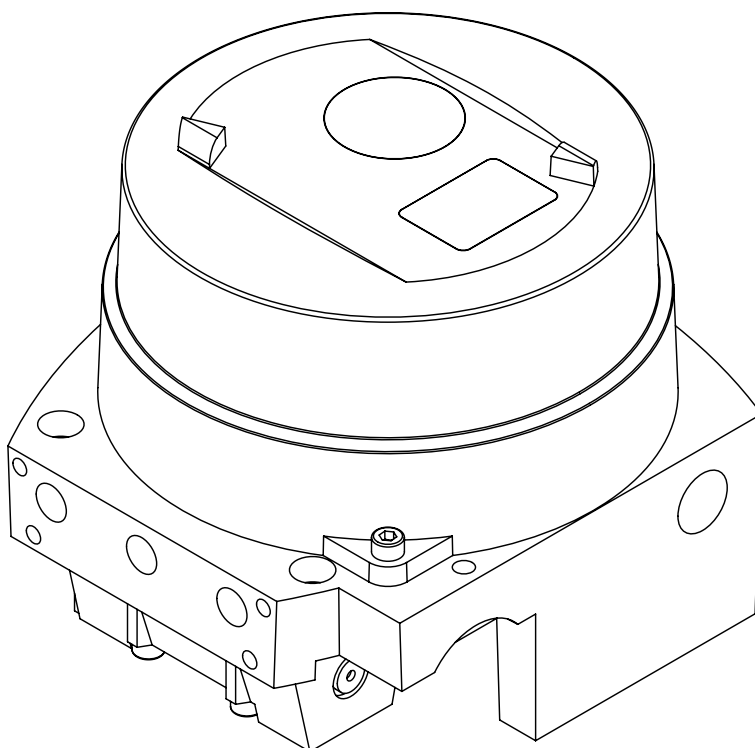


# Neles SwitchGuard™ SG9200H

Rev. 1.0

Installation, Maintenance and  
Operating Instructions



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### READ THESE INSTRUCTIONS FIRST!

These instructions provide information about the safe handling and operation of the intelligent on/off controller. If you require additional assistance, please contact the manufacturer or manufacturer's representative. Addresses and phone numbers are printed on the back cover.

### SAVE THESE INSTRUCTIONS!

Subject to change without notice.

All trademarks are property of their respective owners.

# 1 SG9200H SWITCHGUARD INTELLIGENT ON/OFF CONTROLLER WITH HART COMMUNICATION

## 1.1 General

This manual incorporates Installation, Maintenance and Operation Instructions for the Metso's Neles SwitchGuard. The SG9200H may be used with either cylinder or diaphragm type pneumatic actuators for rotary or linear valves.

### NOTE:

The selection and use of the valve controller in a specific application requires close consideration of detailed aspects. Due to the nature of the product, this manual cannot cover all the likely situations that may occur when installing, using or servicing the valve controller. If you are uncertain about the use of the controller or its suitability for your intended use, please contact Metso's Automation business for more information.

## 1.2 Technical description

The SwitchGuard is a 4–20 mA loop-powered microcontroller-based on/off controller. Binary 24 V DC signal can be used via optional U/I converter. The SwitchGuard operates even at 3.6 mA input signal (see restrictions in Section 4.5.3) and communicates via HART. The device contains a Local User Interface enabling local configuration. A PC with FieldCare software can be connected to the SwitchGuard itself or to the control loop.

The powerful 32-bit microcontroller controls the valve position. The measurements include:

- ☐ Input signal
- ☐ Valve position with contactless sensor
- ☐ Actuator pressures, 2 independent measurements
- ☐ Supply pressure
- ☐ Device temperature

Advanced self-diagnostics guarantees that all measurements operate correctly. Failure of one measurement does not cause the valve to fail if the input signal and position measurements are operating correctly. After connections of electric signal and pneumatic supply the micro controller ( $\mu C$ ) reads the input signal, position sensor ( $\alpha$ ) and pressure sensors ( $P_s$ ,  $P_1$ ,  $P_2$ ). A difference between setpoint according to stroke curve and position sensor ( $\alpha$ ) measurement is detected by the control algorithm inside the  $\mu C$ . The  $\mu C$  calculates a new value for prestage (PR) coil current based on this information. Changed current to the PR changes the pilot pressure to the spool valve. Reduced pilot pressure moves the spool and the actuator pressures change accordingly. The spool opens the flow to the driving side of the double-acting actuator (or air side in the single acting-actuator) and opens the flow out from the other side of the actuator in case of double-acting. The increasing pressure will move the piston. The actuator and feedback shaft rotate clockwise.

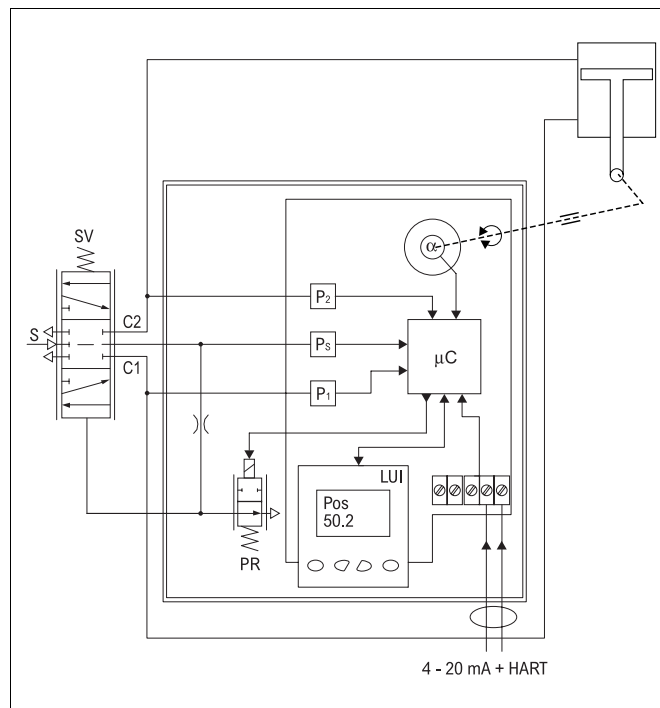


Fig. 1 The principle of operation

## 1.3 Markings

The valve controller is equipped with an identification plate sticker (Fig. 2).

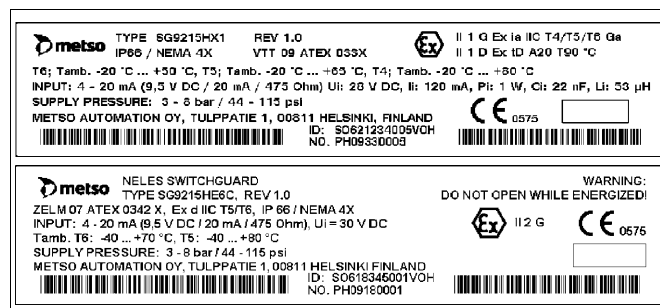


Fig. 2 Examples of the identification plate

Identification plate markings from top to bottom include:

- ☐ Type designation of the on/off controller
- ☐ Revision number
- ☐ Enclosure class
- ☐ Certificate number
- ☐ Hazardous area approval
- ☐ Temperatures classes
- ☐ Input signal and electrical values
- ☐ Supply pressure range
- ☐ Manufacturer
- ☐ CE mark
- ☐ ID code
- ☐ Manufacturing serial number TTYWWNNNN\*)

\*) Manufacturing serial number explained:

TT= device and factory sign  
YY= year of manufacturing  
WW = week of manufacturing  
NNNN = consecutive number

Example: PH09011234 = controller, year 2009, week 1, consecutive number 1234.

## 1.4 Technical specifications

### ATEX NOTE:

**This manual contains technical specifications for several types of the SG9200H valve controller. If in doubt, refer to the type approval certificate of the respective version.**

The certificate is delivered with the field device and is also available from the manufacturer.

### SG9200H ON/OFF CONTROLLER

#### General

Loop powered, no external power supply required.

Suitable for rotary and sliding-stem valves.

Actuator connections in accordance with VDI/VDE 3845 and IEC 60534-6 standards.

Action: Double or single acting  
Travel range: Linear: 10–120 mm  
Rotary: 45–95°  
Measurement range 110° with freely rotating feedback shaft

#### Environmental influence

Standard temperature range:  
-20° to +85 °C / -4° to +185 °F

Optional temperature range:  
-40° to +60 °C / -40° to +140 °F

Influence of vibration on valve position:  
under 2g 5–150 Hz,  
1g 150–300 Hz, 0.5g 300–2000 Hz  
Open and closed position: no effect  
Deviation from profile: <10 %

#### Enclosure

Material: Anodised aluminium alloy and glass window

Protection class: IP66, NEMA 4X

Pneumatic ports: SG921\_ 1/4 NPT  
SG9235 1/2 NPT  
SG9237 1 NPT (1/2 NPT supply)  
(single acting only)

Conduit entry thread: M20 x 1.5

Weight: SG9210 3.0 kg / 6.6 lb  
SG9235 4.6 kg / 10.1 lb  
SG9237 5.0 kg / 11 lb  
limit switch options plus 1.0 kg / 2.2 lb

Mechanical and digital position indicator visible through the main cover

#### Pneumatics

Supply pressure: 3–8 bar/44–116 psi

Air quality: According to ISO 8573-1:2001  
Solid particles: Class 7  
(5 µm filtration is recommended)  
Humidity: Class 1  
(dew point 10 °C / 50 °F below minimum temperature is recommended)  
Oil class: 3 (or <1 ppm)

Spool valve identifiers:

Standard version SG921\_ SPCZ/2163/2  
SG923\_ SPCZ/2164/2

Optional cold version

SG921\_C\_ SPCZ/2163/1

SG923\_C\_ SPCZ/2164/1

Capacity with 4 bar / 60 psi supply:

SG9212 7 Nm<sup>3</sup>/h / 4.1 scfm (Cv =0.06)  
SG9215 90 Nm<sup>3</sup>/h / 53 scfm (Cv =0.7)  
SG9235 380 Nm<sup>3</sup>/h / 223 scfm (Cv =3.2)  
SG9237 feed 380 Nm<sup>3</sup>/h / 223 scfm (Cv =3.2)  
exhaust 700 Nm<sup>3</sup>/h / 412 scfm (Cv =6.4)

Consumption with 4 bar / 60 psi supply:

actuator pressurized 0.22 Nm<sup>3</sup>/h / 1.13 scfm,  
actuator vented 0.25 Nm<sup>3</sup>/h / 1.14 scfm

#### Electronics

Electrical connections: max. 2.5 mm<sup>2</sup>

#### HART

Connections: '+' and '-'  
Supply power: Loop powered, 4–20 mA  
Minimum signal: 3.6 mA (see restrictions in 4.5.3)  
Current max : 23 mA  
Load voltage: up to 9.5 V DC/20 mA  
(corresponding 475 Ω)  
Voltage: max. 30 V DC  
Polarity protection: -30 V DC  
Over current protection:

active over 35 mA

Max power dissipation: 1.05 W  
with position transmitter 1.74 W

Ex d IIC T5/T6: Ui ≤ 30 V  
Pi ≤ 1080 mW

Ex ia IIC T4/T5/T6: Ui ≤ 28 V  
Ii ≤ 120 mA  
Pi ≤ 1 W  
Ci ≤ 22 nF  
Li ≤ 53 µH

Ex nA IIC T4/T5/T6: Ui ≤ 30 V  
Ii ≤ 152 mA

Ex nL IIC T4/T5/T6: Ui ≤ 28 V  
Ii ≤ 152 mA  
Ci ≤ 22 nF  
Li ≤ 53 uH

#### Position transmitter (optional)

Connections: PT: '+' and '-'  
Output signal: 4–20 mA (galvanic isolation;  
600 V DC)  
Supply voltage: 12–30 V  
Resolution: 16 bit / 0.244 µA  
Linearity: <0.05 % FS  
Temperature effect: <0.35 % FS  
External load: max 0–780 Ω  
max 0–690 Ω for intrinsically safe

Ex ia IIC T4/T5/T6: Ui ≤ 28 V  
Ii ≤ 120 mA  
Pi ≤ 1 W  
Ci ≤ 22 nF  
Li ≤ 53 µH

Ex nA IIC T4/T5/T6: Ui ≤ 30 V  
Ii ≤ 152 mA

Ex nL IIC T4/T5/T6:  $U_i \leq 28 \text{ V}$   
 $I_i \leq 152 \text{ mA}$   
 $C_i \leq 22 \text{ nF}$   
 $L_i \leq 53 \text{ uH}$

Ex d IIC T5/T6:  $U_i \leq 30 \text{ V}$   
 $P_i \leq 1080 \text{ mW}$

#### Local user interface functions

- ☐ Monitoring of valve position, input signal, temperature, supply and actuator pressure difference
- ☐ Guided start-up function
- ☐ LUI may be locked remotely to prevent unauthorised access
- ☐ Calibration: Automatic
- ☐ Tuning
- ☐ Mode selection: Automatic/Manual
- ☐ Position trigger level
- ☐ Stroke times, stroke profiles
- ☐ Dead angle
- ☐ Maximum speed
- ☐ Positioner fail action, open/close
- ☐ Signal direction: Direct/reverse acting
- ☐ Actuator type: double/single acting
- ☐ Valve type: rotary/linear IEC
- ☐ Language selection: English, German and French

#### Remote user interface functions

Configuration and diagnostic information is presented in easily understandable way using FDT/DTM technology, such as Neles FieldCare™.

#### APPROVALS

##### Intrinsically safe and non incendive

<b>ATEX</b>	ATEX II 1 G Ex ia IIC T4/T5/T6 Ga (EN60079-0, EN60079-11, EN60070-26)
	II 2 G Ex ia IIC T4/T5/T6 Gb (EN60079-0, EN60079-11)
	II 3 G Ex nA IIC T4/T5/T6
	II 3 G Ex nL IIC T4/T5/T6 (EN60079-15)
	II 1 D Ex tD A20 T90 °C II 2 D Ex tD A21 T90 °C II 3 D Ex tD A22 T90 °C (EN61241-0, EN61241-1)
<b>CSA</b>	IS Class I, Division 1, Groups A, B, C, D, T4/T5/T6
	IS Class I, Zone 0, AEx ia, IIC T4/T5/T6
<b>FM</b>	NI Class I, Division 1, Groups A, B, C, D, T4/T5/T6
	NI Class I, Zone 2, Ex nA IIC, T4/T5/T6
	IS Class I, Division 1, Groups A, B, C, D, T4/T5/T6
	IS Class I, Zone 0, AEx ia, IIC T4/T5/T6
	NI Class I, Division 1, Groups A, B, C, D, T4/T5/T6
	NI Class I, Zone 2, Ex nA IIC, T4/T5/T6

#### Flameproof and explosion proof

**ATEX** ATEX II 2 G Ex d IIC T5/T6  
(EN60079-0, EN60079-1)

#### Electromagnetic protection

Electromagnetic compatibility  
 Emission acc. to EN 61000-6-4 (2001)  
 and FCC 47 CFR PART 15,  
 SUBPART B, CLASS B (1994)  
 Immunity acc. to EN 61000-6-2 (2001)

#### CE marking

89/336/EEC  
 Electromagnetic compatibility

94/9/EC  
 ATEX

## 1.5 Recycling and disposal

Most valve controller parts can be recycled if sorted according to material.

Most parts have material marking. A material list is supplied with the valve controller. In addition, separate recycling and disposal instructions are available from the manufacturer.

A valve controller may also be returned to the manufacturer for recycling and disposal. There will be a charge for this.

## 1.6 Safety precautions

### CAUTION:

#### Do not exceed the permitted values!

Exceeding the permitted values marked on the valve controller may cause damage to the controller and to equipment attached to the controller and could lead to uncontrolled pressure release in the worst case. Damage to the equipment and personal injury may result.

### CAUTION:

#### Do not remove or dismantle a pressurized controller!

Removing or dismantling a pressurized prestage or spool valve of an SwitchGuard leads to uncontrolled pressure release. Always shut off the supply air and release the pressure from the pipelines and equipment before removing or dismantling the controller. Otherwise personal injury and damage to equipment may result.

### WARNING:

**During calibration and tuning the valve operates between open and closed positions. Make sure that the operation does not endanger people or processes!**

### WARNING:

#### Do not operate the device with the cover removed!

Electromagnetic immunity is reduced, valve may stroke.

### ATEX WARNING:

**The locking screw (part 107) of the cover is essential to explosion protection.**

The cover has to be locked in place for Ex d protection. The screw grounds the cover to the housing.

### ATEX WARNING:

#### Spark hazard!

Protect the aluminium housing and cover from impacts.

### ATEX WARNING:

#### Electrostatic charge hazard!

The pointer and display windows are non-conductive. Clean with a damp cloth only!

**ATEX WARNING:****Electrostatic charge hazard!**

The paint of the device can enable charging of the metal parts by high voltage sources. Do not install the device in proximity of high voltage sources!

**Ex i WARNING:**

**Ensure that the complete installation and wiring is intrinsically safe before operating the device!**

**Ex i WARNING:**

**Do not operate the device with electronics cover (39) removed!**

Electromagnetic immunity is reduced, valve may stroke. Ex i: intrinsic safety may be impaired.

**Ex i WARNING:**

**For intrinsically safe applications, the equipment must be connected via a certified Zener barrier placed outside the hazardous area!**

**Ex d NOTE:**

**Only persons familiar with Ex d explosion protection are allowed to work with the device. Special attention has to be paid to careful handling and closing of the cover.**

**Ex d WARNING:**

**Do not open the cover when an explosive atmosphere may be present!**

**Ex d WARNING:**

**Use a cable gland with suitable Ex d certification. For ambient temperature over 70 °C/158 °F use a heat resistant cable and cable gland suitable for at least 90 °C/194 °F.**

**ELECTRICAL SAFETY WARNING:**

**Use fuses for limit switch installations with 50 V AC/75 V DC or higher.**

**NOTE:**

Avoid earthing a welding machine in close proximity to an SG9200H valve controller.  
Damage to the equipment may result.

## 2 TRANSPORTATION, RECEPTION AND STORAGE

The on/off controller is a sophisticated instrument, handle it with care.

- ☐ Check the controller for any damage that may have occurred during transportation.
- ☐ Store the controller preferably indoors, keep it away from rain and dust.
- ☐ Do not unpack the device until installing it.
- ☐ Do not drop or knock the controller.
- ☐ Keep the flow ports and cable glands plugged until installing.
- ☐ Follow instructions elsewhere in this manual.

## 3 MOUNTING

### 3.1 General

**NOTE:**

The enclosure of SwitchGuard on/off controller meets the IP66 protection class according to EN 60529 in any position when the cable entry is plugged according to IP66. Based on good mounting practice, the recommended mounting position is electrical connections placed downwards. This recommendation is shown in our mounting position coding for control valves. If these requirements are not fulfilled, and the cable gland is leaking and the leakage is damaging valve controller or other electrical instrumentation, our warranty is not valid.

If the SwitchGuard is supplied with valve and actuator, the tubes are mounted and the SwitchGuard adjusted in accordance with the customer's specifications. If the controller is ordered separately, the mounting parts for the assembly must be ordered at the same time.

Sample order: (B1CU13)-Z-SG9235HN

The controller is equipped for connection according to VDI/VDE 3845. Also the old Neles mounting face is supported (Z beam) but not recommended for high vibration environments.

Shaft coupling alternatives for the controller for Metso actuators are shown in Fig. 4.

For mounting parts for Metso actuators, see 11.3 - 11.5.

### 3.2 Mounting on Metso actuators with VDI/VDE mounting face

See figure in Section 11.3.

- ☐ Mount the H-shaped coupling (47) to the shaft. Apply the thread-locking compound to the screw (48) and tighten firmly.
- ☐ Remove all protective plastic plugs from the pneumatic connections (3 pcs.).
- ☐ **BJ and other single acting actuators:** mount a metal plug (53) with sealant to the C1 connection.
- ☐ Set the direction arrow of the actuator in the direction of the valve closure member and attach the ear (2) to the indicator cover in the position shown in Section 11.3. Secure the screw of the ear using e.g. Loctite and tighten firmly.
- ☐ Attach the bracket (1) to the SwitchGuard.
- ☐ Attach the bracket (1) to the actuator. The shaft coupling of the SwitchGuard must fit into the ear (2) so that the pointer is located in the position shown in Fig.3.

### 3.3 Mounting on linear actuator with IEC 60534 mounting face

See figure in Section 11.5

- ☐ Attach the feedback arm with spacer to the controller shaft. Note the position of the pointer on the shaft as in 11.5. Apply thread locking compound to the screws and tighten firmly. Attach the spring to the feedback arm as shown in Section 11.5.

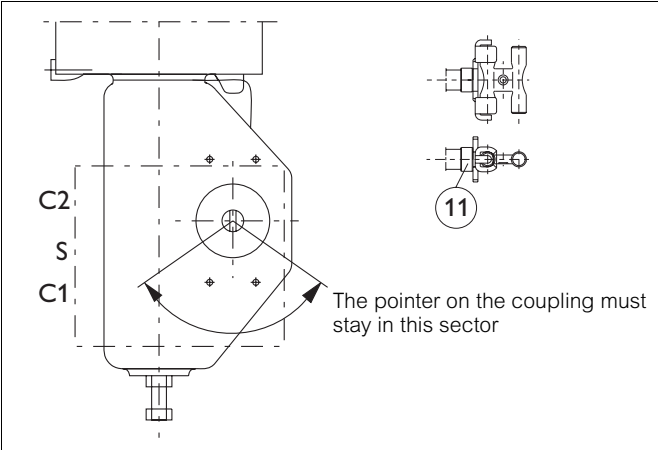


Fig. 3 Mounting on Metso actuator with VDI/VDE mounting face

- ❑ Mount the controller mounting bracket loosely to the yoke of the actuator.
- ❑ Remove all plastic plugs from all actuator connections (3 pcs.).
- ❑ Mount the controller loosely to the mounting bracket guiding the pin on the actuator stem to the slot of the feedback arm.

- ❑ Align the bracket and the controller with the actuator stem and adjust their position so that the feedback arm is approximately at a 90° angle to the actuator stem (in the mid-stroke position).
- ❑ Tighten the controller mounting bracket screws.
- ❑ Adjust the distance of the controller to the pin on the actuator stem so that the pin stays in the lever slot at full stroke. Ensure also that the maximum angle of the lever does not exceed 45° in either direction. Maximum allowed travel of the lever is shown in Section 11.5. Best control performance is achieved when the feedback lever utilises the maximum allowed angle ( $\pm 45^\circ$  from horizontal position). The whole range should be at least 45°.
- ❑ Make sure that the controller is in right angle and tighten all the mounting bolts.
- ❑ Ensure that the controller complies with previous steps. Check that the actuator pin does not touch the controller case throughout the entire stroke of the actuator. If the actuator pin is too long it may be cut to size.
- ❑ Apply grease (Molykote or equivalent) to the contact surfaces of the actuator pin and the feedback arm to reduce wear.

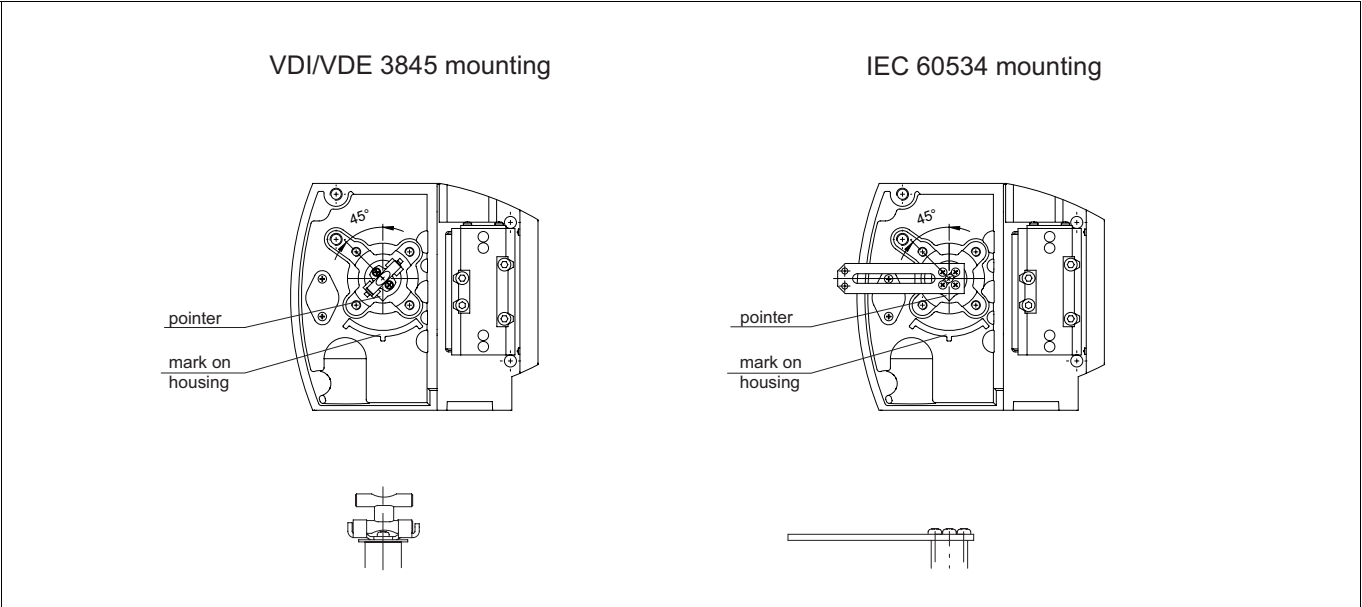


Fig. 4 Shaft coupling alternatives

3.4 Piping

**CAUTION:**  
**Do not exceed the permitted supply pressure of the SwitchGuard!**

Table 2 provides the recommended tube sizes in accordance with actuator sizes. Tube sizes are the minimum values allowed.

Connect the air supply to S.

Connect C1 and C2 to the actuator, see Fig. 5. C1 must be plugged if single-acting actuator.

Liquid sealants, such as Loctite 577 are recommended for the pipe threads.

**CAUTION:**  
**It is important to note, that SwitchGuard mounted on a spring actuator MUST be connected only as single-acting. See Fig. 5.**

**NOTE:**  
An excess of sealant may result in faulty operation of the controller.  
Sealing tape is not recommended.  
Ensure that the air piping is clean.

The air supply must be clean, dry and oil-free instrument air, see Section 1.4.

Table 1 Spring rates

Actuator type	Spring rate (bar/psi)
B1JK	3/43
B1J	4.2/61
B1JV	5.5/80
Adjust regulator pressure to a level that is max 1 bar (14.5 psi) + spring rate.	

Table 2 Piping, stroke times and maximum valve speed (MAXS) parameter selection

Actuator			SG_15 Supply 1/4" NPT Actuator 1/4" NPT				SG_35 Supply 1/2" NPT Actuator 1/2" NPT			SG_37_ (Single acting only) Supply 1/2" NPT Actuator 1" NPT			Maximum Valve Speed Parameter
B1C	Stroke vol. dm <sup>3</sup> / in <sup>3</sup>		NPT	Piping	Open (s)	Close (s)	Piping	Open (s)	Close (s)	Piping	Open (s)	Close (s)	
6	0.3	18	1/4	6 mm or 1/4"	0.6	0.6	-	-	-	-	-	-	FST
9	0.6	37	1/4	6 mm or 1/4"	1.0	1.1	-	-	-	-	-	-	FST
11	1.1	67	3/8	10 mm or 3/8"	0.7	0.7	-	-	-	-	-	-	FST
13	2.3	140	3/8	10 mm or 3/8"	1.3	1.4	-	-	-	-	-	-	STD
17	4.3	262	1/2	10 mm or 3/8"	2.0	2.3	-	-	-	-	-	-	STD
20	5.4	330	1/2	10 mm or 3/8"	2.4	2.6	-	-	-	-	-	-	STD
25	10.5	610	1/2	10 mm or 3/8"	4.5	4.9	16 mm or 5/8"	1.3	1.5	-	-	-	SLO (SG_35) STD (SG_15)
32	21	1282	3/4	10 mm or 3/8"	9.4	9.4	16 mm or 5/8"	2.4	2.7	-	-	-	SLO
40	43	2624	3/4	10 mm or 3/8"	19	19	16 mm or 5/8"	4.9	5.6	-	-	-	SLO
50	84	5126	1	10 mm or 3/8"	38	38	16 mm or 5/8"	9.6	11	-	-	-	SLO
60	121	7380	1	10 mm or 3/8"	54	54	16 mm or 5/8"	14	16	-	-	-	SLO
75	189	11500	1	10 mm or 3/8"	85	85	16 mm or 5/8"	22	25	-	-	-	SLO
502	195	11900	1	10 mm or 3/8"	87	87	16 mm or 5/8"	22	25	-	-	-	SLO
602	282	17200	1	10 mm or 3/8"	126	126	16 mm or 5/8"	32	37	-	-	-	SLO
752	441	26900	1	10 mm or 3/8"	197	197	16 mm or 5/8"	50	57	-	-	-	SLO
B1J B1JA	Stroke vol. dm <sup>3</sup> / in <sup>3</sup>		NPT	Piping	Air (s)	Spring (s)	Piping	Air (s)	Spring (s)	Piping	Air (s)	Spring (s)	
8	0.9	55	3/8	10 mm or 3/8"	0.5	1.0	-	-	-	-	-	-	FST
10	1.8	110	3/8	10 mm or 3/8"	0.7	1.4	-	-	-	-	-	-	FST
12	3.6	220	1/2	10 mm or 3/8"	1.2	2.7	-	-	-	-	-	-	STD
16	6.7	409	1/2	10 mm or 3/8"	3.2	4.8	16 mm or 5/8"	0.7	1.3	-	-	-	SLO (SG_35) STD (SG_15)
20	13	793	3/4	10 mm or 3/8"	4.6	9.3	16 mm or 5/8"	1.4	2.6	-	-	-	SLO
25	27	2048	3/4	10 mm or 3/8"	8.9	18	16 mm or 5/8"	2.9	5.4	25 mm or 1"	2.5	2.9	SLO
32	53	3234	1	10 mm or 3/8"	15	38	16 mm or 5/8"	4.9	11	25 mm or 1"	4.3	5.3	SLO
322	106	6468	1	10 mm or 3/8"	31	77	16 mm or 5/8"	9.8	21	25 mm or 1"	8.5	11	SLO

**CAUTION:**

Always adjust the maximum valve speed parameter according to Table 2. Erroneous value may cause instability.

**CAUTION:**

Extra pneumatics instrumentation (i.e. QEV, VB, etc.) is not allowed with SwitchGuard

**CAUTION:**

The stroking times mentioned in Table 2 are trend-setting. They are measured with 5 bar supply air pressure, but may vary significantly due to different factors such as, but not limited to, pressure difference of the valve, the stiction of the actuator, supply air pressure, the capacity of the supply air system and the dimensions of the supply air pipeline.

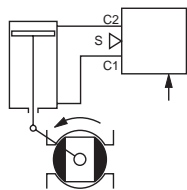
**CAUTION:**

The air supply system must be of sufficient size and capacity to ensure that at maximum flow during valve movement the pressure at the SwitchGuard must not fall below 3 bar. Also note that if the air supply system allows the pressure at the SwitchGuard to fall below the actuator minimum supply pressure during valve movement the stroke speed will be affected.



## DOUBLE-ACTING ACTUATOR

1. Increasing input signal to open valve (shown)



Default setting:

DIR = OPE

ATYP = 2-A

PFA = CLO

A0 and VTYP according to valve type

2. Increasing input signal to close valve (**not recommended**)

Default setting:

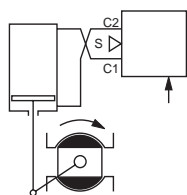
DIR = CLO

ATYP = 2-A

PFA = CLO

A0 and VTYP according to valve type

## DOUBLE-ACTING ACTUATOR, REVERSED PIPING

3. Increasing input signal to open valve (**not recommended**)

Default setting:

DIR = OPE

ATYP = 2-A

PFA = OPE

A0 and VTYP according to valve type

4. Increasing input signal to close valve (shown)

Default setting:

DIR = CLO

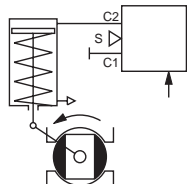
ATYP = 2-A

PFA = OPE

A0 and VTYP according to valve type

## SINGLE-ACTING ACTUATOR, SPRING TO CLOSE

5. Increasing input signal to open valve (shown)



Default setting:

DIR = OPE

ATYP = 1-A

PFA = CLO (must be in the spring direction)

A0 and VTYP according to valve type

6. Increasing input signal to close valve (**not recommended**)

Default setting:

DIR = CLO

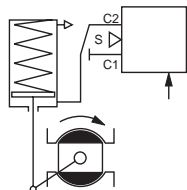
ATYP = 1-A

PFA = CLO (must be in the spring direction)

A0 and VTYP according to valve type

## SINGLE-ACTING ACTUATOR, SPRING TO OPEN

7. Increasing input signal to close valve (shown)



Default setting:

DIR = CLO

ATYP = 1-A

PFA = OPE (must be in the spring direction)

A0 and VTYP according to valve type

8. Increasing input signal to open valve (**not recommended**)

Default setting:

DIR = OPE

ATYP = 1-A

PFA = OPE (must be in the spring direction)

A0 and VTYP according to valve type

Fig. 5 Operation directions and air connections

3.5 Electrical connections

The SG9200H is powered by a standard 4-20 mA current loop that also functions as a carrier to the HART communication.

If a 24 V DC (or up to 230 V AC) output from the control system is used, then an U/I converter is needed as shown in Fig. 7 below. See typecoding in Section 14 for different converter options.

The signal cables are led through M20 x 1.5 cable glands.

Cable shall be one or more single-twisted pair shielded or multiple-twisted pair with overall shield. Single and multiple-pair may be combined in a given network provided all current input devices associated with multiple pairs of the same cable shall be located nominally at one end of the multi-pair cable. Unshielded cable may be used if it is demonstrated that ambient noise or crosstalk does not affect communication.

Connect the conductors to the terminal strip as shown in Fig. 6. (Connections '+' and '-').

The optional position transmitter is connected to 2-pole terminal PT as shown in Fig. 6. The position transmitter needs an external power supply. The SwitchGuard and

the position transmitter circuits are galvanically isolated and withstand a 600 V AC voltage.

The earthing of the cables shall be carried out at the DCS end only.

**NOTE:**  
The SG9200H equals a load of 475 Ω in the current loop.

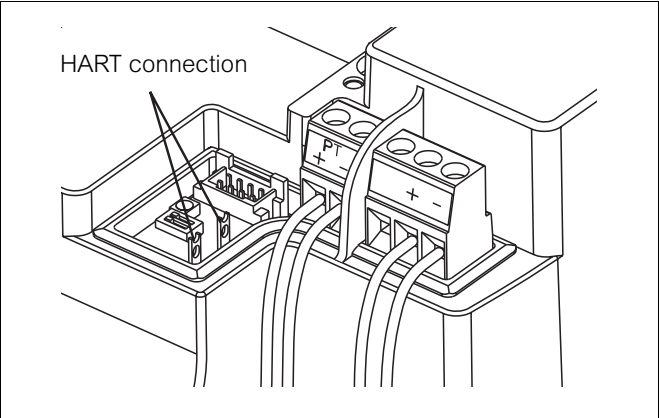


Fig. 6 Terminals when LUI is removed and position transmitter option is in use.

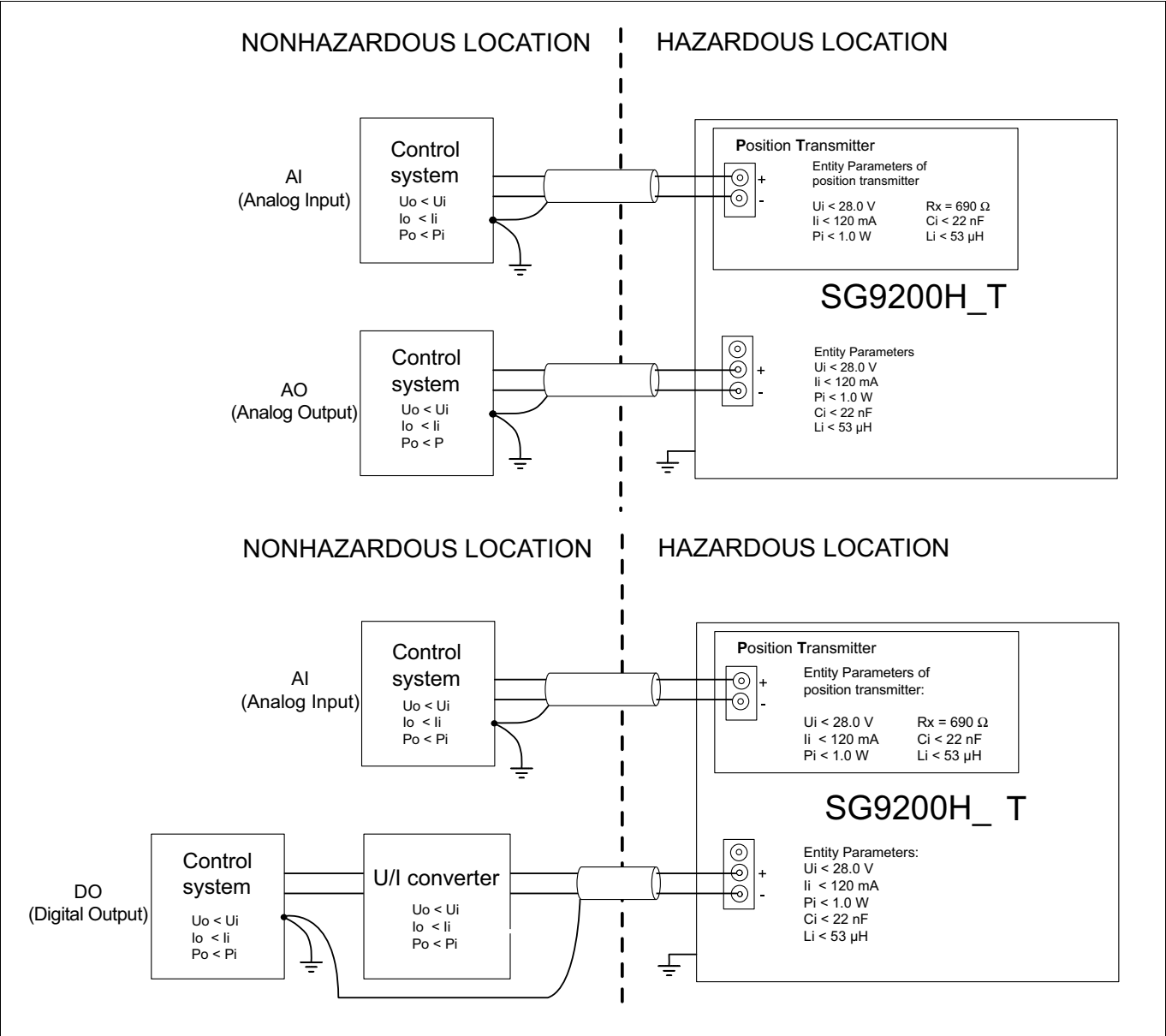


Fig. 7 Control wiring

4 LOCAL USER INTERFACE (LUI)

The local user interface may be used to monitor the device behaviour as well as configuring and commissioning the controller during installation and normal operation. The local user interface consists of two row LCD and four button keypad interface. There are also custom graphical characters for special conditions.

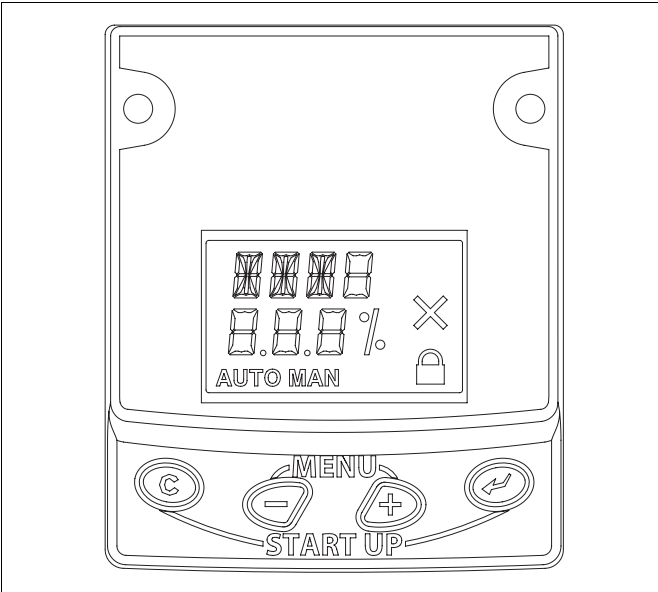


Fig. 8 Local user interface (LUI)





4.1 Measurement monitoring

When the device is powered, it enters the measurement monitoring view. The following measurements may be viewed from the display. The Table 3 identifies the default unit and also optional unit of the measurement.

Table 3 Default / optional units of measurements

Measurement	Default unit	Optional unit
valve position	Percentage of full scale	Angle, where 0 % refers to 0 (angle)
current loop setpoint	mA	Percentage of full scale
actuator pressure difference	bar	psi
supply pressure	bar	psi
device temperature	°Celcius	°Fahrenheit

If the unit selection is altered from the FieldCare software to US units, the pressure default unit will automatically be changed to psi and temperature unit to Fahrenheit.

The active unit may be changed by pressing the  key constantly. The display shows the current unit selection on the top row of the display. You may change the selection by pressing  or  while keeping the  key pressed down. When the buttons are released the current selection will be activated.

If the device has been idle for 1 hour, and there is no user activity on the local user interface, the measurements will start scrolling on the display. This enables the user to view all the measurements through the window of the main cover.

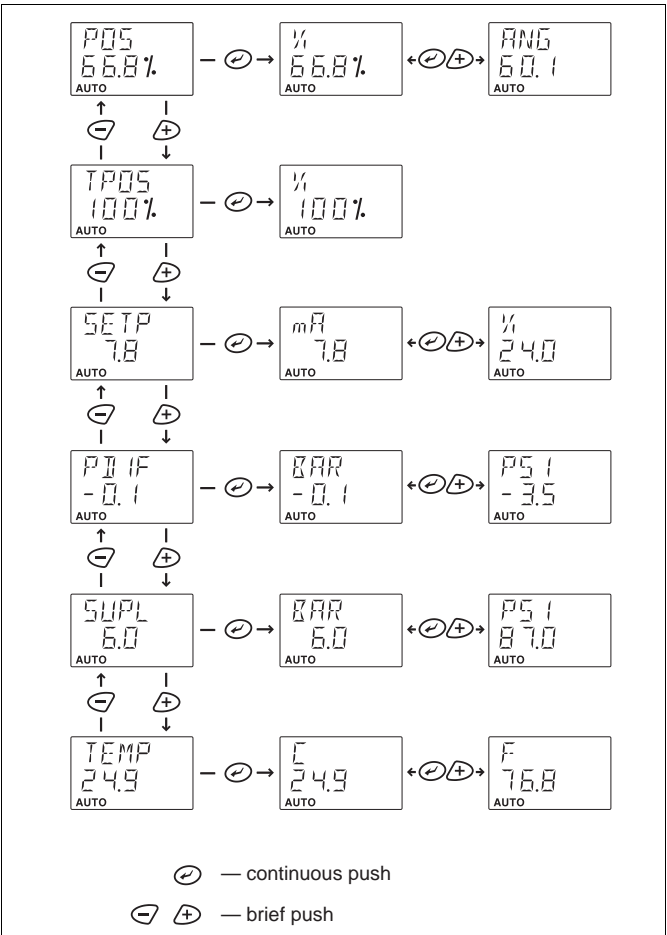




Fig. 9 Measurement unit change

4.2 Guided start-up

Guided startup offers a fast view of the most critical parameters of the SwitchGuard controller, actuator and valve configuration. After verifying the parameters the valve travel calibration is recommended. The guided start-up is entered by pressing the  and  keys simultaneously.

The configuration parameters are listed in following order, see explanation from 4.5:

Valve type	VTYP
Actuator type	ATYP
Maximum Speed	MAXS
Positioner fail action	PFA
Valve dead angle	A0
Stroke Time Open	STOP
Stroke Time Close	STCL

If you modify any of the parameters you will also need to calibrate and tune the device. See 4.6 for detailed description.

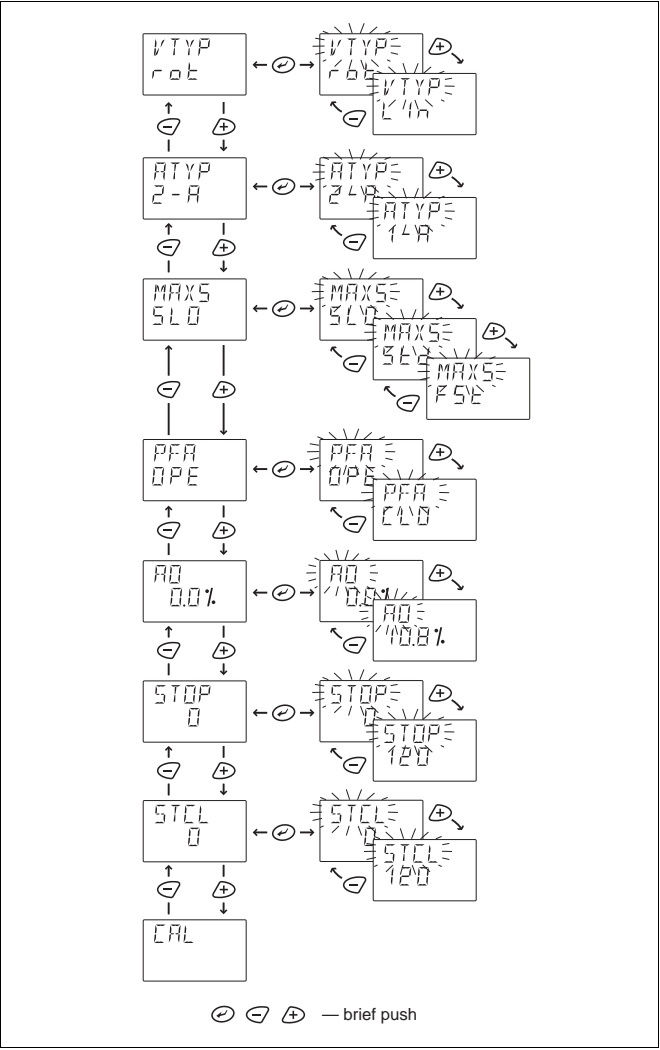


Fig. 10 Guided start-up

**NOTE:**  
You may cancel any action by pressing the ⏏ button. Cancelling of operation returns user interface view one level up in menu hierarchy.

4.3 Configuration menu

The local user interface is organised in a menu structure. To enter the menus press ⏏ and ⏏ simultaneously in the measurement monitoring view panel. To move to the next or previous selection by pressing ⏏ or ⏏ accordingly.

4.4 MODE menu

If the user wants to change the valve operating mode, press the ⏏ key at the MODE selection. The mode will start to flash and by pressing ⏏ or ⏏ you may alter the operation mode selection. User accepts the current selection by pressing the ⏏ key.

There are two options for the operating mode.

4.4.1 AUTO

During the **AUTO** mode, the controller controls the valve position according to the incoming setpoint signal from the 4–20 mA signal source. This mode is used during the normal process control service.

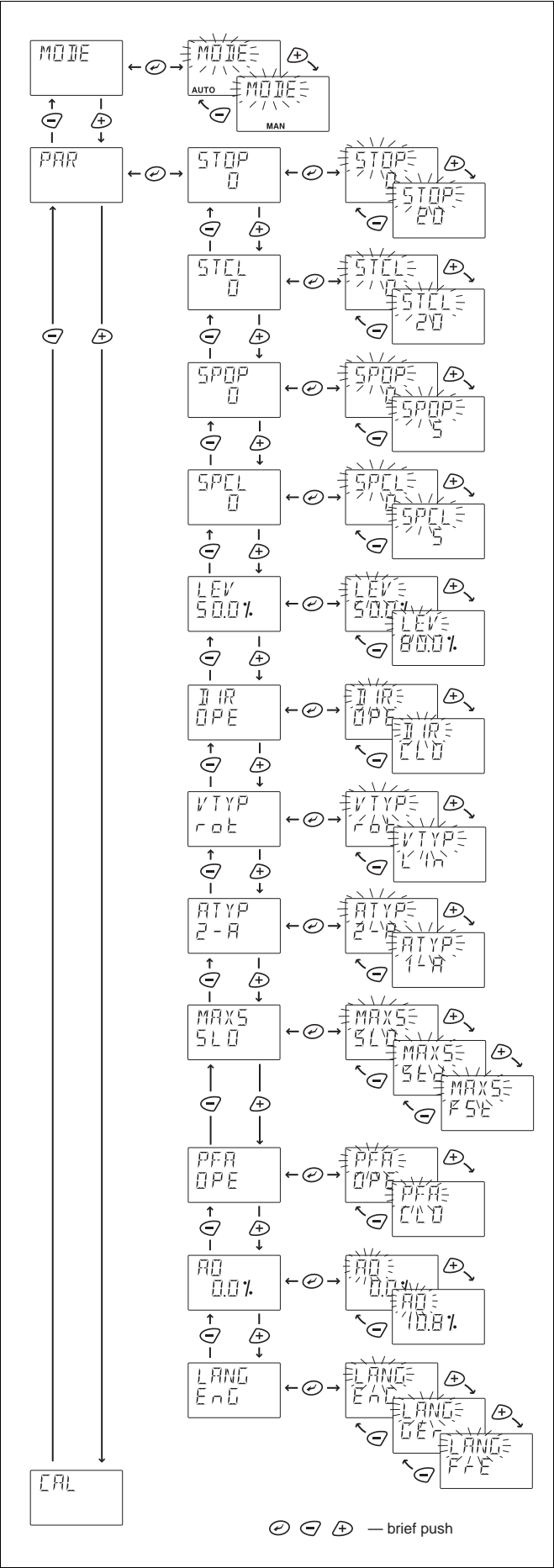


Fig. 11 Configuration

## 4.4.2 MAN

It is possible to control the valve position from the keyboard in the Manual Mode. To do this, you must return to Measurement Monitoring Menu (main menu).

- ❑ Choose *TP05* and press  $\odot$ . In the upper row *TP05* starts to blink and in the lower row you can see the current position of the valve.  
*CL0* = valve closed  
*OPE* = valve open  
 --- = valve is somewhere between open and closed positions.
- ❑ You can control the valve position as follows:  
 $\oplus$  Opens the valve, "---" blinks during movement.  
 $\ominus$  Closes the valve, "---" blinks during movement.  
 Blinking stops when the valve is again fully open or closed.

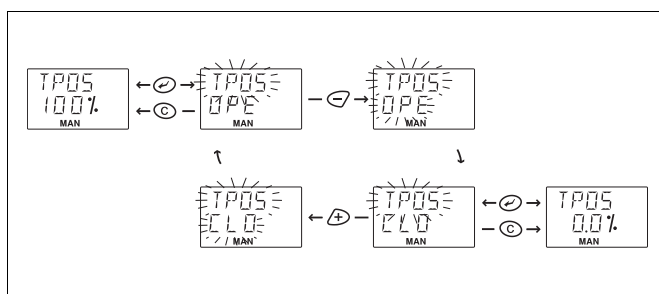


Fig. 12 Setpoint change in MAN mode

## 4.5 Configuration parameters

When *PAR* is on the display you may enter the configuration menu by pressing the  $\odot$  key. In this menu the most important configuration and signal modification parameters are viewable. You may view the current value and edit them by pressing the  $\odot$  key at the relevant parameter. The name of the parameter will appear on the upper row of the display and the current value is on the lower row. See also table in Section 13.

### 4.5.1 Stroke time and profile, *STOP*, *STCL*, *SPOP*, *SPCL*

Valve open and close profiles can be configured with Neles SwitchGuard with the limitation set by valve assembly. Stroke time performance constraints can be seen from the piping table in Section 3.4. Both stroke directions can be set without any connection to the each other.

Opening and closing times can be set with *STOP* (open) and *STCL* (close) parameters. Parameter is given in seconds.

Used stroke profile shape can be set with parameters *SPOP* (open) and *SPCL* (close). Profile can be chosen separately for both direction from one of the five profile shapes: Linear (1), Slow Starting (2), Slow Starting & Ending (3), Equal Percentage (4) and Quick Starting (5). If valve stroke is needed to do as fast as possible, set time stroke time to 0.

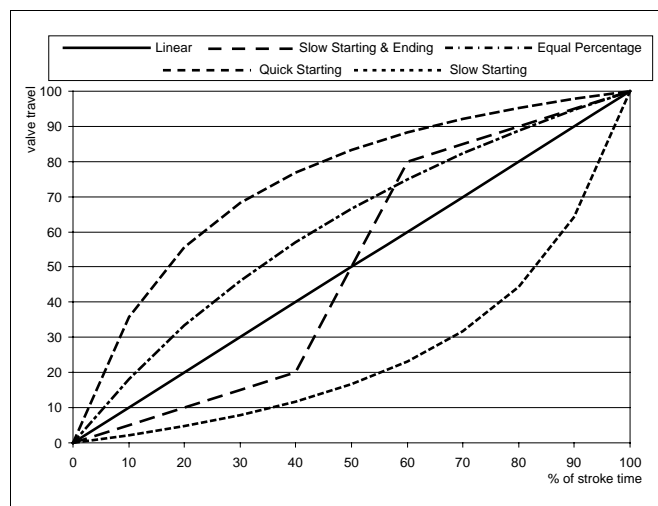


Fig. 13 Stroke profile shapes, opening

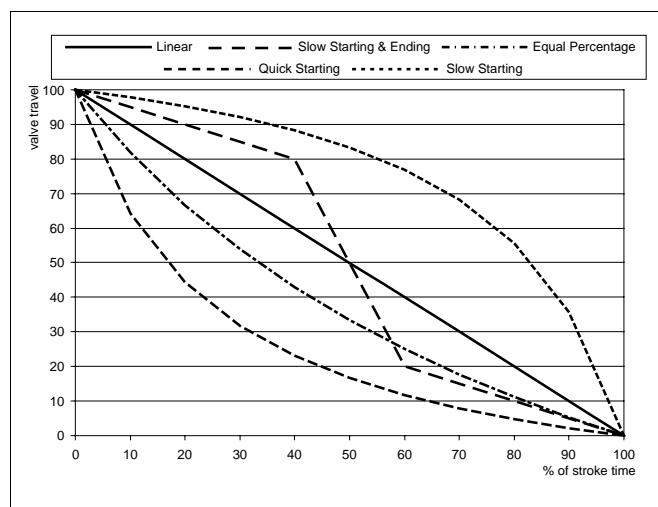


Fig. 14 Stroke profile shapes, closing

### 4.5.2 Trigger level, *LEV*

Input setpoint level to start position transition. A fixed hysteresis is applied on this level (trigger level – 5 %). Default value is 50.0 % and range is 20...80 %.

### 4.5.3 Signal direction, *DIR*

The opening and closing direction of the valve with raising current loop signal is defined by signal direction parameter *DIR*.

- ❑ When *DIR* is displayed press the  $\odot$  key to enter the edit state and *DIR* starts to blink.
- ❑ Select either the *OPE* or *CL0* values by pressing the  $\oplus$  and  $\ominus$  keys. The value *OPE* signifies the raising signal 4–20 mA to open the valve and *CL0* means the raising signal to close the valve.
- ❑ To conclude, press the  $\odot$  key when the desired value is shown on the display.

See default values in Fig. 5.

#### NOTE:

In case of signal direction (*DIR*) is same than Positioner Fail Action (*PFA*) 5 mA input signal is recommended as minimum.

#### 4.5.4 Valve type, $VTYPE$

To compensate for nonlinearity of the position feedback caused by the actuator linkage mechanism of a linear control valve, the appropriate selection must be made on the  $VTYPE$  display.

- ❑ After selecting  $VTYPE$  on the display, press the  $\odot$  key to enter the edit state and the  $VTYPE$  starts to blink.
- ❑ Select between two values  $rot$  or  $Lin$  using the  $\oplus$  and  $\ominus$  keys. The value  $rot$  indicates a rotary valve and  $Lin$  a linear valve.
- ❑ To conclude press the  $\odot$  key when the desired value is shown on the display.

#### 4.5.5 Actuator type, $ATYPE$

In order to optimise the control performance the device needs to be informed about the actuator type.

- ❑ After selecting  $ATYPE$  on the display, press the  $\odot$  key to enter the edit state and  $ATYPE$  starts to blink.
- ❑ Select between two values  $2-A$  or  $1-A$  using the  $\oplus$  and  $\ominus$  keys. The value  $2-A$  indicates a double acting actuator and  $1-A$  a single acting actuator.
- ❑ To conclude press the  $\odot$  key when the desired value is shown on the display.

#### 4.5.6 Maximum valve speed, $MAXS$

##### CAUTION:

Stroke times are defined by parameters  $STOP$  and  $STEL$ . Don't try to adjust the speed with  $MAXS$ .

Maximum Valve Speed parameter does not adjust the speed of the valve. Parameter describes the pneumatic capacity of SwitchGuard when compared to actuator size.

- ❑ Once  $MAXS$  is displayed, press the  $\odot$  key to enter the edit state and the  $MAXS$  will start blinking.
- ❑ You may select between three values by pressing the  $\oplus$  or  $\ominus$  key. For small actuators select  $FST$ , medium size actuators  $STI$  and large size actuators  $SLD$ . See Table 2 for correct settings.

##### CAUTION:

Always adjust the maximum valve speed parameter according to Table 2. Erroneous value may cause instability.

- ❑ After the desired value is displayed, press the  $\odot$  key to conclude the operation.

#### 4.5.7 Positioner fail action, $PFA$

This section describes the function of the actuator.

Set value according to Fig. 5 for double acting actuators. For single acting actuators set value in the spring direction. This action will also take place when the controller software discovers a fatal device failure. See Fig. 5 for correct settings.

- ❑ Once  $PFA$  is displayed, press the  $\odot$  key to enter the edit state and the  $PFA$  will start blinking.
- ❑ You may select between two values by pressing the  $\oplus$  or  $\ominus$  key. The  $CLD$  value indicates that the valve ought to be closed in fail action situations. The  $OPE$  value indicates the valve to be opened in fail action situations.

- ❑ After the desired value is displayed, press the key  $\odot$  to conclude the operation.

##### NOTE:

In case of signal direction (DIR) is same than positioner fail action (PFA) 5 mA input signal is recommended as minimum.

#### 4.5.8 Valve dead angle, $\alpha_0$

The  $\alpha_0$  setting is made for Metso segment and ball valves. This setting takes into account the "dead angle"  $\alpha_0$  of the ball valves. The entire signal range is then used for effective valve opening  $90^\circ - \alpha_0$ . Use 0 % as the "dead angle" for the valves not mentioned in Table 4.

Table 4 Dead angle in percentage

Valve size		Valve series												ZX
		MBV QMBV 1)	MBV QMBV 2)	D, P, C	T5, QT5	QX-T5	T25, QT25	QX-T25	R, QR	E	R-SOFT 3)	FL 4)		
mm	in	Dead angle, %												
15	1/2													15
20	3/4													15
25	1	14	-	-	25.5	19.5	-	-	15	25.5	27			12.5
25/1	1/1								14.5			11		15
25/2	1/2								8			11		16.5
25/3	1/3								8			10		
25/4									8					
40	1 1/2	12	-	-	24.5	12.5	-	-	12	16	21			12.5
50	2	10	9	13.5	24.5	12.5	18	8	17	20.5	23			12.5
65	2 1/2	9	-	-	-	-	-	-	13	-	18			
80	3	10	8	12	18	8	16.5	8.5	9	8.5	15.5			8.5
100	4	10	8	12	16.5	8.5	16	9	8	7	14.5			9.5
125	5	12	-	-	-	-	12	6.5	8	-				
150	6	10	8	11.5	16	9	13.5		8	13.5	13			
200	8	9	7	8.5	12	6.5	9.5		7		11.5			
250	10	9	7	7.5	13.5		9.5		7		10.5			
300	12	8	6	6.5	9.5		7.5		6		9.5			
350	14		6	6	-				5		9.5			
400	16		5	5.5	9.5 (14")				5		9.5			
450	18			6	7.5 (16")									
500	20			6					4.5					
600	24			5.5					6					
650	26			7										
700	28			7					6					
750	30			6										
800	32			-										
900	36			5.5										

1) Seat supported 2) Trunnion 3) Soft seated R-valve 4) Low Cv Finetrol

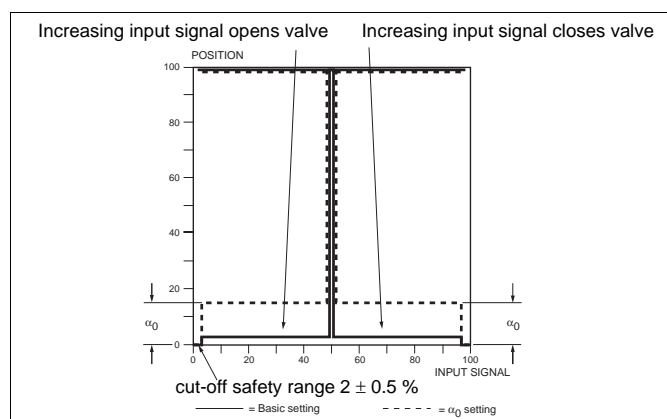


Fig. 15 Principle of setting



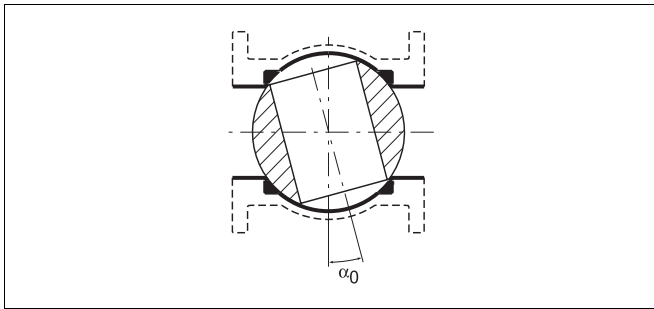


Fig. 16 Dead angle

- ❑ After selecting **AD** on the display, press the **⌂** key to enter the edit state and **AD** starts to blink. The value currently selected appears as a percentage (%) on the display.
- ❑ Modify the parameter value by pressing **+** or **-** keys alternately until the desired value appears on the display.
- ❑ Press the **⌂** key to make your selection and return to the setting state.

#### 4.5.9 Language selection, **LANG**

- ❑ Select between three languages **Eng**, **Ger** or **FrE** (English, German or French) using the **+** and **-** keys.
- ❑ To conclude press the **⌂** key when the desired value is shown on the display.

### 4.6 Valve travel calibration

#### NOTE:

Valve travel calibration is possible only when the valve controller is in **AUTO** mode.

Select **CAL** from the menu by using **+** or **-** keys and press the **⌂** key.

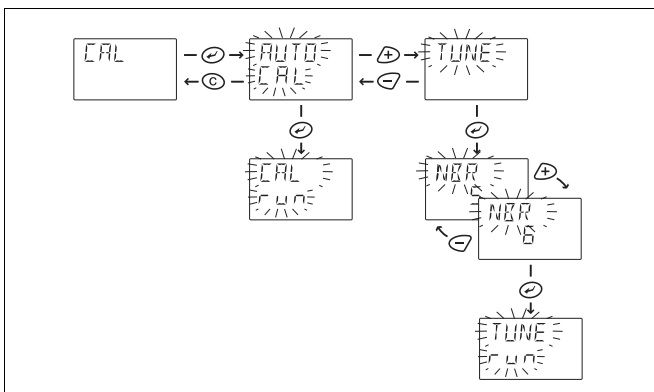


Fig. 17 Calibration selection

#### WARNING:

**Automatic calibration drives the valve against the mechanical open and closed travel limits of the valve-actuator assembly and a tuning procedure is performed. Make sure that these procedures can be safely executed.**

#### 4.6.1 **AUTO CAL** calibration function

During calibration process a blinking text "**CAL run**" will be shown on the display. If calibration ends successfully, a text "**CALIBRATION SUCCESSFUL**" will be shown. Calibration

can be cancelled with the **⌂** key, which will show a text "**CALIBRATION CANCELLED**". If calibration fails, the reason will be shown, eg. "**CALIBRATION START FAILED**", "**POSITION SENSOR RANGE ERROR**", "**CALIBRATION TIMEOUT**" or "**CALIBRATION FAILED**". After calibration the device will return to the main menu (measurement monitoring).

#### 4.6.2 **TUNE Automatic Tuning**

After selecting this option the number of strokes will be asked: **NR 5**.

The user is able to change this number between 2...20. The default value is 5 full strokes (open and close).

During tuning process a blinking text "**TUNE run**" will be shown on the display. If tuning ends successfully, a text "**CALIBRATION SUCCESSFUL**" will be shown. Tuning can be cancelled with the **⌂** key, which will show a text "**CALIBRATION CANCELLED**". If tuning fails, the reason will be shown, eg. "**CALIBRATION START FAILED**", "**POSITION SENSOR RANGE ERROR**", "**CALIBRATION TIMEOUT**" or "**CALIBRATION FAILED**". After tuning the device will return to the main menu (measurement monitoring).

### 4.7 Special displays

#### 4.7.1 User interface locked

In order to prevent unauthorised access, the Local User Interface may be locked. In this mode measurements may be viewed but configurations and calibrations are prohibited. You may lock and unlock the device only via HART. When the Local User Interface is locked the lock symbol will be activated on the display.

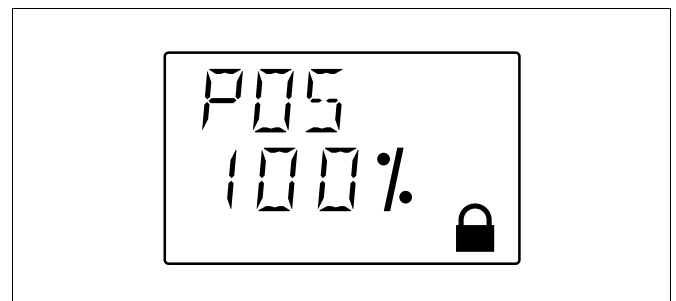


Fig. 18 LUI locked

#### 4.7.2 Online-alarm active

If an online alarm has been detected the **×** symbol is activated. This symbol will disappear after the recovery from online alarm. You may view the reason for the alarm by viewing the latest event while pushing the **⌂** and **-** keys simultaneously or by using FieldCare software where all events may be viewed.

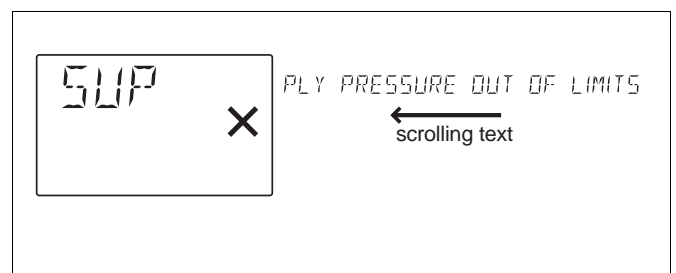


Fig. 19 Online alarm message

### 4.7.3 HART Communication active

When double arrow symbol is indicated, HART communication is activated to device.

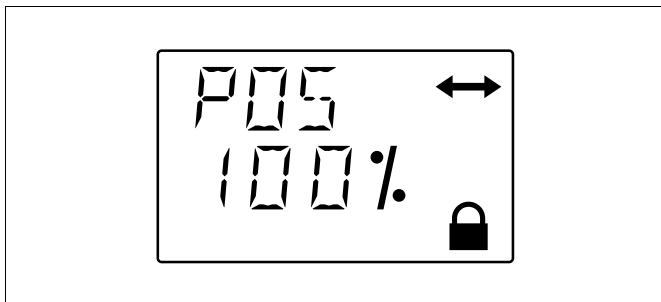






Fig. 20 HART communication activated

### 4.7.4 Viewing of latest event

You may view the latest event by pressing the  and  keys simultaneously in the measurement monitoring view. The message is scrolled on the top row of the display twice. You may stop the scrolling by pressing the  key. By pressing the  key, the message will disappear. For the list of events see Chapter 6.

### 4.7.5 Fail-safe active

When the SwitchGuard detects serious device failure (setpoint, valve position and control signals) it enters fail-safe mode, which drives the control valve into the position defined in the parameter controller fail action (*PFA*). Fail-safe mode is indicated by the display as seen in Fig 19. The error message is displayed until the cause of error is eliminated and the SwitchGuard unit is restarted, i.e. the power loop is momentarily disconnected.

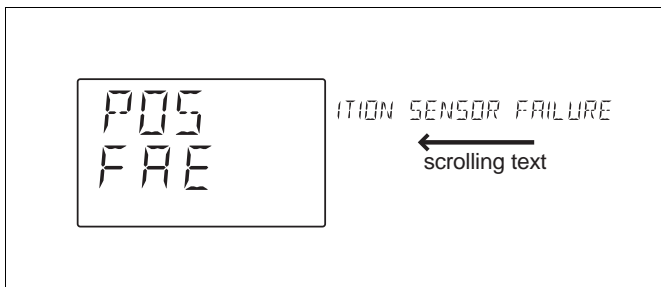


Fig. 21 Failsafe display

## 4.8 HART write protection

The SG9200H is delivered from the factory with the default set as HART write protection OFF. Reading and changing parameters is allowed. HART protection may be enabled with a switch (DIP1) located on the communication circuit board under the Local User Interface module, Fig. 22. Changes that may influence the valve position cannot be made using the FieldCare software or HART hand held when switch no. 1 (on the left-hand side of the switch block) is ON.

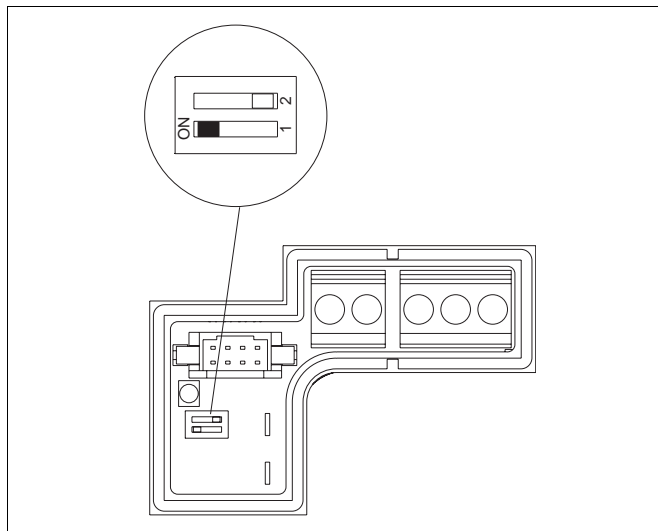


Fig. 22 HART write protection

## 5 MAINTENANCE

### Ex d NOTE:

**Maintenance of the parts of the flameproof enclosure is not allowed!**

Device type SG9200H\_E1\_:

Housing (2), Cover (100), Shaft assembly (11), Limit switch housing (300).

The maintenance requirements of the SwitchGuard valve controller depend on the service conditions, for instance, the quality of instrument air. Under normal service conditions there is no requirement for regular maintenance.

When maintaining the SwitchGuard ensure that the supply air is shut off and pressure is released. In the following text the numbers in brackets ( ) correspond to the part numbers in the exploded view as shown in Chapter 11, unless otherwise stated.

The Switchguard SG9200H includes the following modules: prestage unit (120), spool valve (420), communication circuit board with optional position transmitter (215) and controller circuit board with position and pressure sensors (210).

The spool valve is located on the bottom side of the device while the other modules are located below the cover 100. In the event of failure the whole module must be changed. The module retrofit must be assembled in a clean, dry environment. On reassembly apply a thread-locking compound (for instance, Loctite 243) and tighten the screws firmly.

### NOTE:

Whenever any maintenance operations have been done for the SG9200H, the device should be calibrated and tuned.



## 5.1 Prestage

### NOTE:

The prestage must be handled carefully. In particular the moving parts of the prestage should not be touched when the inner cover (39) is not in place.

### 5.1.1 Removal

- ❑ Loosen the M8 stop screw (110) in the position indicator (109) and turn the position indicator from the shaft (11). Remove the inner cover (39) attached with M3 screws (42, 3 pcs.).
- ❑ Unplug the prestage wire connector from the connector board (182). Unscrew the M4 screws (139, 2 pcs.) and lift up the prestage unit (120). Remove the O-ring (140).

### 5.1.2 Installation

- ❑ Place a new O-ring (140) into the groove in the prestage mounting plate (400) and press the prestage into place. Make sure the nozzle is guided into the O-ring properly. The screws guide the prestage body into the correct position. Tighten the screws (139) evenly.
- ❑ Push the prestage 2-pole wire connector into the socket on the connector board (182). The wire connector can only be fitted in the correct position. Replace the inner cover (39) and tighten the M3 screws

## 5.2 Spool valve

### 5.2.1 Standard capacity

#### 5.2.1.1 Removal

For spool valve removal it is usually necessary to unmount the valve controller from the actuator.

- ❑ Working from the bottom side of the valve controller, unscrew the M5 screws (4 pcs.). Remove the spool valve (420) with gasket. The spool valve may be opened and cleaned if special attention is paid to a clean environment and proper procedure.
- ❑ Clean the spool and the bore of the body with care. Do not leave any fibres from cleaning materials in the bore or on the spool. Do not scratch the mating surfaces of the spool and body.

### NOTE:

Each spool valve body has an individual corresponding spool which cannot be replaced by any other spool. Never alter the orientation of the spool, see Fig. 23.

### 5.2.2 Installation

- ❑ Ensure that the gasket (174) is properly located in the grooves on the bottom of the housing. Mount the spool valve mounting plate (421) and the spool valve (420) to the housing, and tighten the four M5 screws evenly. Required torque is 4.5 Nm.

The spool valve mounting plate (421) can be exchanged to convert capacity between restricted (SG9212) and normal (SG9215).

### NOTE:

If the maintenance operations have been done for the spool valve assembly, the device **must** always be calibrated and tuned.

### 5.2.3 High capacity

#### 5.2.3.1 Removal

- ❑ Unscrew the M5 screws (4 pcs.). Remove the spool valve (420) with gasket from the mounting block (421). The spool valve may be opened and cleaned if special attention is paid to a clean environment and proper procedure.
- ❑ Clean the spool and the bore of the body with care. Do not leave any fibres from cleaning materials in the bore or on the spool. Do not scratch the mating surfaces of the spool and body.

### NOTE:

Each spool valve body has an individual corresponding spool which cannot be replaced by any other spool. Never alter the orientation of the spool, see Fig. 23.

### 5.2.4 Installation

- ❑ Ensure that the gasket (63) is properly located in the grooves in the bottom of the spool valve. Mount the spool valve (420) to the mounting block (421), and tighten the four M5 screws evenly. Required torque is 4.5 Nm.

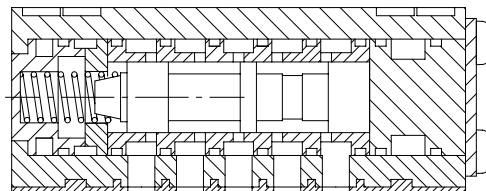


Fig. 23 Spool valve assembly

## 5.3 Communication circuit board

### 5.3.1 Removal

- ❑ Loosen the M8 stop screw (110) in the position indicator (109) and turn the position indicator from the shaft (11). Remove the inner cover (39) attached with M3 screws (42, 3 pcs.).
- ❑ Remove the M3 screws (217, 4 pcs.). Hold the sides of the circuit board and lift it directly upwards and outwards. Handle the board carefully, touching only the sides.

**NOTE:**

Ground yourself on the body of the device before touching the circuit board.

### 5.3.2 Installation

- ❑ Mount the new communication circuit board carefully.
- ❑ Locate the pins with the matching connector on the board. Tighten the M3 screws (217) evenly.
- ❑ Install the inner cover (39).
- ❑ Mount the position indicator (109) on the shaft and tighten the M8 stop screw (110) temporarily. The final orientation and locking of the position indicator should be done after installation of the valve controller to the actuator.

**ATEX WARNING:**

**Grounding of the circuit board is essential to explosion protection.**

The board is grounded to the housing by the mounting screw next to the terminal blocks.

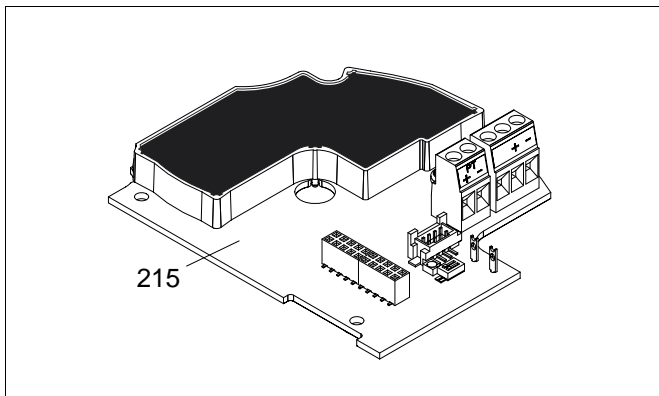


Fig. 24 Communication board

## 6 ERROR MESSAGES

### 6.1 Failsafe errors

Display message	Description
CONTINUED INTERNAL BOOT	Too many consecutive internal resets have been generated
FAILSAFE ACTIVATED	Device is in failsafe state
PARAMETERS DATABASE ERROR	Parameter database initialization failed
PRESTAGE SHORTCUT ERROR	Prestage coil shortcut has been detected
SETPPOINT SENSOR ERROR	Setpoint sensor defect has been detected
SUPPLY PRESSURE FAILSAFE ACTIVATED	Supply pressure has dropped below user defined alarm limit. This causes the device to go to the failsafe state

### 6.2 Alarms

Display message	Description
PNEUMATICS PROBLEM	Actuator pressure difference has not changed even it should have been. Spool valve may be jammed
TOO FAST VALVE CLOSING ALARM	Valve was closed faster than was determined by alarm limit parameter
TOO FAST VALVE OPENING ALARM	Valve was opened faster than was determined by alarm limit parameter
TOO SLOW VALVE CLOSING ALARM	Valve was closed slower than was determined by alarm limit parameter
TOO SLOW VALVE OPENING ALARM	Valve was opened slower than was determined by alarm limit parameter
UNALLOWED VALVE MOVEMENT ALARM	Valve position has changed but setpoint is still in open or close position
VALVE CLOSE STUCK ALARM	Over 5 % difference between setpoint and valve position. Valve may be jammed at close position. Difference is a user configurable parameter
VALVE INTERMEDIATE STUCK ALARM	Over 5 % difference between setpoint and valve position. Valve may be stuck between open and close positions. Difference is a user configurable parameter
VALVE OPEN STUCK ALARM	Over 5 % difference between setpoint and valve position. Valve may be jammed at open position. Difference is a user configurable parameter

## 6.3 Errors

Display message	Description
CALIBRATION FAILED	Calibration process has failed
CALIBRATION START FAILED	Calibration process could not be started
CALIBRATION TIMEOUT	Calibration process has taken too long time
FACTORY SETTINGS CREATE FAIL	Factory settings creation failed
FACTORY SETTINGS RESTORE FAIL	Factory settings restoration failed, i.e. current parameter set could not be loaded with factory settings
INTERNAL BOOT RESET	Software has lost the control and internal watchdog generated reset
POSITION SENSOR FAILURE	Position sensor defect has been detected
POSITION SENSOR RANGE ERROR	Too narrow position sensor range was detected in position calibration process
PRESSURE SENSOR 1 FAILURE	Pressure sensor #1 defect has been detected
PRESSURE SENSOR 2 FAILURE	Pressure sensor #2 defect has been detected
PRESSURE SENSOR 3 FAILURE	Pressure sensor #3 defect has been detected
PRESTAGE CUT ERROR	Prestage coil cut has been detected
PRESTAGE SHORTCUT ERROR	Prestage coil shortcut has been detected
PT COMMUNICATION ERROR	Communication with position transmitter was lost
STATISTICS DATABASE ERROR	Error occurred when writing statistics to database
TEMPERATURE SENSOR FAILURE	Temperature sensor defect has been detected

## 6.4 Warnings

Display message	Description
ACTUATOR FULL STROKES WARNING	Actuator full stroke counter has exceeded the warning limit
CLOSE STROKE DEVIATION WARNING	Valve close stroke deviation time trend has exceeded the warning limit
OPEN STROKE DEVIATION WARNING	Valve open stroke deviation time trend has exceeded the warning limit
REDUCED PERFORMANCE ACTIVATED	Controller can not perform boosting due to pressure sensor failure. Also, position sensor failure cause device to act like any normal solenoid device: position can not be controlled
SPOOL REACTION TIME CLOSE WARNING	Spool valve reaction time close trend has exceeded the warning limit
SPOOL REACTION TIME OPEN WARNING	Spool valve reaction time open trend has exceeded the warning limit
SUPPLY PRESSURE OUT OF LIMITS	Supply pressure is out of warning limits
SUPPLY PRESSURE TREND WARNING	Supply pressure trend value has exceeded the warning limits
TEMPERATURE OUT OF LIMITS	Temperature is out of warning limits
TEMPERATURE TREND WARNING	Temperature trend value has exceeded the warning limits
TOTAL OPERATION TIME WARNING	Total operating time has exceeded the warning limit
VALVE FULL STROKES WARNING	Valve full stroke count has exceeded the warning limit
VALVE REACTION TIME CLOSE WARNING	Valve reaction time close trend has exceeded the warning limit
VALVE REACTION TIME OPEN WARNING	Valve reaction time open trend has exceeded the warning limit

## 6.5 Notifications

Display message	Description
CALIBRATION CANCELLED	Calibration process has been cancelled
CALIBRATION SUCCESSFUL	Calibration process has ended successfully
EXTERNAL RESET	Device has been booted, i.e. power-up reset
FACTORY DEFAULTS ACTIVATED	Device parameters were changed to factory settings
REDUCED PERFORMANCE DEACTIVATED	Recovery for reduced performance activation

## 7 TROUBLE SHOOTING

### Mechanical/electrical defects

1. A change in the valve position setpoint will not affect the position of the actuator

- ☐ Supply pressure too low
- ☐ Spool valve sticks
- ☐ Incorrect configuration parameters
- ☐ Actuator and/or valve jammed
- ☐ Signal wires incorrectly connected, no value on display
- ☐ Circuit boards are defective
- ☐ Calibration has not been carried out
- ☐ Device is in manual mode
- ☐ Prestage is defective
- ☐ Device is in fail-safe mode
- ☐ Spool mounted backwards into spool valve

2. Inaccurate positioning

- ☐ Spool valve dirty
- ☐ Too high actuator load
- ☐ Supply pressure too low
- ☐ Spool or pressure sensors are defective
- ☐ Actuator leakage

3. Overshooting or positioning too slow

- ☐ Spool valve dirty
- ☐ Supply air tube too small or supply air filter dirty
- ☐ Valve sticks
- ☐ Check leakages in tubes between controller and actuator
- ☐ Check leakages in mechanical stop screws
- ☐ Check correctness of MAXS parameter. Change it from "slow" to "fast" or "moderate".

4. Error during valve travel calibration

- ☐ Valve controller is in *MAN* mode
- ☐ Check the coupling alignment with the pointer, see Fig. 4
- ☐ The parameter setting *PFA* incorrectly selected
- ☐ The actuator or valve did not move or was stuck during calibration
- ☐ Supply pressure too low
- ☐ Spool valve dirty

## 8 SG92\_/K\_, SG92\_/I\_, SG92\_/D\_ (WITH LIMIT SWITCHES)

### 8.1 Introduction

#### 8.1.1 General description

SG9200H can be equipped with limit switches. SG92\_/K2\_ has two microswitches, SG92\_/K4\_ has four microswitches, SG92\_/I\_ has two inductive proximity switches and SG92\_/D\_ has a Dual Module sensor with two inductive proximity switches.

The switching points may be chosen freely.

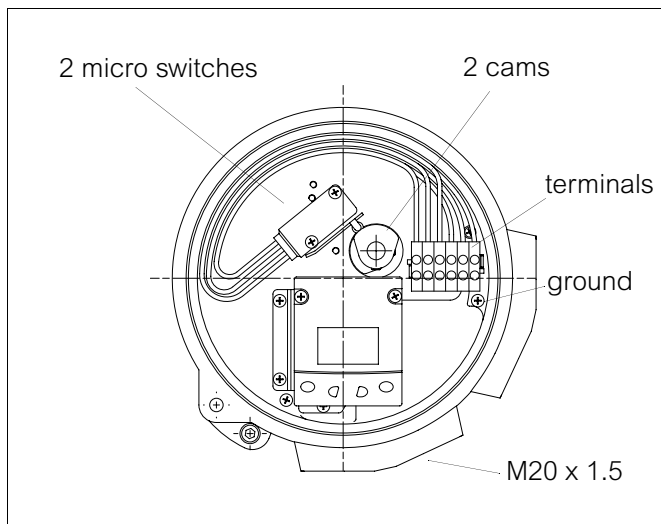


Fig. 25 SG92\_/K2\_ layout

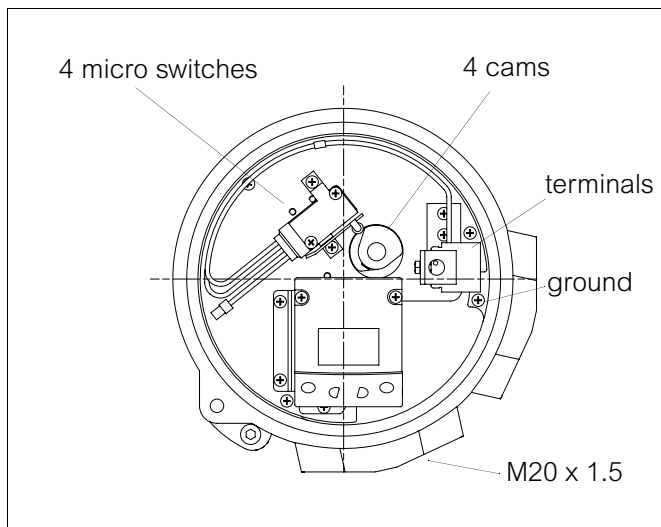


Fig. 26 SG92\_/K4\_ layout

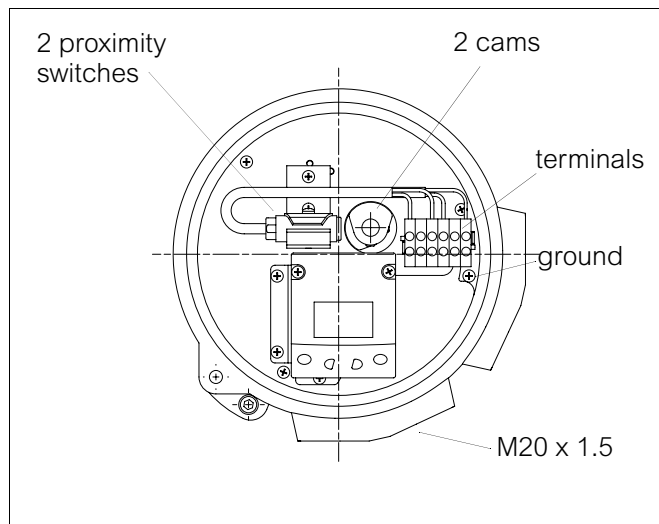


Fig. 27 SG92\_/I\_ layout

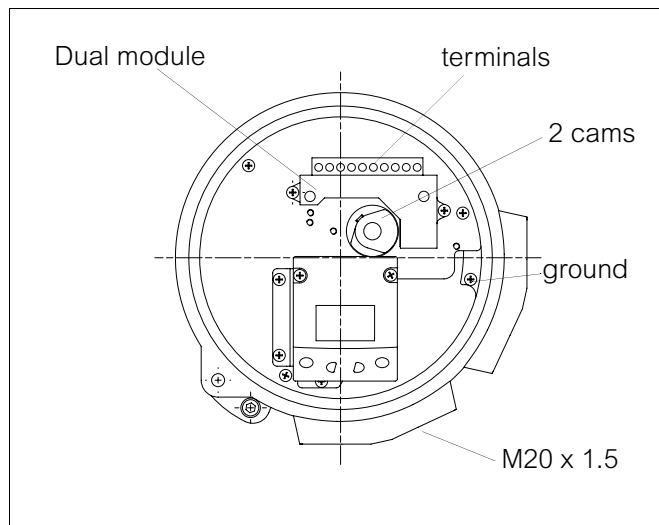


Fig. 28 SG92\_/D\_ layout

#### 8.1.2 Markings

The limit switch is provided with an identification plate sticker, see Fig. 29. Identification plate markings from top to bottom are:

- ☐ Type designation
- ☐ Electrical values
- ☐ Temperature range
- ☐ Enclosure class
- ☐ Conduit entry
- ☐ Manufacturing serial number

The type designation is described in Chapter 14.

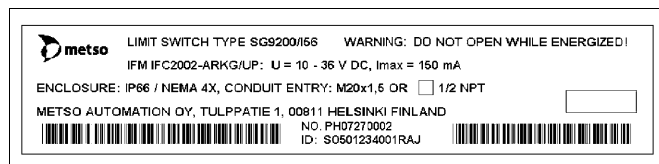


Fig. 29 Identification plate

### 8.1.3 Technical specifications

#### 8.1.3.1 SG92\_/K\_

Microswitch type:	OMRON D2VW-5 (K25 or K45) OMRON D2VW-01 (K26 or K46) (gold-plated contacts) Protection class IP67
Resistive load:	3A: 250 V AC (K25 or K45) 5A: 30 V DC 0.4A: 125 V DC 100 mA: 30 V DC/125 V AC (K26 or K46)
Switch accuracy:	< 2°
Number of switches:	2 (K25 or K26), 4 (K45 or K46)
Protection class of housing:	IP66 (DIN 40050, IEC 60529)
Conduit entry:	M20 x 1.5 (2 pcs.)
Ambient temperature:	-40° to +80 °C / -40° to +176 °F
Weight:	Approx. 1.0 kg / 2.2 lb (addition to the standard SG9200 weight)

#### 8.1.3.2 SG92\_/I\_

Proximity switch:	Inductive, diameter 8–14 mm/ 0.31–0.55 in Sensing range 2 mm / 0.08 in Protection class IP67 P+F NJ2-12GK-SN (I02) P+F; NCB2-12GM35-N0 (I09) Omron; E2E-X2Y1 (I32) ifm IFC2002-ARKG/UP (56) Other switch types on special order
Electrical values:	According to switch type
Switch accuracy:	< 1°
Number of switches:	2
Protection class of housing:	IP66 (DIN 40050, IEC 60529)
Conduit entry:	M20 x 1.5 (2 pcs.)
Ambient temperature:	-40° to +85 °C / -40° to +185 °F (I02) -25° to +85 °C / -13° to +185 °F (I09) -40° to +85 °C / -40° to +185 °F (I32) -25° to +80 °C / -13° to +176 °F (I56)
Weight:	Approx. 1.0 kg / 2.2 lb (addition to the standard SG9200 weight)

#### 8.1.3.3 SG92\_/D\_

Proximity switch:	Inductive, Dual Module 2 sensors, Normally Open (D33), Normally Closed (D44)
Electrical values:	
SST Dual Module (D33)	
Indications:	Target on sensor = LED on Target off sensor = LED off
Operating voltage:	8–125 V DC; 24–125 V AC
Maximum voltage drop:	6.5 V/10 mA 7.0 V/100 mA
Current ratings:	

Max inrush	2.0 A/125 V DC/V AC
Max continuous	0.3 A/125 V DC/V AC
Minimum on current	2.0 mA
Leakage current	<0.15 mA with DC voltage <0.25 mA with AC voltage
Namur Dual Module (D44)	
Indications:	Target on sensor = LED off Target off sensor = LED on
Operating voltage:	6–29 V DC
Current ratings:	Target on (LED off) <1.0 mA Target off (LED on) >3.0 mA
Must use intrinsically safe repeater barrier.	
Namur sensors conform to DIN 19234 standard.	
Number of switches:	2
Protection class of housing:	IP66 (DIN 40050, IEC 60529)
Conduit entry:	M20 x 1.5 (2 pcs.)
Ambient temperature:	-40° to +80 °C / -40° to +176 °F
Weight:	Approx. 1.0 kg / 2.2 lb (addition to the standard SG9200 weight)

### 8.2 Installing SG92\_/K\_, SG92\_/I\_ or SG92\_/D\_ on a valve controller

The limit switch may be installed on an existing valve controller.

- ❑ If the valve controller is already mounted on an actuator/valve assembly, operate the actuator into the closed or open position.
- ❑ Remove the cover (100), the pointer (109), the LUI (223) and electronics cover (39).
- ❑ Turn the shaft (311) onto the shaft (11). Fasten the screw (312) using a locking agent such as Loctite.
- ❑ Mount the electronics cover (39) and the limit switch housing (300) on the valve controller. Lock the housing in place with screw (326). Install the base plate (324) with the limit switches and connector block into the limit switch housing. Fasten the base plate with screws (325), 3 pcs.
- ❑ Install the cam discs (313) and spacers (346) to the shaft.
- ❑ Mount the LUI (223) on the holder (306).
- ❑ Mount the pointer (109) on the shaft (311). Adjust the limit switch according to 8.4.

### 8.3 Electrical connections

Before connecting the power, make sure that the electrical specifications and the wiring meet the installation conditions. See the diagrams in 11.6. Refer to the information on the identification plate.

**SG9200/I or SG9200/D:** Observe the functioning of the proximity switch; activated when the active face is either covered or free.

## 8.4 Adjustment

The pointer (109) need not be removed for adjustment. When the limit switch is ordered together with the valve and the actuator, the valve controller switches are factory-adjusted. The limits may be adjusted by altering the position of the cam discs (313) on the shaft. The lower switch is activated at the closed limit and the upper switch at the open limit.

- ❑ With the actuator in the open or closed position, locate the switching point by turning the cam disc so that the switch state changes approx. 5°–6° before the limit.

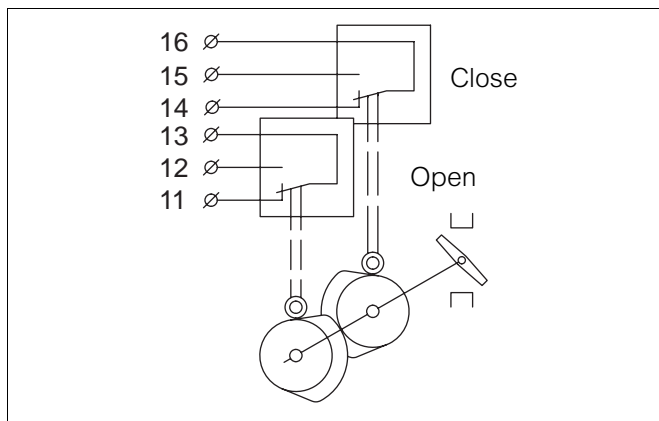


Fig. 30 Limit switch adjustment, 2 switches

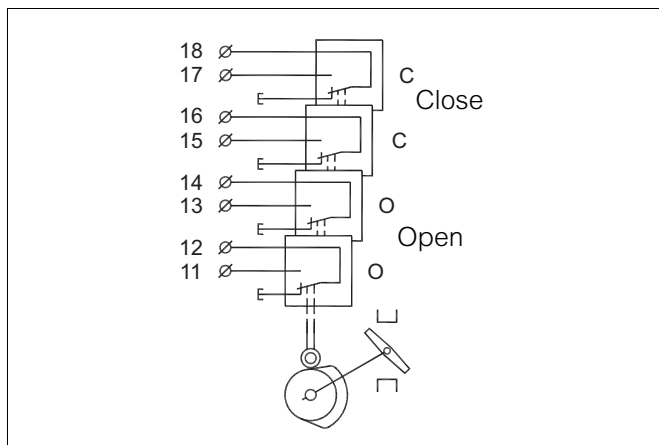


Fig. 31 Limit switch adjustment, 4 switches

- ❑ **SG9200/I00 or SG9200/D:** Use the LED indicator or a separate measuring instrument as an aid.
- ❑ After re-installation of the actuator, first adjust its mechanical limits according to the valve, then the valve controller, and finally the limit switch.
- ❑ When adjustment is completed, turn the pointer (109) so that the yellow line is parallel with the valve closure member.

## 8.5 Removal of the limit switches SG92\_/K\_, SG92\_/I\_ or SG92\_/D for accessing the valve controller

- ❑ Remove the cover (100) and the pointer (109).
- ❑ Loosen the screws (314) in the cam disks (313) and remove the cam disks and spacers (346) from the shaft.
- ❑ Remove the LUI cabling from the circuit board. Disconnect and remove all cabling which enters the limit switch housing (300).
- ❑ Remove screws (325), 3 pcs. and lift out the limit switch base plate (324) complete with switches, LUI and connector block.
- ❑ Open screw (326) and turn the limit switch housing (300) from the positioner housing.
- ❑ Remove the electronics cover (39).
- ❑ Proceed with the valve controller as applicable.
- ❑ Re-install the limit switch according to 8.2 and check the adjustment according to 8.4.

### ATEX WARNING:

**The locking screw of the limit switch housing (Part 326) is essential to explosion protection.**

The limit switch housing has to be locked in place for Ex d protection. The screw grounds the limit switch housing to the housing of the valve controller.

## 8.6 Circuit diagrams

The internal circuitry of the limit switch is shown in the connection diagrams in 11.6 and inside the cover.

## 8.7 Maintenance

Regular maintenance of the limit switch is not necessary.

## 9 TOOLS

No special tools required.

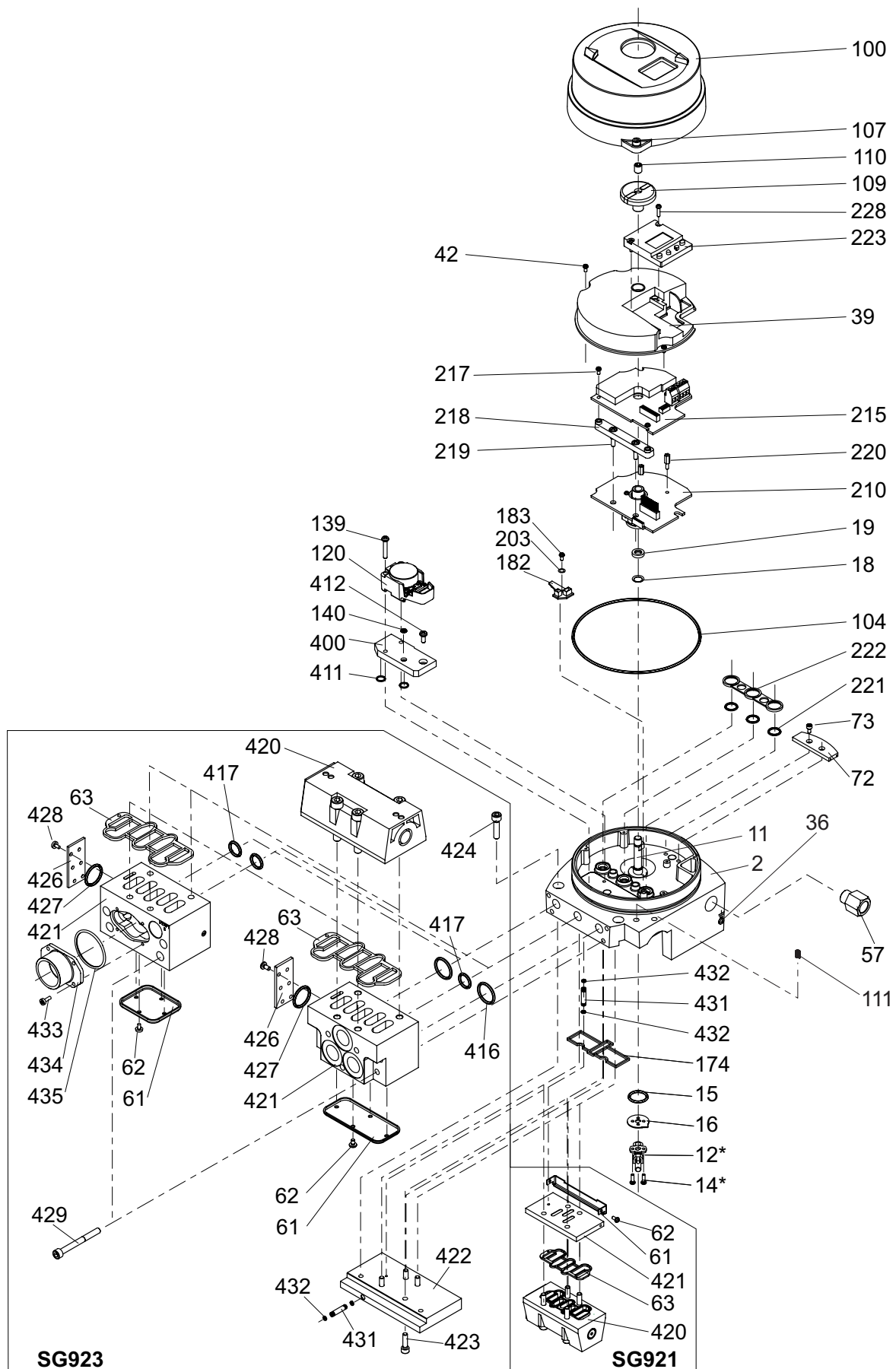
## 10 ORDERING SPARE PARTS

Spare parts are delivered as modules. The available modules are indicated in 11.1.

When ordering spare parts, always include the following information:

- ❑ Valve controller type designation and serial number from the ID plate
- ❑ The code of this manual, the part number, the part name and quantity required

### 11.1 Exploded view and parts list, SG9200H



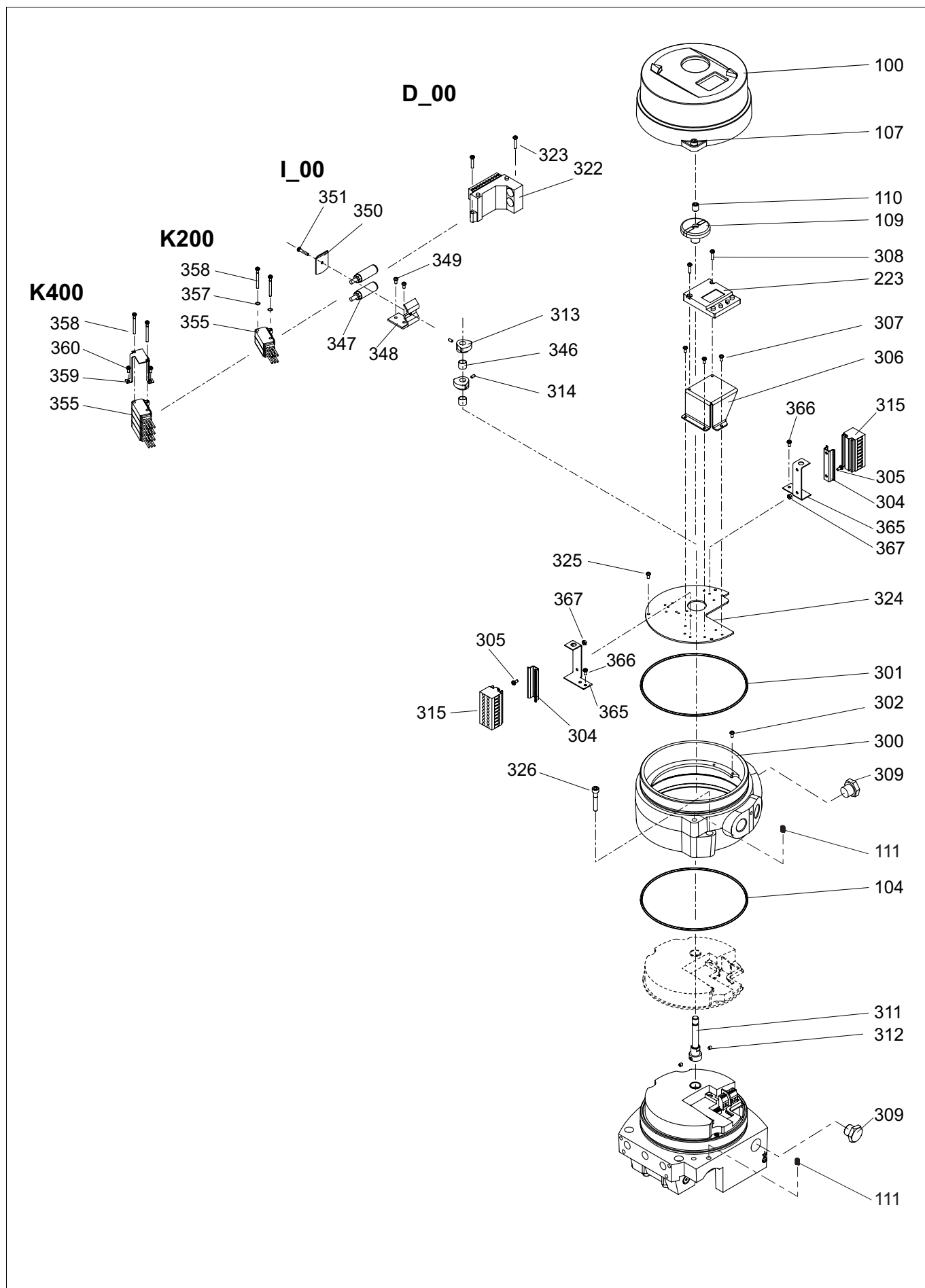


<b>Item</b>	<b>Qty</b>	<b>Description</b>
2	1	Housing
11	1	Shaft assembly
15	1	O-ring
16	1	Washer
18	1	Wave spring
19	1	Bushing
36	1	Grounding screw
39	1	Protection cover
42	3	Screw
57	1	Conduit entry adapter
61	1	Exhaust cover
62	2	Screw (ISO 1)
	4	Screw (ISO 3)
63	1	Gasket
72	1	Cooling plate
73	2	Screw
100	1	Cover
104	1	O-ring
107	1	Screw
109	1	Pointer
110	1	Stop screw
111	1	Spring
120	1	Prestage unit
139	2	Screw
140	1	O-ring
174	1	Gasket
182	1	Prestage board
183	1	Screw
210	1	Controller circuit board
215	1	Communication circuit board
217	4	Screw
218	1	Support
219	2	Screw
220	2	Threaded spacer
221	3	O-ring
222	1	Insulation part
223	1	Local User Interface (LUI)
228	2	Screw
400	1	Adapter plate
411	2	O-ring
412	1	Screw
416	2	O-ring
417	1	O-ring
420	1	Spool valve
421	1	Adapter plate
422	1	Adapter plate
423	4	Screw
424	2	Screw
426	1	Plate
427	1	O-ring
428	6	Screw
429	4	Screw
431	2	Connection pipe
432	4	O-ring
433	4	Screw
434	1	Flange
435	1	O-ring

**AVAILABLE SPARE PART SETS:**

- Spool valve
- Prestage unit assembly
- LUI (Local User Interface)
- Internal cover assembly

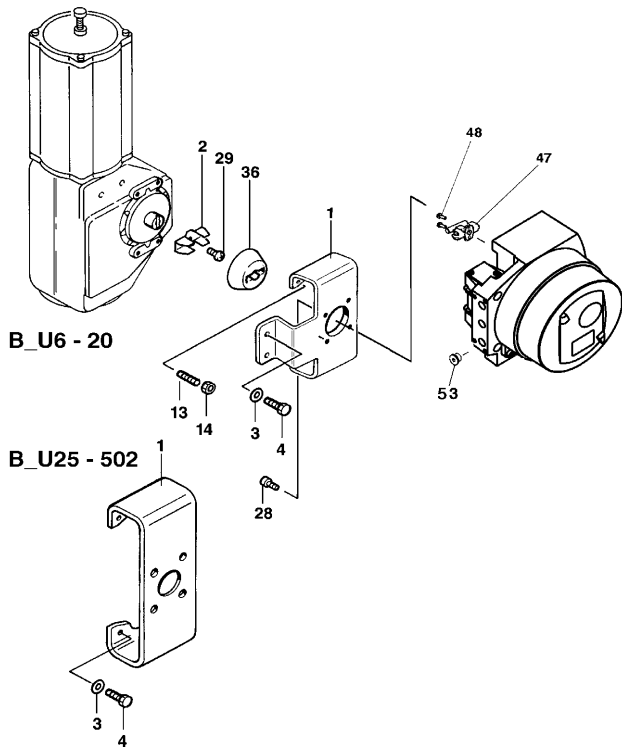
## 11.2 Exploded view and parts list, SG9200H/K\_, SG9200H/I\_, SG9200H/D\_



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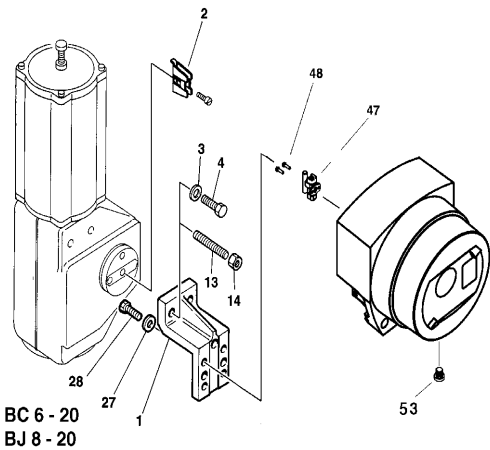
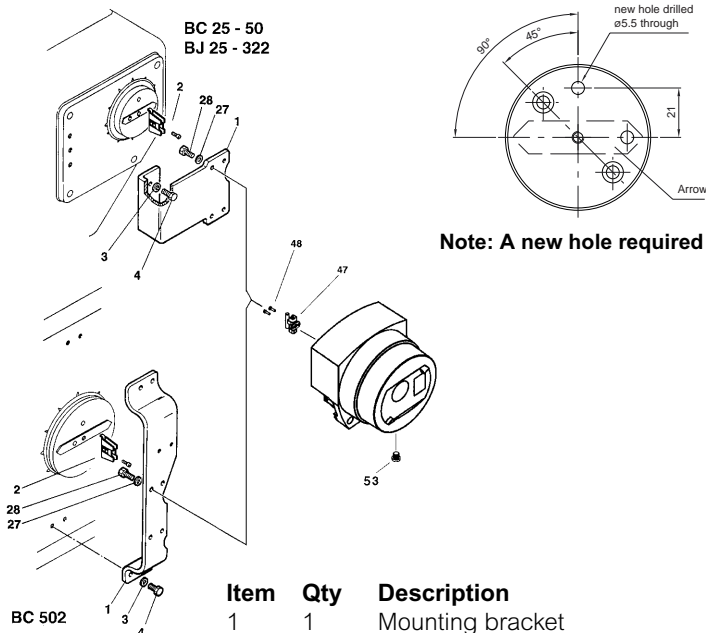
Item	Qty	Description
100	1	Cover
107	1	Screw
109	1	Pointer
110	1	Stop screw
111	2	Spring
223	1	Local user interface (LUI)
300	1	Housing
301	1	O-ring
302	1	Screw
304	1	Bracket
305	2	Screw
306	1	Bracket
307	3	Screw
308	2	Screw
309	2	Plug
311	1	Extension shaft
312	2	Screw
313	2 or 4	Cam disc
314	2 or 4	Screw
315	1	Terminal block
322	1	Proximity switch
323	2	Screw
324	1	Base plate
325	2	Screw
326	1	Screw
346	1	Bearing bushing
347	2	Proximity switch
348	1	Fixing plate
349	2	Screw
350	1	Washer
351	1	Screw
355	2 or 4	Microswitch
357	2	Spring washer
358	2	Screw
359	1	Support band
360	2	Screw
365	1	Bracket
366	2	Screw
367	2	Hex nut

11.3 Mounting parts for Metso actuators with VDI/VDE mounting face



Item	Qty	Description
1	1	Mounting bracket
2	1	Ear
3	2	Washer
4	2	Screw
13	4	Screw
14	4	Hexagon nut
28	4	Screw
29	1	Screw
36	1	Couplings jacket
47	1	Coupler socket
48	2	Screw
53	1	Plug (BJ actuators only)

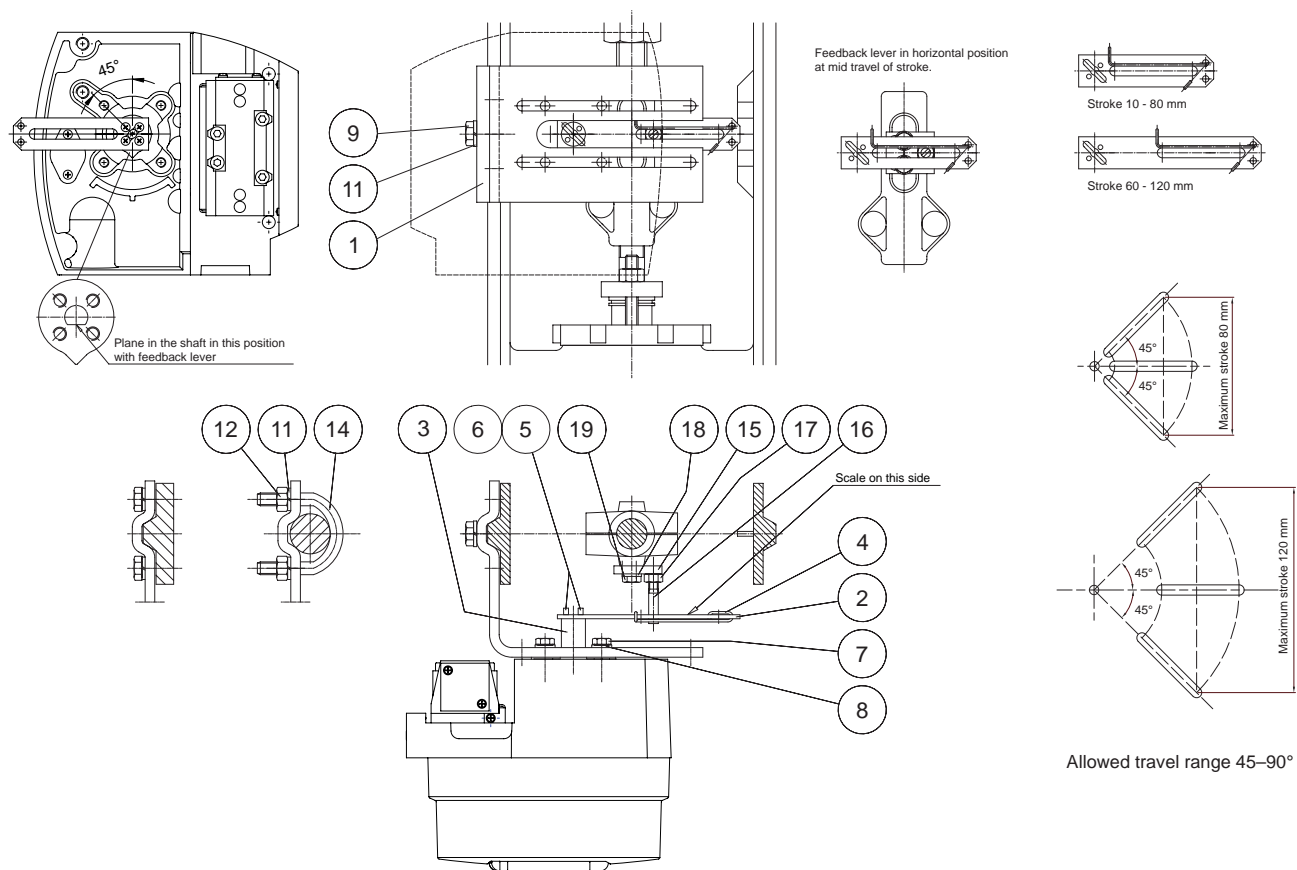
11.4 Mounting parts for old B series actuators



Item	Qty	Description
1	1	Mounting bracket
2	1	Draught piece
3	4	Washer
4	4	Screw
13	2	Screw
14	2	Hexagon nut
27	4	Screw
28	4	Screw
29	1	Screw
47	1	Coupler socket
48	2	Screw
53	1	Plug (BJ actuators only)

NOTE: These mounting parts are not recommended in high vibration installations

## 11.5 Mounting parts for linear actuators

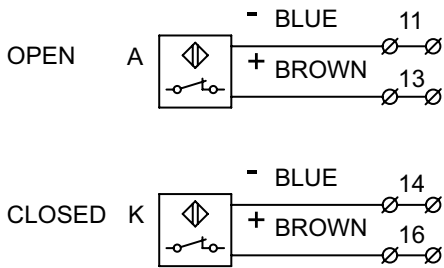


Item	Qty	Description
1	1	Bracket
2	1	Feedback lever
3	1	Filling piece
4	1	Clearance remove spring
5	4	Cross rec head screw
6	4	Washer
7	4	Hexagon screw
8	4	Washer
9	4	Hexagon screw
11	4	Spring washer
12	2	Hexagon nut
14	2	Clamp
15	1	Fixing plate
16	1	Special screw
17	1	Hexagon nut
18	2	Washer
19	2	Hexagon screw

11.6 Connection diagrams

See Section 8.1.3 for additional limit switch data.

SG92\_H/I02, I09



Factory adjustment:  
Active faces of proximity switches are covered when actuator is in intermediate position.  
Active face A (upper switch) becomes free at open limit of travel and face K (lower switch) at closed limit.

Function can be inverted on site by re-adjusting the cam discs.

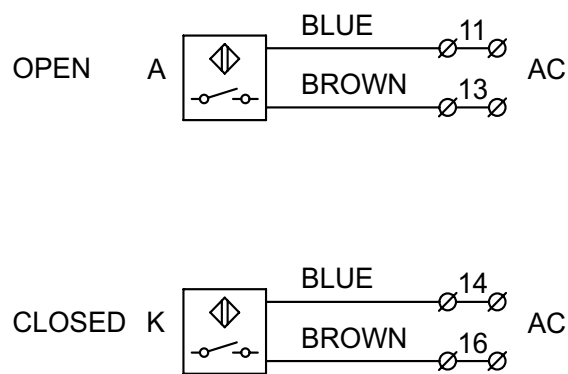
Sensing distance 2...4 mm, depending on type of switch  
Supply voltage 8 V DC (Ri 1 kΩ)  
Current consumption  
    active face free, > 3 mA  
    active face covered, < 1 mA

PROXIMITY SWITCH

Intrinsically safe II 2 G Ex ia IIC T6.  
According to EN 60079-0:2006, EN 60079-11:2007.

Voltage (Ui), current (Ii), power (Pi), inductance (Li) and capacitance (Ci) according to certificate of switch, see table below.

	Type of proximity switch	Electrical values					Ex classification	Certificate
		Ui (V)	Ii (mA)	Pi (mW)	Li (μH)	Ci (nF)		
02	P+F NJ2-12GK-SN	16	52	169	150	50	II 1 G Ex ia IIC T6	PTB 00 ATEX 2049 X
09	P+F NCB2-12GM35-N0	16	52	169	100	90	II 2 G EEx ia IIC T6	PTB 00 ATEX 2048 X

**SG92\_H/I32****Factory adjustment:**

Active faces of proximity switches are free when actuator is in intermediate position. Active face A (upper switch) becomes covered at the open limit of the travel and face K (lower switch) at the closed limit.

Function can be inverted on site by re-adjusting the cam discs.

**PROXIMITY SWITCH**

OMRON E2E-X2Y1-G

2-wire type

Sensing distance 2 mm

Rated voltage  $U = 24 - 240 \text{ V AC}$

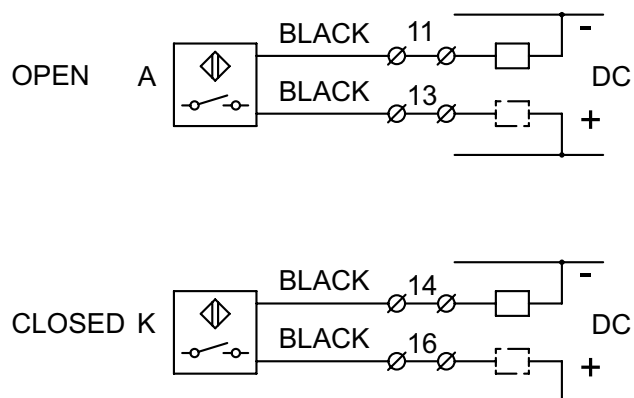
Output current 5 - 100 mA

active face covered, LED on

Quiescent current 1,5 mA

active face free

Ambient temperature  $-25 \dots +70 \text{ }^{\circ}\text{C} / -13 \dots +158 \text{ }^{\circ}\text{F}$

**SG92\_H/I56****Factory adjustment:**

Active faces of proximity switches are free when actuator is in intermediate position. Active face A (upper switch) becomes covered at the open limit of the travel and face K (lower switch) at the closed limit.

Function can be inverted on site by re-adjusting the cam discs.

Connections: Load can be connected to + or -.

**PROXIMITY SWITCH**

ifm electronic IFC2002-ARKG/UP

2-wire type

Sensing distance 2 mm

Rated voltage  $U = 10 - 36 \text{ V DC}$

Output current  $< 150 \text{ mA}$

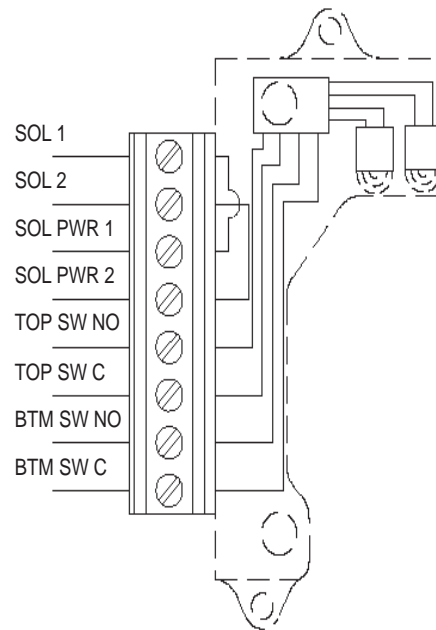
active face covered, LED on

Quiescent current  $< 0,6 \text{ mA}$

active face free

Ambient temperature  $-25 \dots +80 \text{ }^{\circ}\text{C} / -13 \dots +176 \text{ }^{\circ}\text{F}$



**SG92\_H/D33**

Connections SOL1, SOL2, SOL PWR1 and SOLPWR2 are not used.

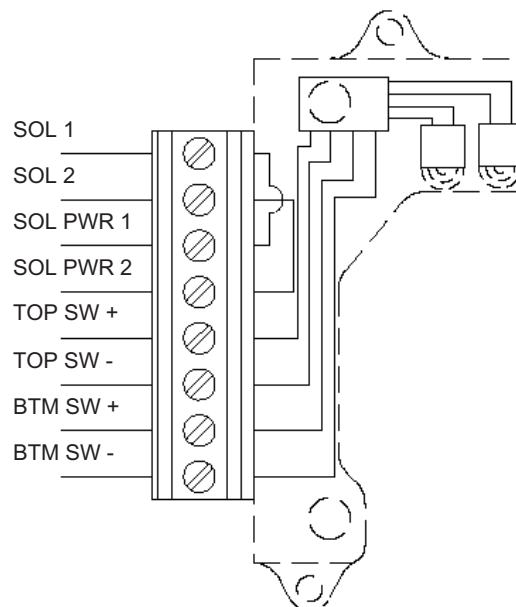
TOP SW NO: Positive connection for top switch

TOP SW C: Negative connection for top switch

BTM SW NO: Positive connection for bottom switch

BTM SW C: Negative connection for bottom switch

See Section 8.1.3.3 for electrical ratings.

**SG92\_H/D44**

Connections SOL1, SOL2, SOL PWR1 and SOLPWR2 are not used.

TOP SW +: Positive connection for top switch

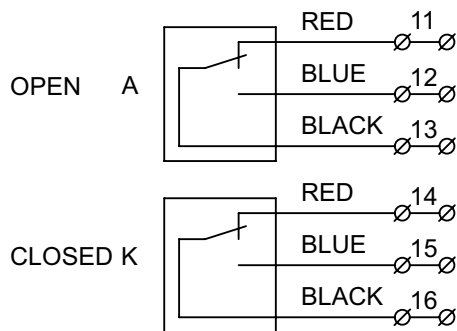
TOP SW -: Negative connection for top switch

BTM SW +: Positive connection for bottom switch

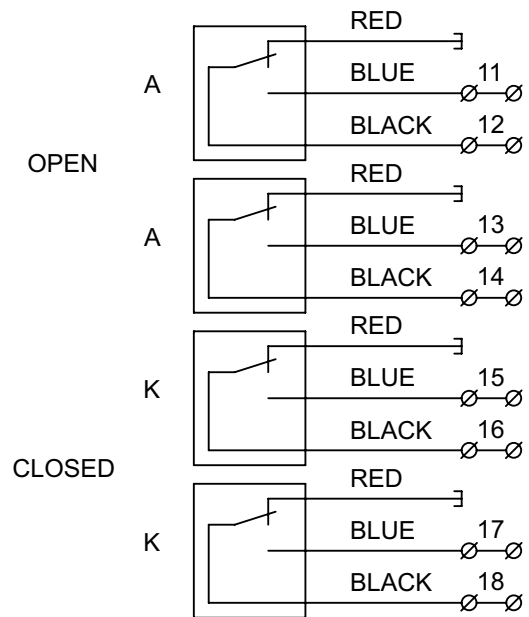
BTM SW -: Negative connection for bottom switch

See Section 8.1.3.3 for electrical ratings.

## SG92\_H/K25, K26, K45, K46



2 pcs.



4 pcs.

Connection diagram shows limit switch when actuator is in intermediate position.  
Switch A (upper) is activated at the open limit of the travel and switch K (lower) at the closed limit.

Electrical characteristics:

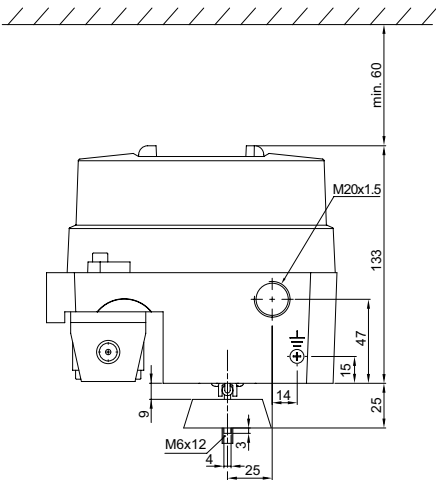
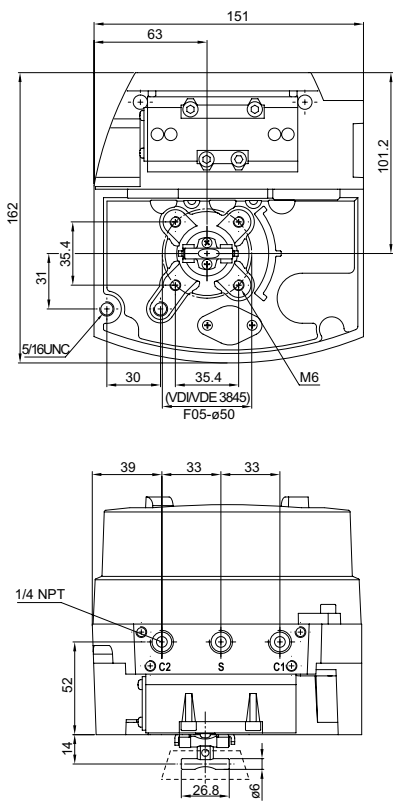
OMRON D2VW-5 (K\_5):  
3 A - 250 V AC, 0.4 A - 125 V DC,  
5 A - 30 V DC

OMRON D2VW-01, gold plated contacts (K\_6):  
100 mA - 30 V DC / 125 V AC

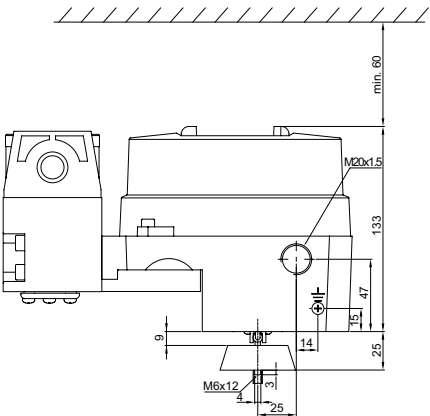
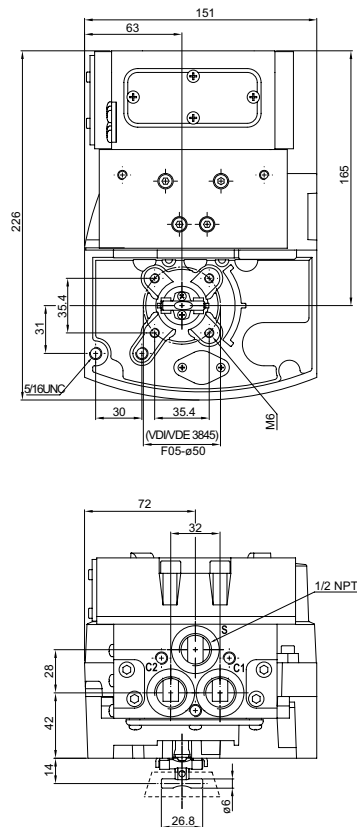
Ambient temperature -40 ... +80 °C / -40 ... +176 °F

12 DIMENSIONS

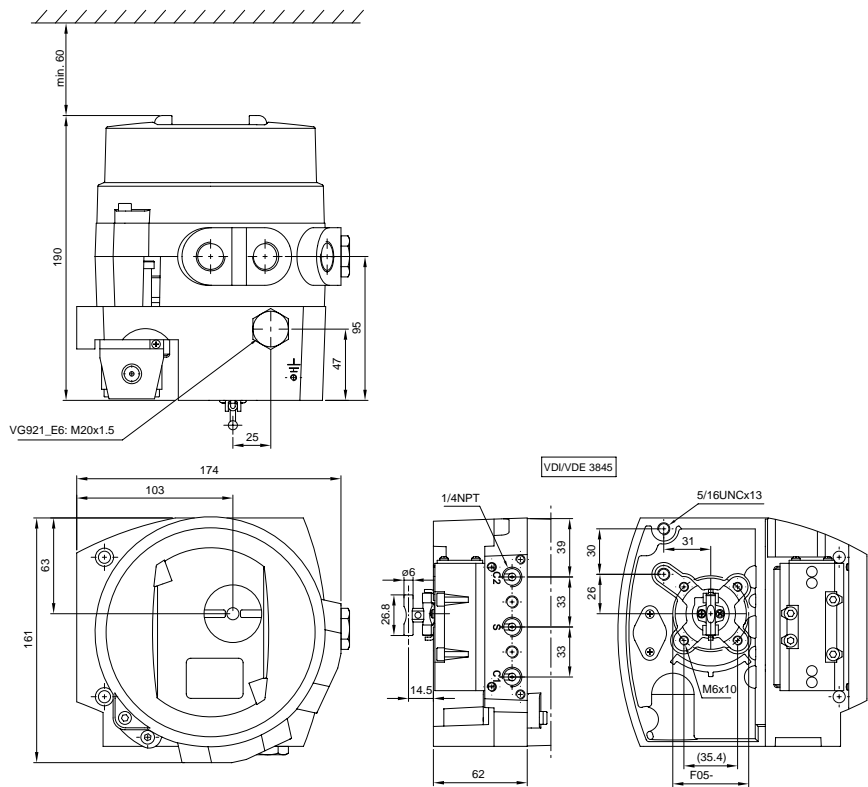
SG921\_\_



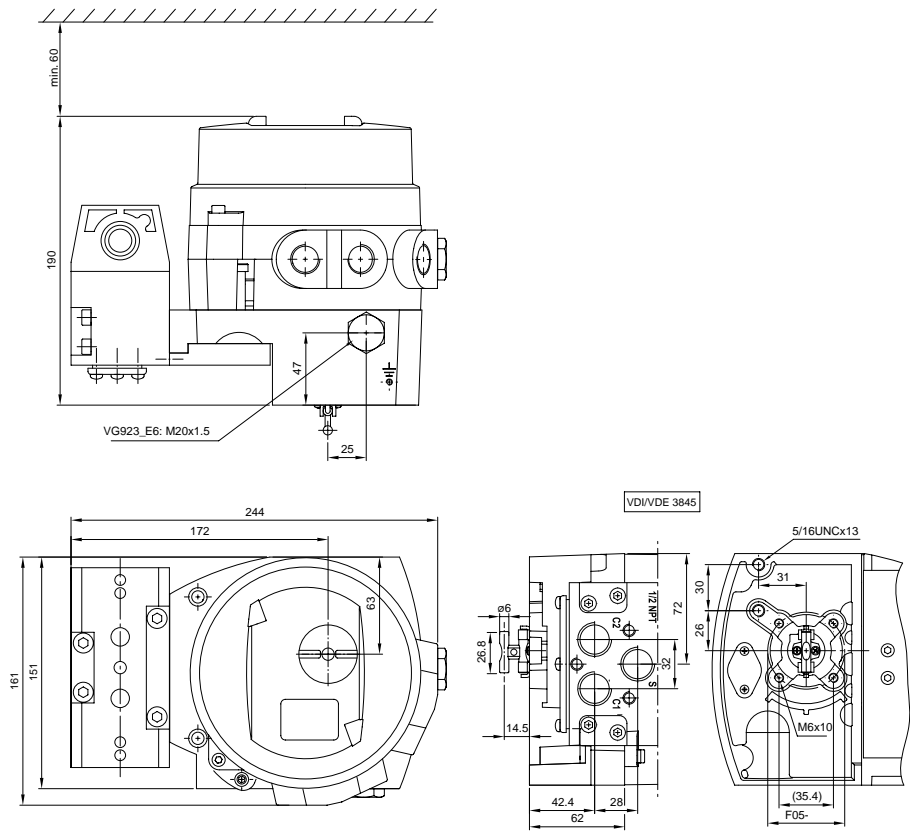
SG923\_\_



SG921\_/I00



SG923\_/I00



## 13 CONFIGURATION PARAMETERS

DTM			LUI *)	
Screen	Parameter	Values / Range	Parameter	Values / Range
	-	-	MODE	<b>AUTO</b> , MAN
	-	-	TUNE	2 ...20 (default 5)
Settings	Frame Language	English, Suomi, Deutsch	LANG	<b>ENG</b> , GER, FRE
Operation Unit	HART Tag	free text (default POS1234)	-	-
	Description	free text (default SG9000)	-	-
	Device Date	free text (default 02.02.2005)	-	-
	Message	free text (default SG9000)	-	-
	HART Long Tag	free text (default SG9000)	-	-
Assembly Related	Actuator Type	Double Acting, Single Acting	ATYP	<b>2-A</b> , 1-A
	Valve Acting Type	Rotary, Linear	VTYP	<b>ROT</b> , LIN
	Maximum Valve Speed	Slow, Moderate, Fast	MAXS	<b>FST</b> , SLO, STD
	Dead Angle	0.0 ... 50.0 %	A0	<b>0.0</b> ... 99.0 %
	Positioner Fail Action Direction	Close, Open	PFA	<b>CLO</b> , OPE
	Position Transmitter Direction	Normal Direction, Reverse, Not In Use	-	-
Signal Modification	Direction	Rising Setpoint to Open, Rising Setpoint to Close	DIR	CLO, <b>OPE</b>
	Setpoint Trigger Level	20.0 ... 80.0 % (default 50.0 %)	LEV	20.0 ... 80.0 % (default 50.0 %)
	SW Limit Switch - Closed Below	0.0 ... 100.0 % (default 0.0%)	-	-
	SW Limit Switch - Open Above	0.0 ... 100.0 % (default 100.0%)	-	-
Stroke Profile Open	Stroke Time	default 10 s	STOP	<b>0</b> ... 999
	Stroke Profile Type	Linear, Slow Start, Slow Start and End, Equal Percentage, Quick Opening	SPOP	<b>1</b> , 2, 3, 4, 5
	Custom Profile	21 parameters, range 0.0 ... 100.0	-	-
Stroke Profile Close	Stroke Time	default 10 s	STCL	<b>0</b> ... 999
	Stroke Profile Type	Linear, Slow Start, Slow Start and End, Equal Percentage, Quick Opening	SPCL	<b>1</b> , 2, 3, 4, 5
	Custom Profile	21 parameters, 0.0 ... 100.0	-	-
Monitoring Dynamic Variables	Sampling Rate	1 ... 60 s	-	-
Warnings Limit for Performance	Stroke Time Deviation - Open	0 ... n s (default 5 s)	-	-
	Stroke Time Deviation - Close	0 ... n s (default 5 s)	-	-
	Spool Valve Reaction Time - Open	0.0 ... 60.0 s (default 5 s)	-	-
	Spool Valve Reaction Time - Close	0.0 ... 60.0 s (default 5 s)	-	-
	Valve Reaction Time - Open	0.0 ... 60.0 s (default 10 s)	-	-
	Valve Reaction Time - Close	0.0 ... 60.0 s (default 10 s)	-	-
	Supply Pressure - Low Limit	2.0 ... 8.0 bar (default 2.5 bar)	-	-
	Supply Pressure - High Limit	2.0 ... 8.0 bar (default 7.5 bar)	-	-
	Temperature - Low Limit	-40.0 ... 85.0 °C (default -35 °C)	-	-
	Temperature - High Limit	-40.0 ... 85.0 °C (default 80 °C)	-	-
Warning Limits for Counters	Total Operation Time	0 ... n h (default 216000 h)	-	-
	Total Valve Full Strokes	0 ... n (default 2000000)	-	-
	Total Actuator Full Strokes	0 ... n (default 2000000)	-	-
Alarm Limits	Stroke Time Deviation Open - High Limit	0 ... n s (default 5 s)	-	-
	Stroke Time Deviation Close - High Limit	0 ... n s (default 5 s)	-	-
	Valve Stuck Deviation - Position Deviation	0.0 ... 100.0 % (default 5.0 %)	-	-
	Valve Stuck Deviation - Latch Time	0 ... 999 s (default 30.0 s)	-	-
	Unallowed Valve Movement - Latch Time	0 ... n s (default 5 s)	-	-
	Supply Pressure - Low Limit	1.0 ... 10.0 bar (default 2.5 bar)	-	-
	Supply Pressure - High Limit	1.0 ... 10.0 bar (default 8 bar)	-	-
	Supply Pressure - Latch Time	0 ... n s (default 30 s)	-	-
	Temperature - Low Limit	-40.0 ... 85.0 °C (default -35 °C)	-	-
	Temperature - High Limit	-40.0 ... 85.0 °C (default 80 °C)	-	-
	Temperature - Latch Time	0 ... n s (default 120 s)	-	-
	Spool Valve Reaction Time - High Limit	0 ... n s (default 50 s)	-	-
	Supply Pressure Fail Action - Low Limit	0.0 ... 8.0 bar (default 1.0 bar)	-	-
HART Configuration	1st Dynamic Variable Code	Setpoint, Valve Position, Cylinder Pressure (C1), Cylinder Pressure (C2), Actuator Pressure Difference, Supply Pressure, Device Temperature, Target Position	-	-
	2nd Dynamic Variable Code	Setpoint, Valve Position, Cylinder Pressure (C1), Cylinder Pressure (C2), Actuator Pressure Difference, Supply Pressure, Device Temperature, Target Position	-	-
	3rd Dynamic Variable Code	Setpoint, Valve Position, Cylinder Pressure (C1), Cylinder Pressure (C2), Actuator Pressure Difference, Supply Pressure, Device Temperature, Target Position	-	-
	4th Dynamic Variable Code	Setpoint, Valve Position, Cylinder Pressure (C1), Cylinder Pressure (C2), Actuator Pressure Difference, Supply Pressure, Device Temperature, Target Position	-	-
	Supply Pressure Unit	bar, psi	-	-
	Pressure Difference Unit	bar, psi	-	-
	Cylinder Pressure (C1) Unit	bar, psi	-	-
	Cylinder Pressure (C2) Unit	bar, psi	-	-
	Device Temperature Unit	°C, °F	-	-
	Response Preambles	5 ... 20	-	-
	Burst Mode Command	1, 2, 3, 9	-	-
	1st Burst Variable Code	Setpoint, Valve Position, Cylinder Pressure (C1), Cylinder Pressure (C2), Actuator Pressure Difference, Supply Pressure, Device Temperature, Target Position	-	-
	2nd Burst Variable Code	Setpoint, Valve Position, Cylinder Pressure (C1), Cylinder Pressure (C2), Actuator Pressure Difference, Supply Pressure, Device Temperature, Target Position	-	-
	3rd Burst Variable Code	Setpoint, Valve Position, Cylinder Pressure (C1), Cylinder Pressure (C2), Actuator Pressure Difference, Supply Pressure, Device Temperature, Target Position	-	-
	4th Burst Variable Code	Setpoint, Valve Position, Cylinder Pressure (C1), Cylinder Pressure (C2), Actuator Pressure Difference, Supply Pressure, Device Temperature, Target Position	-	-
Device HART Address	Multidrop	Disabled, Enabled	-	-
	Address	0, 1 ... 15	-	-

\*) Default values are set in boldface type

## 14 EC DECLARATION OF CONFORMITY



### EC DECLARATION OF CONFORMITY

Manufacturer:  
Metso Automation Oy  
00811 Helsinki  
Finland

Product: **Intelligent On/Off Valve Controller Neles SwitchGuard SG9000-series**

Approvals:

Type	Approval	EC Type examination Certificate
SG92_H_E6/_/_	ATEX II 2 G Ex d IIC T5/T6	ZELM 07 ATEX 0342 X
SG92_H_X1_	ATEX II 1 G Ex ia IIC T4/T5/T6 Ga ATEX II 1 D Ex tD A20 T90	VTT 09 ATEX 033X
SG92_H_X2/_/_	ATEX II 2 G Ex ia IIC T4/T5/T6 Gb ATEX II 2 D Ex tD A21 T90	
SG92_H_X3/_/_	ATEX II 3 G Ex nA IIC T4/T5/T6 ATEX II 3 D Ex tD A22 T90	VTT 09 ATEX 034X
SG92_H_X4/_/_	ATEX II 3 G Ex nL IIC T4/T5/T6 ATEX II 3 D Ex tD A22 T90	VTT 09 ATEX 034X

Applicable directives:  
EMC 89/336/EC and 93/68/EC  
ATEX 94/9/EC

Electrical components  
Electrical and non-electrical components

As the products within our sole responsibility of design and manufacture may be used as parts or components in machinery and are not alone performing functions as described in Article 6(2) in the Machinery Directive (2006/42/EC), we declare that our product(s) to which this Declaration of Conformity relates must NOT be put into service until the relevant machinery into which it is to be incorporated has been declared in conformity with the provisions of the Machinery Directive.

The product above is manufactured in compliance with the applicable European directives and technical specifications/standards.

Protection from e.g. static electricity caused by the process or connected equipment must be considered by the user ( EN 60079-14 §6 ).

The product do not possess any residual risk according to hazard analyses made under the applicable directives providing that the procedures stated by the Installation, Operation and Maintenance manual are followed and the product is used under conditions mentioned in the technical specifications.

Manufacturer's certificates:

Standard / Directive	Notified Body	Certificate No.
ISO 9001:2000	DNV	24888-2008-AQ-FIN-FINAS
ATEX 94/9/EC Annex IV	DNV 0575	DNV-2006-OSL-ATEX-0260Q

Helsinki 6 October 2009

Ralf Liljestrand, Quality Manager  
Authorized person of the manufacturer within the European Community

## 15 TYPE CODING

## SWITCHGUARD SG9200H

	1.	2.	3.	4.	5.	6.	7.	8.	9.
	SG	9	2	15	H	X1	/	I02	

1.	PRODUCT GROUP	
SG	Neles SwitchGuard, Intelligent On/Off Valve Controller.	
2.	SERIES CODE	
9	Series 9000 Intelligent on/off valve controller with universal shaft and attachment face according to standard VDI/VE 3845. Relevant shaft adapter included in mounting kits. When valve controllers are separate deliveries, shaft adapter kit is supplied.	
3.	ENCLOSURE	
2	Standard IP66/NEMA 4X enclosure. Standard temperature range -20° to +85 °C / -4° to +185 °F. (See 7. sign "C" for low temperature option). Applicable to intrinsically safe and flameproof versions.	
4.	SPOOL VALVE	CONNECTIONS
12	Restricted capacity	S, C1 ,C2 = 1/4 NPT
15	Standard capacity. Stroke volume of actuator < 13 dm³	S, C1 ,C2 = 1/4 NPT
35	High capacity. Stroke volume of actuator > 13 dm³	S, C1 ,C2 = 1/2 NPT
37	Extended capacity. For single acting actuators	S = 1/2 NPT, C2= 1 NPT
5.	COMMUNICATION / INPUT SIGNAL RANGE	
H	4–20 mA, HART communication. Supply voltage 30 V DC. Load voltage up to 9.5 V DC at 20 mA corresponding to 475 Ω (maximum voltage drop).	
6.	APPROVALS FOR HAZARDOUS AREAS	
N	No approvals for hazardous areas.	
X1	<b>ATEX certifications:</b> II 1 G Ex ia IIC T4/T5/T6 Ga <b>SG9_HX1:</b> Ui < 28 V, Ii < 120 mA, Pi < 1 W, Li = 53 µH, Ci = 22 nF. Temperature range: T4: -40° to +80 °C / -40° to +176 °F, T5: < +65 °C / < +149 °F, T6: < +50 °C / < +122 °F. Not available with limit switches, 8. sign I, D or K.	
	<b>ATEX certifications:</b> II 2 G Ex ia IIC T4/T5/T6 Gb <b>SG9_HX2:</b> Ui = 28 V, Ii = 120 mA, Pi = 1 W, Li = 53 µH, Ci = 22 nF. Temperature range: T4: -40° to +80 °C / -40° to +176 °F, T5: < +65 °C / +149 °F, T6: < +50 °C / +122 °F. Only available with ATEX certified inductive limit switches (e.g. I02, I09).	
X3	<b>ATEX certifications:</b> II 3 G Ex nA IIC T4/T5/T6 No Zener Barrier needed. <b>SG9_HX3:</b> Ui = 30 V, Pmax = device limits itself. Temperature range: T4: -40° to +85 °C / -40° to +185 °F, T5: < +75 °C / +167 °F, T6: < +60 °C / +140 °F. Available without limit switches or with ATEX certified inductive limit switches (e.g. I02, I09).	
	<b>ATEX certifications:</b> II 3 G Ex nL IIC T4/T5/T6 No Zener Barrier needed. <b>SG9_HX4:</b> Ui = 30 V, Ii ≤ 152 mA, Li = 53 µH, Ci = 22 nF, Pmax = device limits itself. Temperature range: T4: -40° to +85 °C / -40° to +185 °F, T5: < +75 °C / +167 °F, T6: < +60 °C / +140 °F. Available without limit switches or with ATEX certified inductive limit switches (e.g. I02, I09).	
X4	<b>ATEX certifications:</b> II 3 G Ex nL IIC T4/T5/T6 No Zener Barrier needed. <b>SG9_HX4:</b> Ui = 30 V, Ii ≤ 152 mA, Li = 53 µH, Ci = 22 nF, Pmax = device limits itself. Temperature range: T4: -40° to +85 °C / -40° to +185 °F, T5: < +75 °C / +167 °F, T6: < +60 °C / +140 °F. Available without limit switches or with ATEX certified inductive limit switches (e.g. I02, I09).	
	<b>ATEX certifications:</b> II 2 G Ex d IIC T5/T6 <b>SG9_HE6:</b> Ui = 30 V Temperature range: T5: -40° to +80 °C / -40° to +176 °F, T6: -40° to +70 °C / -40° to +158 °F Available with or without limit switches.	
E6	<b>FM and CSA certifications:</b> IS Class I, Division 1, Groups A, B, C, D, T4/T5/T6 IS Class I, Zone 0, AEx ia, IIC T4/T5/T6 <b>SG92_HU1:</b> Ui ≤ 28 V, Ii ≤ 120 mA, Pi ≤ 1 W, Li = 53 µH, Ci = 22 nF. Temperature range: T4: -40° to +80 °C / -40° to +176 °F, T5: < +65 °C / +149 °F, T6: < +50 °C / +122 °F. Not available with any limit switches (8. sign I, K or B).	
U1	<b>FM and CSA certifications:</b> NI Class I, Division 1, Groups A, B, C, D, T4/T5/T6 NI Class I, Zone 2, Ex nA IIC, T4/T5/T6 No Zener Barrier needed. <b>SG92_HU2:</b> Ui ≤ 30 V, Pmax = device limits itself, external load resistance 0–780 Ω Temperature range: T4: -40° to +85 °C / -40° to +185 °F, T5: < +70 °C / +158 °F, T6: < +55 °C / +131 °F. Not available with any limit switches (8. sign I, K or B).	
	<b>FM and CSA certifications:</b> NI Class I, Division 1, Groups A, B, C, D, T4/T5/T6 NI Class I, Zone 2, Ex nA IIC, T4/T5/T6 No Zener Barrier needed. <b>SG92_HU2:</b> Ui ≤ 30 V, Pmax = device limits itself, external load resistance 0–780 Ω Temperature range: T4: -40° to +85 °C / -40° to +185 °F, T5: < +70 °C / +158 °F, T6: < +55 °C / +131 °F. Not available with any limit switches (8. sign I, K or B).	
7.	OPTIONS OF VALVE CONTROLLER	
T	<b>SG9_NT:</b> Internal 2-wire (passive) position transmitter. Analog position feedback signal, output 4–20 mA, supply voltage 12–30 V DC, external load resistance 0–780 Ω.	

7.	OPTIONS OF VALVE CONTROLLER	
T	<b>SG9_X1T and SG9_X2T:</b> Ui < 28 V, Ii < 120 mA, Pi < 1 W, Li = 53 µH, Ci = 22 nF, external load resistance 0–690 Ω <b>SG9_X3T:</b> Ui = 30 V, Pmax = device limits itself, external load resistance 0–780 Ω <b>SG9_E6T:</b> Ui = 30 V, Pmax = device limits itself, external load resistance 0–780 Ω <b>SG9_U1T:</b> Ui ≤ 28 V, Ii ≤ 120 mA, Pi ≤ 1 W, Li = 53 µH, Ci = 22 nF, external load resistance 0–780 Ω <b>SG9_U2T:</b> Ui = 30 V, Pmax = device limits itself, external load resistance 0–780 Ω.	
	Low temperature. Temperature range -40° to +60 °C / -40° to +140 °F.	
C	Special construction.	
Y	Special construction.	
8.	LIMIT SWITCH TYPE	
I02	<b>Inductive proximity switches, 2 pcs.</b> IP 66 / NEMA 4X enclosure. M20 x 1.5 conduit entry (2 pcs.). P+F; NJ2-12GK-SN, 2-wire type, DC; > 3 mA; < 1 mA. Intrinsically safe according to ATEX II 2 G Ex ia IIC T6. Temperature range -40° to +85 °C / -40° to +185 °F. Not applicable to 6. sign N or X1.	
	P+F; NCB2-12GM35-N0, 2-wire type, DC; > 3 mA; < 1 mA. Intrinsically safe according to ATEX II 2 G Ex ia IIC T6. Minimum temperature -25° to +85 °C / -13° to +185 °F. Not applicable to 6. sign N or X1.	
I09	Omron; E2E-X2Y1; 2-wire type; AC; <100 mA; 24–240 V AC. Temperature range -40° to +85 °C / -40° to +185 °F. Not applicable to 6. sign X1, X2 and X3.	
I32	ifm IFC2002-ARKG/UP, 2-wire type, DC; 150 mA, 10–36 V DC, leakage current < 0.6 mA. Temperature range -25° to +80 °C / -13° to +176 °F. Not applicable to 6. sign X1, X2 and X3.	

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