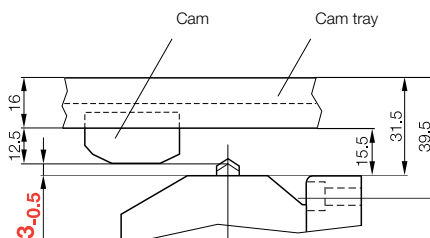


Switch element	
Contact material	Silver, gold plated
Switching principle	Snap switch
Contact system	Dual changeover, one normally-open and one normally-closed, galvanically isolated
Electrical data	see page 15.2

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 3.0.5 is especially critical.

Mechanical Switches

Series F 60 per DIN 43693

Safety Single Position

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

- Positive-opening contacts and rigid plungers for additional security per DIN EN 60204-1/VDE 0113
- Dual-chamber system with IP 67 protection: wear-free membrane with hermetic sealing from plunger mechanism and switch chamber
- Maintenance-free, self-lubricating plunger guide with slide bearing
- Plunger not rotatable, approach direction cannot be changed (see ordering code)

Single position switch with function indicator

- Function indication for selectable three voltage ranges

Single position switch with wiper plate

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

Connection options

- Thread for cable gland M16×1.5 (gasketed plugs included)
- Connector (note permissible operating voltage for the connectors, see page 15.16)

Ordering example:

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

BNS 813-X####-F_-60-18_-_-_-_-

				See page 15.14 for connector options
	Plunger style	Switch elements	optional Function indication	optional Connector
D	Chisel	3 BSE 61 Approach direction longitudinal, parallel to mounting surface	FD 6...60 V AC/DC (for BSE 61)	S80R 5-pin, dual keyway right
K	Ball			S80L 5-pin, dual keyway left
R	Roller	5 BSE 61 Approach direction lateral, 90° to mounting surface	FE 90...250 V AC/DC (for BSE 61)	
L	Roller bearing	6 BSE 85 Approach direction longitudinal, parallel to mounting surface	FC 24...28 V DC (for BSE 85)	
E	Chisel with wiper plate	7 BSE 85 Approach direction lateral, 90° to mounting surface		

X####

Unique number to indicate special configuration, such as custom pre-wired connector
(blank = standard assembly)

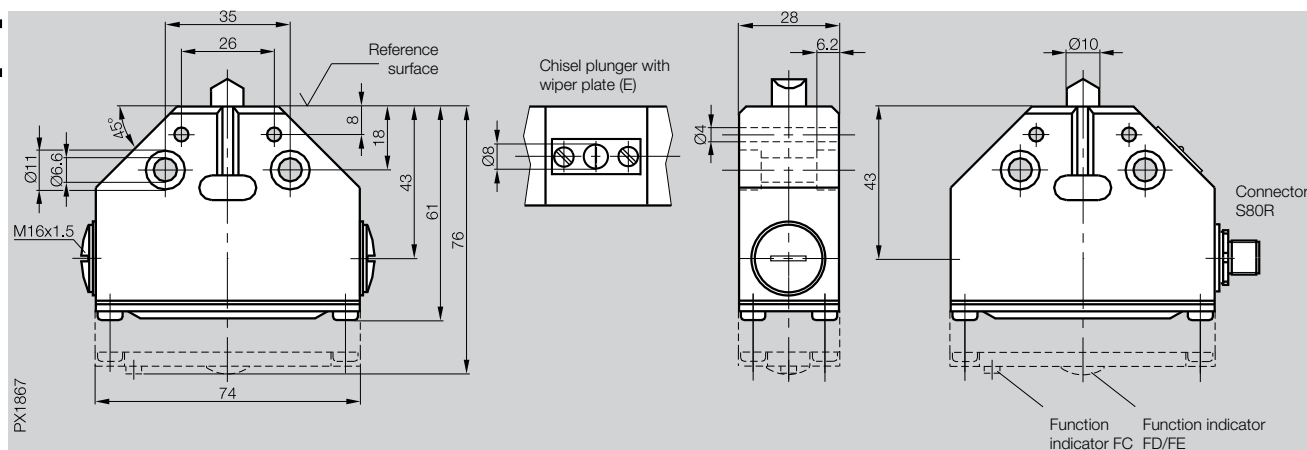
X512

Hardened aluminum bushing

Note:
Flip switch over for connector on left side.



Type	Single position switch with positive-opening contacts
Mounting and function dimensions	per DIN 43693



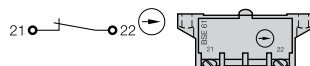
Plunger style	Chisel (D), Ball (K), Roller (R), Roller bearing (L) or Chisel with wiper plate (E)
Plunger material	Stainless steel, contact surfaces induction hardened
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	M16x1.5 for cable gland or connector
Ambient temperature range	-5...+85 °C
Degree of protection per IEC 60529	IP 67
Function indicator	LED 6...60 V AC/DC (FD), 90...250 V AC/DC (FE) or 24...28 V DC (FC)

With switch element

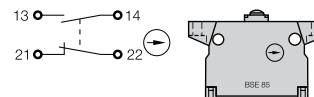
Part number

Wiring diagram, style

BSE 61 per
DIN EN 60204-1/VDE 0113
BNS 813-F -60-**183/185**- - - -



BSE 85 to
DIN EN 60204-1/VDE 0113
BNS 813-F -60-**186/187**- - - -

**Switch element**

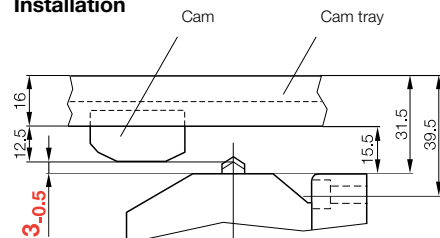
Contact material	Silver
Switching principle	Creep switch, positive-opening
Contact system	Normally-closed, double interruption

Electrical data

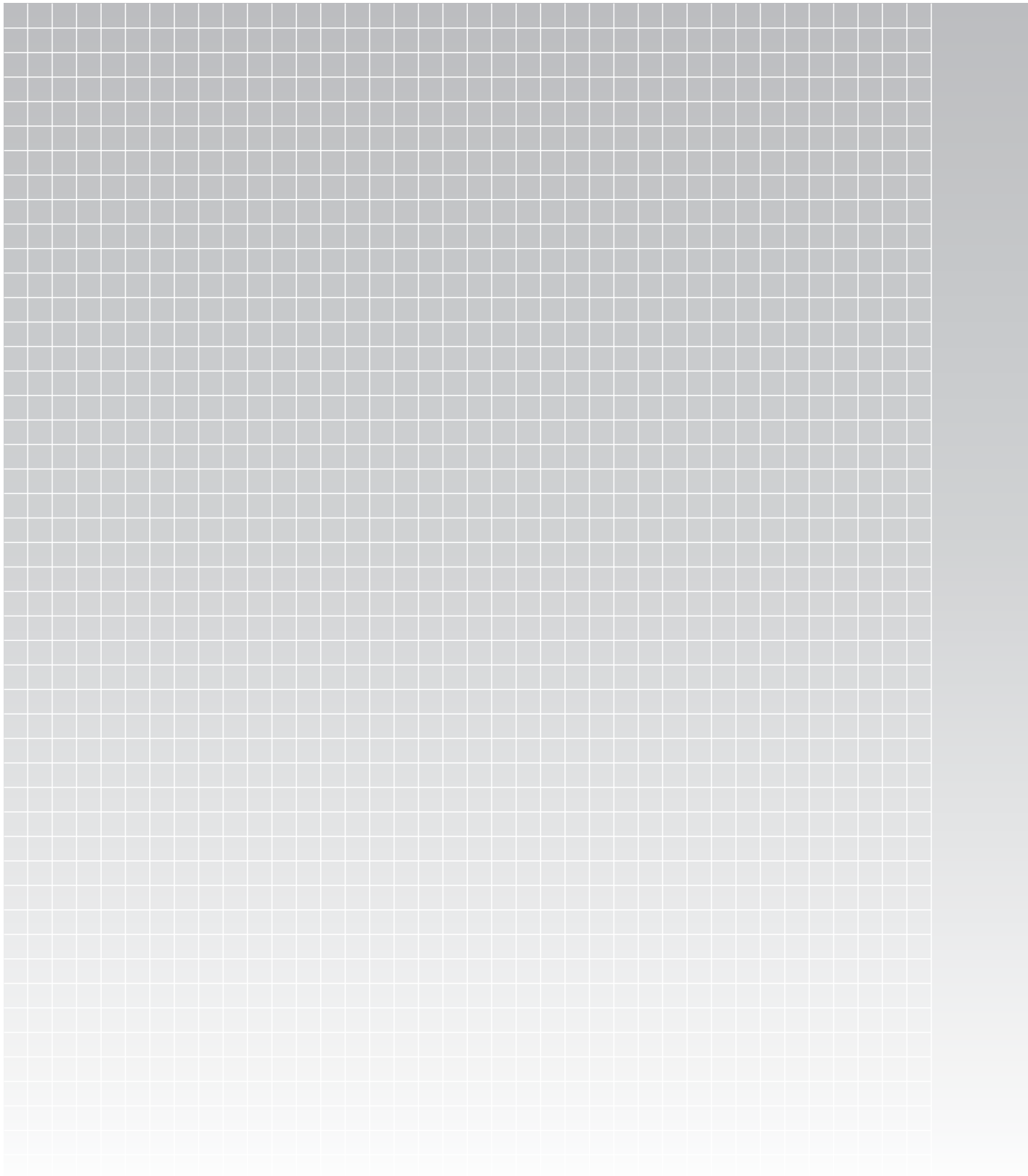
see page 15.2

Mechanical data

Plunger point to reference surface	8 mm	8 mm
Switchpoint to reference surface	7 mm	4.5 mm
Maximum plunger travel	4 mm	6.5 mm
Assured opening after plunger travel	2.5 mm	2.5 mm
Switching actuating force on plunger	min. 15 N	min. 30 N
Switching frequency	max. 300/min	max. 160/min
Approach speed	Plunger D 40 m/min	40 m/min
	Plunger E 30 m/min	30 m/min
	Plunger K 10 m/min	10 m/min
	Plunger R 60 m/min	60 m/min
	Plunger L 120 m/min	80 m/min
Repeatability	Plunger D,E,K ± 0.002 mm	± 0.02 mm
	Plunger R, L ± 0.01 mm	± 0.02 mm

Installation**Note!**

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



Mechanical Switches

Contents

Series 99/100 Single Position Switches

- Miniature single position limit switch
- Miniature switch elements
- Switch elements for low power
- Selectable approach axis

8.2 Standard 819

8.4 Safety 813

Series 99 & 100

8



Mechanical Switches

Series 99 and 100

Single Position

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

- Available with chisel plunger only
- Use in wet areas with adhering media
- Use in dry areas with small chip presence
- Prevents plunger from sticking in the guide

Switching elements for low-current applications

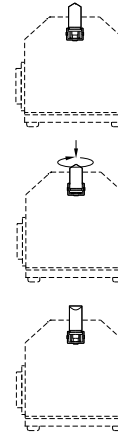
Snap switch elements BSE 73.1 or BSE 74.1 have specially formed gold contacts making them suitable for low currents ≥ 10 mA.

Connection variants

- Thread for cable gland M12x1.5 for series 99, Thread for cable gland M16x1.5 for series 100 (gasketed plugs included)
- Connector (note permissible operating voltage for the connectors, see page 15.16)

Approach from two directions possible (parallel or perpendicular)

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



Ordering example:

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

BNS 819-X####- -1- -

X####

Unique number to indicate special configuration, such as custom pre-wired connector

(blank = standard assembly)

X512

Hardened aluminum bushing

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

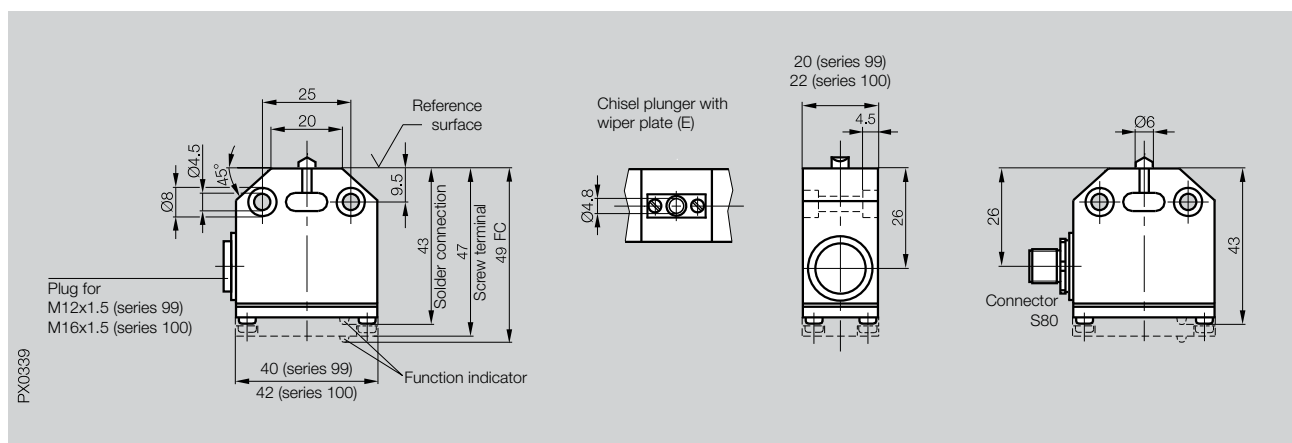
See page 15.14 for connector options

optional Connector

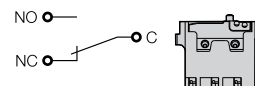
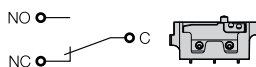
S4 4-pin
S80 5-pin, dual keyway



Type	Single position switch



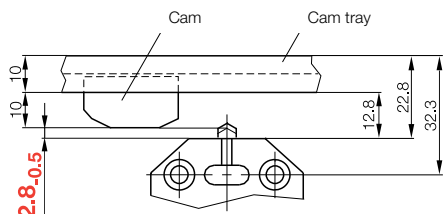
Plunger style	Chisel (D), Ball (K), Roller (R) or Chisel with wiper plate (E)
Plunger material	Stainless steel, contact surfaces induction hardened
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	Cable gland (M12x1.5 series 99, M16x1.5 series 100) or connector
Ambient temperature range	-5...+85 °C
Degree of protection per IEC 60529	IP 67
Function indicator	LED 24...28 V DC (FC)
With switch element	
Part number	BSE 69.1 BNS 819-99/100- -10 BSE 73.1 BNS 819-99/100- -12 BSE 70.1 BNS 819-99/100- -11 BSE 74.1 BNS 819-99/100- -13
Wiring diagram, style	



Switch element				
Contact material	Silver	Gold	Silver	Gold
Switching principle	Snap switch	Snap switch	Snap switch	Snap switch
Contact system	Single-pole changeover	Single-pole changeover	Single-pole changeover	Single-pole changeover
Connection type	Solder connection	Solder connection	Screw terminal	Screw terminal
Electrical data	see page 15.3	see page 15.3	see page 15.3	see page 15.3

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

Installation



Note!

To ensure switching function, the dimension 2.8_{-0.5} is especially critical.

Mechanical Switches

Series 99 and 100

Safety Single Position

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
- Available with chisel plunger only

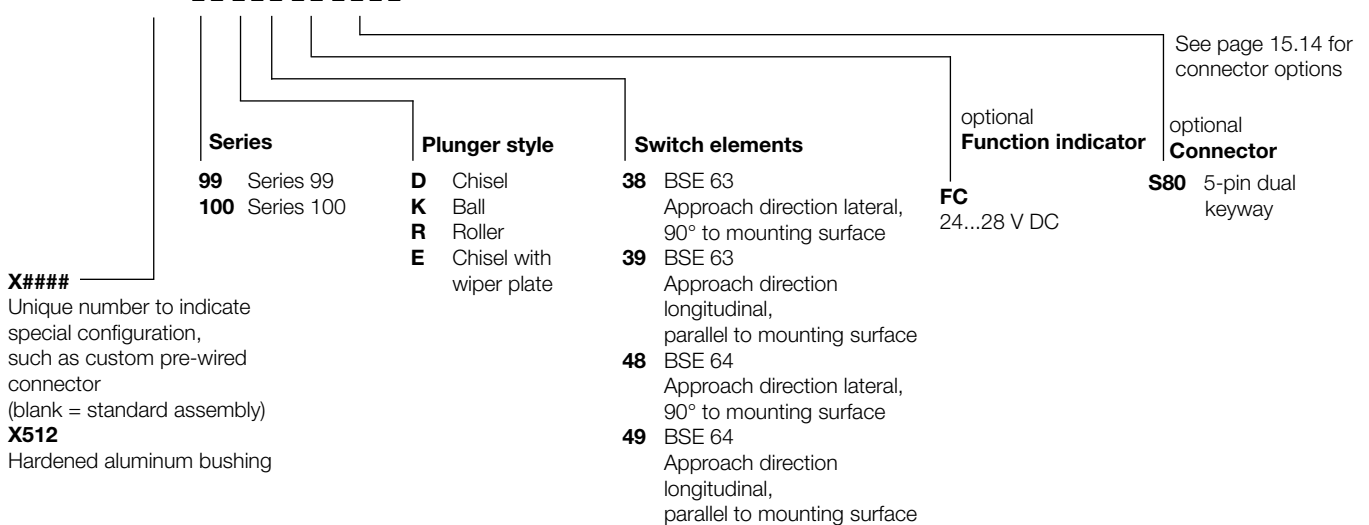
Connection options

- Thread for cable gland M12×1.5 for Series 99, Thread for cable gland M16×1.5 for Series 100 (gasketed plugs included)
- Connector (note permissible operating voltage for the connectors, see page 15.16)

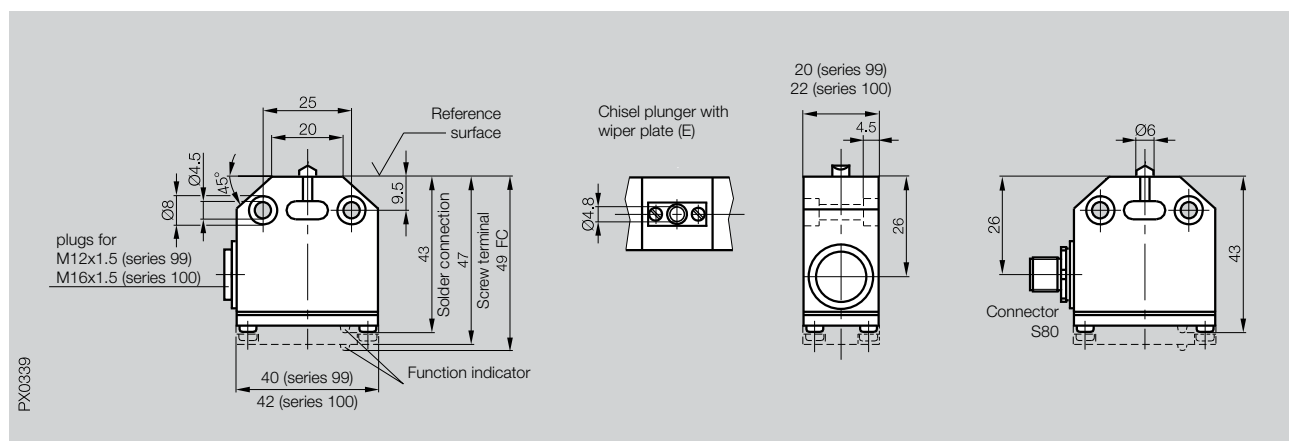
Ordering example:

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

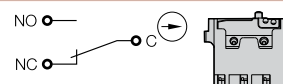
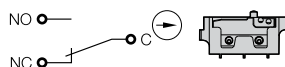
BNL 813-X####-



Type	Single position switch with forced opening contacts



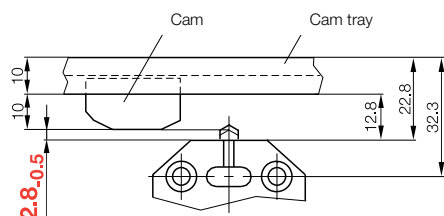
Plunger style	Chisel (D), Ball (K), Roller (R) or Chisel with wiper plate (E)
Plunger material	Stainless steel, contact surfaces induction hardened
Housing material	Cast aluminum, corrosion-resistant, anodized finish
Connection type	Cable gland (M12x1.5 series 99, M16x1.5 series 100) or connector
Ambient temperature range	-5...+85 °C
Degree of protection per IEC 60529	IP 67
Function indicator	LED 24...28 V DC (FC)
With switch element	
Part number	BSE 63 BNS 813-99/100- -3 - - - BSE 64 BNS 813-99/100- -4 - - -
Wiring diagram, style	



Switch element		
Contact material	Silver	Silver
Switching principle	Snap switch	Snap switch
Contact system	Single-pole change-over, NO with snap function, NC with forced opening	Single-pole change-over, NO with snap function, NC with forced opening
Connection type	Solder connection	Screw terminal
Electrical data	see page 15.3	see page 15.3

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

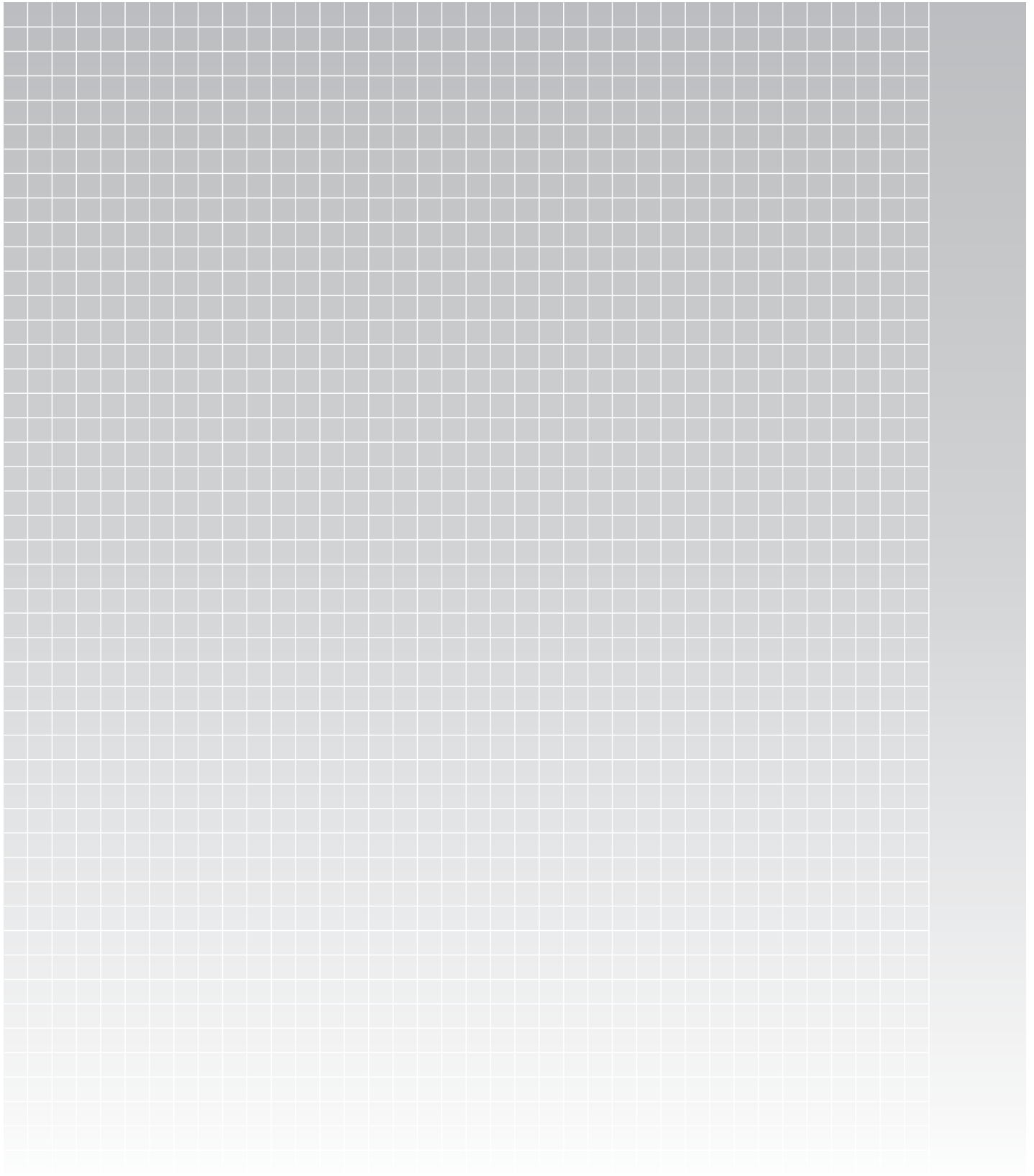
Installation



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



Mechanical Switches



Mechanical Switches

Contents

Series H2 and H3 Single Position Switches

- Miniature single position inductive
- PNP and NPN
- Complementary

9.2 Inductive

Series H2 & H3

9



Mechanical Switches

Series H2 and H3

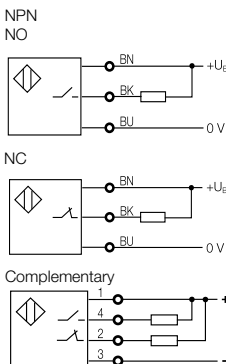
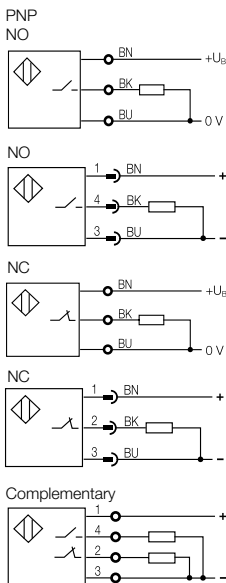
These series offer the combined advantages of the inductive system with the benefits of our mechanical housing series for position switches.

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

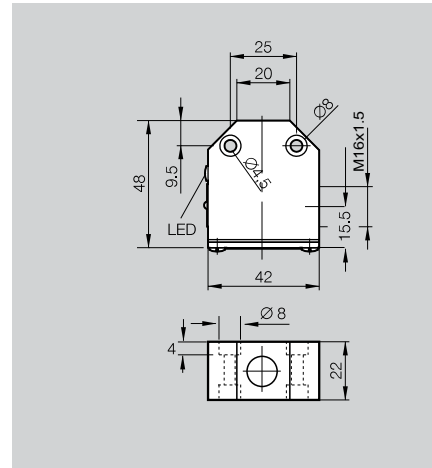
Features

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

Wiring diagrams



Housing Size	42x48x22
Mounting	flush
Rated Operating Distance s_n	5 mm
Assured Operating Distance s_a	0...4 mm



PNP	Normally-open	BES 516-346-H2-Y
	Normally-closed	BES 516-341-H2-Y
	Complementary	
NPN	Normally-open	BES 516-344-H2-Y
	Normally-closed	
	Complementary	

Rated Operational Voltage U_e	24 Vdc
Supply Voltage U_B	10...30 Vdc
Voltage Drop U_d at I_e	≤ 3.5 V
Rated Insulation Voltage U_i	250 Vac
Load Current Capacity	130 mA
Current Consumption (closed/open)	≤ 25 mA/ ≤ 15 mA
Off-state Current I_r	≤ 80 μ A
Protected Against Polarity Reversal	yes
Short Circuit Protected	yes
Load Capacitance	≤ 1.0 μ F
Repeat Accuracy R	≤ 5 %
Ambient Temperature Range T_a	-25...+70 °C
Operating Frequency f	500 Hz
Function/Supply Voltage Indication	yes/—
Degree of Protection per IEC 60529	IP 67
Housing Material	aluminum alloy
Material of Sensing Face	PA 12
Connection	screw terminals
Recommended Connector	

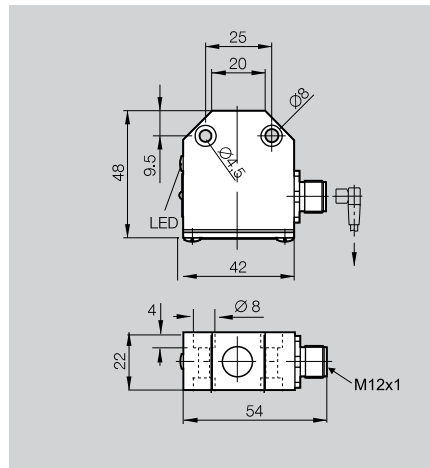
Other cable lengths and jacket materials may be available. Additional models may also exist. Refer to company website for details.

Mechanical Switches

Series H2 and H3

Series H2 & H3

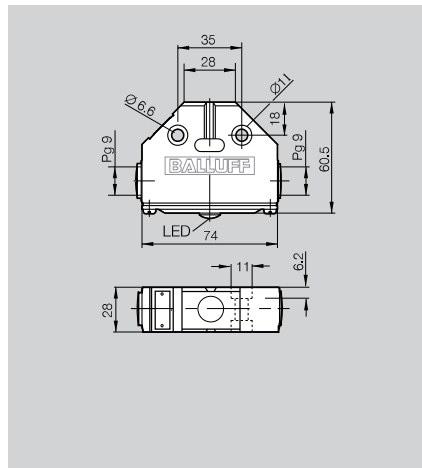
42×48×22
flush
5 mm
0...4 mm



BES 516-346-H2-Y-S4
BES 516-341-H2-Y-S4

24 Vdc
10...30 Vdc
≤ 3.5 V
75 Vdc
130 mA
≤ 25 mA/≤ 12 mA
≤ 80 µA
yes
yes
≤ 1.0 µF
≤ 5 %
-25...+70 °C
500 Hz
yes/—
IP 67
aluminum alloy
PA 12
connector
BCC M415-0000-1A-003-VX44T2-050

60.5×74×28
flush
7 mm
0...5.7 mm



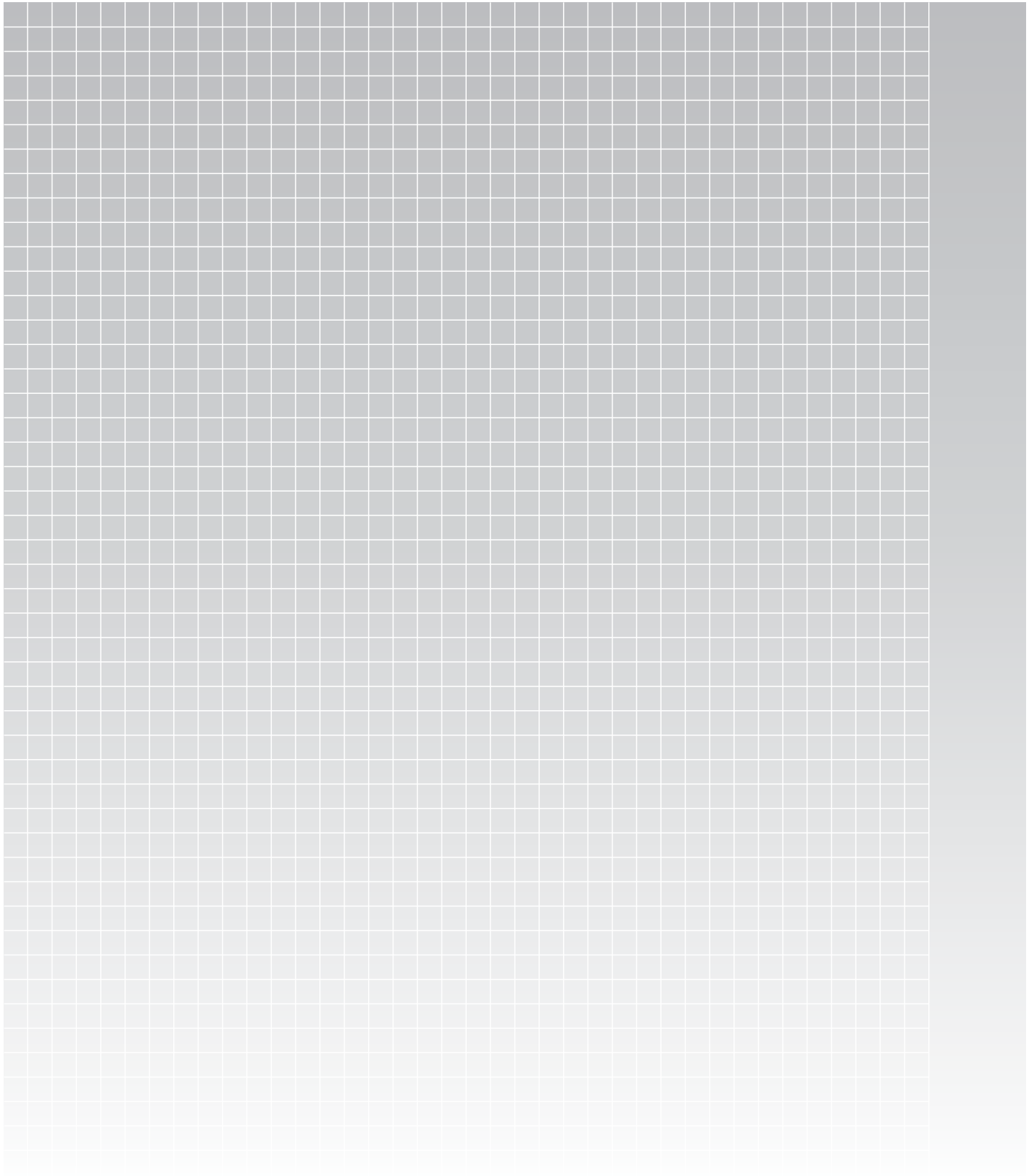
BES 516-161-H3-L

24 Vdc
10...30 Vdc
≤ 1.5 V
75 Vdc
400 mA
≤ 30 mA/≤ 20 mA
≤ 130 µA
yes
no
≤ 1.0 µF
≤ 5 %
-25...+70 °C
300 Hz
yes/—
IP 67
aluminum alloy
PA 12
screw terminals





Mechanical Switches



Mechanical Switches

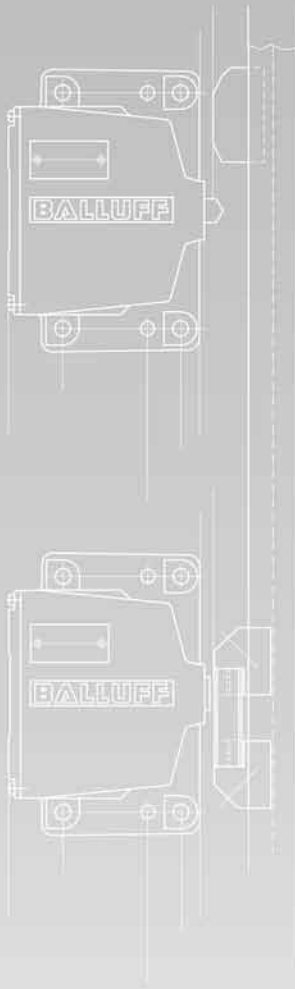
Contents

Mixed Assembly

- 10.2 Multiple position switches with mechanical and inductive switch positions

Mixed Assembly

10



Mechanical Switches

Mixed Assembly

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:

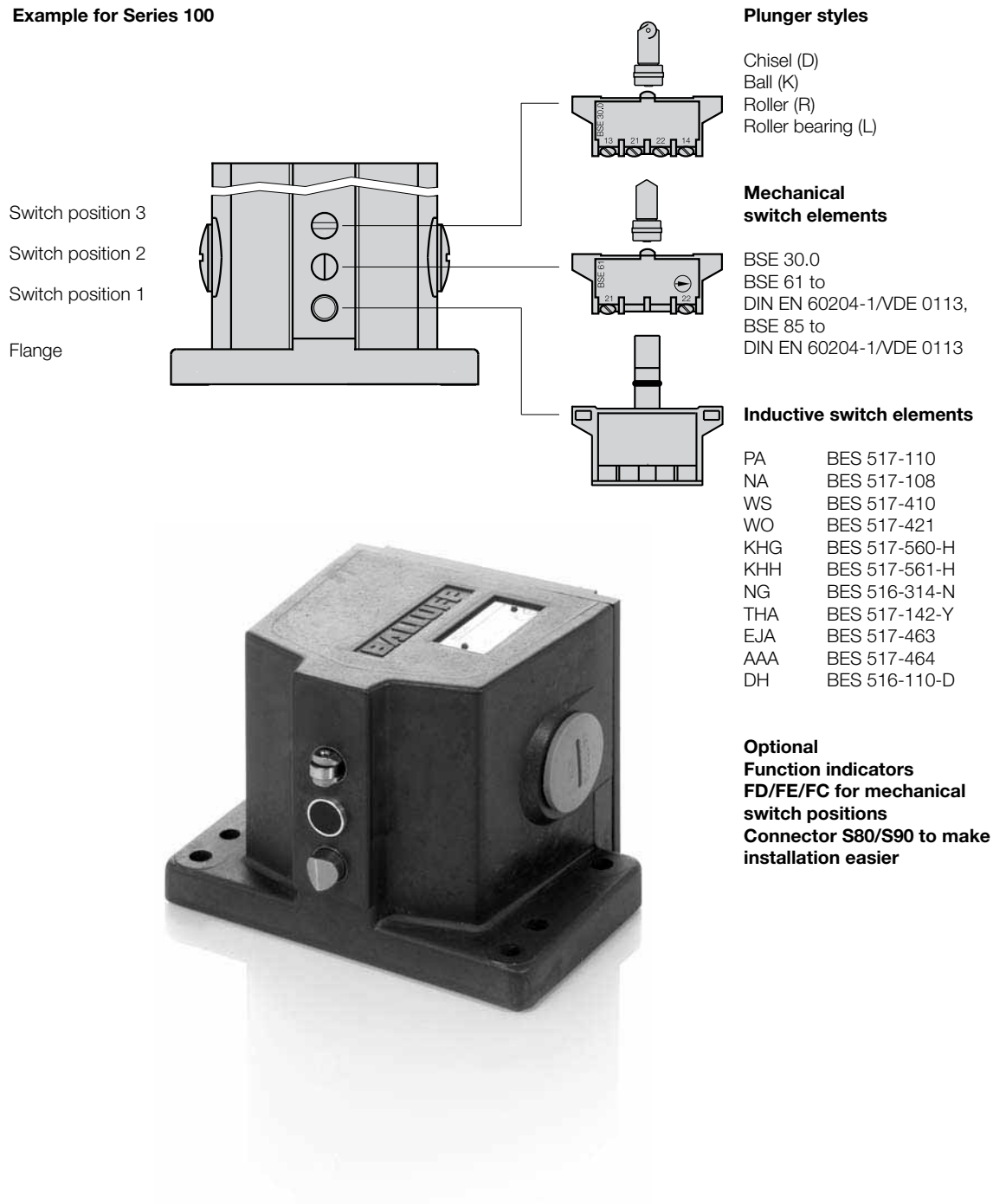
- Mechanical switch element actuated with telescoping plunger
- Safety switch element per DIN EN 60204-1/VDE 0113 actuated with rigid plunger
- Inductive switch element

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



Note for standard series

The standard versions are described in:

Section 1
Mechanical Single and Multiple
Position Switches

Section 2
Inductive Single and Multiple

Position Switches

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

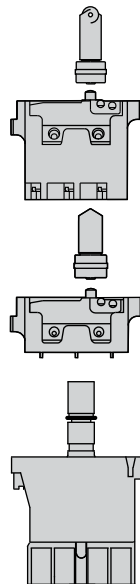
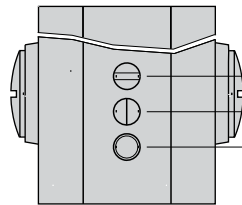
Section 5
Mechanical and Inductive Switch

Elements

Section
Principles

Example for Series 40

Switch position 3
Switch position 2
Switch position 1



Plunger styles

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

Mechanical switch elements

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

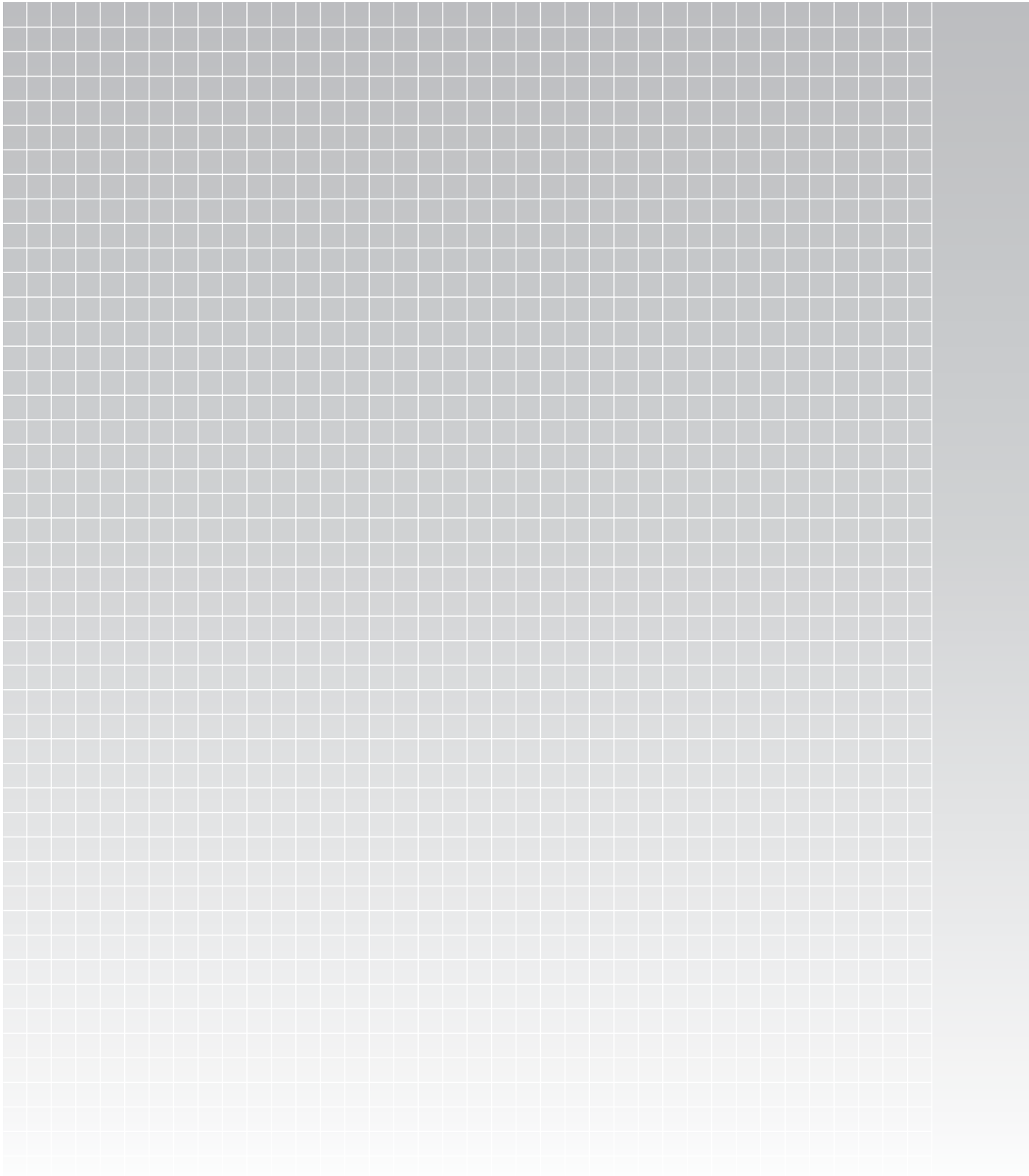
Inductive switch elements

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

Optional

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





Mechanical Switches

Contents

Linear Cam Trays

- 8, 12, and 16 mm spacing
- Aluminum extruded U-channel for drop-in cam installation
- Aluminum extruded T-slot for drop-in captive cam installation
- With or without mounting holes or side flanges

- 11.2 8 mm U-channel without side flanges, with mounting holes
- 11.2 8 mm U-channel with side flanges, with mounting holes
- 11.3 12 mm U-channel with side flanges, with and without mounting holes*
- 11.4 12 mm U-channel without side flanges, with mounting holes*
- 11.4 12 mm U-channel without side flanges, without mounting holes
- 11.5 12 mm T-slot without side flanges, without mounting holes
- 11.5 12 mm T-slot with side flanges, without mounting holes
- 11.6 12 mm T-slot with side flanges, with mounting holes
- 11.6 12 mm T-slot without side flanges, with mounting holes

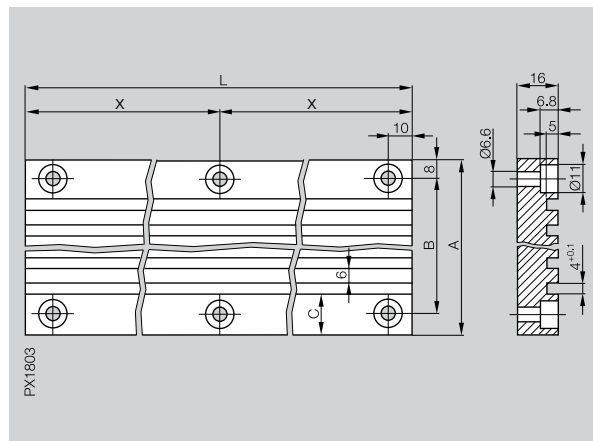
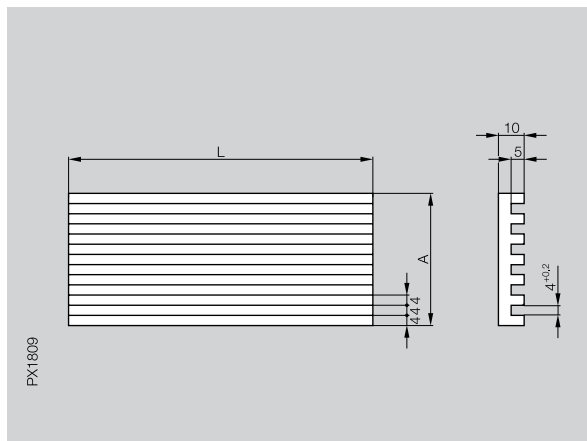
*16 mm versions available



Mechanical Switches

Linear Cam Trays

Type	Aluminum cam trays with 8 mm U-slot spacing w/o side flanges and w/o mounting holes	Aluminum cam trays with 8 mm U-slot spacing w/ side flanges and w/o mounting holes
Cams	BNN 520-81-S-___ or BEN 516-19-___	BNN 520-81-S-___ or BEN 516-19-___
Switches	40, 46, 99/100, 603-11, 650-11	40, 46, 99/100, 603-11, 650-11



Part number	BNL 5304-080-_____-	
-------------	---	--

Cam trays

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

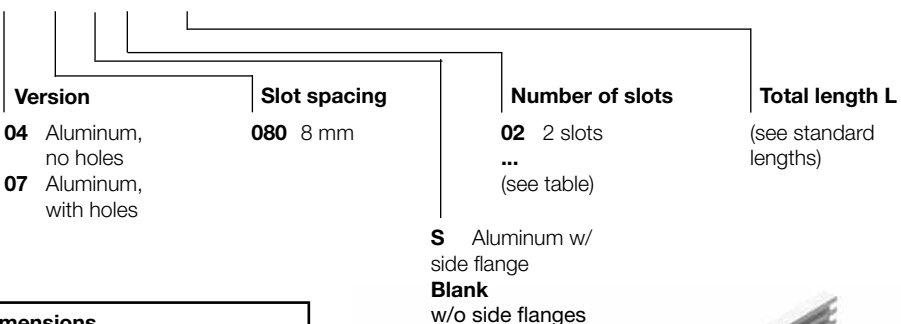
Installation note

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

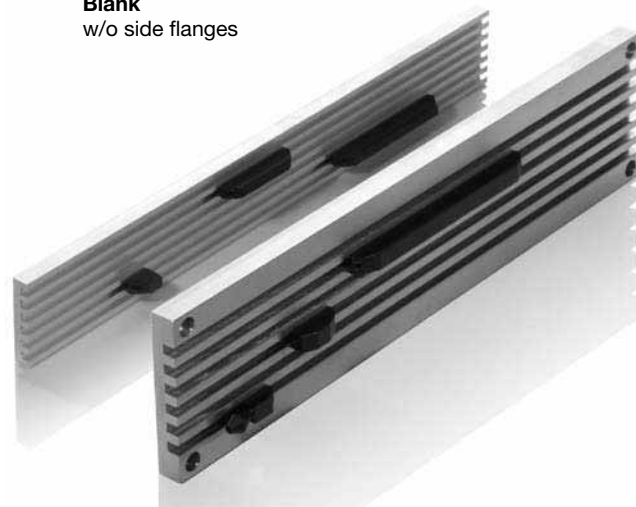
Ordering example:

BNL 5304-080-S04-1000

BNL 53 ___ **-080-** ___ -___



Cam Tray Mounting Hole Dimensions			
Length (L)	0 - 499 mm	500 - 1599 mm	1600 - 2500 mm
Mounting Holes	(4) 2 Rows of 2	(6) 2 Rows of 3	(8) 2 Rows of 4
X Dimension	L - 20 mm	(L - 20 mm) / 2	(L - 20 mm) / 3

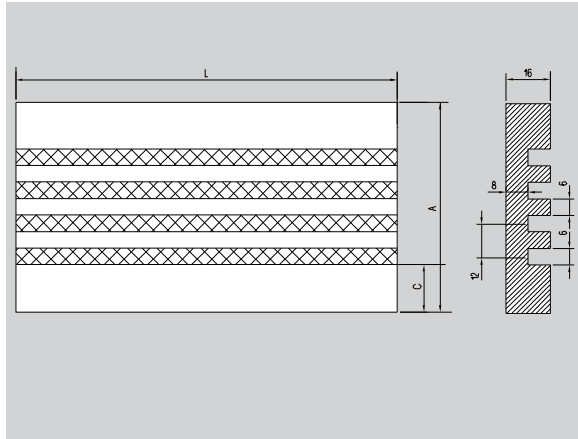


Mechanical Switches

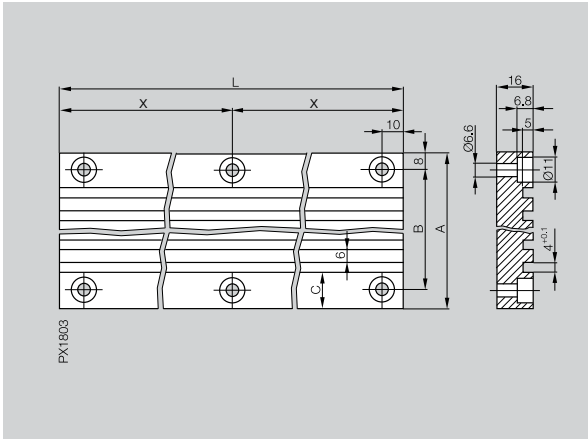
Linear Cam Trays

Linear Cam Trays

Aluminum cam trays with **12 mm** U-slot spacing
w/ side flanges and w/o mounting holes
BNN 520-UA/UB-____ or BEN 516-14-____
61, 62, 72, 100, 602-11, 605-11, 610-11, 611-11, 612-11, 613-11



Aluminum cam trays with **12 mm** U-slot spacing
w/side flanges and w/ mounting holes
BNN 520-UA/UB-____ or BEN 516-14-____
61, 62, 72, 100, 602-11, 605-11, 610-11, 611-11, 612-11, 613-11



BNL 5304-120-S - - - - - without holes

Number of slots	Dimension A
02	50
03	62
04	74
05	86
06	98
08	122

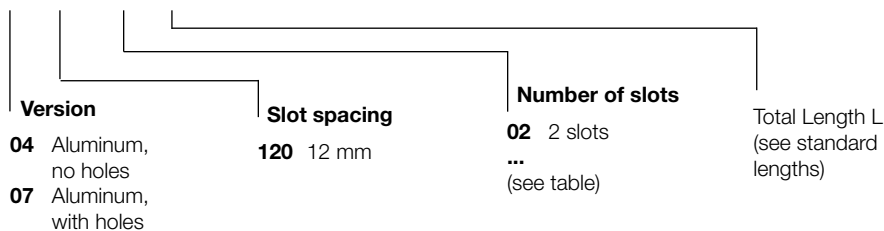
BNL 5307-120-S - - - - - with holes

Number of slots	Dimension A	Dimension B	Dimension C
02	50	34	16
03	62	46	16
04	74	58	16
05	86	70	16
06	98	82	16
08	122	106	16

L = Standard cam tray lengths: 1000, 1500, 2000 or 2500 mm
Special length on request.

Ordering example:
BNL 5304-120-S04-1000

BNL 53 - -120-S - - - - -



Cam Tray Mounting Hole Dimensions			
Length (L)	0 - 499 mm	500 - 1599 mm	1600 - 2500 mm
Mounting Holes	(4) 2 Rows of 2	(6) 2 Rows of 3	(8) 2 Rows of 4
X Dimension	L - 20 mm	(L - 20 mm) / 2	(L - 20 mm) / 3

Technical drawing of a perforated metal sheet. The drawing shows a side view with dimensions L (length) and A (width). The cross-section view shows a series of rectangular holes. The distance between the centers of two adjacent holes is $16 \text{ mm} = 9.85$. The width of each hole is $12 \text{ mm} = 6$. The thickness of the sheet is $e = 0.2$. The distance from the center of a hole to the edge of the sheet is 8.5 . The distance from the edge of the sheet to the center of a hole is $16 \text{ mm} = 9.85$. The distance from the edge of the sheet to the edge of a hole is $12 \text{ mm} = 5.5$.

Technical drawing of the PX1810 profile. The drawing includes a front view and a cross-sectional view.

Front View Dimensions:

- Overall width: 10
- Overall height: A
- Height of the top flange: B
- Height of the bottom flange: C
- Radius of the top flange: 5.5
- Radius of the bottom flange: 6
- Distance between the centers of the top and bottom flanges: 6

Cross-sectional View Dimensions:

- Outer diameter: $\varnothing 6.6$
- Inner diameter: $\varnothing 1.1$
- Thickness of the top flange: 8.5
- Thickness of the bottom flange: 6 ± 0.3

PX1810

A black and white photograph showing two aluminum extrusion profiles. The profiles are L-shaped with multiple longitudinal slots. They are shown from a perspective view, with one profile slightly behind and to the left of the other. Black plastic or metal inserts are visible in some of the slots, and screws are used to secure them. The profiles are set against a plain white background.

Linear Cam Trays

Technical drawing of a corrugated metal profile. The left view is a side elevation showing a corrugated surface with a total length dimension L . The right view is a cross-section showing a Z-shaped profile. Key dimensions for the cross-section include: a top flange width of 16, a top flange thickness of 1.5, a web thickness of 6.2, a web height of 12, a bottom flange width of 9.6, and a total height dimension A . A small dimension ω is indicated at the bottom right of the cross-section.

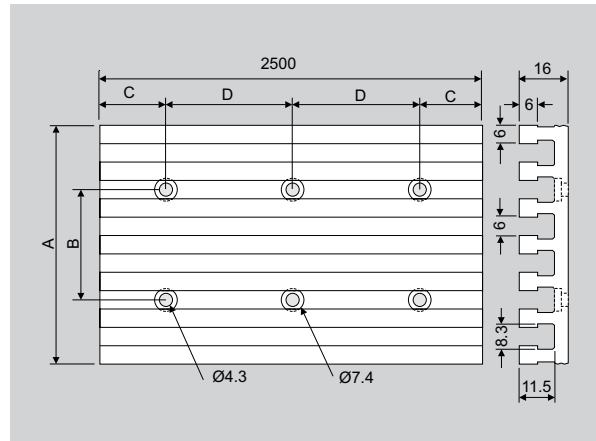
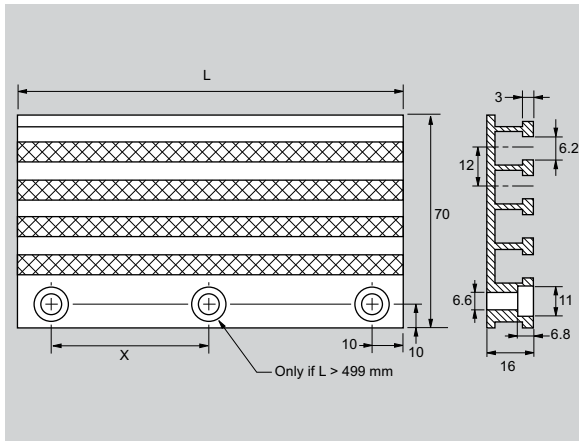
The technical drawing illustrates the dimensions of a composite panel. The front view shows a rectangular panel with a total length labeled as L and a total height of 70. The panel features a series of horizontal layers: a solid top layer, followed by four alternating layers of cross-hatched material and solid material, and a solid bottom layer. The side view shows the profile of the panel, which has a total width of 16. It details the thickness of the individual layers, including a top layer of 3, a hatched layer of 12, and another hatched layer of 6.2.

11

Mechanical Switches

Linear Cam Trays

Type	Aluminum cam trays with 12 mm T-slot spacing w/ side flange and w/ mounting holes	Aluminum cam trays with 12 mm T-slot spacing w/o side flange w/ mounting holes
Cams	BNN 520-TA,TB-____ or BEN 516-13-____	BEN 516-11-1000
Switch	61, 62, 72, 100, 602-11, 605-11, 610-11, 611-11, 612-11, 613-11	61, 62, 72, 100, 602-11, 605-11, 610-11, 611-11, 612-11, 613-11



Part number	BNL 5311-120-S04-____ with holes	BNL 5315-120-____-2500 with holes
	Number of slots	Number of slots
	04	04
		06
		08
Dimensions in mm	L = Standard cam tray lengths: 1000, 1500, 2000 or 2500 mm Special length on request.	Standard cam tray length = 2500 mm

Cam trays

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

Installation note

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

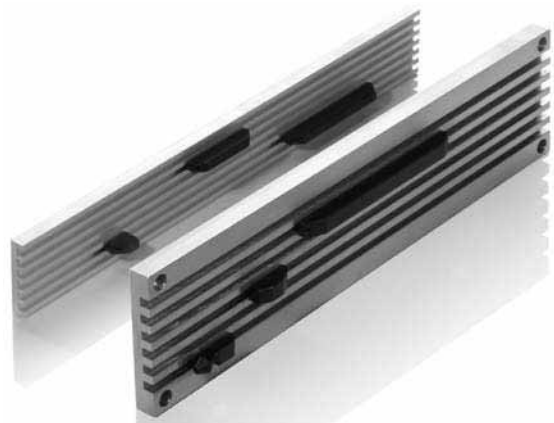
Ordering example:

BNL 5311-120-04-1000

BNL 53 _ _ _ _ _

Version	Slot spacing	Number of slots	Total length L
11 Aluminum w/ side flange w/ mounting holes	120 12 mm	04 4 slots	(see standard lengths)
15 Aluminum w/o flange w/ mounting holes			

Cam Tray Mounting Hole Dimensions			
Length (L)	0 - 499 mm	500 - 1500 mm	1600 - 2500 mm
Mounting Holes	(2) 1 Row of 2	(3) 1 Row of 3	(4) 1 Row of 4
X Dimension	L - 20 mm	(L - 20 mm) / 2	(L - 20 mm) / 3



Mechanical Switches

Contents

Rotary Cam Drums and Trays

- 12 and 16 mm spacing
- Rotary cam drums are machined solid aluminum
- Rotary cam drums are extruded aluminum rolled into a semi-circle
- U-channel for drop-in installation
- T-slot for drop-in captive cam installation

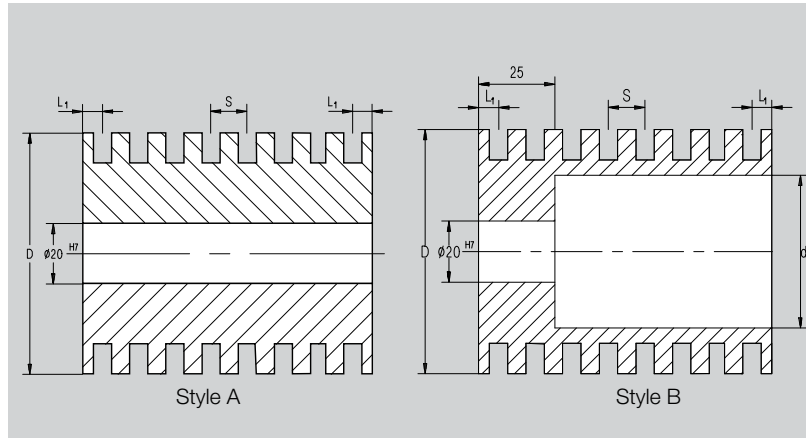
12.2	12 mm U-channel rotary drums*
12.3	12 mm T-slot rotary drums*
12.4	12 mm T-slot rotary cam trays

*16 mm versions available

Mechanical Switches

Rotary Cam Drums

Type	Machined aluminum cam drums with 12 mm U-slot spacing
Cams	BNN UR-
Switch	61, 62, 72, 100, 602-11, 605-11, 610-11, 611-11, 612-11, 613-11



	Style A								Style B							
Part number	BNL URN-12 - - -A								BNL URN-12 - - -B							
	Drum Diameter and Style															
	80		100		150		200		250		320					
Number of Slots	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
01	■		■		■		■		■						■	
02	■		■		■		■		■						■	
03	■		■		■	■	■		■						■	
04	■		■			■		■		■		■			■	
05	■		■			■		■		■		■			■	
06	■		■			■		■		■		■			■	
07	■		■			■		■		■		■			■	
08	■		■			■		■		■		■			■	

Cam Drums

Cam drums are used for holding radial cams.
We offer these in standard diameters.

Notes

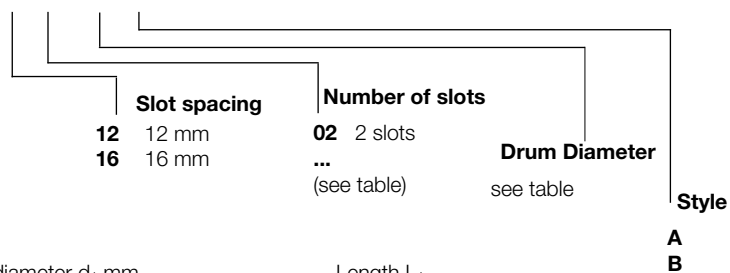
Machined drums are specified by diameter and cams are specified by radius.

Standard drums are furnished with a 20 mm diameter smooth bore (no keyway).

Ordering example:

BNL URN-1204-150-B

BNL URN- - - - -



Inside diameter d₁ mm

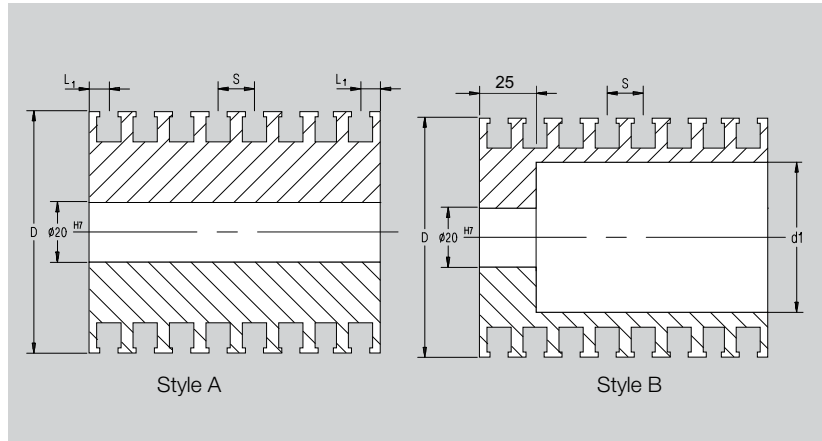
Length L₁

Drum	Diameter	Spacing	Length
80mm	N/A	12mm	7mm
100mm	N/A	16mm	8mm
150mm	120		
200mm	170		
250mm	220		
320mm	290		

Mechanical Switches

Rotary Cam Drums

Type	Machined aluminum cam drums with 12 mm T-slot spacing
Cams	BNN TR-
Switch	61, 62, 72, 100, 602-11, 605-11, 610-11, 611-11, 612-11, 613-11



	Style A								Style B			
Part number	BNL TRN-12 - -A								BNL TRN-12 - -B			
	Drum Diameter and Style											
Number of Slots	80		100		150		200		250		320	
	A	B	A	B	A	B	A	B	A	B	A	B
01												
02	■		■		■		■		■			■
03	■		■		■		■		■			■
04	■		■		■	■	■		■			■
05	■		■			■		■		■		■
06	■		■			■		■		■		■
07	■		■			■		■		■		■
08	■		■			■		■		■		■
	■		■			■		■		■		■

Cam Drums

Cam drums are used for holding radial cams.
We offer these in standard diameters.

Notes

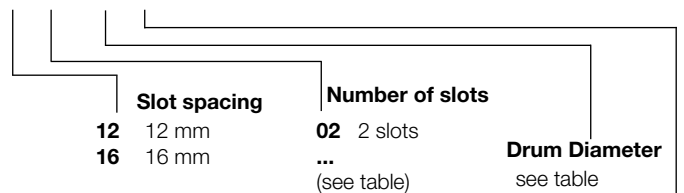
Machined drums are specified by diameter and cams are specified by radius.

Standard drums are furnished with a 20 mm diameter smooth bore (no keyway).

Ordering example:

BNL TRN-1204-150-B

BNL TRN- - - -



Style
A
B

12

Inside diameter d₁ mm

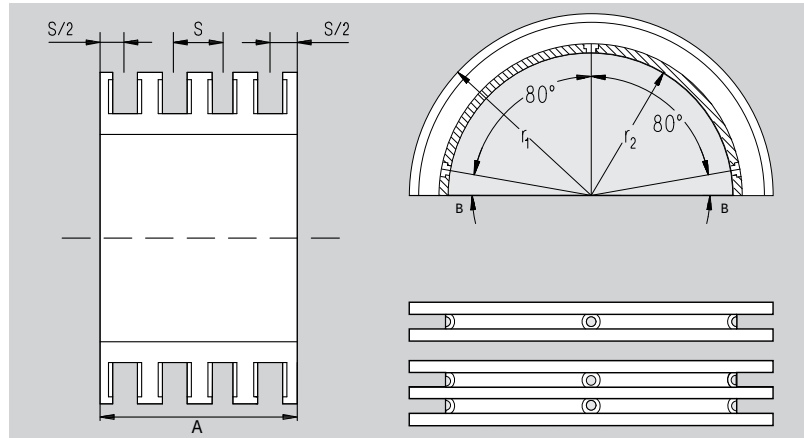
Length L₁

Drum	Diameter	Spacing	Length
80mm	N/A	12mm	7mm
100mm	N/A	16mm	8mm
150mm	120		
200mm	170		
250mm	220		
320mm	290		

Mechanical Switches

Rotary Cam Drums

Type	Aluminum cam trays with 12 mm T-slot spacing, extruded semicircle
Cams	BEN 516-17, BNN 520-R, or BNN 550-R
Switch	61, 62, 72, 100, 602-11, 605-11, 610-11, 611-11, 612-11, 613-11



Part number	BNL LAH-12 _ _ _ _ -B			
Number of Slots	Dimension A	Outside Radius r1	Inside Radius r2	Hole Center
02	24	75	59	12
04	48	100	84	36
06	72	125	109	36
08	96	160	144	36
		250	234	60
		395	379	
		400	384	
		450	434	
		545	529	

Special radius on request, quantities may be required.

Mounting hole locations - B

Less than 250 mm radius = 10°, 90°, 170°

Greater than 250 mm radius = 6°, 90°, 174°

Number of mounting holes

01 channel = 1 row of 3

02, 04, 06, 08 channels = 2 rows of 3

Cam Drum Halves

Cam drums are used for holding radial cams.

We offer these in standard diameters.

Note

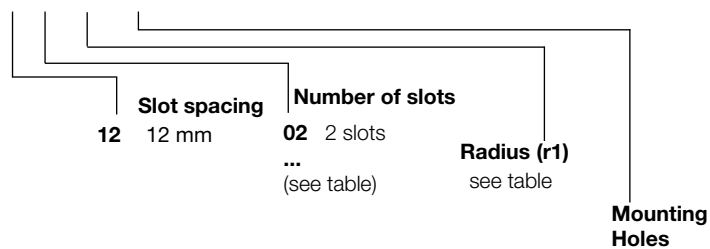
Drum halves are specified by cam radius and cams are specified by radius.

M4 button head screws are required for mounting.

Ordering example:

BNL LAH-1206-395-B

BNL LAH-12 _ _ _ _ -B



Mechanical Switches

Contents

Linear Trip Cams

- Mechanical contact or inductive non-contact
- U-channel mounts by friction wedges for drop-in cam installation
- T-slot mounts by T-nuts or pressure plates for drop-in captive installation
- Single piece with single set screw for very short lengths
- Single piece with two set screws for intermediate lengths
- Modular U-channel or T-slot end ramps for longer custom lengths

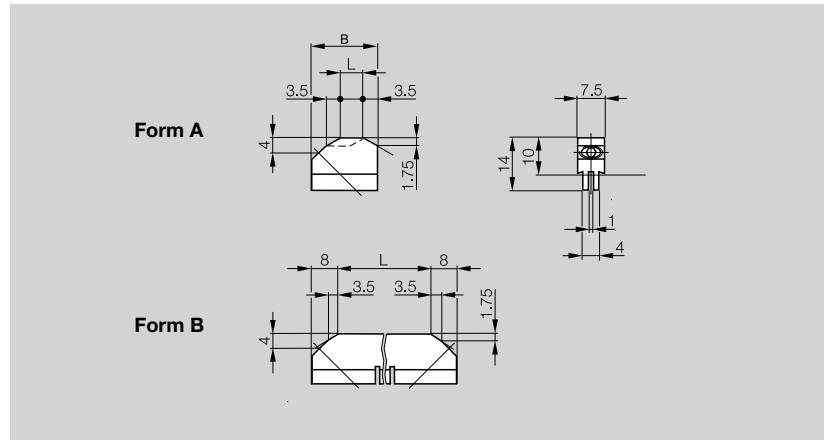
13.2	8 mm U-channel mechanical
13.3	12 mm U-channel mechanical
13.4	12 mm T-slot mechanical
13.5	12 mm U-channel or T-slot modular mechanical
13.6	12 mm U-channel mechanical precision
13.7	12 mm T-slot modular inductive
13.9	8 mm U-channel inductive
13.9	12 mm T-slot inductive
13.9	12 mm U-channel inductive

Linear Trip Cams



13

Type	BNN 520-81-S-
Cams	BNL 5304-080-... or BNL 5307-080 U-slot cam trays
Switch	40, 46, 99/100



Form A - Single set screw		L	B
Part number	BNN 520-81-S-0	0	18
	BNN 520-81-S-6.5	6.5	18
	BNN 520-81-S-10	10	21.5

Form B - Twin set screw		L	B
Part number	BNN 520-81-S-20	20	36
	BNN 520-81-S-25	25	41
	BNN 520-81-S-30	30	46
	BNN 520-81-S-40	40	56
	BNN 520-81-S-48	48	64
	BNN 520-81-S-60	60	76
	BNN 520-81-S-80	80	96
	BNN 520-81-S-100	100	116
	BNN 520-81-S-145	145	161
	BNN 520-81-S-200	200	216
	BNN 520-81-S-250	250	266
	BNN 520-81-S-440	440	416

Dimensions in mm

L = Length of switching surface.
Additional lengths on request.
Quantities may be required.

Material:

Steel with hardened and burnished surface. HRC 61+2

Installation:

As the screw is tightened, the lower portion of the cam spreads apart holding the cam firmly in place.

Replacement Set Screw:

GEW-STIFT M6x14-701533

Note!

Cams used in safety applications must be permanently secured to the cam tray.

Ordering example:

BNN 520-81-S-25

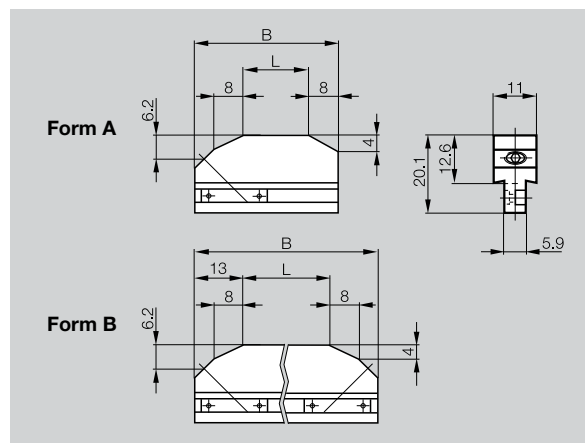
BNL 520-81-S- _ _ _

U channel
8 mm spacing

Actuation Length
See Table



Type	BNN 520-UA-... , BNN 520-UB-... per DIN 69639
Cams	BNL 5304/5307-120/160-... BNL 5315 U-slot
Switch	61, 62, 72, 100, 602-11, 605-11, 610-11, 611-11, 612-11, 613-11



Dimensions in mm

L = Length of switching surface.
Additional lengths on request.
Quantities may be required.

Material:

Steel with hardened and burnished surface. HRC 61+2

Installation:

Tightening the screw causes the pressure plate to press against the side of the cam tray channel, securing the cam in the cam tray.

Replacement Set Screw:

GEW-STIFT M6x14-701533

For safety applications, use self threading screw:

SCHNEIDSHR.D7513-M4x20 ST-BE-718329

Note!

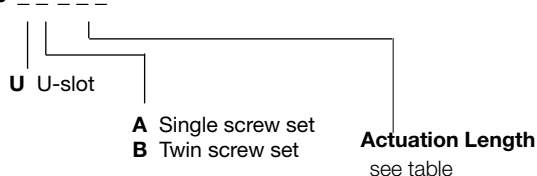
Cams used in safety applications must be permanently secured to the cam tray.

Form A		L	B
Part number	BNN 520-UA-0	0	21
	BNN 520-UA-4	4	25
	BNN 520-UA-10	10	31
	BNN 520-UA-16	16	37
Form B		L	B
Part number	BNN 520-UB-25	25	51
	BNN 520-UB-30	30	56
	BNN 520-UB-40	40	66
	BNN 520-UB-50	50	76
	BNN 520-UB-63	63	89
	BNN 520-UB-80	80	106
	BNN 520-UB-100	100	126
	BNN 520-UB-120	120	146
	BNN 520-UB-130	130	156
	BNN 520-UB-140	140	166
	BNN 520-UB-150	150	176
	BNN 520-UB-160	160	186
	BNN 520-UB-180	180	206
	BNN 520-UB-185	185	211
	BNN 520-UB-190	190	216
	BNN 520-UB-200	200	226
	BNN 520-UB-225	225	251
	BNN 520-UB-250	250	276
	BNN 520-UB-300	300	326
	BNN 520-UB-350	350	376
	BNN 520-UB-400	400	426
	BNN 520-UB-450	450	476
	BNN 520-UB-480	480	506
	BNN 520-UB-500	500	526
	BNN 520-UB-600	600	626
	BNN 520-UB-650	650	676
	BNN 520-UB-700	700	726
	BNN 520-UB-800	800	826
	BNN 520-UB-1000	1000	1026
	BNN 520-UB-1100	1100	1126
	BNN 520-UB-1200	1200	1226
	BNN 520-UB-1300	1300	1326

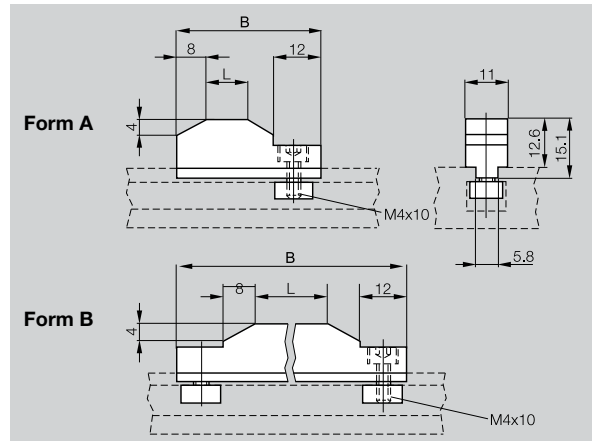
Ordering example:

BNN 520-UB-100

BNL 520- - - -



Type	BNN 520-TA-___, BNN 520-TB-___ per DIN 69639
Use w/switch spacing	BNL 5310-120-... BNL 5311 T-slot cam trays
Use w/cam tray	61, 62, 72, 100, 602-11, 605-11, 610-11, 611-11, 612-11, 613-11



Dimensions in mm

L = Length of switching surface.
Additional lengths on request.
Quantities may be required.

Material:

Steel with hardened and burnished surface. HRC 61+2

Installation:

Tightening the screw causes the plate to raise, sandwiching the T-flange between the cam and the plate, securing the cam to the cam tray.

Replacement Set Screw:

GEW-STIFT M6x14-701533

For safety applications, use self threading screw:

SCHNEIDSHR.D7513-M4x20 ST-BE-718329

Note!

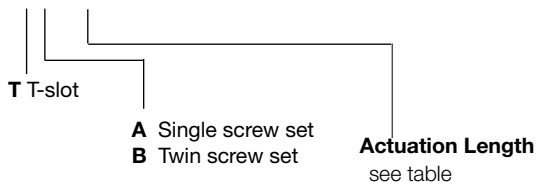
Cams used in safety applications must be permanently secured to the cam tray.

Form A - Single set screw		L	B
Part number	BNN 520-TA-0	0	28
	BNN 520-TA-4	4	32
	BNN 520-TA-10	10	38
	BNN 520-TA-16	16	44
Form B - Twin set screw		L	B
Part number	BNN 520-TB-25	25	65
	BNN 520-TB-40	40	80
	BNN 520-TB-63	63	103
	BNN 520-TB-80	80	120
	BNN 520-TB-100	100	140
	BNN 520-TB-120	120	160
	BNN 520-TB-150	150	190
	BNN 520-TB-200	200	240
	BNN 520-TB-250	250	290
	BNN 520-TB-300	300	340
	BNN 520-TB-380	380	420
	BNN 520-TB-500	500	540
	BNN 520-TB-600	600	640
	BNN 520-TB-790	790	830
	BNN 520-TB-1000	1000	1040
	BNN 520-TB-1200	1200	1240

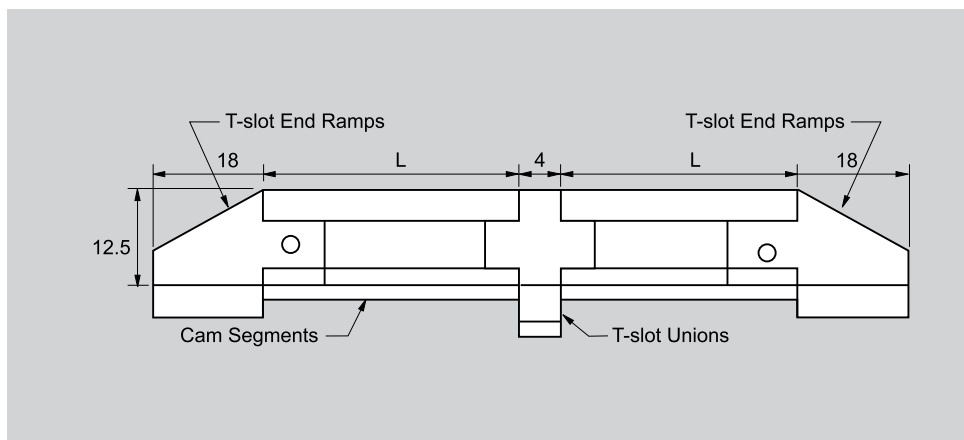
Ordering example:

BNN 520-TB-100

BNL 520-_-_-_-



Type	Modular end ramps	Modular T-slot unions	Modular Cams
Switches	61, 62, 72, 100, 602-11, 605-11	610-11, 611-11, 612-11, 613-11	



Use with cam tray:			
BNL 5310/11 T-slot	BNN MTE-012	BNN HNT	
BNL 5315 T-slot	BNN MTE-012	BNN HNAU	
BNL 5304/07, 5315 U-slot	BNN MUE-012		
			L
			BNN ZN-0025-12 25
			BNN ZN-0040-12 40
			BNN ZN-0063-12 63
			BNN ZN-0080-12 80
			BNN ZN-0100-12 100
			BNN ZN-0140-12 140
			BNN ZN-0224-12 224
			BNN ZN-0250-12 250
			BNN ZN-0350-12 350
			BNN ZN-0400-12 400
			BNN ZN-0500-12 500
			BNN ZN-0650-12 650
			BNN ZN-0700-12 700
			BNN ZN-0800-12 800
			BNN ZN-0960-12 960
			BNN ZN-1000-12 1000

U-slot Installation:

Tightening the screw causes the pressure plate to press against the side of the cam tray channel, securing the cam to the cam tray.

T-slot Installation:

Tightening the screw causes the plate to raise and sandwich the t-flange between the cam and the plate, securing the cam to the cam tray.

Replacement Mounting Shoe for T-slot and End Ramp
(includes T-block, screw, and spring)

BNN MTE-012-12

Replacement Mounting Shoe for U-slot and End Ramp
(includes U-block, screw, and spring)

BNN MUE-012-12

Note:

Cam assembly must be terminated with an end ramp on both ends.

Cams used in safety applications must be permanently secured to the cam tray. For safety applications, use self threading screw: SCHNEIDSHR.D7513-M4x20 ST-BE 718329.

Dimensions in mm.

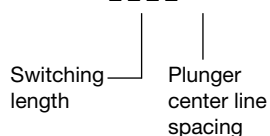
L = Length of switching surface.

Additional lengths on request (quantities may be required).

Material: Hardened steel

Ordering example:

BNL ZN- - - -12

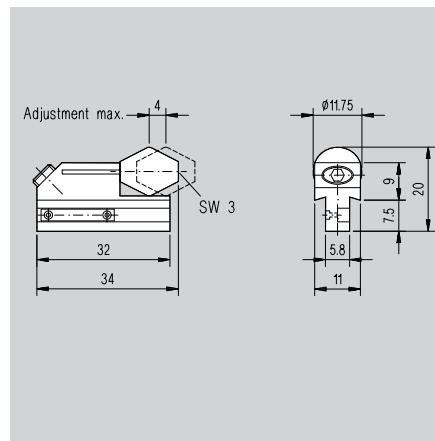
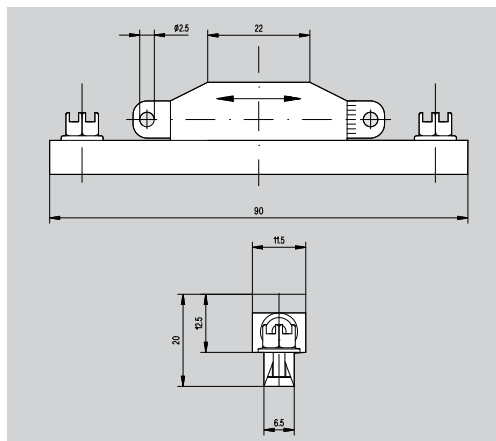


Mechanical Switches

Linear Cams

Precision Mechanical Cams

Type	Precision adjustment cam	Precision adjustment cam
Cam trays	BNL 5304/5307-120/160, 5315	BNL 5304/5307-120/160, 5315
Switches	61, 62, 72, 100	61, 62, 72, 100



Part number	BNN 520-X-041	BNN 520-120-V
-------------	---------------	---------------

Linear cam with precision adjustment with 2.5 mm diameter pin (not included). Maximum adjustment on both sides is 5.5 mm (11 mm total). Scale has 25 graduations (1 grad = .02 mm).

Use with 12 mm and 16 mm switch spacing.

Linear cam with precision adjustment with hex wrench (not included). Maximum adjustment on both sides is 2 mm (4 mm total).

Use with 12 mm and 16 mm switch spacing.

Type	BEN 516-11
Cam tray	BNL 5315
Switches	602-11, 605-11, 610-11, 611-11, 612-11, 613-11

Non-contact Inductive Cam	
Part Number	BEN 516-11-1000
Non-contact Linear End Ramp (two required for segment)	
Part Number	BEN 516-16-12.5-00

Installation:

BEN516-11

Insert end ramps into each end of linear cam. Position cam segment into BNL 5315 cam. As the set screw is tightened, the threads will grip into the T-slot side flange.

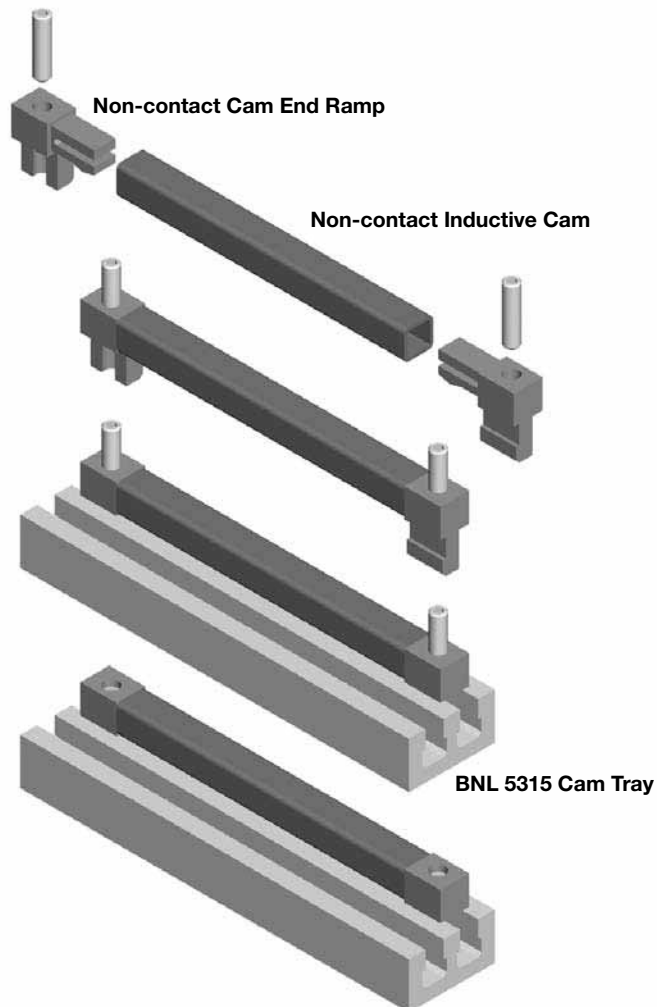
Cams are available only in one meter pieces. Cams can be cut for applications less than one meter (add 12.5 mm for each end ramp for total length).

Cams can be installed end-to-end for applications longer than one meter (add 12.5 mm for each end ramp for total length).

Notes:

Cams used in safety applications must be permanently secured to the cam tray.

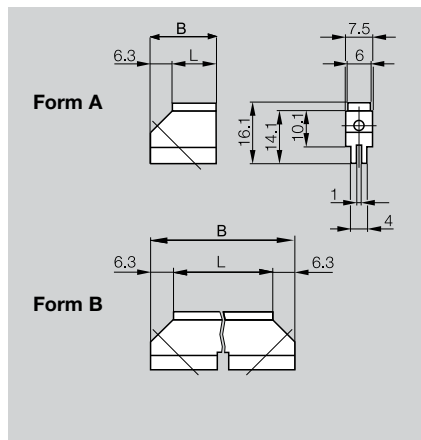
BEN style cams are intended for non-contact operations or inductive sensors only. Misapplication for use as trip cams for mechanical limit switches will result in extremely rapid wear and failure.



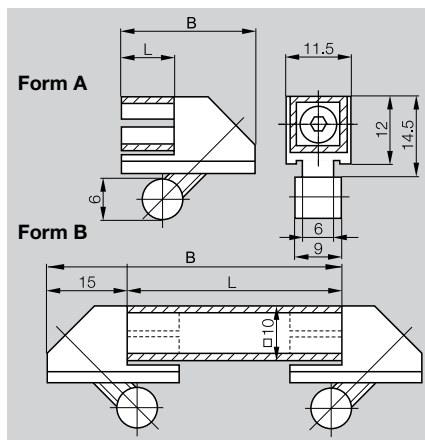
Inductive Cams

[illegible]

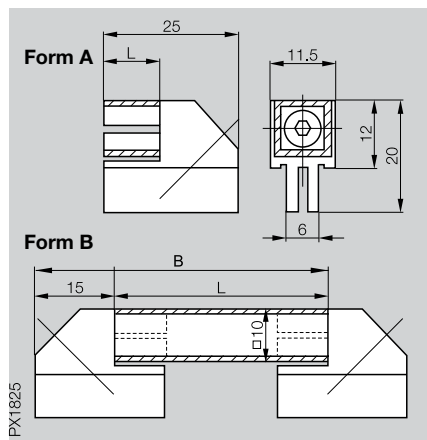
BEN 516-19
BNL 5304/5307-080-...
603-11, 650-11



BEN 516-13
BNL 5310-120-...
602-11, 605-11, 610-11, 611-11, 612-11, 613-11



BEN 516-14
BNL 5304/5307-120/160-..., 5315
602-11, 605-11, 610-11, 611-11, 612-11, 613-11



	L	B
BEN 516-19-10	10	16.3
BEN 516-19-15	15	21.3

	L	B
BEN 516-13-00	0	15
BEN 516-13-10	10	25
BEN 516-13-20	20	35

	L	B
BEN 516-14-00	0	15
BEN 516-14-10	10	25
BEN 516-14-20	20	35

	L	B
BEN 516-19-20	20	32.6
BEN 516-19-30	30	42.6
BEN 516-19-40	40	52.6
BEN 516-19-50	50	62.6
BEN 516-19-60	60	72.6
BEN 516-19-80	80	92.6
BEN 516-19-90	90	102.6
BEN 516-19-100	100	112.6
BEN 516-19-120	120	132.6
BEN 516-19-150	150	162.6
BEN 516-19-250	250	262.6

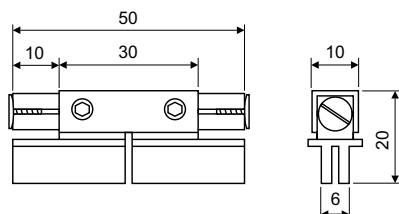
	L	B
BEN 516-13-30	30	60
BEN 516-13-40	40	70
BEN 516-13-50	50	80
BEN 516-13-100	100	130
BEN 516-13-180	180	210
BEN 516-13-200	200	230
BEN 516-13-300	300	330
BEN 516-13-675	675	705

	L	B
BEN 516-14-25	25	55
BEN 516-14-30	30	60
BEN 516-14-40	40	70
BEN 516-14-50	50	80
BEN 516-14-63	63	93
BEN 516-14-80	80	110
BEN 516-14-90	90	120
BEN 516-14-100	100	130
BEN 516-14-120	120	150
BEN 516-14-130	130	160
BEN 516-14-140	140	170
BEN 516-14-150	150	180
BEN 516-14-160	160	190
BEN 516-14-180	180	210
BEN 516-14-200	200	230
BEN 516-14-250	250	280
BEN 516-14-280	280	310
BEN 516-14-300	300	330
BEN 516-14-360	360	390
BEN 516-14-400	400	430
BEN 516-14-500	500	530
BEN 516-14-600	600	630
BEN 516-14-650	650	680
BEN 516-14-700	700	730
BEN 516-14-750	750	780
BEN 516-14-800	800	830
BEN 516-14-900	900	930
BEN 516-14-1000	1000	1030
BEN 516-14-1200	1200	1230

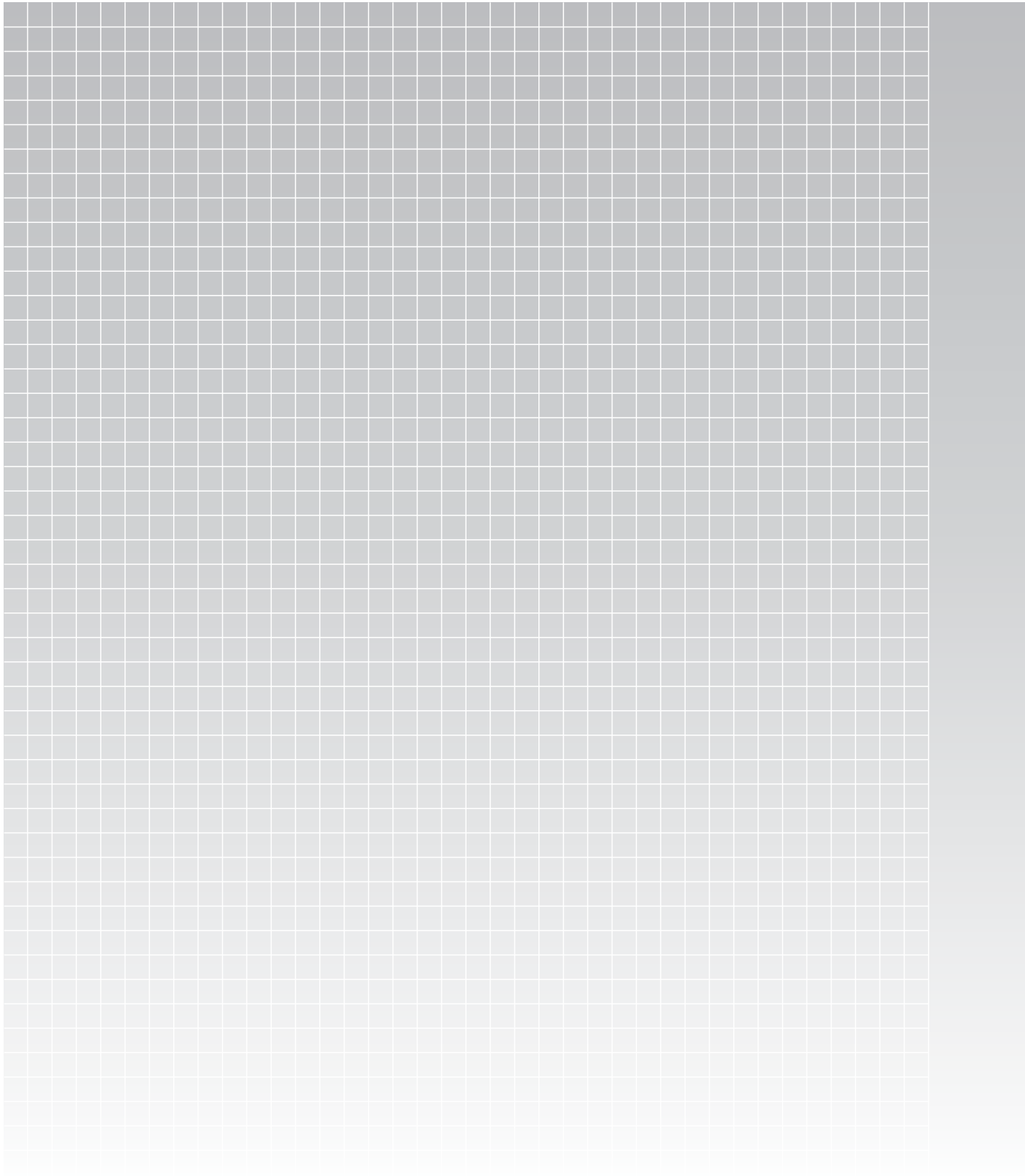
Material: Steel with burnished surface.

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

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



BEN 516-14V
Union for non-contact cams



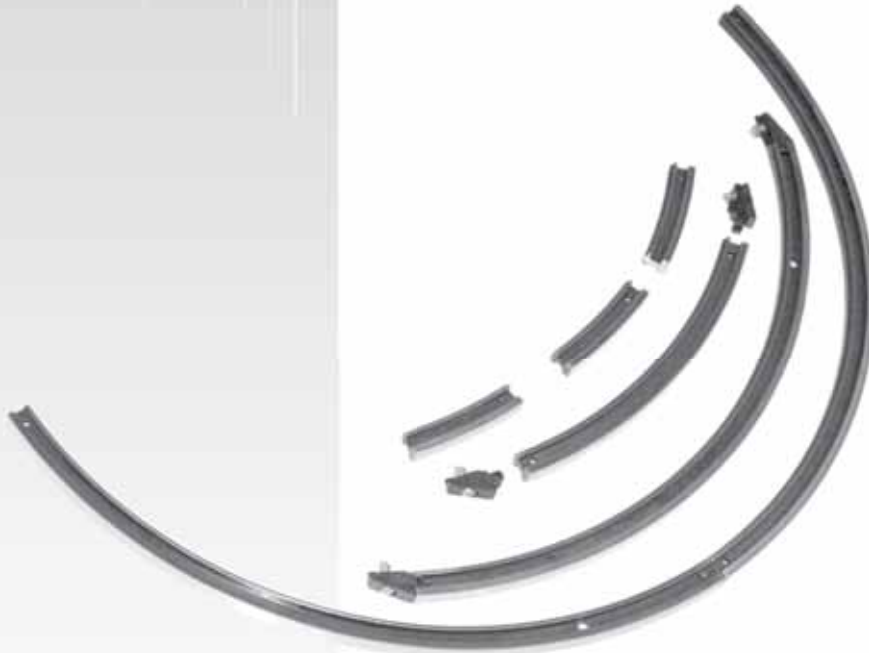
Mechanical Switches

Contents

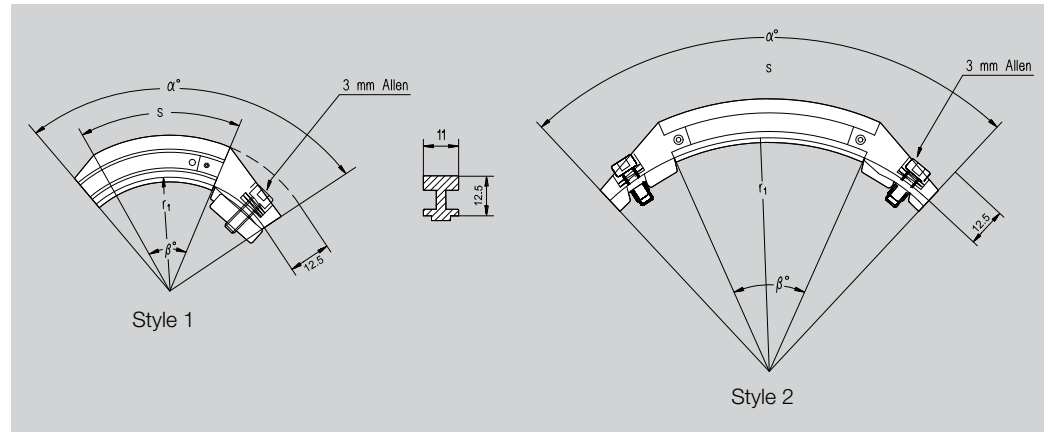
Radial Trip Cams

- Mechanical contact or inductive non-contact
- U-channel mount by friction wedges for drop-in cam installation
- T-slot mount by T-nuts or pressure plates for drop-in captive installation
- Two piece with single set screw for small angles
- Three piece with two set screws for larger angles

14.2	12 mm U-channel mechanical
14.4	12 mm T-slot mechanical
14.6	12 mm T-slot inductive
14.8	12 mm U-channel segmented mechanical cam kits for robot zone limit systems
14.10	12 mm T-slot segmented inductive cam kits for robot zone limit systems



Type	BNN UR
Cam drum	BNL URN
Switch	61, 62, 72, 100, 602-11, 605-11, 610-11, 611-11, 612-11, 613-11



U-slot Installation:

Tightening the set screw causes the pressure plate to press against the side of the cam drum channel, securing the cam.

Replacement End Ramps:

Radius	Part number
40-50 mm	BNN URE-040-12
75-124 mm	BNN URE-75-12
125-249 mm	BNN URE-125-12

Replacement Pressure

Block:
BNN URENU-1202

Note:

Cams used in safety applications must be permanently secured to the cam drum. For safety applications, use: SCHNEIDSHR.D7513-M4x20ST-BE 718329

Material:

Steel with hardened burnished surface and chrome plated. HRC 63+2

Dimensions in mm.

Additional radii and swept angles available on request (quantities may be required).

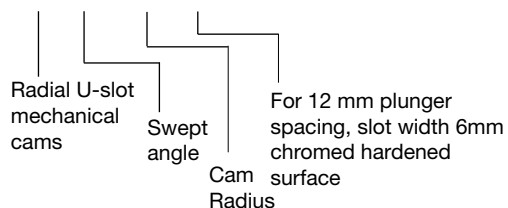
See ordering example on bottom of page 14.3.

Nominal Radius	Part number	Swept angle (°)	S Arc length (mm)	Total angle (°)	Style
40 mm	BNN UR-004-040-12C	4	4	46	1
	BNN UR-010-040-12C	10	10	52	1
	BNN UR-015-040-12C	15	14	57	1
	BNN UR-030-040-12C	30	28	72	1
	BNN UR-045-040-12C	45	41	87	1
	BNN UR-060-040-12C	60	55	116	2
	BNN UR-075-040-12C	75	69	131	2
	BNN UR-090-040-12C	90	83	156	2
50 mm	BNN UR-004-050-12C	4	4	37	1
	BNN UR-009-050-12C	9	10	42	1
	BNN UR-015-050-12C	15	16	49	1
	BNN UR-030-050-12C	30	33	63	1
	BNN UR-045-050-12C	45	49	78	1
	BNN UR-060-050-12C	60	65	104	2
	BNN UR-075-050-12C	75	82	119	2
	BNN UR-090-050-12C	90	98	134	2
75 mm	BNN UR-003-075-12C	3	4	26	1
	BNN UR-007-075-12C	7	10	30	1
	BNN UR-015-075-12C	15	23	38	1
	BNN UR-030-075-12C	30	46	60	2
	BNN UR-045-075-12C	45	69	75	2
	BNN UR-060-075-12C	60	92	90	2
	BNN UR-075-075-12C	75	114	105	2
	BNN UR-090-075-12C	90	137	120	2
100 mm	BNN UR-120-075-12C	120	184	150	2
	BNN UR-180-075-12C	180	274	210	2
100 mm	BNN UR-003-100-12C	3	4	19	1
	BNN UR-005-100-12C	5	10	22	1
	BNN UR-010-100-12C	10	20	27	1
	BNN UR-015-100-12C	15	29	37	2
	BNN UR-030-100-12C	30	56	56	2
	BNN UR-045-100-12C	45	88	67	2
	BNN UR-060-100-12C	60	118	82	2
	BNN UR-075-100-12C	75	147	97	2
	BNN UR-090-100-12C	90	177	112	2
	BNN UR-105-100-12C	105	206	127	2
	BNN UR-120-100-12C	120	236	144	2
	BNN UR-180-100-12C	180	354	202	2

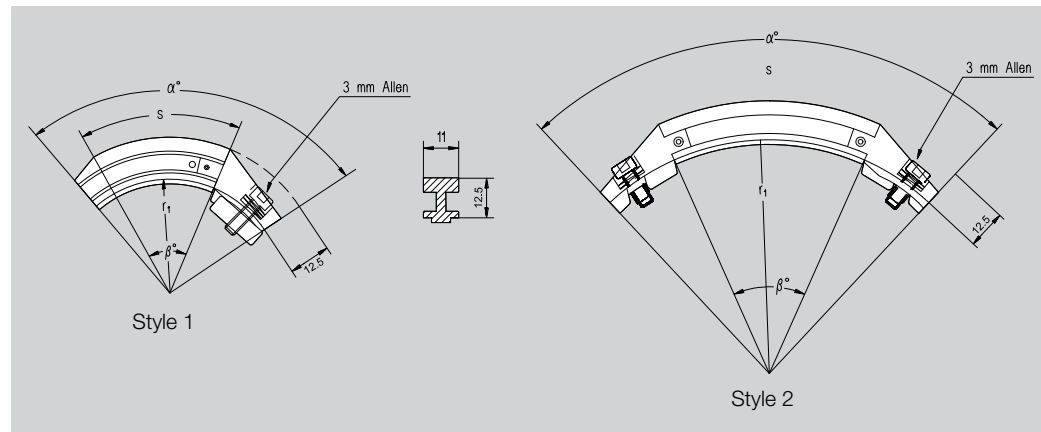
Nominal Radius	Part Number	Swept angle (°)	S Arc length (mm)	Total angle (°)	Style
125 mm	BNN UR-002-125-12C	2	4	16	1
	BNN UR-004-125-12C	4	10	18	1
	BNN UR-009-125-12C	9	20	23	1
	BNN UR-015-125-12C	15	36	33	2
	BNN UR-030-125-12C	30	72	48	2
	BNN UR-045-125-12C	45	108	63	2
	BNN UR-060-125-12C	60	144	78	2
	BNN UR-075-125-12C	75	180	93	2
	BNN UR-090-125-12C	90	216	108	2
	BNN UR-100-125-12C	100	240	118	2
	BNN UR-105-125-12C	105	252	123	2
	BNN UR-120-125-12C	120	288	138	2
	BNN UR-150-125-12C	150	360	168	2
	BNN UR-180-125-12C	180	432	198	2
	BNN UR-210-125-12C	210	504	228	2
	BNN UR-225-125-12C	225	240	243	2
	BNN UR-240-125-12C	240	576	258	2
	BNN UR-255-125-12C	255	612	273	2
	BNN UR-260-125-12C	260	624	278	2
	BNN UR-270-125-12C	270	648	288	2
	BNN UR-285-125-12C	285	684	303	2
	BNN UR-300-125-12C	300	720	318	2
	BNN UR-315-125-12C	315	756	333	2
	BNN UR-320-125-12C	320	768	338	2
	BNN UR-330-125-12C	330	792	348	2
160 mm	BNN UR-001-160-12C	1	4	12	1
	BNN UR-003-160-12C	3	10	14	1
	BNN UR-007-160-12C	7	20	18	1
	BNN UR-015-160-12C	15	45	29	2
	BNN UR-030-160-12C	30	90	44	2
	BNN UR-045-160-12C	45	135	59	2
	BNN UR-060-160-12C	60	181	74	2
	BNN UR-075-160-12C	75	226	89	2
	BNN UR-090-160-12C	90	271	104	2
	BNN UR-105-160-12C	105	316	119	2
	BNN UR-120-160-12C	120	361	134	2
250 mm	BNN UR-001-250-12C	1	4	9	1
	BNN UR-002-250-12C	2	10	10	1
	BNN UR-004-250-12C	4	20	12	1
	BNN UR-015-250-12C	15	69	25	2
	BNN UR-030-250-12C	30	137	40	2
	BNN UR-045-250-12C	45	206	55	2
	BNN UR-060-250-12C	60	275	70	2
	BNN UR-075-250-12C	75	343	85	2
	BNN UR-090-250-12C	90	412	100	2
	BNN UR-105-250-12C	105	481	115	2
	BNN UR-120-250-12C	120	549	130	2

Ordering example:
BNN UR-030-125-12C

BNN UR- - - -12C



Type	BNN TR
Cam drum	BNL TRN, BNL LAH
Switch	61, 62, 72, 100, 602-11, 605-11, 610-11, 611-11, 612-11, 613-11



T-slot Installation:

Tightening the screw causes the plate to raise and sandwich the T-flange between the plate and cam, securing the cam to the drum

Replacement End Ramps:

Radius	Part number
40-50 mm	BNN TRE-040-12
75-124 mm	BNN TRE-75-12
125-249 mm	BNN TRE-125-12

Replacement Pressure

Block:
BNN URENU-1202

Note:

Cams used in safety applications must be permanently secured to the cam drum. For safety applications, use: SCHNEIDSHR.D7513-M4x20ST-BE 718329

Material:

Steel with hardened burnished surface and chrome plated. HRC 63+2

Dimensions in mm.

Additional radii and swept angles available on request (quantities may be required).

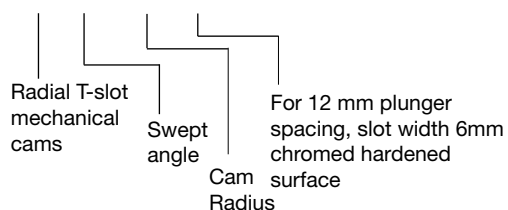
See ordering example on bottom of page 13.5.

Nominal Radius	Part number	Swept angle (°)	S Arc length (mm)	Total angle (°)	Style
40 mm	BNN TR-004-040-12C	4	4	46	1
	BNN TR-010-040-12C	10	10	52	1
	BNN TR-015-040-12C	15	14	57	1
	BNN TR-030-040-12C	30	28	72	1
	BNN TR-045-040-12C	45	41	87	1
	BNN TR-060-040-12C	60	55	116	2
	BNN TR-075-040-12C	75	69	131	2
	BNN TR-090-040-12C	90	83	156	2
50 mm	BNN TR-004-050-12C	4	4	37	1
	BNN TR-009-050-12C	9	10	42	1
	BNN TR-015-050-12C	15	16	49	1
	BNN TR-030-050-12C	30	33	63	1
	BNN TR-045-050-12C	45	49	78	1
	BNN TR-060-050-12C	60	65	104	2
	BNN TR-075-050-12C	75	82	119	2
	BNN TR-090-050-12C	90	98	134	2
75 mm	BNN TR-003-075-12C	3	4	26	1
	BNN TR-007-075-12C	7	10	30	1
	BNN TR-015-075-12C	15	23	38	1
	BNN TR-030-075-12C	30	46	60	2
	BNN TR-045-075-12C	45	69	75	2
	BNN TR-060-075-12C	60	92	90	2
	BNN TR-075-075-12C	75	114	105	2
	BNN TR-090-075-12C	90	137	120	2
100 mm	BNN TR-002-100-12C	2	4	19	1
	BNN TR-003-100-12C	3	4	19	1
	BNN TR-005-100-12C	5	10	22	1
	BNN TR-010-100-12C	10	20	27	1
	BNN TR-015-100-12C	15	29	37	2
	BNN TR-030-100-12C	30	56	56	2
	BNN TR-045-100-12C	45	88	67	2
	BNN TR-060-100-12C	60	118	82	2
	BNN TR-075-100-12C	75	147	97	2
	BNN TR-090-100-12C	90	177	112	2
	BNN TR-105-100-12C	105	206	127	2
	BNN TR-120-100-12C	120	236	144	2

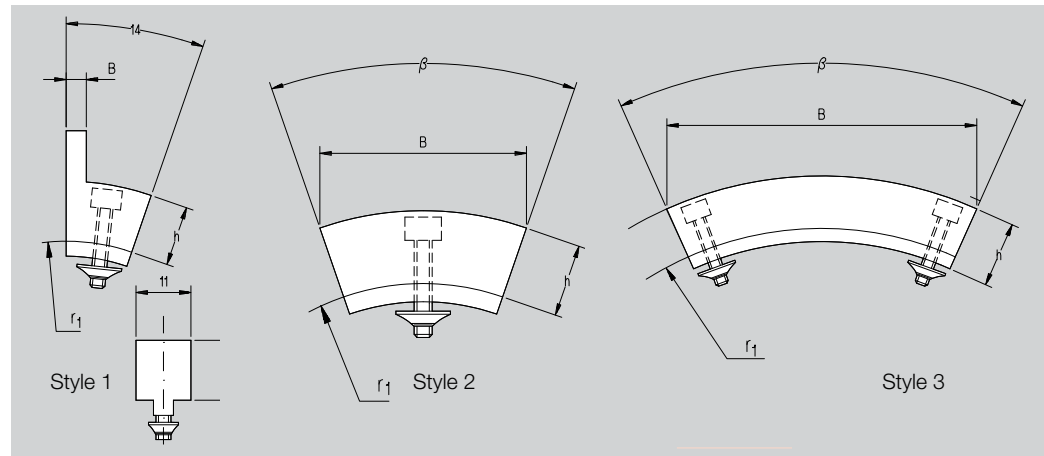
Nominal Radius	Part Number	Swept angle (°)	Arc length (mm)	Total angle (°)	Style
125 mm	BNN TR-002-125-12C	2	4	16	1
	BNN TR-004-125-12C	4	10	18	1
	BNN TR-009-125-12C	9	20	23	1
	BNN TR-015-125-12C	15	36	33	2
	BNN TR-030-125-12C	30	72	48	2
	BNN TR-045-125-12C	45	108	63	2
	BNN TR-060-125-12C	60	144	78	2
	BNN TR-075-125-12C	75	180	93	2
	BNN TR-090-125-12C	90	216	108	2
	BNN TR-105-125-12C	105	252	123	2
	BNN TR-120-125-12C	120	288	138	2
	BNN TR-345-125-12C	345	828	363	2
160 mm	BNN TR-001-160-12C	1	4	12	1
	BNN TR-003-160-12C	3	10	14	1
	BNN TR-004-160-12C	4	12	15	1
	BNN TR-007-160-12C	7	20	18	1
	BNN TR-015-160-12C	15	45	29	2
	BNN TR-030-160-12C	30	90	44	2
	BNN TR-045-160-12C	45	135	59	2
	BNN TR-060-160-12C	60	181	74	2
	BNN TR-075-160-12C	75	226	89	2
	BNN TR-090-160-12C	90	271	104	2
	BNN TR-105-160-12C	105	316	119	2
	BNN TR-120-160-12C	120	361	134	2
	BNN TR-180-160-12C	180	543	194	2
250 mm	BNN TR-001-250-12C	1	4	9	1
	BNN TR-002-250-12C	2	10	10	1
	BNN TR-004-250-12C	4	20	12	1
	BNN TR-015-250-12C	15	69	25	2
	BNN TR-030-250-12C	30	137	40	2
	BNN TR-045-250-12C	45	206	55	2
	BNN TR-060-250-12C	60	275	70	2
	BNN TR-075-250-12C	75	343	85	2
	BNN TR-090-250-12C	90	412	100	2
	BNN TR-105-250-12C	105	481	115	2
	BNN TR-120-250-12C	120	549	130	2
	BNN TR-135-250-12C	135	618	145	2
	BNN TR-150-250-12C	150	687	160	2
	BNN TR-165-250-12C	165	756	175	2
	BNN TR-180-250-12C	180	824	190	2
	BNN TR-225-250-12C	225	1030	235	2
	BNN TR-240-250-12C	240	1099	250	2
	BNN TR-255-250-12C	255	1065	265	2
	BNN TR-270-250-12C	270	1236	280	2
	BNN TR-315-250-12C	315	1442	325	2
	BNN TR-345-250-12C	345	1579	355	2

Ordering example:
BNN UR-030-125-12C

BNN TR- - - -12C



Type	BEN IR
Cam	BNL TRN
Switch	602-11, 605-11, 610-11, 611-11, 612-11, 613-11



T-slot Installation:

BEN IR cams use channel locks. As the screw is tightened, the lock is raised to the T-flange and conforms to the drum.

Replacement Channel Lock without Screw

BEN IRNU-1202

Note:

Cams used in safety applications must be permanently secured to the cam drum.

BEN style cams are intended for non-contact operations of inductive sensors only. Mis-applications for use as trip cams for mechanical limit switches will result in extremely rapid wear and failure.

Material:

Mild solid steel, Oxide coated.

Dimensions in mm.

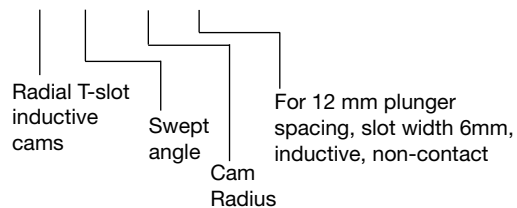
Additional radii and swept angles available on request (quantities may be required).

See ordering example on bottom of page 14.7.

Nominal Radius	Part number	Swept angle (°)	Arc length (mm)	Style
40 mm	BEN IR-004-040-12	4	4	1
	BEN IR-010-040-12	10	10	2
	BEN IR-015-040-12	15	14	2
	BEN IR-030-040-12	30	28	2
	BEN IR-045-040-12	45	41	3
	BEN IR-060-040-12	60	55	3
	BEN IR-075-040-12	75	69	3
	BEN IR-090-040-12	90	83	3
50 mm	BEN IR-004-050-12	4	4	1
	BEN IR-009-050-12	9	10	2
	BEN IR-015-050-12	15	16	2
	BEN IR-030-050-12	30	33	2
	BEN IR-045-050-12	45	49	3
	BEN IR-060-050-12	60	65	3
	BEN IR-075-050-12	75	82	3
	BEN IR-090-050-12	90	98	3
75 mm	BEN IR-003-075-12	3	4	1
	BEN IR-007-075-12	7	10	2
	BEN IR-015-075-12	15	23	2
	BEN IR-030-075-12	30	46	2
	BEN IR-045-075-12	45	69	3
	BEN IR-060-075-12	60	92	3
	BEN IR-075-075-12	75	114	3
	BEN IR-090-075-12	90	137	3
100 mm	BEN IR-003-100-12	3	4	1
	BEN IR-005-100-12	5	10	2
	BEN IR-010-100-12	10	20	2
	BEN IR-015-100-12	15	29	2
	BEN IR-030-100-12	30	56	2
	BEN IR-045-100-12	45	88	3
	BEN IR-060-100-12	60	118	3
	BEN IR-075-100-12	75	147	3
	BEN IR-090-100-12	90	177	3
	BEN IR-105-100-12	105	206	3
	BEN IR-120-100-12	120	236	3

Nominal Radius	Part Number	Swept angle (°)	Arc length (mm)	Style
125 mm	BEN IR-002-125-12	2	4	1
	BEN IR-004-125-12	4	10	2
	BEN IR-009-125-12	9	20	2
	BEN IR-015-125-12	15	36	2
	BEN IR-030-125-12	30	72	3
	BEN IR-045-125-12	45	108	3
	BEN IR-060-125-12	60	144	3
	BEN IR-075-125-12	75	180	3
	BEN IR-090-125-12	90	216	3
	BEN IR-105-125-12	105	252	3
	BEN IR-120-125-12	120	288	3
160 mm	BEN IR-001-160-12	1	4	1
	BEN IR-003-160-12	3	10	2
	BEN IR-007-160-12	7	20	2
	BEN IR-015-160-12	15	45	2
	BEN IR-030-160-12	30	90	2
	BEN IR-045-160-12	45	135	3
	BEN IR-060-160-12	60	181	3
	BEN IR-075-160-12	75	226	3
	BEN IR-090-160-12	90	271	3
	BEN IR-105-160-12	105	316	3
	BEN IR-120-160-12	120	361	3
250 mm	BEN IR-001-250-12	1	4	2
	BEN IR-002-250-12	2	10	2
	BEN IR-004-250-12	4	20	3
	BEN IR-015-250-12	15	69	3
	BEN IR-030-250-12	30	137	3
	BEN IR-045-250-12	45	206	3
	BEN IR-060-250-12	60	275	3
	BEN IR-075-250-12	75	343	3
	BEN IR-090-250-12	90	412	3
	BEN IR-105-250-12	105	481	3
	BEN IR-120-250-12	120	549	3

Ordering example:

BNL IR- - - -12

Robot Zone Limit

Segmented cam kits are designed to be used in a complementary, redundant zone limit system. The kit includes one 180° cam segment, one 90° cam segment, one 45° degree cam segment, and three 15° cam segments. By attaching different combinations of cam segments together, two complementary cam sets can be created. The arc lengths of the two cam sets can be varied in increments of 15°. Below are the complementary cam sets that can be created.

Complementary Angles	Cam Set One	Cam Set Two
180°/180°	180°	90°, 45°, 15°, 15°, 15°
195°/165°	180°, 15°	90°, 45°, 15°, 15°
210°/150°	180°, 15°, 15°	90°, 45°, 15°
225°/135°	180°, 45°	90°, 15°, 15°, 15°
240°/120°	180°, 45°, 15°	90°, 15°, 15°
255°/105°	180°, 45°, 15°, 15°	90°, 15°
270°/90°	180°, 90°	45°, 15°, 15°, 15°
285°/75°	180°, 90°, 15°	45°, 15°, 15°
300°/60°	180°, 90°, 15°, 15°	45°, 15°
315°/45°	180°, 90°, 45°	15°, 15°, 15°
330°/30°	180°, 90°, 45°, 15°	15°, 15°
345°/15°	180°, 90°, 45°, 15°, 15°	15°

Segmented Mechanical Cam Kit Package Contents

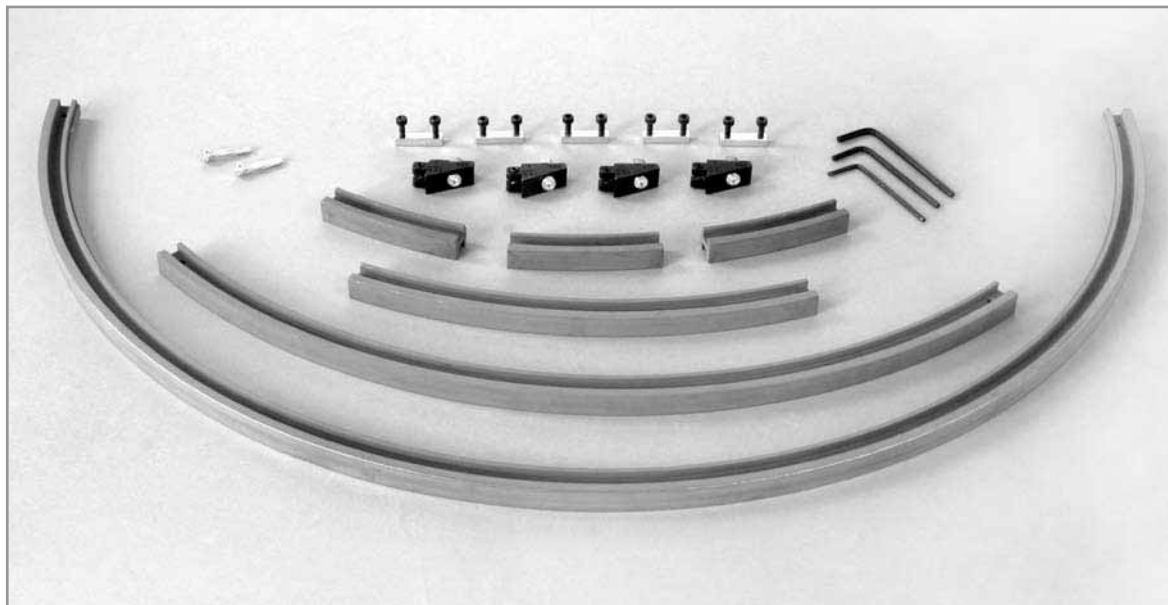
Description	Quantity
Cam segment, 180°	1 (not sold separately)
Cam segment, 90°	1 (not sold separately)
Cam segment, 45°	1 (not sold separately)
Cam segment, 15°	3 (not sold separately)
End ramp assembly	4
Connector	5
M3x8 socket head screw	10
M4x20 self-tapping screw	2
1.5 mm hex wrench	1
2.5 mm hex wrench	1
3.0 mm hex wrench	1

Note:

Due to manufacturing processes, cam sets with radii larger than 450 mm will have three 90° segments

Replacement Parts:

Connector – Z/Connector-segmented cam (312735)
T-slot end ramp – BNN TRE-250-12
U-slot end ramp – BNN URE-250-12
M3x8 screw – Z/SCREW-M3x8-w/loctite (312736)
M4x20 screw – SCHNEIDSHR.D7513-M4x20ST.BE (718329)



Segmented Mechanical Cam Kits			
Part Number	Inside Radius	Mounting Style	Cam Drum
BNN 520-R250-360-T-SEG-KIT-C	250	T-Slot	
BNN 520-R260-360-U-SEG-KIT-C	250	U-Slot	
BNN 520-R350-360-U-SEG-KIT-C	342	U-Slot	BNL M710I-CAM-DRUM
BNN 520-R373-360-U-SEG-KIT-C	395	U-Slot	BNL 5304-120-06-R373-2000
BNN 520-R545-360-T-SEG-KIT-C	545	T-Slot	BNL LAH-12_-545-B-01
BNN 520-R545-360-U-SEG-KIT-C	545	U-Slot	BNL M410IB-CAM-DRUM-01
BNN 550-R379-S01-K01	250	T-Slot	BNL LAH-12_-250-B
BNN 550-R380-S00-K01	125	T-Slot	BNL LAH-12_-125-B
BNN 550-R381-S00-K01	395	T-Slot	BNL LAH-12_-395-B-01
BNN 550-R383-S03-K02	600	T-Slot	BNL LAH-12_-600-B-01
BNN 550-R385-S00-K01	280	T-Slot	
BNN 550-R390-S00-K01	450	T-Slot	BNL LAH-12_-450-B-01
BNN 550-R392-S00-K01	200	T-Slot	BNL LAH-12_-200-B-01
BNN 551-R391-S04-K03	160	U-Slot	BNL LAH-12_-160-B

SO_

Quantity of Segments In Set							
Set Number	180° Segments	137.5° Segments	90° Segments	45° Segments	30° Segments	15° Segments	End Ramps
S00	1		1	1		3	4
S01			3	1	1	1	6
S02	1		1	1		3	0
S03			3	1		3	4
S04		2					4

KO_

Components Included In Kit							
	Z/ALLEN-WRENCH-1.5MM	HEX-WRENCH-2.0MM	HEX-WRENCH-2.5MM	HEX-WRENCH-3MM	Z/CONNEC-TOR-SEG-MENTED-CAM	Z/SCREW-M3-X-8-W/ LOCTITE	SCHNEIDSHR. D7513-M4X20 ST-BE
Kit Number	327086	326788	326783	311107	312735	312736	718329
01		1	1	1	5	10	2
02	1	1	1	1	6	12	2
03					1	2	2

Robot Zone Limit

Segmented cam kits are designed to be used in a complementary, redundant zone limit system. The kit includes one 180° cam segment, one 90° cam segment, one 45° degree cam segment, and three 15° cam segments. By attaching different combinations of cam segments together, two complementary cam sets can be created. The arc lengths of the two cam sets can be varied in increments of 15°. Below are the complementary cam sets that can be created.

Complementary Angles	Cam Set One	Cam Set Two
180°/180°	180°	90°, 45°, 15°, 15°, 15°
195°/165°	180°, 15°	90°, 45°, 15°, 15°
210°/150°	180°, 15°, 15°	90°, 45°, 15°
225°/135°	180°, 45°	90°, 15°, 15°, 15°
240°/120°	180°, 45°, 15°	90°, 15°, 15°
255°/105°	180°, 45°, 15°, 15°	90°, 15°
270°/90°	180°, 90°	45°, 15°, 15°, 15°
285°/75°	180°, 90°, 15°	45°, 15°, 15°
300°/60°	180°, 90°, 15°, 15°	45°, 15°
315°/45°	180°, 90°, 45°	15°, 15°, 15°
330°/30°	180°, 90°, 45°, 15°	15°, 15°
345°/15°	180°, 90°, 45°, 15°, 15°	15°

Segmented Non-Contact Cam Kit Package Contents

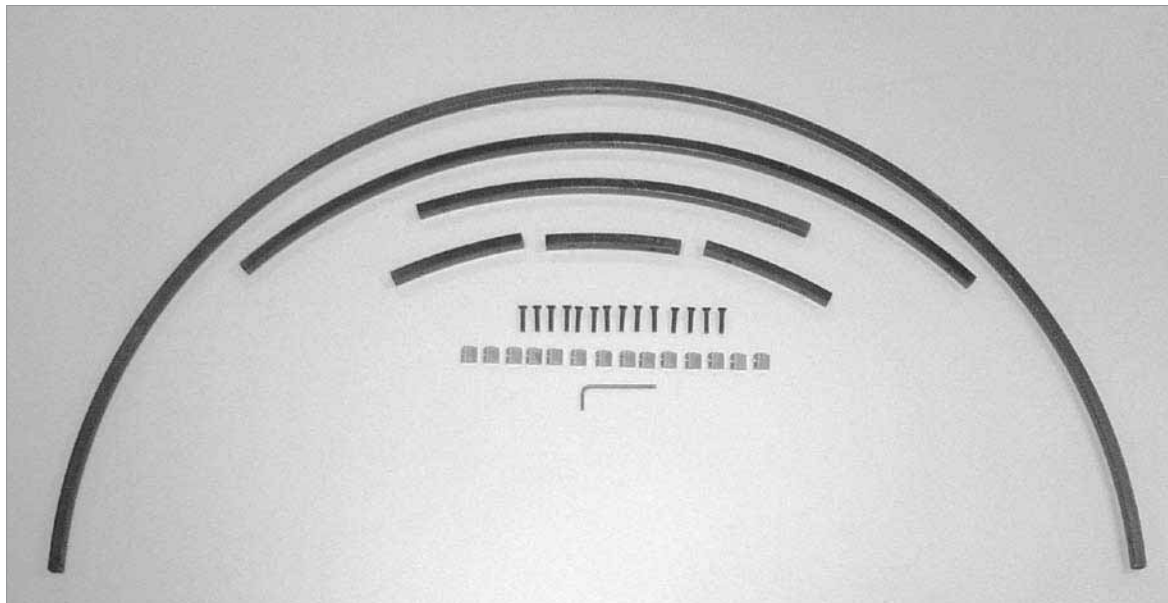
Description	Quantity
Cam segment, 180°	1 (not sold separately)
Cam segment, 90°	1 (not sold separately)
Cam segment, 45°	1 (not sold separately)
Cam segment, 15°	3 (not sold separately)
M4x20 screws	14
Special M4 nut	14
2.5 mm hex wrench	1

Note:

BEN style cams are intended for non-contact operations of inductive sensors only. Mis-applications for use as trip cams for mechanical limit switches will result in extremely rapid wear and failure.

Replacement Parts:

M4x20 screw – Z/SCREW-SHCS-M4-X-20-FH (317248)
M4 T-nut – NOCKENKOERPER-ROHTEIL 516-17 (149398)
Tamper proof label – Label Tamper Proof (167282)
Spanner screwdriver bit – Spanner BIT 1/4 Hex (167279)
Tamper proof spanner screw – SCREW Spanner M4X25 DIN 7167 (167208)



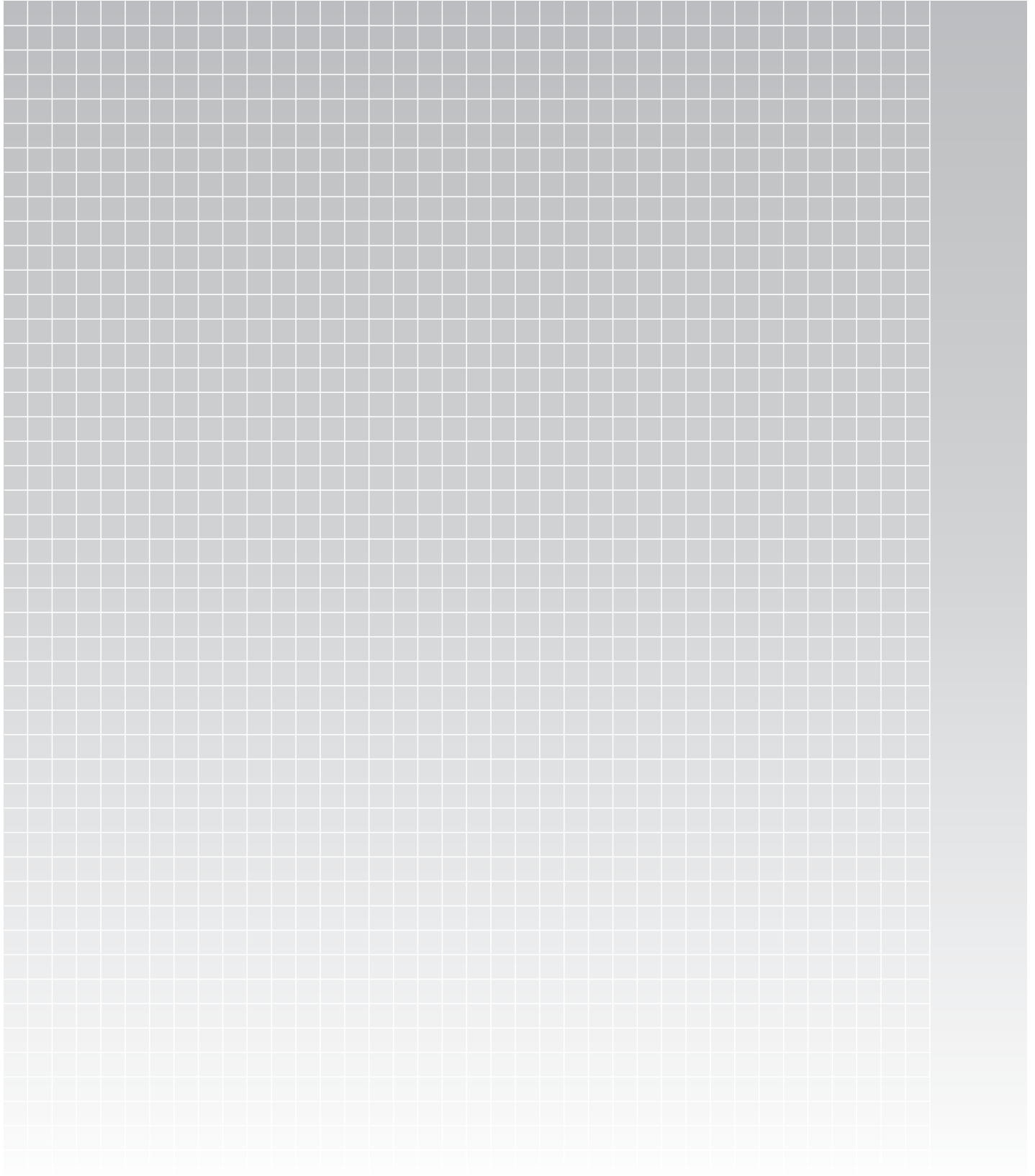
Segmented Non-Contact Cam Kits			
Part Number	Inside Radius	Mounting Style	Cam Drum
BEN 516-17-R210,0-S00-K01	200	T-Slot	BNL LAH-12_-200-B-01
BEN 516-17-R260,0-S00-K01	250	T-Slot	BNL LAH-12_-250-B
BEN 516-17-R290,0-S00-K01	280	T-Slot	
BEN 516-17-R405,0-S00-K01	395	T-Slot	BNL LAH-12_-395-B-01
BEN 516-17-R460,0-S00-K01	450	T-Slot	BNL LAH-12_-450-B-01
BEN 516-17-R555,0-S00-K01	545	T-Slot	BNL LAH-12_-545-B-01

SO_

Quantity of Segments In Set				
Set Number	180° Segments	90° Segments	45° Segments	15° Segments
S00	1	1	1	3

KO_

Components Included In Kit			
	HEX-WRENCH-2.5MM	M4 T-Nut	Z/SCREW-SHCS-M4-X-20-FH
Kit Number	326783	149398	317248
01	1	14	14
02			1
03			

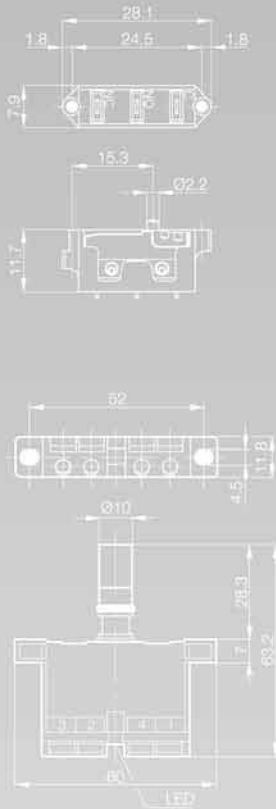


Mechanical Switches

Contents

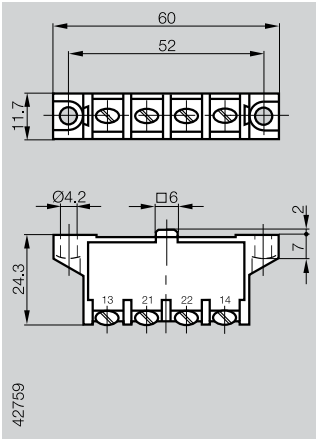
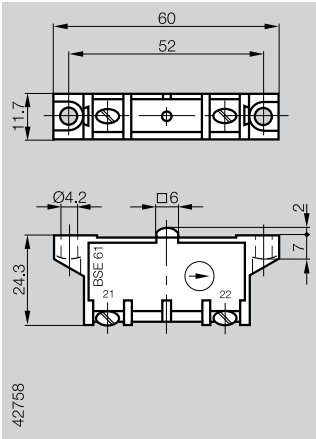
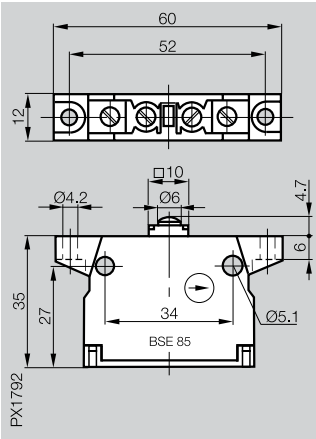
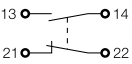
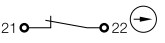
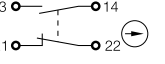
Accessories

- 15.2 Full size snap switch elements
- 15.2 Full size creep switch elements
- 15.3 Miniature snap switch elements
- 15.3 Miniature creep switch elements
- 15.4 Miniature inductive switch elements
- 15.4 Full size inductive switch elements
- 15.8 61 series quick-change plunger blocks
- 15.9 100 series quick-change plunger blocks
- 15.10 PG to Metric cross reference
- 15.11 Metric to NPT adapter
- 15.11 Metric to pg adapters
- 15.11 PG to metric adapters
- 15.11 Metric increasers
- 15.12 Cord seals
- 15.12 Metric reducers
- 15.12 Set-up gauges
- 15.12 Replacement plungers
- 15.13 Replacement wiper plates
- 15.13 BNS protective cover
- 15.16 Connectors
- 15.18 Cables



Mechanical Switches

Replacement Switch Elements

Type	Snap switch element BSE 30.0	Creep switch element BSE 61 to DIN EN 60204-1	Snap switch element BSE 85 to DIN EN 60204-1
for multiple position switches series	100, 62, 61, 72	100, 62, 61, 72	100, 62, 61, 72
for single position switches series	F 60	F 60	F 60
			
Part number	BSE 30.0-RK	BSE 61-RK	BSE 85-RK
Construction			
Contact material	Silver, gold plated	Silver	Silver
Switching principle	Snap switch	Creep switch, positive-opening	Snap switch, positive opening (normally-closed)
Contact system	Dual changeover, one normally open and one normally closed, galvanically isolated	Normally-closed, double interruption	Dual-changeover: 1. NO (snap function), 2. Positive-opening (double-interruption), all galvanically isolated
Contact arrangement	NO 13 + 14 NC 21 + 22 	NC 21 + 22 	NO 13 + 14 NC 21 + 22 
Wire AWG	2 x 16 AWG	2 x 16 AWG	2 x 16 AWG
Connection type	Screw connection M3	Screw connection M3	Screw terminal M3.5
Mechanical data			
Switching actuation force on telescoping plunger	min. 20 N		
Switching actuation force on rigid plunger		min. 15 N	min. 30 N
Bounce time	≤ 1.5 ms		≤ 3 ms
Switchover time	≤ 10 ms		≤ 5 ms
Switching frequency	300 operations/min	300 operations/min	160 operations/min
Housing material	Duro- and Thermoplast	Duro- and Thermoplast	Thermoplast
Tightening torque max.	0.5 Nm	0.5 Nm	0.9 Nm
Ambient temperature range T _a	-5...+85 °C	-5...+85 °C	-5...+85 °C
Electrical data			
Isolation	Group C (VDE 0110) 240 V AC	Group C (VDE 0110) 250 V AC	Group C (VDE 0110) 250 V AC
Nominal voltage	6 A	6 A	6 A
Constant current	≥ 20 mA	≥ 20 mA	≥ 20 mA
Minimum load at 24 V DC	< 40 mΩ	< 40 mΩ	< 40 mΩ
Contact resistance	6 A, cos φ = 1		
Switching capacity	AC 250 V 40...60 Hz 220 V DC 24 V	Depends on traverse speed and switching frequency	2 A, cos φ = 0.8
Service life			
Mechanical data	> 30 mil. switching operations (VDE 0660)	> 30 mil. switching operations (VDE 0660)	> 1 mil. switching operations (VDE 0660)
Electrical data	Depending on load, switching frequency and traverse speed	Depending on load, switching frequency and traverse speed	Depending on load, switching frequency and traverse speed
Approval	UL, CSA	CSA	cULus, CSA

Note: Positive opening contact for safety applications. May only be operated with a rigid plunger.

Mechanical Switches

Replacement Switch Elements

Snap switch element BSE 69.1, BSE 73.1		Snap switch element BSE 70.1, BSE 74.1		Snap switch element with positive-opening BSE 63		Snap switch element with positive-opening BSE 64	
46, 40		46, 40		46, 40		46, 40	
99, 100		99, 100		99, 100		99, 100	
BSE 69.1-RK BSE 73.1-RK		BSE 70.1-RK BSE 74.1-RK		BSE 63-RK		BSE 64-RK	
Silver Gold		Silver Gold		Silver		Silver	
Snap switch		Snap switch		Snap switch		Snap switch	
Single-pole changeover		Single-pole changeover		Single-pole changeover		Single-pole changeover	
18		18		18		18	
Solder connection		Screw terminal		Solder connection		Screw terminal	
min. 8 N		min. 8 N		min. 7.5 N		min. 7.5 N	
≤ 2 ms		≤ 2 ms		≤ 2 ms		≤ 2 ms	
≤ 10 ms		≤ 10 ms		≤ 10 ms		≤ 10 ms	
200 operations/min		200 operations/min		200 operations/min		200 operations/min	
Thermoplast		Thermoplast		Thermoplast		Thermoplast	
0.12 Nm		0.12 Nm		0.12 Nm		0.12 Nm	
-5...+85 °C		-5...+85 °C		-5...+85 °C		-5...+85 °C	
Group C (VDE 0110)		Group C (VDE 0110)		Group C (VDE 0110)		Group C (VDE 0110)	
250 V AC 30 V DC		250 V AC 30 V DC		250 V AC		250 V AC	
5 A		5 A		5 A		5 A	
≥ 20 mA		≥ 20 mA		≥ 20 mA		≥ 20 mA	
< 240 mΩ		< 240 mΩ		< 100 mΩ		< 100 mΩ	
2 A, cos φ = 0.8		2 A, cos φ = 0.8		5 A, cos φ = 0.75		5 A, cos φ = 0.75	
5 A, L/R = 10 ms		5 A, L/R = 10 ms		5 A, L/R = 10 ms		5 A, L/R = 10 ms	
> 10 mil. switching operations (VDE 0660)		> 10 mil. switching operations (VDE 0660)		> 10 mil. switching operations (VDE 0660)		> 10 mil. switching operations (VDE 0660)	
Depending on load, switching frequency and traverse speed		Depending on load, switching frequency and traverse speed		Depending on load, switching frequency and traverse speed		Depending on load, switching frequency and traverse speed	
UL, CSA		UL, CSA		cULus, CSA		cULus, CSA	

Mechanical Switches

Replacement Switch Elements

DC 3-/4-Wire

Code for inductive switch elements
Rated operating distance s_n
Assured operating distance s_a
for multiple position switches series

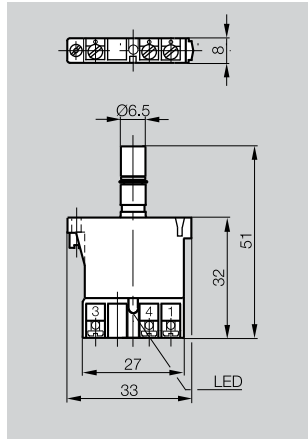


TOB

1.1 mm

0...0.9 mm

603, 650

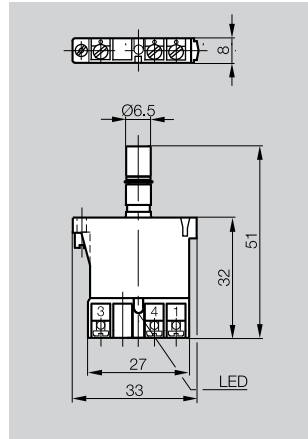


TNB

1.1 mm

0...0.9 mm

603, 650

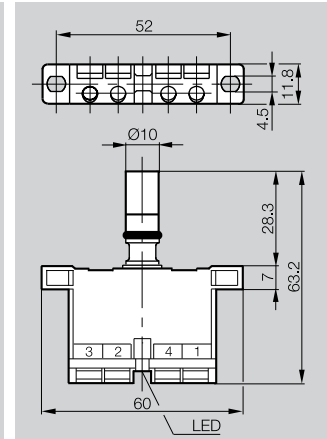


PA

2 mm

0...1.6 mm

602, 610...613, 605



Part number

PNP/NO
PNP/Complementary
NPN/NO
NPN/Complementary

BES 517-312-Y-RK

BES 517-311-Y-RK

BES 517-110-RK

Rated operational voltage U_e

24 V DC

24 V DC

24 V DC

Supply voltage U_B

10...30 V DC

10...30 V DC

10...60 V DC

Voltage drop U_d at I_e static

≤ 3.5 V

≤ 3.5 V

≤ 1.5 V

Rated insulation voltage U_i

75 V DC

75 V DC

75 V DC

Rated operational current I_e

130 mA

130 mA

200 mA

No-load current I_0 damped/undamped

≤ 25 mA/≤ 12 mA

≤ 25 mA/≤ 12 mA

≤ 15 mA/≤ 12 mA

Off-state current I_r

≤ 80 μ A

≤ 80 μ A

≤ 50 μ A

Polarity reversal protected

yes

yes

yes

Short circuit protected

yes

yes

yes

Permissible load capacitance

≤ 1 μ F

≤ 1 μ F

≤ 0.5 μ F

Repeat accuracy R

≤ 5 %

≤ 5 %

≤ 5 %

Ambient temperature range T_a

-25...+70 °C

-25...+70 °C

-25...+70 °C

Switching frequency f

500 Hz

500 Hz

1500 Hz

Utilization category

DC 13

DC 13

DC 13

Function indicator

yes

yes

yes

Degree of protection per IEC 60529

IP 67

IP 67

IP 67

Housing material

PA 6.6

PA 6.6

PA 12

Material of sensing face

PVDF

PVDF

PA 12

Connection type

Screw terminals

Screw terminals

Screw terminals

Wire AWG

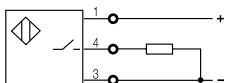
18

18

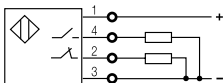
16

Wiring diagrams

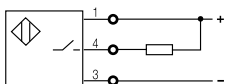
PNP, normally open



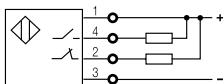
PNP, complementary

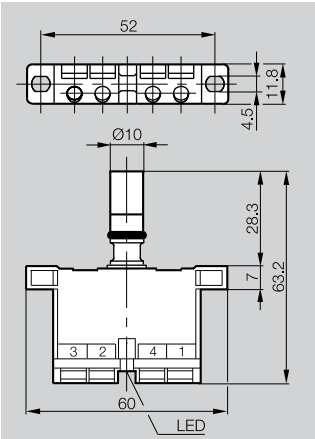
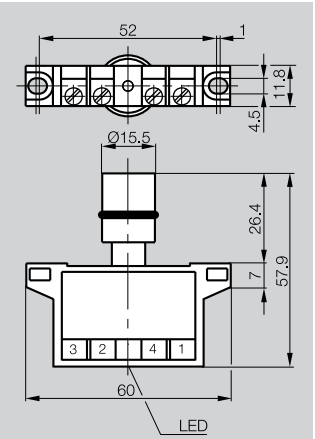
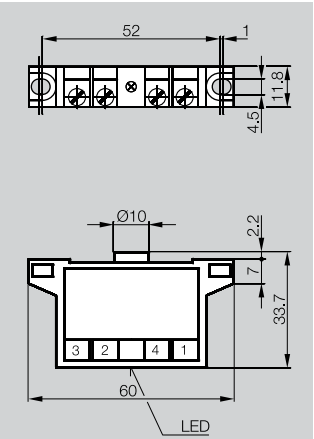


NPN, normally closed



NPN, complementary



NA 2 mm	THA 5 mm	DH 2, 2 mm
0...1.6 mm	0...4 mm	0...1.8 mm
602, 610...613, 60	602, 611, 613, 605	100, 62, 72, 61
		
	BES 517-142-Y-RK	BES 516-110-D-RK
BES 517-108-RK		
24 V DC	24 V DC	24 V DC
10...60 V DC	10...30 V DC	10...30 V DC
≤ 1.5 V	≤ 3.5 V	≤ 1.2 V
75 V DC	75 V DC	75 V DC
200 mA	130 mA	400 mA
≤ 15 mA/≤ 12 mA	≤ 30 mA/≤ 30 mA	≤ 30 mA/≤ 30 mA
≤ 50 µA	≤ 80 µA	≤ 100 µA
yes	yes	yes
yes	yes	no
≤ 0.5 µF	≤ 1 µF	≤ 1 µF
≤ 5 %	≤ 5 %	≤ 5 %
-25...+70 °C	-25...+70 °C	-25...+70 °C
1500 Hz	500 Hz	1000 Hz
DC 13	DC 13	DC 13
yes	yes	yes
IP 67	IP 67	IP 67
PA 12	PA 12	PA 12
PA 12	PBT	PA 12
Screw terminals	Screw terminals	Screw terminals
16	14	14

Mechanical Switches

Replacement Switch Elements

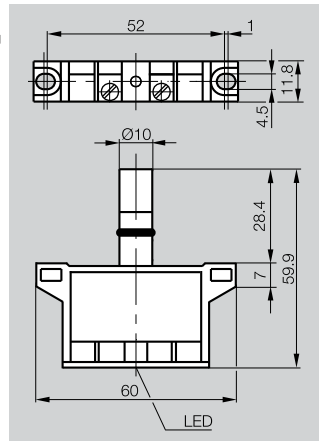
AC/DC 2-Wire

Code for inductive switch elements
Rated operating distance sn
Assured operating distance sa
for multiple position switches series



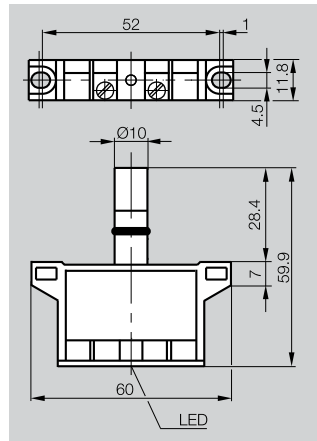
WS
2 mm

0...1.6 mm
602, 610...613, 605



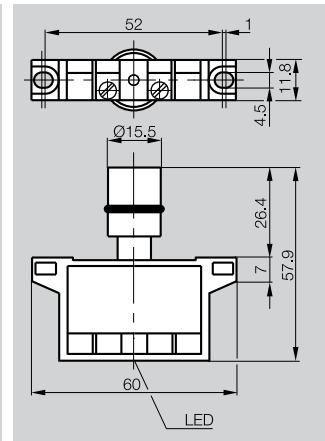
WO
2 mm

0...1.6 mm
602, 610...613, 605



EJA
5 mm

0...4 mm
602, 611, 613, 605



for replacement switch elements

AC/NO
AC/NC

DC/NO
DC/NC
NAMUR

BES 517-410-RK

BES 517-421-RK

BES 517-463-RK

Rated operational voltage U_e

110 V AC

110 V AC

220 V AC

Supply voltage U_B

35...250 V AC

35...250 V AC

90...250 V AC

Voltage drop U_d at I_e static

≤ 8.5 V

≤ 8.5 V

≤ 8.5 V

Rated insulation voltage U_i

250 V AC

250 V AC

250 V AC

Rated operational current I_e

100 mA

100 mA

100 mA

No-load current I_0 damped/undamped

Off-state current I_r

≤ 1700 μ A

≤ 1700 μ A

≤ 3000 μ A

Polarity reversal protected

yes

yes

yes

Short circuit protected

no

no

no

Permissible load capacitance

Repeat accuracy R

≤ 5 %

≤ 5 %

≤ 5 %

Ambient temperature range T_a

-25...+70 °C

-25...+70 °C

-25...+70 °C

Switching frequency f

10 Hz

10 Hz

15 Hz

Utilization category

AC 140

AC 140

AC 140

Function indicator

yes

yes

yes

Degree of protection per IEC 60529

IP 67

IP 67

IP 67

Housing material

PA

PA

PA

Material of sensing face

PA 12

PA 12

PA 12

Connection type

Screw terminals

Screw terminals

Screw terminals

Wire AWG

14

14

14

Approval

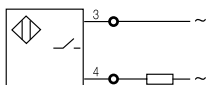
cULus

cULus

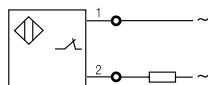
cULus

Wiring diagrams

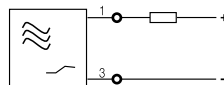
AC, NO



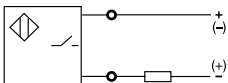
AC, NC



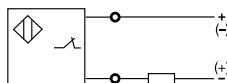
NAMUR



DC, NO



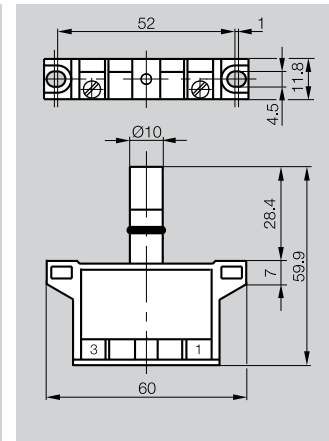
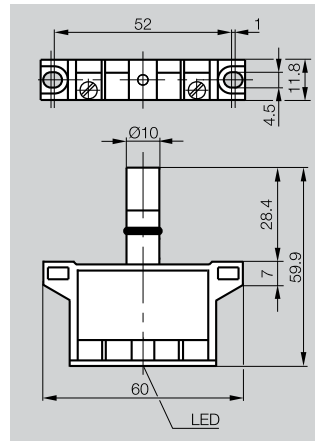
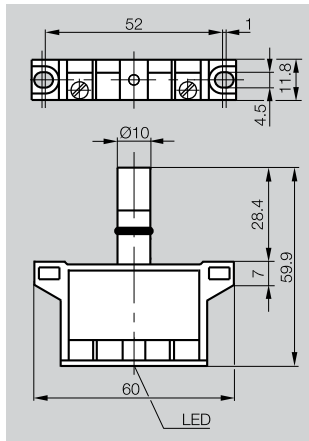
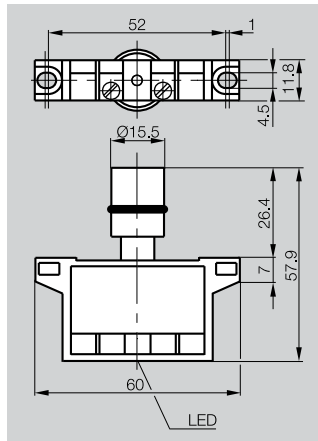
DC, NC



AC/DC 2-Wire

Mechanical Switches Replacement Switch Elements

AAA	KHG	KHH	NG
5 mm	2 mm	2 mm	2 mm
0...4 mm	0...1.6 mm	0...1.6 mm	0...1.6 mm
602, 611, 613, 605	602, 610...613, 605	602, 610...613, 605	602, 610...613, 605



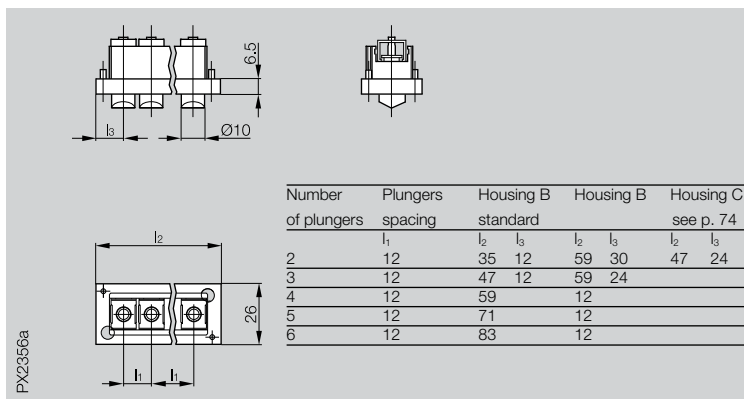
BES 517-464-RK			
	BES 517-560-H-RK	BES 517-561-H-RK	BES 516-314-N-RK
220 V AC	24 V DC	24 V DC	8.2 V DC
90...250 V AC	10...55 V DC	10...55 V DC	7.7...9 V DC
≤ 8.5 V	≤ 7 V DC	≤ 7 V DC	
250 V AC	75 V DC	75 V DC	75 V DC
100 mA	100 mA	100 mA	
≤ 3000 µA	≤ 1350 µA	≤ 1350 µA	
yes	yes	yes	yes
no	yes	yes	no
	≤ 0.5 µF	≤ 0.5 µF	
≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %
-25...+70 °C	-25...+70 °C	-25...+70 °C	-25...+70 °C
15 Hz	1000 Hz	1000 Hz	1000 Hz
AC 140	DC 13	DC 13	
yes	yes	yes	no
IP 67	IP 67	IP 67	IP 67
PA 12	PA 12	PA 12	PBT
PA 12	PA 12	PA 12	PBT
Screw terminals	Screw terminals	Screw terminals	Screw terminals
14	14	14	14
cULus			

*Output signal:	Current change (no trigger response)
Fully undamped	≥ 4 mA
Fully damped	≤ 1 mA
Permissible series resistance R _v	550...1100 Ohm

Mechanical Switches

Quick-Change Plunger Block for Series 61

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



Part Number	BNP 2 - - - -61-
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-D12-61-12

BNP 29- - - -61- - -

No. of plungers	Plunger style	Plunger spacing l1	Distance l3
02 2x	D Chisel	12 12 mm	12 12 mm
...	K Ball	16 16 mm	16 16 mm
06 6x	R Roller		24 24 mm
	L Roller bearing		30 30 mm

Note!

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

Ordering example for safety application:
BNP 23-04-D12-61-A-01

BNP 23- - - -61- - -

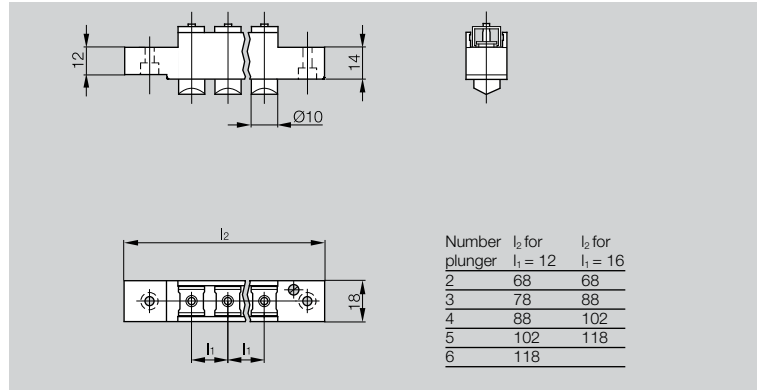
No. of plungers	Plunger style	Plunger spacing l1	Distance l3	Safety switch elements
02 2x	D Chisel	12 12 mm	A 12 mm	No. from flange
...	K Ball	16 16 mm	B 16 mm	
06 6x	R Roller		C 24 mm	
	L Roller bearing		D 30 mm	



Mechanical Switches

Quick-Change Plunger Block for Series 100

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



Part Number	BNP 2 - - - -100
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

No. of plungers	Plunger style	Plunger spacing l ₁
02 2×	D Chisel	12 12 mm
...	K Ball	16 16 mm
06 6×	R Roller	
	L Roller bearing	

Note!

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

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

BNP 23- - - -100- -

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





Mechanical Switches

PG to Metric Cross Reference

Mechanical Multiple Positon Switches

Switch housing	Threaded Opening		Adapters	Ordering Code	
	Old	New		Old	New
40	PG9	M16	BKV-819-M16/P09	BNS 519-B__ - _ 08-40-__	BNS 819-B__ - _ 08-40-__
46	PG11	M16	BKV-819-M16/P11	BNS 519-B__ - ___ -46-__	BNS 819-B__ - ___ -46-__
61	PG13.5	M20	BKV-819-M20/P13	BNS 543-B__ - ___ -61-__	BNS 819-B__ - ___ -61-__
62	PG16	M20	BKV-819-M20/P16	BNS 519-B__ - ___ -62-__	BNS 819-B__ - ___ -62-__
72 2 plungers	PG16	M25	BKV-819-M25/P16	BNS 542-B__ - ___ -72-__	BNS 819-B__ - ___ -72-__
72 3 or more plungers	PG21	M25	BKV-819-M25/P21	BNS 542-B__ - ___ -72-__	BNS 819-B__ - ___ -72-__
100 2 - 5 plungers	PG16	M25	BKV-819-M25/P16	BNS 519-B__ - ___ -100-__	BNS 819-B__ - ___ -100-__
100 6 or more plungers	PG21	M25	BKV-819-M25/P21	BNS 519-B__ - ___ -100-__	BNS 819-B__ - ___ -100-__

Inductive Multiple Positon Switches

Switch housing	Threaded Opening		Adapters	Ordering Code	
	Old	New		Old	New
602-11 2 - 5 plungers	PG16	M25	BKV-819-M25/P16	BNS 516-B__ - ___ -12-602-11	BNS 816-B__ - ___ -12-602-11
602-11 6 or more plungers	PG21	M25	BKV-819-M25/P21	BNS 516-B__ - ___ -12-602-11	BNS 816-B__ - ___ -12-602-11
603-11	PG11	M16	BKV-819-M16/P11	BNS 516-B__ - ___ -12-603-11	BNS 816-B__ - ___ -12-603-11
605-11 2 plungers	PG16	M25	BKV-819-M25/P16	BNS 516-B__ - ___ -12-605-11	BNS 816-B__ - ___ -12-605-11
605-11 3 or more plungers	PG21	M25	BKV-819-M25/P21	BNS 516-B__ - ___ -12-605-11	BNS 816-B__ - ___ -12-605-11
610-11	PG13.5	M20	BKV-819-M20/P13	BNS 516-B__ - ___ -12-610-11	BNS 816-B__ - ___ -12-610-11
611-11	PG13.5	M20	BKV-819-M20/P13	BNS 516-B__ - ___ -12-611-11	BNS 816-B__ - ___ -12-611-11
612-11	PG13.5	M20	BKV-819-M20/P13	BNS 516-B__ - ___ -12-612-11	BNS 816-B__ - ___ -12-612-11
613-11	PG13.5	M20	BKV-819-M20/P13	BNS 516-B__ - ___ -12-613-11	BNS 816-B__ - ___ -12-613-11
650-11	PG9	M16	BKV-819-M16/P09	BNS 516-B__ - _ 08-650-11	BNS 816-B__ - _ 08-650-11

Mechanical Single Positon Switches

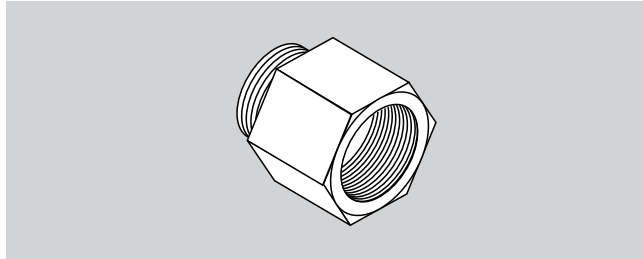
Switch housing	Threaded Opening		Adapters	Ordering Code	
	Old	New		Old	New
99	PG7	M12	BKV-819-M12/P07	BNS 519-99-__-__	BNS 819-99-__-__
100	PG9	M16	BKV-819-M16/P09	BNS 519-100-__-__	BNS 819-100-__-__
F 60	PG9	M16	BKV-819-M16/P09	BNS 519-F _-60-__	BNS 819-F _-60-__

Mechanical Switches

Fittings

Accessory Type

Metric to NPT Adapter
Converts metric threaded
opening in BNS switch to NPT
threaded conduit fitting

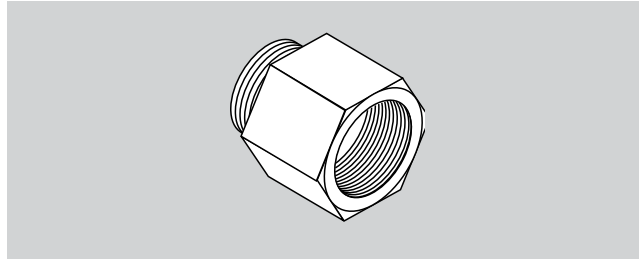


Male M16 to Female 1/2"NPT	Z/M16-M-TO-1/2"-F-NPT
Male M20 to Female 1/2"NPT	Z/M20-M-TO-1/2"-F-NPT
Male M25 to Female 3/4"NPT	Z/M25-M-TO-3/4"-F-NPT

Material	Nickel-Plated Brass

Accessory Type

Metric to PG Adapter
Converts metric threaded
opening in BNS switch
to PG threaded conduit fitting

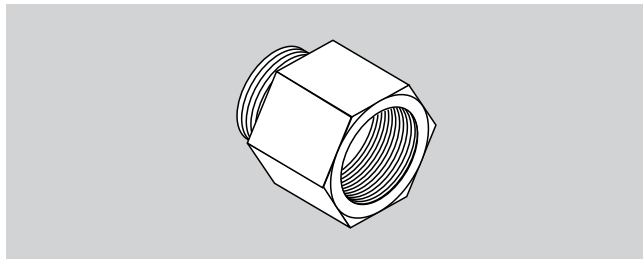


Male M12 to Female PG 07	BKV 819-M12/P07
Male M16 to Female PG 09	BKV 819-M16/P09
Male M16 to Female PG 11	BKV 819-M16/P11
Male M20 to Female PG 13	BKV 819-M20/P13
Male M20 to Female PG 16	BKV 819-M20/P16
Male M25 to Female PG 16	BKV 819-M25/P16
Male M25 to Female PG 21	BKV 819-M25/P21

Material	Nickel-Plated Brass
	O-Ring Included

Accessory Type

PG to Metric Adapter
Converts PG threaded
opening to metric conduit
fittings

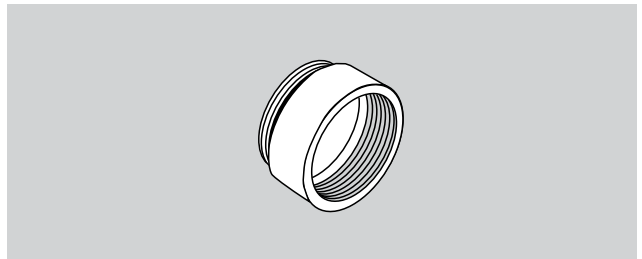


Male PG 07 to Female M12	BKV 819-P07/M12
Male PG 09 to Female M16	BKV 819-P09/M16
Male PG 11 to Female M16	BKV 819-P11/M16
Male PG 13 to Female M20	BKV 819-P13/M20
Male PG 16 to Female M20	BKV 819-P16/M20
Male PG 16 to Female M25	BKV 819-P16/M25
Male PG 21 to Female M25	BKV 819-P21/M25

Material	Nickel-Plated Brass
	O-Ring Included

Accessory Type

Metric Increases
Increases the metric
opening in the BNS switch



Male M12 to Female M16	BKV 819-M12/M16
Male M16 to Female M20	BKV 819-M16/M20
Male M20 to Female M25	BKV 819-M20/M25

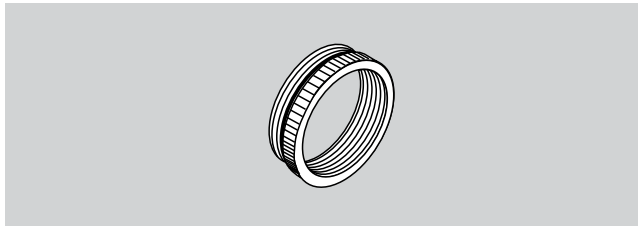
Material	Nickel-Plated Brass
	O-Ring Included

Mechanical Switches

Fittings

Accessory Type

Metric Reducers
Decreases the metric opening
in the BNS switch



Male M16 to Female M12
Male M20 to Female M12
Male M20 to Female M16
Male M25 to Female M16
Male M25 to Female M20

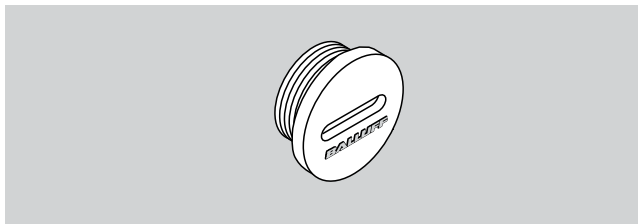
BKV 819-M16/M12
BKV 819-M20/M12
BKV 819-M20/M16
BKV 819-M25/M16
BKV 819-M25/M20

Material

Nickel-Plated Brass
O-Ring Included

Accessory Type

Sealing Cap
Plastic metric threaded
sealing cap
Supplied with O-Ring



M16 Plastic Cap
M20 Plastic Cap
M25 Plastic Cap

VERSCHLUSSCHR. KPL. M16X1,5
VERSCHLUSSCHR. KPL. M20X1,5
VERSCHLUSSCHR. KPL. M25X1,5

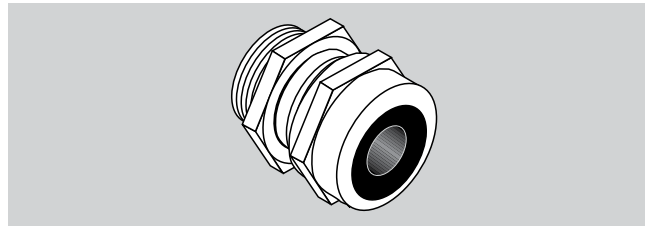
Material

Plastic
O-Ring Included

Accessory Type

Accessory Type

Cord Seal
Metric threads
Viton form seal and O-ring
150 PSI



M12 Cable Range 2 - 5 mm
M16 Cable Range 4 - 8 mm
M20 Cable Range 7 - 12 mm
M20 Cable Range 10 - 14 mm
M25 Cable Range 9 - 16 mm
M25 Cable Range 13 - 18 mm
M32 Cable Range 13 - 20 mm

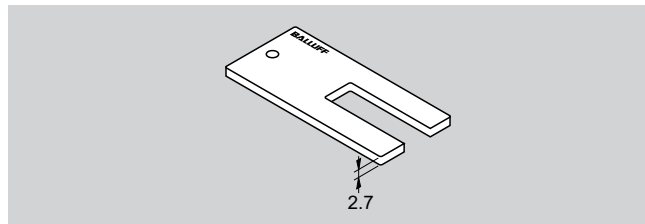
BKV 820-M12/2-5-01-M
BKV 820-M16/4-8-01-M
BKV 820-M20/7-12-01-M
BKV 820-M20/10-14-01-M
BKV 820-M25/9-16-01-M
BKV 820-M25/13-18-01-M
BKV 820-M32/13-20-01-M

Material

Nickel-Plated Brass
PVDF Spline Bushing

Accessory Type

BNS Set Up Gauge
Used to set distance
between BNS
switch face and cams



BSE-85 Elements
BSE-30 & BSE 61 Elements
**Inductive Switches with 3.2 mm
assured sensing distance**

BNL Z/GAUGE-X508
BNL GAUGE-100-3MM
GAGE BAM-AC-NS 127.
x25.4x1.60 ALU

Material

Steel
Aluminum

Replacement Plungers
Stainless steel plungers
Telescoping style for
standard switches
Rigid style for safety switches



D - Rigid Chisel Plunger (813 or 823) - Safety
D - Telescoping Chisel Plunger (819 or 829) - Standard
K - Rigid Ball Plunger (813 or 823) - Safety
K - Telescoping Ball Plunger (819 or 829) - Standard
L - Rigid Roller Bearing Plunger (813 or 823) - Safety
L - Telescoping Roller Bearing Plunger (819 or 829) - Standard
R - Rigid Roller Plunger (813 or 823) - Safety
R - Telescoping Roller Plunger (819 or 829) - Standard

STOESSELEINHEIT KPL. D10 813
STOESSELEINHEIT KPL. D10 819
STOESSELEINHEIT KPL. K10 813
STOESSELEINHEIT KPL. K10 819
STOESSELEINHEIT KPL. L10 813
STOESSELEINHEIT KPL. L10 819
STOESSELEINHEIT KPL. R10 813
STOESSELEINHEIT KPL. R10 819

Accessory Type

Replacement Wiper Plate
includes plate and mounting screws



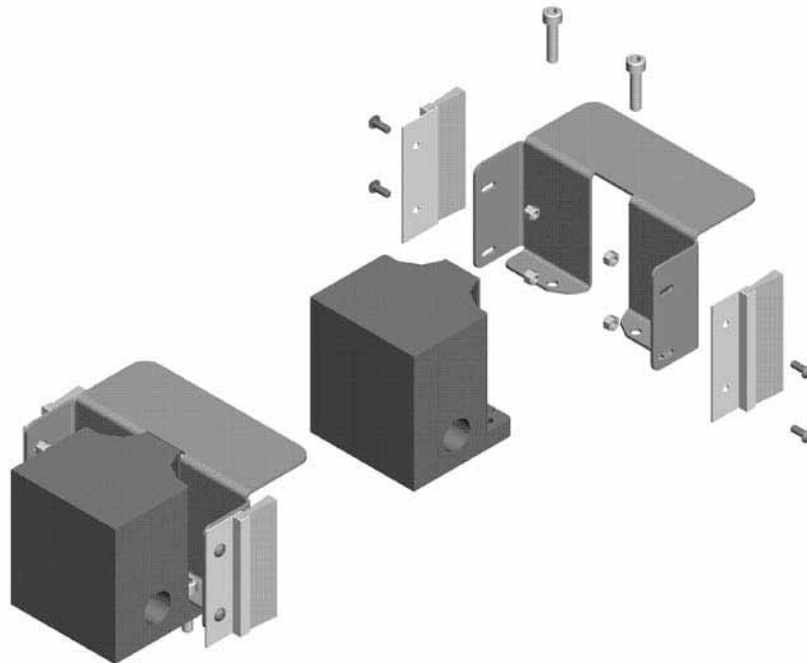
Wiper Plate

10 mm plunger
8 mm plunger

ABSTREIFPLATTE KPL. F. STOESSEL E10 NEU
ABSTREIFPLATTE KPL. F. STOESSEL E6 NEU

Accessory Type

BNS Protection Cover for 4 and 6 Position 61 and 100 Series
Provide additional protection for mechanical and inductive switches in harsh environments. Brass brushes rub against cams to help remove foreign debris.



4 position 61 series

6 position 61 series

4 position 100 series

6 position 100 series

BAM SH-NS-61-V1-04

BAM SH-NS-61-V1-06

BAM SH-NS-100-V1-04

BAM SH-NS-100-V1-06

Brush Replacement Kits

4 position brush

6 position brush

BAM SH-NS-V1-RK2-48mm

BAM SH-NS-V1-RK2-72mm

Brush Holder and Brush Replacement Kits

4 position

6 position

BAM SH-NS-V1-RK1-48mm

BAM SH-NS-V1-RK1-72mm

Mechanical Switches

Accessories - Pre-wired Connectors

BNS Switches With Number of Pre-Wired Connectors										
	X#### Unique Part Number Assigned By Factory		Number of Connectors Required							
Switch Housing Series	Connector Suffix	Connector Description	Number of Switch Positions							
			2	3	4	5	6	8	10	12
40 / 650-11 Series	S80	5 Pole Dual Keyway Connector without LED	1	1	2	2	2			
	S80	5 Pole Dual Keyway Connector with LED	1	2	2					
	S72	5 Pole Center Pin Ground Connector without LED	1	1	2	2	2			
	S72	5 Pole Center Pin Ground Connector with LED	1	2	2					
	X #####	8 Pole Connector without LED	1	1	1	1	1			
	X #####	8 Pole Connector with LED	1	1	1	1	2			
	X #####	9 Pole Connector without LED	1	1	1	1	1			
	X #####	9 Pole Connector with LED	1	1	1	1	2			
	S90	12 Pole Connector without LED	1	1	1	1	1			
	S90	12 Pole Connector with LED	1	1	1	1	1			
46 / 603-11 Series	S80	5 Pole Dual Keyway Connector without LED	1	1	2	2	2			
	S80	5 Pole Dual Keyway Connector with LED	1	2	2					
	S72	5 Pole Center Pin Ground Connector without LED	1	1	2	2	2			
	S72	5 Pole Center Pin Ground Connector with LED	1	2	2					
	X #####	8 Pole Connector without LED	1	1	1	1	1	2	2	
	X #####	8 Pole Connector with LED	1	1	1	1	2	2	2	
	X #####	9 Pole Connector without LED	1	1	1	1	1	2	2	
	X #####	9 Pole Connector with LED	1	1	1	1	2	2	2	
	S90	12 Pole Connector without LED	1	1	1	1	1	1	1	
	S90	12 Pole Connector with LED	1	1	1	1	1	2	2	
61 / 610-11 / 611-11 / 612-11 / 613-11 Series	S80	5 Pole Dual Keyway Connector without LED	1	1	2	2	2			
	S80	5 Pole Dual Keyway Connector with LED	1	2	2					
	S72	5 Pole Center Pin Ground Connector without LED	1	1	2	2	2			
	S72	5 Pole Center Pin Ground Connector with LED	1	2	2					
	X #####	8 Pole Connector without LED	1	1	1	1	1			
	X #####	8 Pole Connector with LED	1	1	1	1	2			
	X #####	9 Pole Connector without LED	1	1	1	1	1			
	X #####	9 Pole Connector with LED	1	1	1	1	2			
	S90	12 Pole Connector without LED	1	1	1	1	1			
	S90	12 Pole Connector with LED	1	1	1	1	1			
	X #####	19 Pole Connector without LED	1	1	1	1	1			
	X #####	19 Pole Connector with LED	1	1	1	1	1			
	X#####	24 Pin Harting DD Connector with LED	1	1	1	1	1			
	X#####	24 Pin Harting DD Connector without LED	1	1	1	1	1			
	X#####	32 Pin Harting EE Connector with LED	1	1	1	1	1			
	X#####	32 Pin Harting EE Connector without LED	1	1	1	1	1			

Mechanical Switches

Accessories - Pre-wired connectors

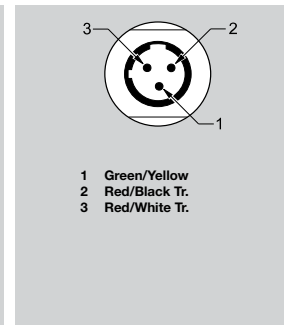
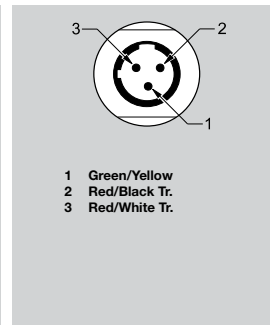
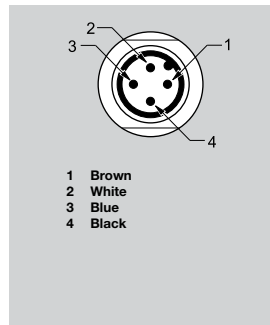
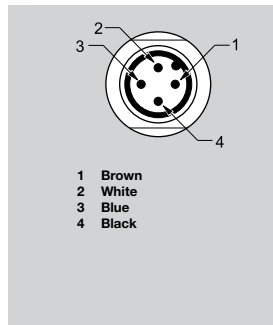
BNS Switches With Number of Pre-Wired Connectors										
	X#### Unique Part Number Assigned By Factory		Number of Connectors Required							
Switch Housing Series	Connector Suffix	Connector Description	Number of Switch Positions							
			2	3	4	5	6	8	10	12
62 / 72 / 605-11 Series	S80	5 Pole Dual Keyway Connector without LED	1	1	2	2	2			
	S80	5 Pole Dual Keyway Connector with LED	1	2	2					
	S72	5 Pole Center Pin Ground Connector without LED	1	1	2	2	2			
	S72	5 Pole Center Pin Ground Connector with LED	1	2	2					
	X #####	8 Pole Connector without LED	1	1	1	1	1	2	2	
	X #####	8 Pole Connector with LED	1	1	1	1	2	2	2	
	X #####	9 Pole Connector without LED	1	1	1	1	1	2	2	
	X #####	9 Pole Connector with LED	1	1	1	1	2	2	2	
	S90	12 Pole Connector without LED	1	1	1	1	1	1	1	
	S90	12 Pole Connector with LED	1	1	1	1	1	2	2	
	X #####	19 Pole Connector without LED	1	1	1	1	1	1	1	
	X #####	19 Pole Connector with LED	1	1	1	1	1	1	1	
	X #####	24 Pin Harting DD Connector with LED	1	1	1	1	1	1	1	
	X #####	24 Pin Harting DD Connector without LED	1	1	1	1	1	1	1	
	X #####	32 Pin Harting EE Connector with LED	1	1	1	1	1	1	1	
	X #####	32 Pin Harting EE Connector without LED	1	1	1	1	1	1	1	
100 / 602-11 Series	S80	5 Pole Dual Keyway Connector without LED	1	1	2	2	2			
	S80	5 Pole Dual Keyway Connector with LED	1	2	2					
	S72	5 Pole Center Pin Ground Connector without LED	1	1	2	2	2			
	S72	5 Pole Center Pin Ground Connector with LED	1	2	2					
	X #####	8 Pole Connector without LED	1	1	1	1	1	2	2	2
	X #####	8 Pole Connector with LED	1	1	1	1	2	2	2	
	X #####	9 Pole Connector without LED	1	1	1	1	1	2	2	2
	X #####	9 Pole Connector with LED	1	1	1	1	2	2	2	
	S90	12 Pole Connector without LED	1	1	1	1	1	1	1	2
	S90	12 Pole Connector with LED	1	1	1	1	1	1	2	2
	X #####	19 Pole Connector without LED	1	1	1	1	1	1	1	1
	X #####	19 Pole Connector with LED	1	1	1	1	1	1	1	1
	X #####	24 Pin Harting DD Connector with LED	1	1	1	1	1	1	1	1
	X #####	24 Pin Harting DD Connector without LED	1	1	1	1	1	1	1	1
	X #####	32 Pin Harting EE Connector with LED	1	1	1	1	1	1	1	1
	X #####	32 Pin Harting EE Connector without LED	1	1	1	1	1	1	1	1

S80L 5 Pin Connector Left Side of Switch
 S80R 5 Pin Connector Right Side of Switch
 S80S 5 Pin Connector Both Sides of Switch

Mechanical Switches

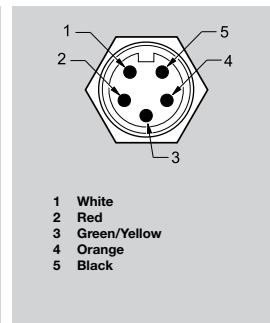
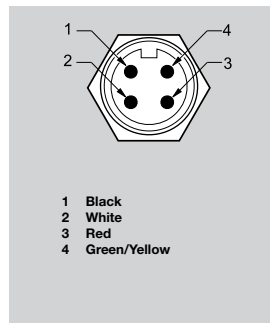
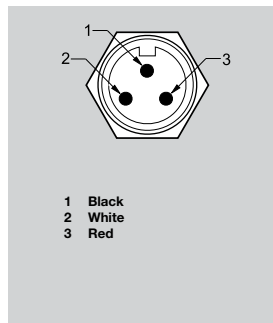
Connectors

Connector	Micro DC	Micro DC	Micro AC 1/2"x20 UNF	Micro AC 1/2"x20 UNF
Style	M12 - 4 pole	M12 - 4 pole	Micro AC - 3 pole	Micro AC - 3 pole
Configuration	Straight Male	Straight Male	Straight Male	Straight Male



M16 x 1.5	Fig. 1	R04 CN-04-K-22A-010F	R21 CA-03-K-22B-010F	
M20 x 1.5	Fig. 2			R21 CA-03-L-22B-010F
Voltage Rating		300 Vac/Vdc	300 Vac/Vdc	300 Vac/Vdc
Amperage		4 Amps	4 Amps	4 Amps
Wire Gauge		22 AWG	22 AWG	22 AWG
Jacket		PVC	PVC	PVC
Shell		nickel plated brass	anodized aluminum	anodized aluminum
O-ring		viton	viton	viton
Protection		IP 67	IP 67	IP 67
Ambient Operating Temp.		-40 to 221°F	-4 to 221°F	-4 to 221°F
cULus Recognized		yes	yes	yes

Connector	Mini Size A	Mini Size A	Mini Size A
Style	3 pole	4 pole	5 pole
Configuration	Straight Male	Straight Male	Straight Male



M20 x 1.5	Fig. 3	R05 CA-03-L-18C-010F	R05 CA-04-L-18C-010F	R0A CA-05-L-18C-010F
Voltage Rating		300 Vac/Vdc	300 Vac/Vdc	300 Vac/Vdc
Amperage		8 Amps	5 Amps	5 Amps
Wire Gauge		18 AWG	18 AWG	18 AWG
Jacket		PVC	PVC	PVC
Shell		anodized aluminum	anodized aluminum	anodized aluminum
O-ring		viton	viton	viton
Protection		IP 67	IP 67	IP 67
Ambient Operating Temp.		-40 to 194°F	-40 to 194°F	-40 to 194°F
cULus Recognized		yes	yes	yes

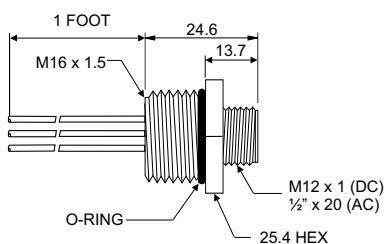


Fig. 1 (Male)

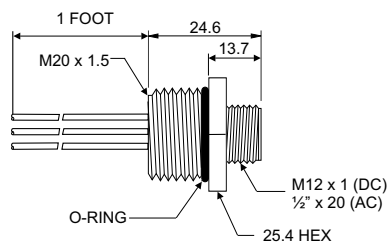


Fig. 2 (Male)

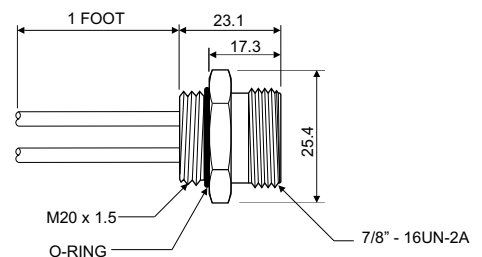
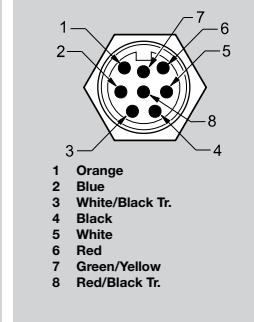
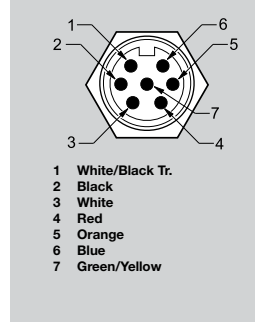
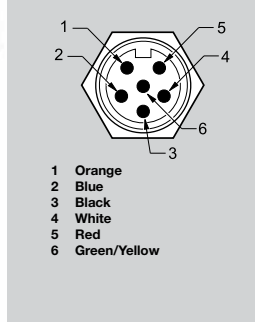


Fig. 3 (Male)

Mechanical Switches

Connectors

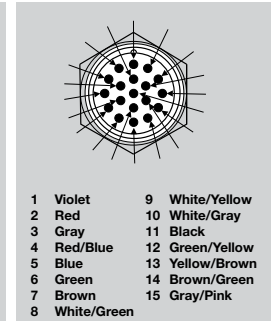
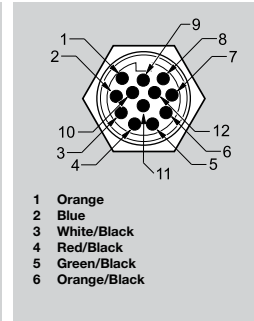
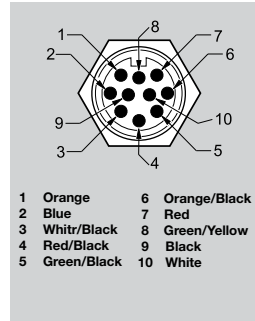
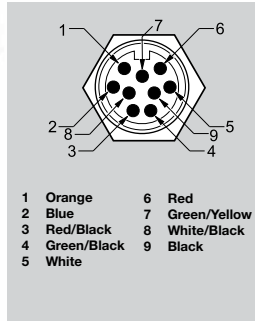
Connector	Mini Size B	Mini Size B	Mini Size B
Style	6 pole	7 pole	8 pole
Configuration	Straight Male	Straight Male	Straight Male



M20 x 1.5	Fig. 4	R0B CA-06-L-18C-010F	R0B CA-07-L-18C-010F	R0B CA-08-L-18C-010F
------------------	--------	----------------------	----------------------	----------------------

Voltage Rating	300 Vac/Vdc	300 Vac/Vdc	300 Vac/Vdc
Amperage	5 Amps	5 Amps	5 Amps
Wire Gauge	18 AWG	18 AWG	18 AWG
Jacket	PVC	PVC	PVC
Shell	anodized aluminum	anodized aluminum	anodized aluminum
O-Ring	viton	viton	viton
Protection	IP 67	IP 67	IP 67
Ambient Operating Temp.	-40 to 221°F	-40 to 221°F	-40 to 221°F
cULus Recognized	yes	yes	yes

Connector	Mini Size C	Mini Size C	Mini Size C	Mini Size C
Style	9 pole	10 pole	12 pole	19 Pole
Configuration	Straight Male	Straight Male	Straight Male	Straight Male



M20 x 1.5	Fig. 5	R0C CA-09-L-18C-010F	R0C CA-10-L-18C-010F	R0C CA-12-L-18C-010F	R0C CA-19-M-22C-010F*
------------------	--------	----------------------	----------------------	----------------------	-----------------------

Voltage Rating	300 Vac/Vdc	300 Vac/Vdc	300 Vac/Vdc	300 V
Amperage	4 Amps	4 Amps	4 Amps	4 Amps
Wire Gauge	18 AWG	18 AWG	18 AWG	3/18 & 16/22 AWG
Jacket	PVC	PVC	PVC	PVC
Shell	anodized aluminum	anodized aluminum	anodized aluminum	clear anodized aluminum
O-ring	viton	viton	viton	viton
Protection	IP 67	IP 67	IP 67	IP 67
Ambient Operating Temp.	-4 to 221°F	-4 to 221°F	-4 to 221°F	-4 to 221°F
cULus Recognized	yes	yes	yes	yes

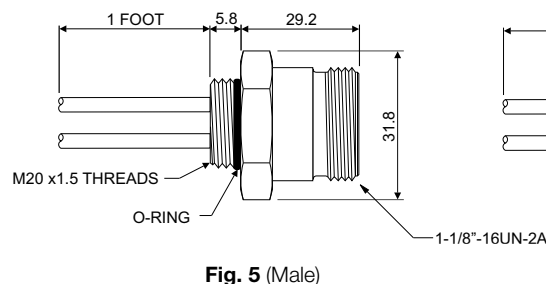
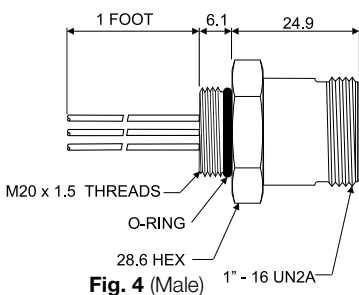
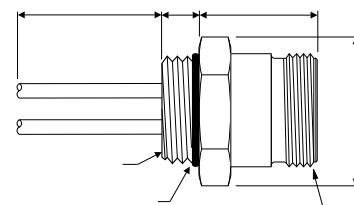


Fig. 5 (Male)



*Fig. 5 (Male)

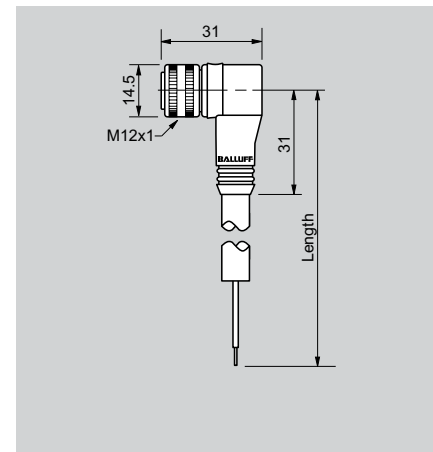
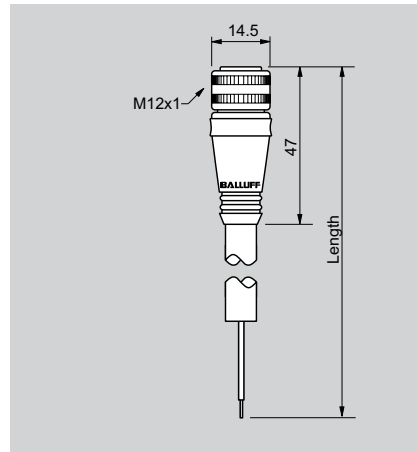
Mechanical Switches

Cables

Connector
Style
Configuration

Micro
M12 DC Single Keyway
Straight Female

Micro
M12 DC Single Keyway
Right Angle Female



3 Wire PVC
3 Wire TPE
4 Wire PVC
4 Wire TPE
5 Wire, non-LED

BCC M415-0000-1A-001-VX43T2-XXX
BCC M415-0000-1A-001-EX43T2-XXX
BCC M415-0000-1A-003-VX44T2-XXX
BCC M415-0000-1A-003-EX44T2-XXX
C04 AEQ-00-VY-050M

BCC M425-0000-1A-001-VX43T2-XXX
BCC M425-0000-1A-001-EX43T2-XXX
BCC M425-0000-1A-003-VX44T2-XXX
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C04 BEQ-00-VY-050M

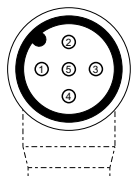
Voltage Rating (non-LED)
Amperage
Wire Gauge
Jacket
Coupling Nut *8-pole Nickel Plated Brass
Protection
Ambient Operating Temperature
UL Listed
CSA Certified

250 Vac/Vdc (36 Vdc-8 wire)
4 Amps
22 AWG (24 AWG-8 wire)
Yellow PVC, TPE (PUR-8 wire)
Black Epoxy Coated Zinc
IP 67
-5° C to 105° C
yes
yes

250 Vac/Vdc (36 Vdc-8 wire)
4 Amps
22 AWG (24 AWG- 8 wire)
Yellow PVC, TPE (PUR-8 wire)
Black Epoxy Coated Zinc
IP 67
-5° C to 105° C
yes
yes

- Notes:**
1. 5 meter cable length is standard (other lengths available - consult factory)
 2. Additional cable options are available from the part matrix. Consult factory for availability. Minimum order quantities and lead times may apply.

Female 2-5 pin face view

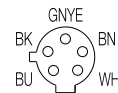
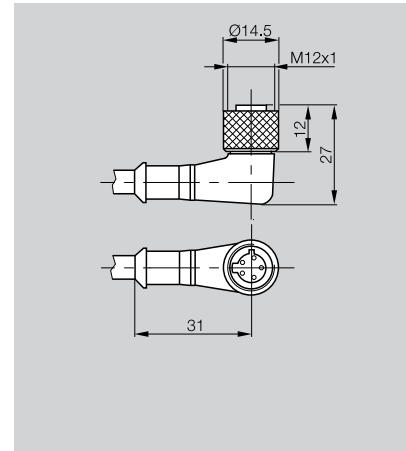


3-wire	
Pin #	Color
1	Brown
2	
3	Blue
4	Black
5	

4-wire	
Pin #	Color
1	Brown
2	White
3	Blue
4	Black
5	

5-wire	
Pin #	Color
1	Brown
2	White
3	Blue
4	Black
5	Grey

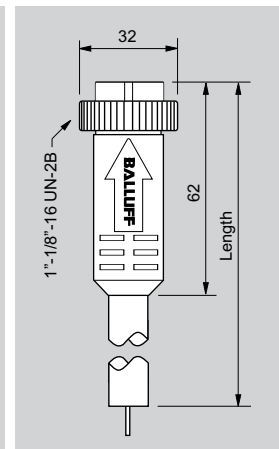
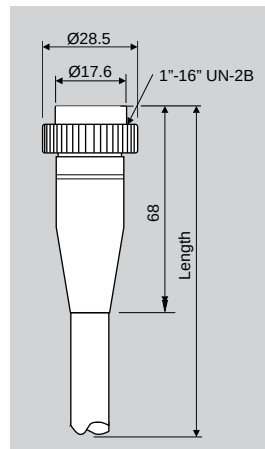
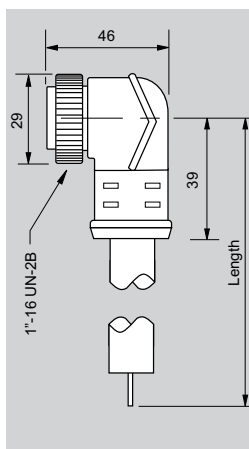
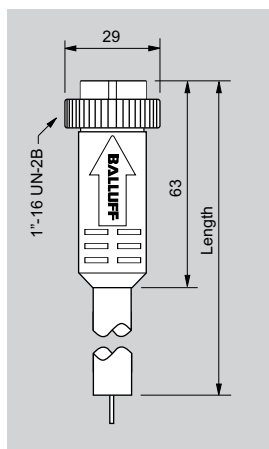
12-pin		
5-pin		
4-pin	BKS-S 80-G-PU-05	BKS-S 80-W-PU-05
3-pin		
Supply voltage U _B		
Cable	300 V AC/10...60 V DC	300 V AC/10...60 V DC
No. of wires × AWG	5 m molded-on PUR	5 m molded-on PUR
Degree of protection per IEC 60529	5×20	5×20
Ambient temperature range T _a	IP 67	IP 68 per BWN Pr. 20
View of female side	−25...+90 °C	−25...+90 °C



Mechanical Switches

Cables

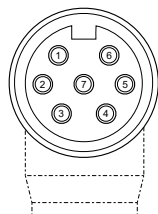
Connector	7-8 Pole Mini	7-8 Pole Mini	8-9 Pole Mini	12 Pole
Style	Mini Size B	Mini Size B	Mini Size B	Mini Size C
Configuration	Straight Female	Right Angle Female	Straight Female	Straight Female



Mini Connectors				
7 Pole	CB 07-AE-16-VY-XXXF	CB 07-BE-16-VY-150F	CB 08-AA-16-VY-200FH	
8 Pole	CB 08-AE-16-VY-XXXF	CB 08-BE-16-VY-150F	CC 09-AA-16-VY-200FH	
9 Pole				
12 Pole				CC 12-AE-16-VY-150F
Voltage Rating	600 Vac/Vdc	600 Vac/Vdc	600 Vac/Vdc	600 Vac/Vdc
Amperage	8A (7 pole) / 7A (8 pole)	8A (7 pole) / 7A (8 pole)	7A (8/9 pole)	5A
Wire Gauge	16 AWG	16 AWG	16 AWG	16 AWG
Jacket	PVC	PVC	PVC	PVC
Coupling Nut	Black Epoxy Coated Zinc	Black Epoxy Coated Zinc	Black Epoxy Coated Zinc	Black Epoxy Coated Zinc
Protection	IP 68 / NEMA 6P	IP 68 / NEMA 6P	IP 68 / NEMA 6P	IP 68 / NEMA 6P
Ambient Operating Temp.	-4 to 221°F	-4 to 221°F	-4 to 194°F	-4 to 221°F
UL Listed	yes	yes		yes
CSA Certified	yes	yes		yes

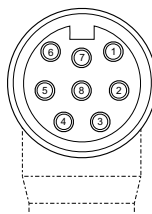
Note: Additional variations/lengths available - consult factory.

Female 7-pin face view



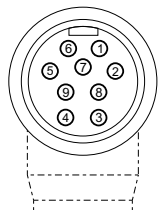
Pin #	Color
1	White/Black
2	Black
3	White
4	Red
5	Orange
6	Blue
7	Green

Female 8-pin face view



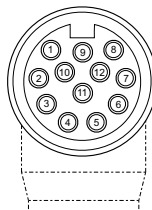
Pin #	Color
1	Orange
2	Blue
3	White/Black
4	Black
5	White
6	Red
7	Green
8	Red/Black

Female 9-pin face view



Pin #	Color
1	Orange
2	Blue
3	Red/Black
4	Green/Black
5	White
6	Red
7	Green
8	White/Black
9	Black

Female 12-pin face view



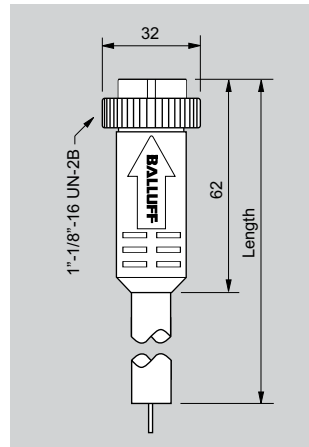
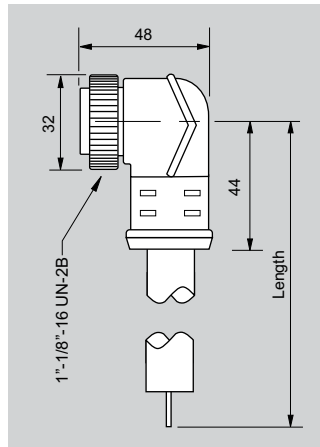
Pin #	Color
1	Orange
2	Blue
3	White/Black
4	Red/Black
5	Green/Black
6	Orange/Black
7	Blue/Black
8	Black/White
9	Green
10	Red
11	White
12	Black



Mechanical Switches

Cables

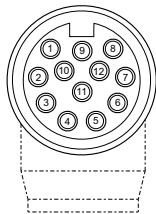
Connector	12 Pole	19 Pole
Style	Mini Size C	Mini Size C
Configuration	Right Angle Female	Straight Female



Mini Connectors		
12 Pole	CC 12-BE-16-VY-150F	
19 Pole		CC 19-AE-22-PB-XXXM
19 Pole (High Flex)		
Voltage Rating	600 Vac/Vdc	300 Vac/Vdc
Amperage	5A	3 A LG Pins / 2 A Small Pins
Wire Gauge	16 AWG	318 AWG / 1622 AWG
Jacket	PVC	PVC
Coupling Nut	Black Epoxy Coated Zinc	Black Epoxy Coated Zinc
Protection	IP 68 / NEMA 6P	IP 68 / NEMA 6P
Ambient Operating Temp.	-4 to 221°F	-25 to 176°F
UL Listed	yes	yes
CSA Certified	yes	yes

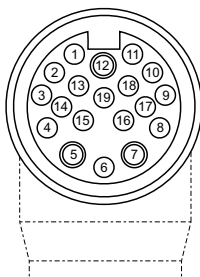
Note: Additional variations/lengths available - consult factory.

Female 12-pin face view



Pin #	Color
1	Orange
2	Blue
3	White/Black
4	Red/Black
5	Green/Black
6	Orange/Black
7	Blue/Black
8	Black/White
9	Green
10	Red
11	White
12	Black

Female 19-pin face view



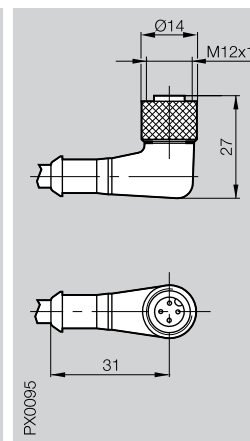
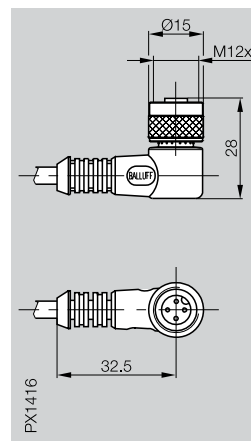
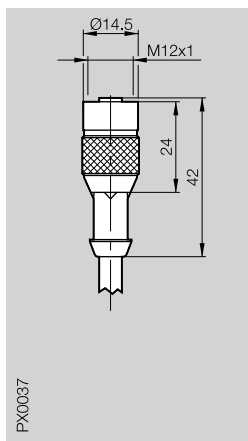
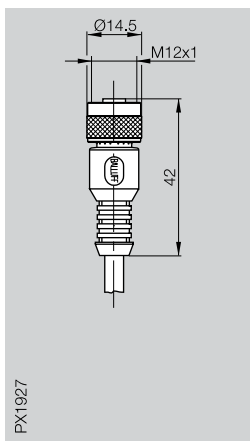
Pin #	Color	Pin #	Color
1	Violet	11	Black
2	Red	12	Green/Yellow
3	Grey	13	Yellow/Brown
4	Red/Blue	14	Brown/Green
5	Blue	15	White
6	Green	16	Yellow
7	Brown	17	Pink
8	White/Green	18	Grey/Brown
9	White/Yellow	19	Grey/Pink
10	White/Grey		



Mechanical Switches

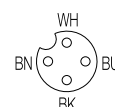
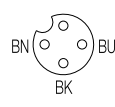
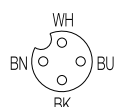
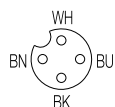
IO-Link Cables

Connector	BKS-B 19	BKS-S 19	BKS-B 20	BKS-S 20
Version	Straight female	Straight female	Right angle female	Right angle female
Use	BNS ...-S4_-I (IO-Link)	BNS ...-S4_-I (IO-Link)	BNS ...-S4_-I (IO-Link)	BNS ...-S4_-I (IO-Link)



4-pin	BKS-B 19-3-05	BKS-S 19-3-PU-03		BKS-S 20-3-PU-03
3-pin	BKS-B 19-1-03	BKS-S 19-1-PU-03	BKS-B 20-1-03	BKS-S 20-1-PU-03
Supply voltage U_B	10...30 V DC	10...30 V DC	10...30 V DC	10...30 V DC
Cable	3 m/5 m molded-on PVC	3 m molded PUR	3 m molded PVC	3 m molded PUR
No. of wires x cross-section	3x0.34 mm ² /4x0.34 mm ²	3x0.34 mm ² /4x0.34 mm ²	3x0.34 mm ²	3x0.34 mm ² /4x0.34 mm ²
Degree of protection per IEC 60529	IP 67	IP 68 per BWN Pr. 20	IP 67	IP 68 per BWN Pr. 20
Ambient temperature range T_a	-25...+85 °C	-25...+70 °C	-25...+85 °C	-25...+70 °C

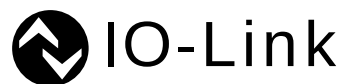
Other cable lengths on request.



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.



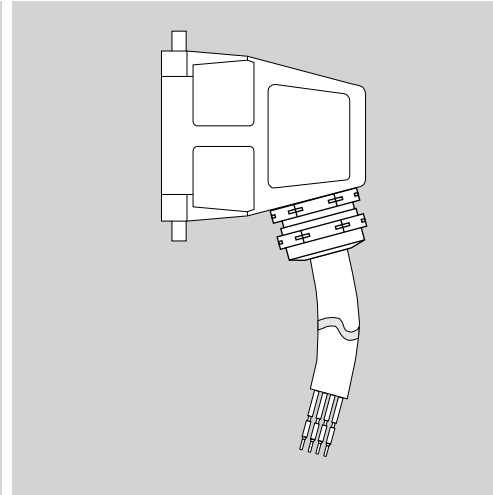
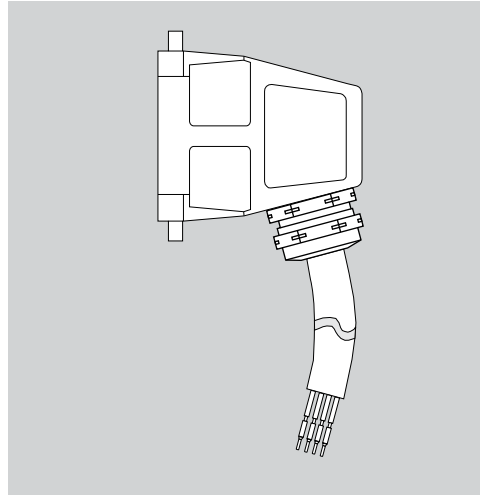
For additional information, visit
www.balluff.com/iolink



Mechanical Switches

Harting Cables

Connector	Harting 24-pin DD	Harting 24-pin DD
Version	Right angle with flying leads	Right angle with flying leads hi-flex
Use	BNS with 24-pin connector	BNS with 24-pin connector



Part number	BKS X518-CABLE-10FT	BKS X518-CABLE-HI-FLEX-15FT
	BKS X518-CABLE-20FT	BKS X518-CABLE-HI-FLEX-20FT
	BKS X518-CABLE-25FT	BKS X518-CABLE-HI-FLEX-30FT
	BKS X518-CABLE-30FT	BKS X518-CABLE-HI-FLEX-40FT
	BKS X518-CABLE-40FT	BKS X518-CABLE-HI-FLEX-60FT
	BKS X518-CABLE-50FT	BKS X518-CABLE-HI-FLEX-100FT
	BKS X518-CABLE-65FT	BKS X518-CABLE-HI-FLEX-120FT
	BKS X518-CABLE-75FT	
	BKS X518-CABLE-85FT	
	BKS X518-CABLE-100FT	

Housing	24 DD right angle	24 DD right angle
Insert	24 DD female	24 DD female
Contacts	Silver plated female sockets	Silver plated female sockets
Wire size	18 AWG	16 AWG
Jacket	PVC, Gray	TPE, Yellow
Voltage rating	600 VAC/VDC	600 VAC/VDC
Number of conductors	25	31
Temperature	-5°...90°C	-5°...90°C

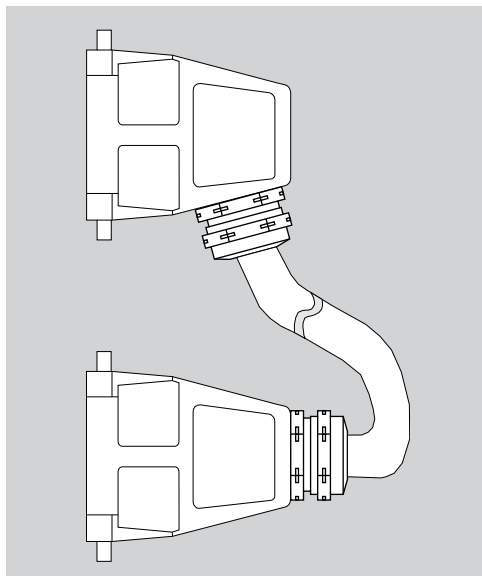
Notes:

- Pin 1 bottom left when facing connector
- Wired straight through (wire 1 on PIN 1)

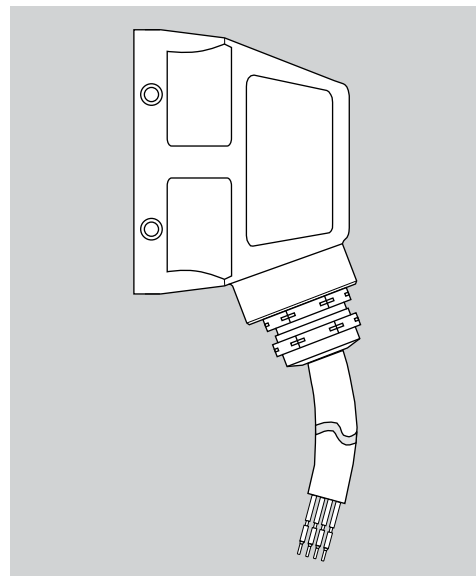
Mechanical Switches

Harting Cables

Connector	Harting 24-pin DD
Version	Right angle/straight double ended
Use	BNS with 24-pin connector



Connector	Harting 32-pin EE
Version	Right angle with flying leads
Use	BNS with 32-pin connector



Part number	BKS X518-CABLE-EXTENSION-020FT
	BKS X518-CABLE-EXTENSION-040FT
	BKS X518-CABLE-EXTENSION-050FT
	BKS X518-CABLE-EXTENSION-060FT
	BKS X518-CABLE-EXTENSION-080FT
	BKS X518-CABLE-EXTENSION-095FT

Part number	BKS X524-CABLE-40FT

Housing	Right angle female/straight male
Insert	24 DD female/24 DD male
Contacts	Silver plated female sockets/male pins
Wire size	18 AWG
Jacket	PVC, Gray
Voltage rating	600 VAC/VDC
Number of conductors	25
Temperature	-5°...90°C

Housing	32 EE right angle
Insert	32 EE female
Contacts	Silver plated female sockets
Wire size	18 AWG
Jacket	PVC, Gray
Voltage rating	600 VAC/VDC
Number of conductors	25
Temperature	-5°...90°C

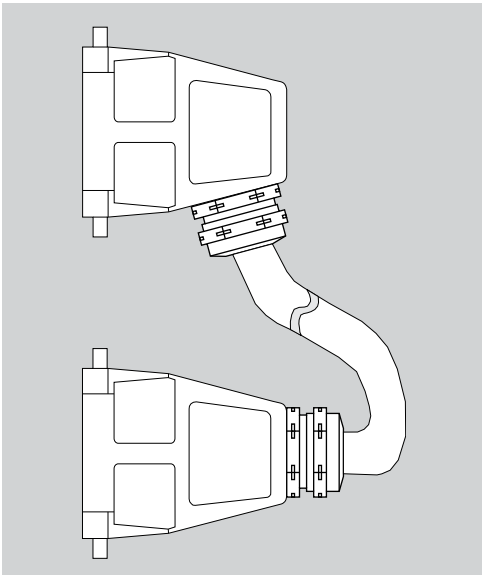
Notes:

- Pin 1 bottom left when facing connector
- Wired straight through (wire 1 on PIN 1)

Mechanical Switches

Harting Cables

Connector	Harting 32-pin EE
Version	Right angle double ended hi-flex
Use	BNS with 32-pin connector



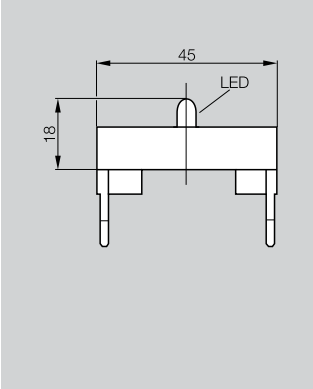
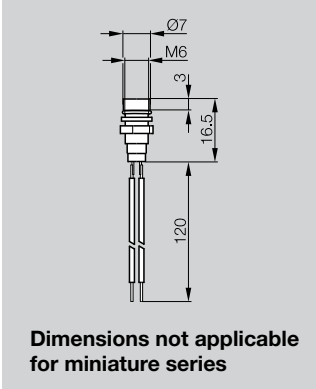
Part number	BKS X524-CABLE-HI-FLEX-EXT-30FT
	BKS X524-CABLE-HI-FLEX-EXT-50FT
	BKS X524-CABLE-HI-FLEX-EXT-60FT
	BKS X524-CABLE-HI-FLEX-EXT-90FT

Housing	Right angle female/male
Insert	32 EE female/32 EE male
Contacts	Silver plated female sockets/male pins
Wire size	16 AWG
Jacket	TPE, Yellow
Voltage rating	600 VAC/VDC
Number of conductors	31
Temperature	-5°...90°C

- Notes:
- Pin 1 bottom left when facing connector
 - Wired straight through (wire 1 on PIN 1)

Mechanical Switches

Function Indicators FD, FE, FC

Type	FD/FE	FC
		
		Dimensions not applicable for miniature series
Application with		
Multiple position switches	FD 6...60 V DC/AC	
Multiple position switches	FE 90...250 V DC/AC	
Multiple position switches	FD 24...28 V DC/AC	
	510870	
	510880	
		149730
Function indicator	LED yellow	LED yellow
Material	PBT	PBT
Version	plug-in	universal

Plug-in function indication

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

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

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

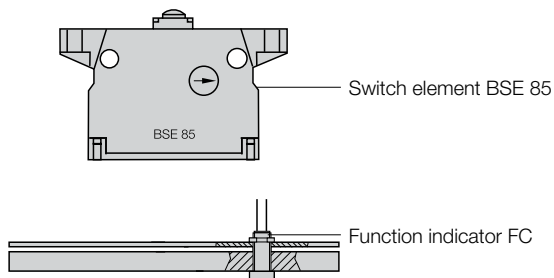
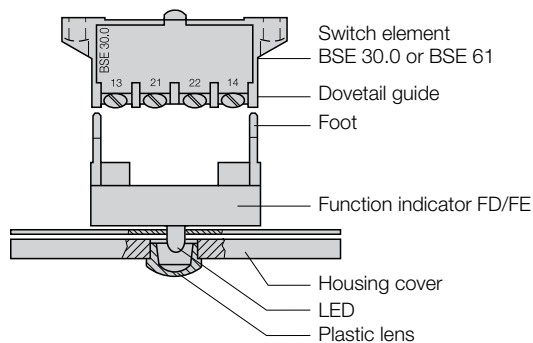
- 6...60 V AC/DC (FD)
- 90...250 V AC/DC (FE)
- 24...28 V DC (FC)

Installation for FD/FE

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

Installation for FC

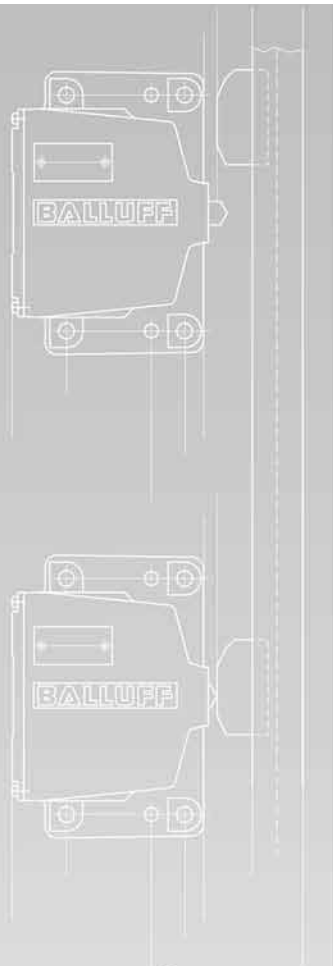
The FC function indicator is screwed directly into the cover.



Mechanical Switches

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Mechanical Switches

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BCC M415-0000-1A-001-EX43T2-XXX.....	N/A	15.18
BCC M415-0000-1A-001-VX43T2-XXX.....	N/A	15.18
BCC M415-0000-1A-003-EX44T2-XXX.....	N/A	15.18
BCC M415-0000-1A-003-VX44T2-XXX.....	N/A	15.18
BCC M425-0000-1A-001-EX43T2-XXX.....	N/A	15.18
BCC M425-0000-1A-001-VX43T2-XXX.....	N/A	15.18
BCC M425-0000-1A-003-EX44T2-XXX.....	N/A	15.18
BCC M425-0000-1A-003-VX44T2-XXX.....	N/A	15.18
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BNS 819-D02-R12-100-10-FE-SP66	BNS02YZ	1.2	BNS 819-D04-D16-100-10-FE	BNS00H2	1.2
BNS 819-D02-R12-100-10-S80L	BNS00CH	1.2	BNS 819-D04-D16-100-10-FE-S90L	BNS00H3	1.2
BNS 819-D02-R12-100-10-S80R	BNS00CJ	1.2	BNS 819-D04-D16-62-10	BNS01JZ	2.2
BNS 819-D02-R12-62-10	BNS01HL	2.2	BNS 819-D04-E12-100-10-FD	BNS00H7	1.2
BNS 819-D02-R12-62-10-FD	BNS01HM	2.2	BNS 819-D04-E12-100-10-FD-L4	BNS030A	1.2
BNS 819-D02-R12-62-10-FE	BNS01HP	2.2	BNS 819-D04-E12-100-10-FD-R4	BNS030C	1.2
BNS 819-D02-R16-100-10	BNS00CM	1.2	BNS 819-D04-E12-100-10-FE	BNS00HA	1.2
BNS 819-D02-R16-100-10-FD	BNS00CN	1.2	BNS 819-D04-E12-100-55-FD-1043	BNS00HH	10.2
BNS 819-D02-R16-100-10-FE-S80R	BNS00CR	1.2	BNS 819-D04-E12-62-10	BNS01K3	2.2
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BNS 819-D03-D12-100-10-FD	BNS00CU	1.2	BNS 819-D04-K12-100-10-FD	BNS00HM	1.2
BNS 819-D03-D12-100-10-FD-L3	BNS02Z0	1.2	BNS 819-D04-K12-100-10-FD-B121	BNS030E	1.2
BNS 819-D03-D12-100-10-FD-R3	BNS02Z1	1.2	BNS 819-D04-K12-100-10-FD-B122	BNS030F	1.2
BNS 819-D03-D12-100-10-FD-S80S	BNS03TZ	1.2	BNS 819-D04-K12-62-10	BNS01K5	2.2
BNS 819-D03-D12-100-10-FD-S90L	BNS0189	1.2	BNS 819-D04-K16-62-10-FD	BNS01K8	2.2
BNS 819-D03-D12-100-10-FD-S90R	BNS00CW	1.2	BNS 819-D04-L12-100-10	BNS00HR	1.2
BNS 819-D03-D12-100-10-FE	BNS00CY	1.2	BNS 819-D04-L12-100-10-FD	BNS00HT	1.2
BNS 819-D03-D12-100-10-FE-SP56	BNS02Z2	1.2	BNS 819-D04-L12-100-10-FE	BNS00HY	1.2
BNS 819-D03-D12-100-10-FE-SP66	BNS02Z3	1.2	BNS 819-D04-L12-100-14-DH	BNS00J0	1.10
BNS 819-D03-D12-100-10-SP09	BNS02Z4	1.2	BNS 819-D04-L12-62-10	BNS01K9	2.2
BNS 819-D03-D12-100-10-SP11	BNS02Z5	1.2	BNS 819-D04-L12-62-10-FD	BNS01KA	2.2
BNS 819-D03-D12-100-10-SP22	BNS02Z6	1.2	BNS 819-D04-L12-62-10-FD-SP18	BNS030H	2.2
BNS 819-D03-D12-100-10-SP23	BNS02Z7	1.2	BNS 819-D04-L16-100-10	BNS00J1	1.2
BNS 819-D03-D12-100-10-SP51	BNS02Z8	1.2	BNS 819-D04-R12-100-10	BNS00J4	1.2
BNS 819-D03-D12-62-10-FD	BNS01HW	2.2	BNS 819-D04-R12-100-10-B093	BNS030J	1.2
BNS 819-D03-D12-62-10-FE	BNS01J0	2.2	BNS 819-D04-R12-100-10-B094	BNS030K	1.2
BNS 819-D03-D12-62-10-JT	BNS02Z9	2.2	BNS 819-D04-R12-100-10-FD	BNS00J5	1.2
BNS 819-D03-D12-62-10-JT-SP03	BNS02ZA	2.2	BNS 819-D04-R12-100-10-FD-B121	BNS030L	1.2
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BNS 819-D03-D16-100-10-FD	BNS00E3	1.2	BNS 819-D04-R12-62-10-FD	BNS01KH	2.2
BNS 819-D03-D16-100-10-FE	BNS00E4	1.2	BNS 819-D04-R12-62-10-FE	BNS01KK	2.2
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BNS 819-D03-L12-62-10	BNS01JA	2.2	BNS 819-D05-E12-100-10	BNS00JR	1.2
BNS 819-D03-L16-100-10-FD	BNS00ET	1.2	BNS 819-D05-L12-100-10	BNS00K3	1.2
BNS 819-D03-R12-100-10	BNS00EW	1.2	BNS 819-D05-L12-100-10-FD	BNS00K4	1.2
BNS 819-D03-R12-100-10-A036	BNS02ZT	1.2	BNS 819-D05-R12-100-10	BNS00K6	1.2
BNS 819-D03-R12-100-10-A037	BNS02ZU	1.2	BNS 819-D05-R12-100-10-A038	BNS030U	1.2
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BNS 819-D06-D12-62-10-FE	BNS01LH	2.2	BNS 819-X496-99-P-11	BNS008H	8.2
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BNS 819-D06-E12-100-10-FE	BNS00L3	1.2	BNS 819-X497-99-K-10	BNS008M	8.2
BNS 819-D06-E12-62-10	BNS01LM	2.2	BNS 819-X505-99-K-10	BNS0054	8.2
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BNS 819-D06-L12-100-10-FD	BNS00LC	1.2	BNS 819-X512-B02-K08-40-13	BNS021T	6.2
BNS 819-D06-L12-100-10-FE	BNS00LF	1.2	BNS 819-X512-B02-R08-40-13	BNS021U	6.2
BNS 819-D06-L12-100-10-S90L	BNS03R4	1.2	BNS 819-X512-B04-R08-40-13	BNS0220	6.2
BNS 819-D06-L12-100-10-S90R	BNS03PP	1.2	BNS 819-X512-D02-D12-100-10	BNS032N	1.2
BNS 819-D06-L16-100-10-FE	BNS00LK	1.2	BNS 819-X512-D02-E12-100-10-FD	BNS00PF	1.2
BNS 819-D06-R12-100-10	BNS00LL	1.2	BNS 819-X512-D02-L12-100-10-FD-L2	BNS031F	1.2
BNS 819-D06-R12-100-10-FD	BNS00LM	1.2	BNS 819-X512-D03-D12-100-10	BNS00PJ	1.2
BNS 819-D06-R12-100-10-FE	BNS00LP	1.2	BNS 819-X512-D03-E12-62-10	BNS01N6	2.2
BNS 819-D06-R12-62-10	BNS01LY	2.2	BNS 819-X512-D03-E12-62-10-F050	BNS031H	2.2
BNS 819-D06-R16-100-10-FD	BNS00LY	1.2	BNS 819-X512-D03-E12-62-10-F051	BNS031J	2.2
BNS 819-D08-D12-100-10	BNS00MO	1.2	BNS 819-X512-D04-E12-100-10	BNS02R8	1.2
BNS 819-D08-D12-100-10-FD	BNS00M1	1.2	BNS 819-X512-D04-L12-100-10-FD-L4	BNS031K	1.2
BNS 819-D08-D12-100-10-FD-S90R	BNS00M2	1.2	BNS 819-X512-D04-L12-100-10-FD-S90L	BNS018F	1.2
BNS 819-D08-D12-100-10-FE	BNS00M3	1.2	BNS 819-X512-D04-R12-100-10-FE	BNS02R9	1.2
BNS 819-D08-D12-62-10	BNS01M1	2.2	BNS 819-X512-D05-E12-100-10-FD-F077	BNS031L	1.2
BNS 819-D08-D12-62-10-FD	BNS01M2	2.2	BNS 819-X512-D05-E12-100-10-FD-F078	BNS031M	1.2
BNS 819-D08-D12-62-10-FD-S90R	BNS01M3	2.2	BNS 819-X512-FD-60-101-S21R	BNS009P	7.2
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BNS 819-D08-E12-100-10-FD	BNS00M8	1.2	BNS 819-X575-B02-E12-61-24-10	BNS032N	3.2
BNS 819-D08-E12-100-10-FE	BNS00M9	1.2	BNS 819-X576-B04-E12-61-12-10	BNS032P	3.2
BNS 819-D08-E12-62-10	BNS01M6	2.2	BNS 819-X581-B03-D12-61-12-10	BNS032R	3.2
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BNS 819-D08-L12-100-10	BNS00MK	1.2	BNS 819-X587-D03-E12-100-10	BNS032U	1.2
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BNS 819-D08-R12-100-10-FE	BNS00MT	1.2	BNS 819-X624-D03-R12-100-10	BNS0335	2.2
BNS 819-D08-R12-62-10	BNS01MA	2.2	BNS 819-X633-D02-E12-100-10	BNS0336	1.2
BNS 819-D08-R12-62-10-FD	BNS01MC	2.2	BNS 819-X634-D02-E12-100-10	BNS0337	1.2
BNS 819-D08-R16-100-10	BNS00MY	1.2	BNS 819-X638-D02-D12-62-10	BNS0338	2.2
BNS 819-D08-R16-100-10-FD	BNS00MZ	1.2	BNS 819-X639-D02-D12-62-10	BNS0339	2.2
BNS 819-D10-D12-100-10	BNS0001	1.2	BNS 819-X641-FR-60-101	BNS001H	7.2
BNS 819-D10-D12-100-10-FD	BNS00N1	1.2	BNS 819-X643-D04-E12-100-10	BNS033C	1.2
BNS 819-D10-D12-62-10	BNS01MJ	2.2	BNS 819-X644-D04-E12-100-10	BNS033E	1.2
BNS 819-D10-L12-100-10-FD	BNS00NC	1.2	BNS 819-X645-D02-D12-100-10	BNS033F	1.2
BNS 819-D10-L12-100-10-FE	BNS00NE	1.2	BNS 819-X645-D02-R12-100-10	BNS033H	1.2
BNS 819-D10-L12-62-10-FE	BNS01MR	2.2	BNS 819-X646-D02-D12-100-10	BNS033J	1.2
BNS 819-D10-R12-100-10	BNS00NH	1.2	BNS 819-X646-D02-R12-100-10	BNS033K	1.2
BNS 819-D12-D12-100-10	BNS00NL	1.2	BNS 819-X649-D02-D12-100-10	BNS033L	1.2
BNS 819-D12-D12-62-10	BNS01MY	2.2	BNS 819-X659-D05-R12-100-10-FD	BNS033R	1.2
BNS 819-D12-R12-100-10	BNS00NY	1.2	BNS 819-X661-D03-E12-100-10-FD	BNS033T	1.2
BNS 819-D12-R12-100-10-FD-S90S	BNS03RM	1.2	BNS 819-X662-D03-E12-100-10-FD	BNS033U	2.2
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BNS 819-X698-100-E-12-S4.....	BNS0077	8.2	BNS 829-D04-R12-100-10-FD.....	BNS019M	1.6
BNS 819-X698-100-E-13-S4.....	BNS0078	8.2	BNS 829-D06-D12-100-10.....	BNS019U	1.6
BNS 819-X698-100-K-11-S4.....	BNS0079	8.2	BNS 829-D06-R12-100-10.....	BNS01A0	1.6
BNS 819-X698-100-K-12-S4.....	BNS007A	8.2	BNS 829-X557-D04-L12-100-10-FC.....	BNS037K	1.6
BNS 819-X698-100-K-13-S4.....	BNS007C	8.2	BNS 829-X891-D04-D12-100-10-FD.....	BNS03TR	1.6
BNS 819-X698-100-R-11-S4.....	BNS007E	8.2	BNS 829-X892-D04-D12-100-10-FD.....	BNS03TT	1.6
BNS 819-X698-100-R-12-S4.....	BNS007F	8.2	BNS 829-X933-D03-D12-100-10-FD.....	BNS03Y8	1.6
BNS 819-X698-100-R-13-S4.....	BNS007H	8.2	BSE 30.0-RK.....	BSE0005	15.2
BNS 819-X698-99-D-11-S4.....	BNS0056	8.2	BSE 61-RK.....	BSE0009	15.2
BNS 819-X698-99-K-13-S4.....	BNS0098	8.2	BSE 63-RK.....	N/A	15.3
BNS 819-X699-B03-R08-40-13-S4R.....	BNS034N	6.2	BSE 64-RK.....	N/A	15.3
BNS 819-X700-D04-R12-100-10.....	BNS034P	1.2	BSE 69.1-RK.....	BSE000F	15.3
BNS 819-X701-D04-R12-100-10.....	BNS034R	1.2	BSE 70.1-RK.....	BSE000J	15.3
BNS 819-X706-D05-R12-100-10-FE.....	BNS034Z	1.2	BSE 73.1-RK.....	BSE000K	15.3
BNS 819-X707-D05-R12-100-10-FE.....	BNS0350	1.2	BSE 74.1-RK.....	BSE000L	15.3
BNS 819-X710-FD-60-101-S4R.....	BNS009U	7.2	BSE 85-RK.....	BSE000N	15.2
BNS 819-X710-FR-60-101-S4R.....	BNS009W	7.2	C04 AEQ-00-VY-050M.....	BCC01EK	15.18
BNS 819-X711-FK-60-101.....	BNS0099	7.2	C04 BEQ-00-VY-050M.....	BCC01JF	15.18
BNS 819-X713-D02-E12-100-10-FD.....	BNS0351	1.2	GAGE BAM-AC-NS 127.....	N/A	15.12
BNS 819-X713-D04-E12-100-10-FE.....	BNS0352	1.2	R04 CN-04-K-22A-010F.....	N/A	15.16
BNS 819-X714-D02-E12-100-10-FD.....	BNS0353	1.2	R04 CN-04-L-22A-010F.....	N/A	15.16
BNS 819-X714-D04-E12-100-10-FE.....	BNS0354	1.2	R05 CA-03-L-18C-010F.....	BCC018U	15.16
BNS 819-X721-D03-R12-100-10-FD.....	BNS0355	1.2	R05 CA-04-L-18C-010F.....	BCC0190	15.16
BNS 819-X722-D03-R12-100-10-FD.....	BNS0356	1.2	R0A CA-05-L-18C-010F.....	BCC019E	15.16
BNS 819-X723-D03-R12-100-10-S90L.....	BNS0357	1.2	ROB CA-06-L-18C-010F.....	BCC019J	15.17
BNS 819-X723-D03-R12-100-10-S90R.....	BNS0358	1.2	ROB CA-07-L-18C-010F.....	BCC019L	15.17
BNS 819-X723-D04-R12-100-10-S90L.....	BNS0359	1.2	ROB CA-08-L-18C-010F.....	BCC04ZL	15.17
BNS 819-X723-D04-R12-100-10-S90R.....	BNS035A	1.2	ROC CA-09-L-18C-010F.....	BCC019Z	15.17
BNS 819-X724-D02-R12-100-10-FD-S90L.....	BNS035C	1.2	ROC CA-10-L-18C-010F.....	BCC01A0	15.17
BNS 819-X732-D02-R12-100-10.....	BNS035L	1.2	ROC CA-12-L-18C-010F.....	BCC04ZM	15.17
BNS 819-X733-D02-R12-100-10.....	BNS035M	1.2	R21 CA-03-K-22B-010F.....	BCC01A8	15.16
BNS 819-X734-B02-D08-46-13-S4L.....	BNS035N	5.2	R21 CA-03-L-22B-010F.....	BCC01A9	15.16
BNS 819-X734-B02-D08-46-13-S4R.....	BNS035P	5.2	ROC CA-19-M-22C-010F.....	N/A	15.17
BNS 819-X737-B03-D12-61-12-10.....	BNS035U	3.2	STOESSELEINHEIT KPL. D10 813.....	N/A	15.13
BNS 819-X738-B03-D12-61-12-10.....	BNS035W	3.2	STOESSELEINHEIT KPL. D10 819.....	N/A	15.13
BNS 819-X743-D05-R12-62-10-FD.....	BNS035Y	2.2	STOESSELEINHEIT KPL. K10 813.....	N/A	15.13
BNS 819-X744-D05-R12-62-10-FD.....	BNS035Z	2.2	STOESSELEINHEIT KPL. K10 819.....	N/A	15.13
BNS 819-X745-D06-R12-100-10-FD.....	BNS0360	1.2	STOESSELEINHEIT KPL. L10 813.....	N/A	15.13
BNS 819-X746-D06-R12-100-10-FD.....	BNS0361	1.2	STOESSELEINHEIT KPL. L10 819.....	N/A	15.13
BNS 819-X749-D05-D12-62-10.....	BNS0364	2.2	STOESSELEINHEIT KPL. R10 813.....	N/A	15.13
BNS 819-X761-B04-D12-61-12-10.....	BNS0366	3.2	STOESSELEINHEIT KPL. R10 819.....	N/A	15.13
BNS 819-X767-B04-D12-61-12-10.....	BNS0367	3.2	VERSCHLUSSSCHR. KPL. M16X1,5.....	N/A	15.12
BNS 819-X780-B03-D12-61-12-10.....	BNS036A	3.2	VERSCHLUSSSCHR. KPL. M20X1,5.....	N/A	15.12
BNS 819-X784-D03-E12-100-10-FD-S90L.....	BNS036C	1.2	VERSCHLUSSSCHR. KPL. M25X1,5.....	N/A	15.12
BNS 819-X784-D03-E12-100-10-FD-S90R.....	BNS036E	1.2	x25.4x1.60 ALU.....	N/A	15.12
BNS 819-X797-D03-E12-62-10.....	BNS036F	2.2	Z/M16-M-TO-1/2"-F-NPT.....	N/A	15.11
BNS 819-X798-D06-D12-100-10-FD.....	BNS036H	1.2	Z/M20-M-TO-1/2"-F-NPT.....	BAM0134	15.11
BNS 819-X799-D06-D12-100-10-FD.....	BNS036J	1.2	Z/M20-M-TO-1/2"-F-NPT.....	N/A	15.11
BNS 819-X801-D06-L12-100-10-FD.....	BNS036K	1.2	Z/M25-M-TO-3/4"-F-NPT.....	BAM0135	15.11
BNS 819-X802-D06-L12-100-10-FD.....	BNS036L	1.2	Z/M25-M-TO-3/4"-F-NPT.....	N/A	15.11
BNS 819-X807-D03-D12-100-55.....	BNS036M	1.2			
BNS 819-X808-D03-R12-100-55.....	BNS036N	10.2			
BNS 819-X810-FK-60-101-FD-S72R.....	BNS009C	7.2			
BNS 819-X811-D04-R12-100-10-FD.....	BNS036P	1.2			
BNS 819-X812-D04-R12-100-10-FD.....	BNS036R	1.2			
BNS 819-X813-D04-R12-100-10-FD.....	BNS036T	1.2			
BNS 819-X814-D04-R12-100-10-FD.....	BNS036U	1.2			
BNS 819-X822-D03-R12-100-10-FD.....	BNS036W	1.2			
BNS 819-X825-B02-D12-61-12-10.....	BNS036Y	3.2			
BNS 819-X831-D03-R12-100-55.....	BNS036Z	10.2			
BNS 819-X847-D04-L12-100-10-FD.....	BNS0372	1.2			
BNS 819-X853-D10-L12-100-10-FD-S90S.....	BNS0373	1.2			
BNS 819-X863-B06-K12-72-10.....	BNS0374	4.2			
BNS 819-X867-D03-R12-100-10-S90R.....	BNS0375	1.2			
BNS 819-X870-D03-R12-100-10.....	BNS0376	1.2			
BNS 819-X875-B02-R08-46-12.....	BNS0377	5.2			
BNS 819-X878-B03-R08-40-11.....	BNS03NT	6.2			
BNS 819-X880-D05-D12-100-10-FD.....	BNS03RT	1.2			
BNS 819-X881-B02-R08-40-11.....	BNS03PU	6.2			
BNS 819-X883-D16-R12-100-10-FD.....	BNS03R5	1.2			
BNS 819-X890-B02-R08-40-11.....	BNS03RU	6.2			
BNS 819-X895-D10-K12-100-10.....	BNS03TK	1.2			
BNS 819-X923-B03-R08-40-13-FC-S80L.....	BNS03WN	6.2			
BNS 823-B02-L12-61-A-22-02.....	BNS02CN	3.8			
BNS 823-B04-L12-61-A-22-04.....	BNS02CR	3.8			
BNS 823-B06-L12-61-A-22-06.....	BNS02CT	3.8			
BNS 823-X518-B06-L12-61-A-22-06.....	BNS0378	3.8			
BNS 823-X518-D06-L12-100-22-06.....	BNS0379	1.8			
BNS 823-X574-B02-L12-61-A-22-02.....	BNS037A	3.8			
BNS 823-X651-B02-L12-61-A-22-02.....	BNS037C	3.8			

Object Detection



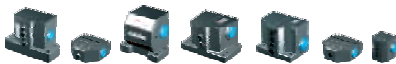
Sensor Product Line

Inductive sensors BES DC 3-/4-wire
Inductive sensors BES DC 2-wire
Inductive sensors BES AC/DC
Inductive sensors BES with special properties
Sensors for pneumatic cylinders BMF
Magnetic field sensors BMF
Capacitive sensors BCS
Pressure sensors BSP



Photoelectric Product Line

Diffuse energetic BOS with fore- and background suppression
Retro-reflective sensors BOS
Through-beam sensors BOS (emitter/receiver)
Fiber optic systems BFB
Through-beam fork sensors BGL
Dynamic optical windows BOWA
Light grids BLG
Contrast sensors BKT
Luminescence sensors BLT
Color sensors BFS
Photoelectric distance sensors BOD



Mechanical Product Line

Mechanical Single and Multiple Position Switches
Mechanical single and multiple position switches to DIN EN 60204-1/VDE 0113
Mechanical single and multiple position switches with positive opening
Mechanical multiple position switches with quick plunger change-out
Inductive single and multiple position switches
Inductive single and multiple position switches with extended switching distance
Mechanical wireless position switches
Mixed assembly multiple position switches

Linear Position and Sensing



Linear Displacement Product Line

Micropulse® transducer BTL Profile Series
Micropulse® transducer BTL AT Series
Micropulse® transducer BTL Rod-Style Series
Micropulse® transducer BTL Compact Rod Series
Micropulse® processors, BUS interfaces
BML magnetic linear encoder system
BDG/BRG incremental and absolute encoders
BIW pulse-Inductive linear displacement sensor
BAW inductive distance sensors
BIL magnetoinductive position sensors
BOD photoelectric distance sensors

Industrial Identification



Industrial Identification

BIS C Industrial RFID systems
BIS L Industrial RFID systems
BIS M Industrial RFID systems
BIS S Industrial RFID systems
BVS Vision Sensor

Industrial Networking and Connectivity



Industrial Networking and Connectivity

BCC connectors and cables
BPI passive splitter boxes
BNI active splitter boxes
IO-Link
Inductive transmission systems - Remote
BIC inductive couplers
BUS systems
Wireless
Electrical Devices

Mechanical Accessories



Mechanical Accessories

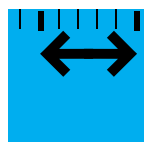
Holders and Fastening Systems
BMS mounting system

BALLUFF

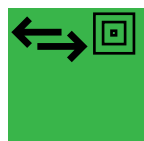
sensors worldwide



Object Detection



Linear Position and Measurement



Industrial Identification



Networking and Connectivity



Accessories



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