SCHMERSAL

Contents

1. About this document

1.1 Function

These operating instructions provide the information needed for assembly, commissioning, safe operation and disassembly of the safety switchgear. The operating instructions must be kept in a legible and accessible state at all times.

1.2 Target group: authorised specialist personnel

The work outlined in these operating instructions may only be carried out by trained specialist personnel who have been authorised by the system operator.

Install and commission the device only after reading and understanding the operating instructions and familiarising yourself with the applicable occupational health and safety and accident prevention regulations.

Selection of and installation of the devices as well as their integration into the control system are linked to qualified knowledge of the applicable laws and requirements of the standards by the machine manufacturer.

1.3 Symbols used

Information, tip, note:
This symbol indicates useful additional information.

Caution: Failure to observe this warning information could result in faults or malfunctions.
Warning: Failure to observe this warning information could result in personal injury and/or damage to the machine.

1.4 Intended use

The Schmersal range of products is not intended for private consumers.

The products outlined here have been developed to assume safety-related functions as part of a complete system or machine. Ensuring the correct overall function is the responsibility of the manufacturer of a system or machine.

The switchgear may only be used in accordance with the following models or for the applications authorised by the manufacturer. Detailed information on the field of application can be found in the section entitled ‘Product description’.

1.5 General safety instructions

The safety information in the operating instructions as well as local installation, safety and accident prevention regulations must be observed.

Additional technical information may be found in the Schmersal catalogues and/or the online catalogue at products.schmersal.com.

All information is subject to correction. The right to make changes in the course of technical progress is reserved.

The residual risks are not known in the event of observance of the information on safety and the instructions concerning installation, commissioning, operation and maintenance.

1.6 Warning against improper use

If the switchgear is not used properly or not used in accordance with its intended use or is manipulated in any way, personal injury or material damage to the machine and plant components cannot be ruled out.

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1.7 Exclusion of liability

No liability will be accepted for damage and malfunctions caused as a result of installation errors or failure to observe these operating instructions. All liability for damage resulting from the use of replacement or accessory parts not approved by the manufacturer are excluded.

Any unauthorised repairs, conversions or changes are not permitted for reasons of safety and the manufacturer shall accept no liability for resulting damage.

2. Product description

2.1 Ordering code

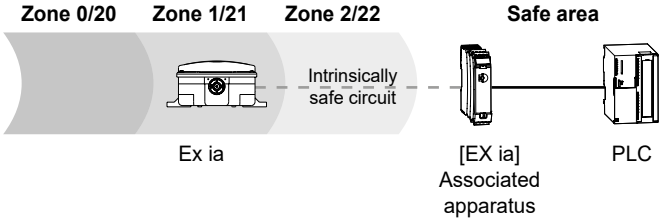
These operating instructions apply to the following types:

		EX-I-BS655	EX-BS655-2D	EX-BS655
Zone	Zone 1 Gas	x		x
	Zone 21 Dust	x	x	x
Ignition protection type	Ex de, Gas			x
	Ex t, Dust	x	x	x
	Ex i, Gas (Associated apparatus required)	x		x
	Ex i, Dust (Associated apparatus required)	x		x
Construction	Terminal strip	x	x	
Communication	Dupline		x	

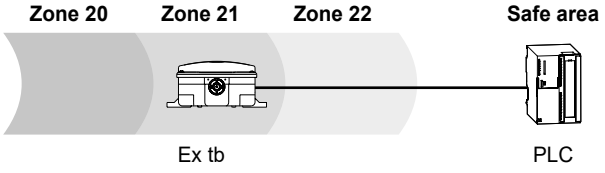
EX-I-BS655-①②

No.	Option	Description
①	T22	Slow action, 2 NO/2 NC
	Z22	Snap action, 2 NO/2 NC
②		Contacts silver-plated
	A1	Contacts gold-plated 0.3 µm
	A2	Contacts gold-plated 1.0 µm
	A3	Contacts gold-plated 3.0 µm

EX-I-BS655 can be installed in both gaseous and dusty atmospheres, provided that ignition protection type Ex i (intrinsic safety) is used. This requires an associated apparatus.



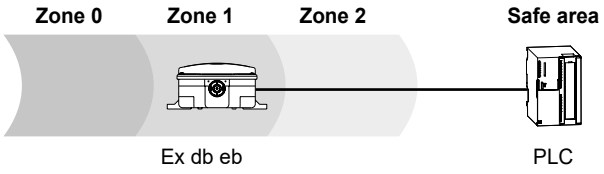
EX-I-BS655 can be used in dusty atmospheres **without** associated apparatus for Ex i, provided that ignition protection type Ex t (protection by enclosure) is used.



EX-BS655-T22①

No.	Option	Description
①		Contacts silver-plated
	A1	Contacts gold-plated 0.3 µm
	A2	Contacts gold-plated 1.0 µm
	A3	Contacts gold-plated 3.0 µm

EX-BS655-T22 is particularly suitable for gaseous atmospheres and does not require an associated apparatus.

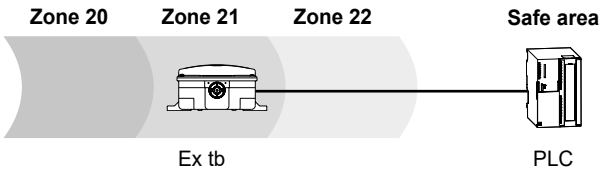


EX-BS655-①②-③-2D

Version with integrated Dupline® input module

No.	Option	Description
①	T22	Slow action, 2 NO/2 NC
	Z22	Snap action, 2 NO/2 NC
②		Contacts silver-plated
	A1	Contacts gold-plated 0.3 µm
	A2	Contacts gold-plated 1.0 µm
	A3	Contacts gold-plated 3.0 µm
③	DN	with Dupline® input module
	DS	with DuplineSafe® input module

EX-BS655-…-DN-2D/…-DS-2D offers communication over Dupline. The device may only be used in dusty atmospheres, provided that ignition protection type Ex t (protection by enclosure) is used.



Devices are modular and are supplied without actuating element. Different functions are possible through combination with a specific actuating element.

Actuating elements

Position switch lever (roll diameter 50 mm)

BS-H50-110-RKS	stainless steel lever with plastic roller
BS-H50-110-RVA	stainless steel lever with stainless steel roller

Level lever

BS-N100-200-RVA	level lever with conical stainless steel plate

Belt misalignment lever (running surface 150 mm)

BS-B30-150-RVA	stainless steel lever with 30 mm stainless steel roller for belt speeds up to 2.5 m/s
BS-B50-150-RVA	stainless steel lever with 50 mm stainless steel roller for belt speeds up to 5 m/s
BS-B90-150-RVA	stainless steel lever with 90 mm stainless steel roller for belt speeds up to 10 m/s

Only if the conversions outlined in these operating instructions are carried out correctly can the function and, therefore, compliance with the Explosion Protection Directive be ensured.

2.2 Special versions

In the case of special versions not listed under type code 2.1, the aforementioned information and information below applies analogously, provided that these versions are consistent with the standard versions.

2.3 Use

Position switches can be used wherever moving parts on machines and systems needs to be positioned, controlled and monitored.

Basic switches with level levers can be used for material detection and to monitor material upper limits on conveyor belts.

Belt misalignment switches monitor the straight alignment of conveyor systems and are arranged in pairs on both sides of the belt, close to the drive pulleys and idlers. In the event of conveyor belt deviations, a staggered signal is generated as a pre-warning or to switch off the conveyor belt (see switching angle diagram).

With the Dupline® or DuplineSafe® version, the switching states are queried by the Dupline® input module and transmitted to a control unit via the Dupline® 2-wire installation bus.

Once the Dupline® input module has been installed, its technical data must be observed for the device as a whole. Please see the operating instructions of the Dupline® input module in the online catalogue at products.schmersal.com for details.

2.4 Determination and use for explosion protection

The EX-I-BS655 version without Dupline® input module can be installed in potentially explosive gaseous atmospheres of Zones 1 and 2, categories 2G and 3G, and in dusty atmospheres of Zones 21 and 22, categories 2D and 3D, provided that ignition protection type intrinsic safety Ex i is used.

If ignition protection type Ex tb (protection by enclosure) is used, the device can also be used in potentially explosive dusty atmospheres without associated apparatus.

The switch may only be operated in the temperature range specified on the data sheet. External influences, e.g. solar radiation and external sources of cold, must be considered and appropriate precautionary measures taken as required.

In case of installation in intrinsically safe circuits (Ex i), the device may only be connected to an associated apparatus (e.g. SRB 200EXi-…, barrier, isolating amplifier). The safety-related data of both devices must be compared.

The version with integrated Dupline® input module is certified exclusively for use in potentially explosive dusty atmospheres of Zones 21 and 22, category 2D and 3D.

The requirements regarding installation and maintenance must be satisfied in accordance with the series of 60079 standards.

Cable glands and stopping plugs (not included with the delivery content) must be suitable for the potentially explosive atmosphere. For corresponding accessories, please see ‘Electrical connection’, the Schmersal catalogues or the online catalogue found at products.schmersal.com.

The overall concept of the control system into which the safety component is integrated must be validated according to the relevant standards.

The safety-related data and features according to the valid type examination certificate (or further approvals, if applicable) are listed in the technical data.

2.5 Technical data

EX-I-BS655:

Marking in accordance with the ATEX Directive:	Ⓔx II 2G Ⓔx II 2D
Marking in accordance with standards:	Ex ia IIC T6 Gb Ex ia IIIC T85°C Db Ex tb IIIC T85°C Db
Applied standards:	EN 60947-5-1
- ATEX:	EN IEC 60079-0, EN 60079-11, EN 60079-31
- IECEx:	IEC 60079-0, IEC 60079-11, IEC 60079-31
- INMETRO:	ABNT NBR IEC 60079-0, ABNT NBR IEC 60079-11, ABNT NBR IEC 60079-31
- CCC-Ex, NEPSI:	GB/T 3836.1, GB/T 3836.4, GB/T 3836.31
Certificate numbers:	
- ATEX:	TÜV 19 ATEX 8428
- IECEx:	IECEx TUR 19.0061
- INMETRO:	TÜV 24.0148
- CCC-Ex:	2021322304003984
- NEPSI:	GYJ21.2860

EX-BS655:

Marking in accordance with the ATEX Directive:	Ⓔx II 2G Ⓔx II 2D
Marking in accordance with standards:	Ex db eb IIC T6 Gb Ex tb IIIC T85°C Db Ex ia IIC T6 Gb Ex ia IIIC T85°C Db
Applied standards:	EN 60947-5-1
- ATEX:	EN IEC 60079-0, EN 60079-1, EN IEC 60079-7, EN 60079-11, EN 60079-31
- IECEx:	IEC 60079-0, IEC 60079-1, IEC 60079-7, IEC 60079-11, IEC 60079-31
- INMETRO:	ABNT NBR IEC 60079-0, ABNT NBR IEC 60079-1, ABNT NBR IEC 60079-7, ABNT NBR IEC 60079-11, ABNT NBR IEC 60079-31
- CCC-Ex, NEPSI:	GB/T 3836.1, GB/T 3836.2, GB/T 3836.3, GB/T 3836.4, GB/T 3836.31
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- INMETRO:	TÜV 24.0148
- CCC-Ex:	2021322304003984
- NEPSI:	GYJ21.2860

EX-BS655…-DN-2D / …-DS-2D:

Marking in accordance with the ATEX Directive:	Ⓔx II 2D
Marking in accordance with standards:	Ex tb IIIC T85°C Db
Applied standards:	EN 60947-5-1
- ATEX:	EN IEC 60079-0, EN 60079-31
- IECEx:	IEC 60079-0, IEC 60079-31
- INMETRO:	ABNT NBR IEC 60079-0, ABNT NBR IEC 60079-31
- CCC-Ex, NEPSI:	GB/T 3836.1, GB/T 3836.31
Certificate numbers:	
- ATEX:	TÜV 19 ATEX 8428
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- INMETRO:	TÜV 24.0148
- CCC-Ex:	2021322304003984
- NEPSI:	GYJ21.2860

General technical data:

Housing/cover:	grey cast iron, painted
Degree of protection:	IP66, IP67 to EN 60529 IP66, IP67 to the standard series 60079
Protection class:	I
Degree of contamination:	3
Contact material:	silver
- Ordering suffix A1, A2, A3:	contact gold plating 0.3 µm, 1.0 µm, 3.0 µm
Switch elements:	changeover with double break Zb, 2 NO/2 NC

Switching system:	⊖ EN 60947-5-1 snap action (Z22), or slow action (T22), positive-break NC
Wire entry:	2 x M25
EX cable gland:	⟨Ex⟩ II 2GD
Clamping range:	Ø 7 to 12 mm
Type of connection:	
- EX-I-BS655:	Central connection terminal strip with spring-loaded clamps
- EX-BS655:	switching element with screw terminals
- EX-BS655-…-DN-2D / …-DS-2D:	Screw terminals on Dupline® board
Conductor type:	rigid, single-wire or flexible
Connection cross-section:	0.75 to 2.5 mm²
Tightening torques:	Cover screws: 3 Nm Earth screws: PE 1 Nm, PA 1,2 Nm
Rated impulse withstand voltage U_{imp}:	4 kV
Measured insulation voltage U_i:	300 V
Thermal continuous current I_{the}:	6 A
Usage category:	DC-13, AC-15
Rated operating current/voltage I_e/U_e:	3 A/24 V/DC 3 A/230 V/AC
Short-circuit protection:	6 A gG D-fuse
Conditional short-circuit current:	400 A
Ambient temperature:	
- EX-BS655:	-25°C to +65°C
- EX-I-BS655, EX-BS655-…-DN-2D / …-DS-2D:	-25°C to +70°C
Mechanical service life:	1,000,000 switching operations
Mechanical service life of the actuators:	10,000 km
Adjustability of the lever:	in 10° increments
Maximum lever deflection:	80°

Deviating data of versions with Dupline® -DN or DuplineSafe® -DS:

Supply voltage:	8.2 V/DC
Current draw:	
-Dupline® -DN version:	100 µA
- DuplineSafe® -DS version:	1 mA
Device fuse protection:	internally short-circuit proof
Measured impulse voltage resistance U_{imp}:	800 V
Measured insulation voltage U_i:	30 V/DC
Conductor type:	rigid, single-wire or flexible
Connection cross-section:	
- Conductor, rigid single-wire:	0.2 to 4 mm²
- Conductor, flexible:	0.25 to 2.5 mm² (including wire-end ferrule)

2.6 Safety consideration

Requirements:	EN ISO 13849-1
B_{10D} (NC contact):	2,000,000
Mission time:	20 years

$$MTTF_D = \frac{B_{10D}}{0{,}1 \times n_{op}} \qquad n_{op} = \frac{d_{op} \times h_{op} \times 3600\ s/h}{t_{cycle}}$$

(Determined values may vary according to the application-specific parameters h_{op}, d_{op} and t_{cycle} and the load.)

If multiple safety components are connected in series, the Performance Level in accordance with EN ISO 13849-1 is, in some cases, reduced due to lower error detection. **Series connection for devices in ignition protection type Ex i is not permissible.**

2.7 Safety-related data – intrinsic safety

To ensure explosion protection with ignition protection type intrinsic safety (Ex i), the switchgear must be wired with suitable associated apparatus. Associated apparatus is considered suitable if the safety-related data of the devices are consistent in accordance with the 'Verification of intrinsic safety'.

Safety-related data – intrinsic safety*	
Voltage U_i:	60 V
Current I_i:	100 mA
Power P_i:	6 W
Capacity C_i:	0
Inductance L_i:	0

Comparison of safety-related data*
$U_i \geq U_o$
$I_i \geq I_o$
$P_i \geq P_o$
$C_i + C_{cable} \leq C_o$
$L_i + L_{cable} \leq L_o$

* U_o, I_o, P_o, C_o, L_o can be found in the documentation for the associated apparatus.

3. Assembly

3.1 General assembly instructions

Assembly is only permitted when the device is dead and may only be carried out by authorised specialist personnel.

There are two fastening holes for fastening.

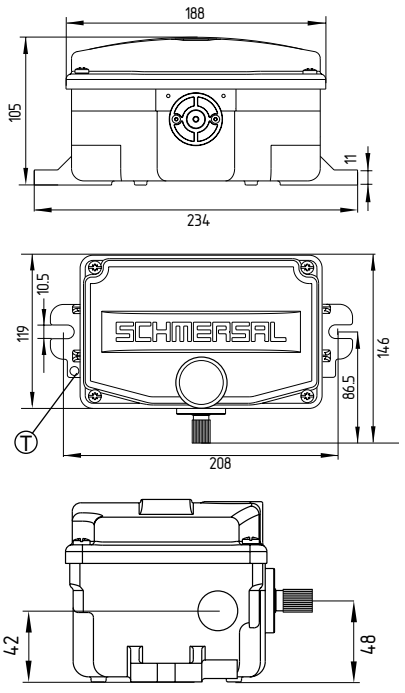
Belt misalignment switches are arranged in pairs on both sides of the belt, close to the drive pulleys and idlers. It must be ensured that the belt misalignment lever is placed at a distance of 10 to 20 mm from the belt.

All switchgear devices satisfy the requirements for safety switches with positive break contacts in accordance with EN 60947-5-1 and positive fit via the toothed shaft between the basic device and all actuating elements. The corresponding positive break angles can be found in 4.2 of the switching path diagrams.

Please note the tightening torque specifications in the technical specifications.

3.2 Dimensions

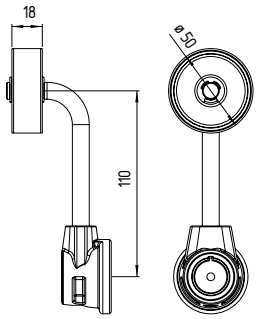
All dimensions in mm.



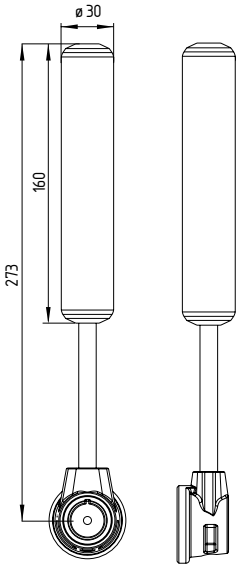
3.3 Actuating element accessories (not part of delivery content)

The switchgear device EX-(I-)BS655 specified in the type code may only be used with the following actuating elements.

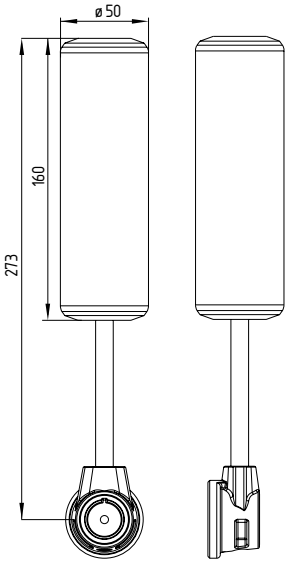
BS-H50-110-RKS
BS-H50-110-RVA



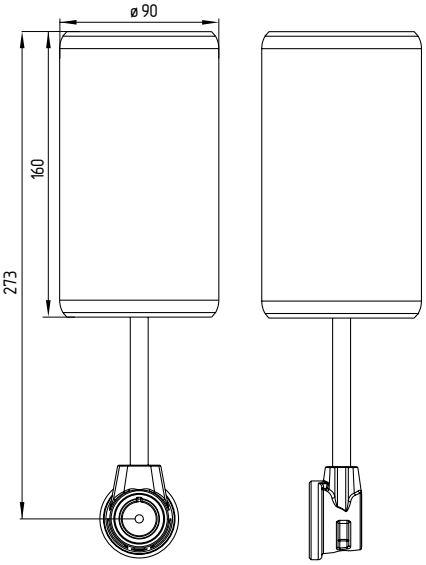
BS-B30-150-RVA



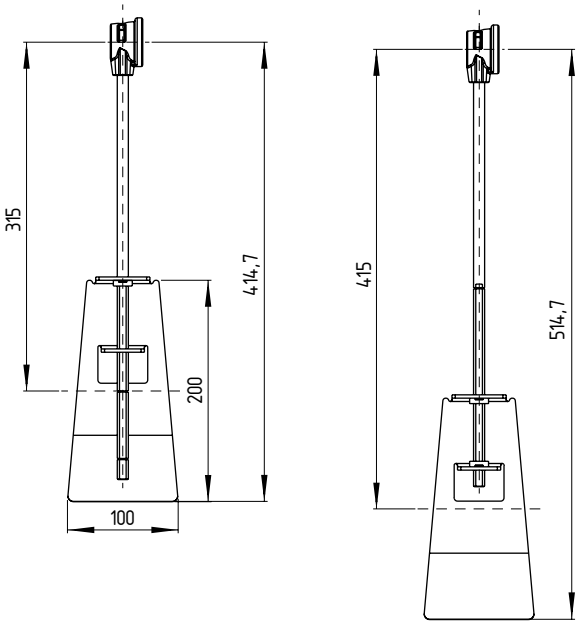
BS-B50-150-RVA



BS-B90-150-RVA

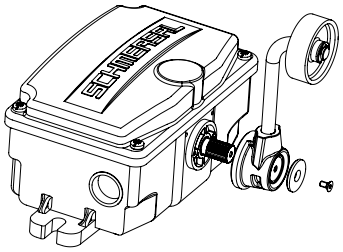


BS-N100-200-RVA

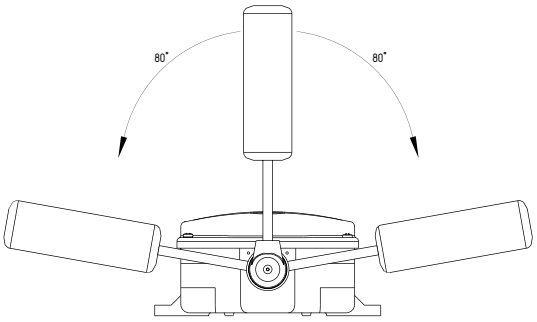


3.4 Actuating element assembly information

Place the actuating element in the desired position (adjustable in 10° increments) on the toothed shaft of the basic switch and secure with the Allen screw provided. Tightening torque 1 Nm.



The maximum lever deflection is 80°.



4. Electrical connection

4.1 General information on electrical connection

Electrical connection is only permitted when the device is dead and may only be carried out by authorised specialist personnel.

To avoid damage to the wire due to mechanical influences, a wire reserve must not be routed in the free space under the switch insert cover.

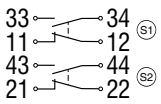
After wiring, position the housing cover and tighten the screws evenly (tightening torque 3 Nm).

Connection of the external equipotential bonding terminal must be in accordance with EN 60079-14, Section 6.3.

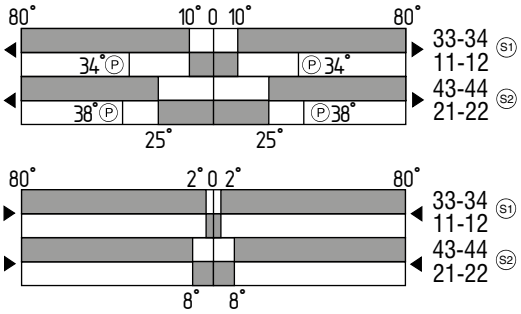
4.2 Contact variants

All NC positive break ⊖.

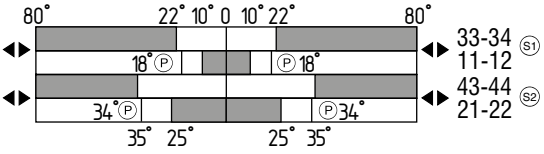
2 NO / 2 NC



Snap action -Z22



Slow action -T22

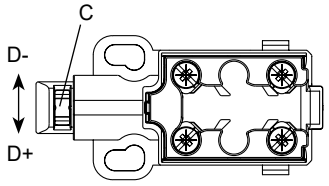


Key:

S1, S2	switch insert S1, S2
	Contact closed
	Contact open
P	Positive break angle

4.3 Adjustable switching points

The pre-set switching points can be set by authorised specialist personnel in a range between 10° and 35°. To do this, move the setting wheel of the respective switching element to the desired position.



C: Setting wheel
D: Switching angle

Setting the switching angles on the setting wheel
(smaller switching angles are set analogously in direction D-)

Switching element		2 rotations in direction D+	Additional 1.5 rotations in direction D+
S1	**10°**	25°	35°
S2	10°	**25°**	35°

Switching angle in as-delivered condition

4.4 Accessories for wire entry

Only use EX cable glands/wire entries approved for the respective area of application and EX stopping plugs with integrated or associated seal. Assemble the cable gland/ wire entry according to the applicable operating instructions. The cable gland is only permitted for permanent cables and wires. The person responsible for installation must ensure the necessary strain relief. Seal off all unused wire entries with EX-approved stopping plugs. Cable glands and stopping plugs are not included.

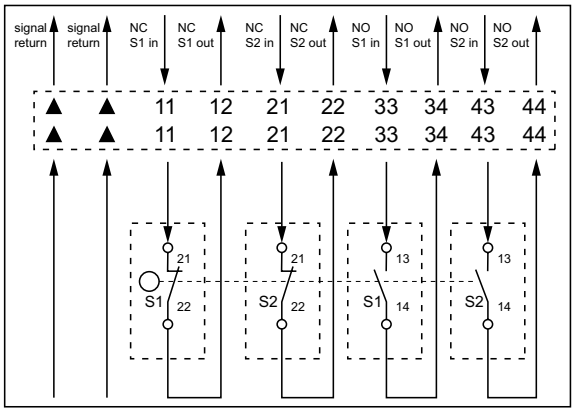
Accessories for wire entry (not part of delivery content)	Ordering number	Tightening torque
Ex cable gland with locking nut, stainless steel	101204779	12 Nm
Ex stopping plug, nickel-plated brass	101205617	8 Nm

Always use the cable gland in accordance with the requisite wire cross-section.

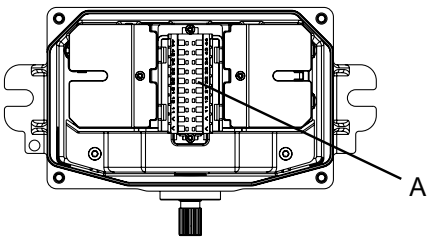
4.5 Connection EX-I-BS655

In the as-delivered condition, the two NC contacts and two NO contacts are placed on one side of the central connection terminal strip. The other side of the terminal strip is intended for user-side connection.

The connection diagram is located in the cover of the switch for all variants with a central connection terminal. In addition to the switching contacts, terminals ('signal return') are available for the return of the signal lines in series connection.

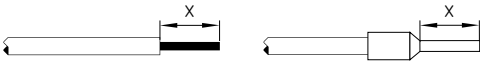


The series has a closed switch insert cover for the switch shaft, cams and switch contacts. After wiring, a switch insert cover must be used and, in addition to constructive cable guidance, must be protected from dirt and dust.



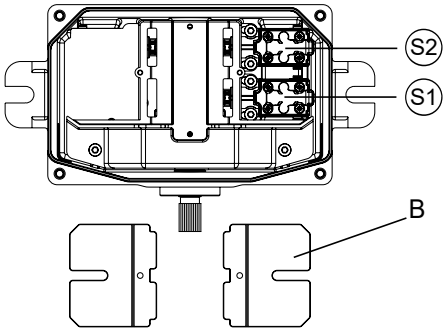
A: Central connection terminal strip

Settling length x of the conductor:
- At terminal types s or f: 8 to 9 mm
- At the equipotential bonding terminal: 9 mm



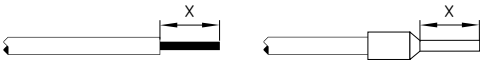
4.6 Connection EX-BS655

Once the wiring to the switching elements S1 and S2 has been completed, the use of the switching insert covers is mandatory and, in addition to the constructive cable routing, also serves as protection against dust and dirt.



B: Switch insert covers
(S1), (S2) : Switch insert S1, S2

Settling length x of the conductor:
- At screw terminals: 8 mm
- At the equipotential bonding terminal : 9 mm



4.7 Connection EX-BS655-…-DN-2D / …-DS-2D

Before electrical installation, the Dupline®/DuplineSafe® input module must be addressed and parametrised in accordance with Dupline® specifications (www.dupline.com).

Dupline®

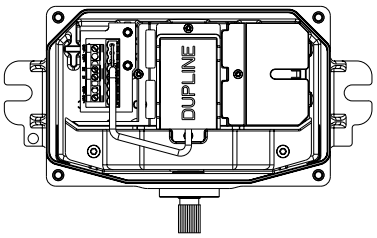
Remove the connector from the circuit board board with connection to the Dupline® input module and connect it to the programming device with the ACC-PRGC-DN programming cable. The connector must be connected to the address bar again once addressing is complete.

DuplineSafe®

Remove the multiple plug connector from the connector strip and, once addressing is complete, connect it to the strip again.

Connect the wires of the Dupline® installation bus to the terminals marked DUP+/DUP-. Adjacent terminals marked DUP+/DUP- are used to connect to the next Dupline® bus participant.

Connection example, DuplineSafe®

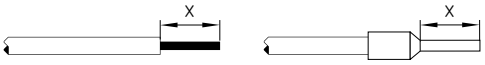


Cable Dupline®

Rigid wire: 0.2 - 4 mm²
Flexible wire: 0.25 - 2.5 mm²

8-9 mm

Settling length x of the conductor:
- at the equipotential bonding terminal: 9 mm



The two NC contacts of the switching elements are already connected to the Dupline® input module.

For proper operation, observe the installation instructions of the Dupline® input module. The following Dupline® system components are required to supply and address the Dupline® input modules.

4.8 Dupline® system components

Dupline® accessories	Ordering number
Handheld programming device GAP1605	103010199
Test unit GTU8	103013800
Programming cable ACC-PRGC-DN	103033601
Dupline® master channel generator SD2DUG24	103033128
Wire termination DT01	103010203

DuplineSafe® accessories	Ordering number
DuplineSafe® configuration device and test unit GS73800080	103010115
Dupline® master channel generator SD2DUG24	103033128
DuplineSafe® safety relay GS38300143 230	103010174
Wire termination DT01	103010203

5. Commissioning and maintenance

5.1 Function check

The switchgear device must have its function tested. In this regard, the following must be ensured beforehand:

1. Assembly has been properly carried out.
2. The cable has been properly routed and connected.
3. The connection has been properly established.
4. Remove any dirt residue.
5. Check the ease of movement of the actuating element.
6. Check the switch function and, if necessary, the set switching angles.

5.2 Maintenance

With careful assembly, taking into account the information provided above, only minimal maintenance is required. In harsh environmental conditions, we recommend regular maintenance with the following steps:

1. Check for damage and firm seating.
2. Remove any dirt residue.
3. Check that the cover screws are firmly seated.
4. Check the wire entry and connections in the dead state
5. Check the ease of movement of the actuating element.
6. Check the roller of the belt misalignment lever for ease of movement every six months.

Avoid electrostatic charge. Clean with a damp cloth only.
Do not open the enclosure under tension.

For explosion safety reasons, replace the device after max. 1 million switching operations.

Damaged or faulty devices must be replaced.

6. Disassembly and disposal

6.1 Disassembly

The switchgear device may only be disassembled when dead.

6.2 Disposal

The switchgear device must be properly disposed of in accordance with national laws and regulations.

7. EU Declaration of Conformity

EU Declaration of Conformity

SCHMERSAL

Original

SCHMERSAL
Industrial Switchgear (Shanghai) Co., Ltd.
Cao Ying Road 3336
201712 Shanghai / Qingpu
P.R. CHINA
http://www.schmersal.com.cn

We hereby declare that the following components are consistent with the following European directives on account of their design and construction.

Name of the component:	EX-I-BS655[1)]	EX-BS655[2)]	EX-BS655-…-DN-2D[3)] EX-BS655-…-DS-2D[3)]
Marking:	Ex II 2G Ex ia IIC T6 Gb Ex II 2D Ex ia IIIC T85°C Db Ex II 2D Ex tb IIIC T85°C Db	Ex II 2G Ex db eb IIC T6 Gb Ex II 2D Ex tb IIIC T85°C Db Ex II 2G Ex ia IIC T6 Gb Ex II 2D Ex ia IIIC T85°C Db	Ex II 2D Ex tb IIIC T85°C Db
Type:	See type code		
Description of the component:	Position, level, belt misalignment switches, [3)] optionally with Dupline® or DuplineSafe® input module		

Relevant Directives:	Machinery Directive	2006/42/EC
	Explosion Protection Directive (ATEX)	2014/34/EU
	[3)] EMC Directive	2014/30/EU
	RoHS Directive	2011/65/EU

Applied standards:
EN 60947-5-1:2017 + AC:2020, EN ISO 13849-1:2015
[1)] EN IEC 60079-0:2018, EN 60079-11:2012, EN 60079-31:2014
[2)] EN IEC 60079-0:2018, EN 60079-1:2014, EN IEC 60079-7:2015 + A1:2018, EN 60079-11:2012, EN 60079-31:2014
[3)] EN IEC 60079-0:2018, EN 60079-31:2014

Notified body, which approved the full quality assurance system, referred to Appendix IV, 2014/34/EU and for the ATEX certification:
TÜV Rheinland Industrie Service GmbH
Am Grauen Stein, 51105 Köln
ID n°: 0035

EU-Type Examination Certificate:
TÜV 19 ATEX 8428

This certificate refers only to the certification of the products in accordance with the Explosion Protection Directive 2014/34/EU (ATEX). Product conformity in accordance with the Machinery Directive 2006/42/EC is declared by the manufacturer under its own responsibility.

Person authorised for the compilation of the technical documentation:
Oliver Wacker
Möddinghofe 30
42279 Wuppertal, Germany

Place and date of issue:
Shanghai, June 28, 2023

Authorised signature
Michele Seassaro
Managing Director

EX-BS655-D-EN

The currently valid declaration of conformity can be downloaded from the internet at products.schmersal.com.

K.A. Schmersal GmbH & Co. KG
Möddinghofe 30, 42279 Wuppertal
Germany
Phone: +49 202 6474-0
Fax: +49 202 6474-100
E-Mail: info@schmersal.com
Internet: www.schmersal.com

Production site:
SCHMERSAL
Industrial Switchgear (Shanghai) Co., Ltd.
Cao Ying Road 3336
201712 Shanghai / Qingpu, P.R.CHINA
Phone: +86-21-63 75 82 87
Fax: +86-21-69 21 43 98
E-Mail: info@schmersal.com.cn
Internet: www.schmersal.com.cn