

Neles ValvGuard™ VG9000H

Rev. 2.3

Installation, Maintenance and
Operating Instructions

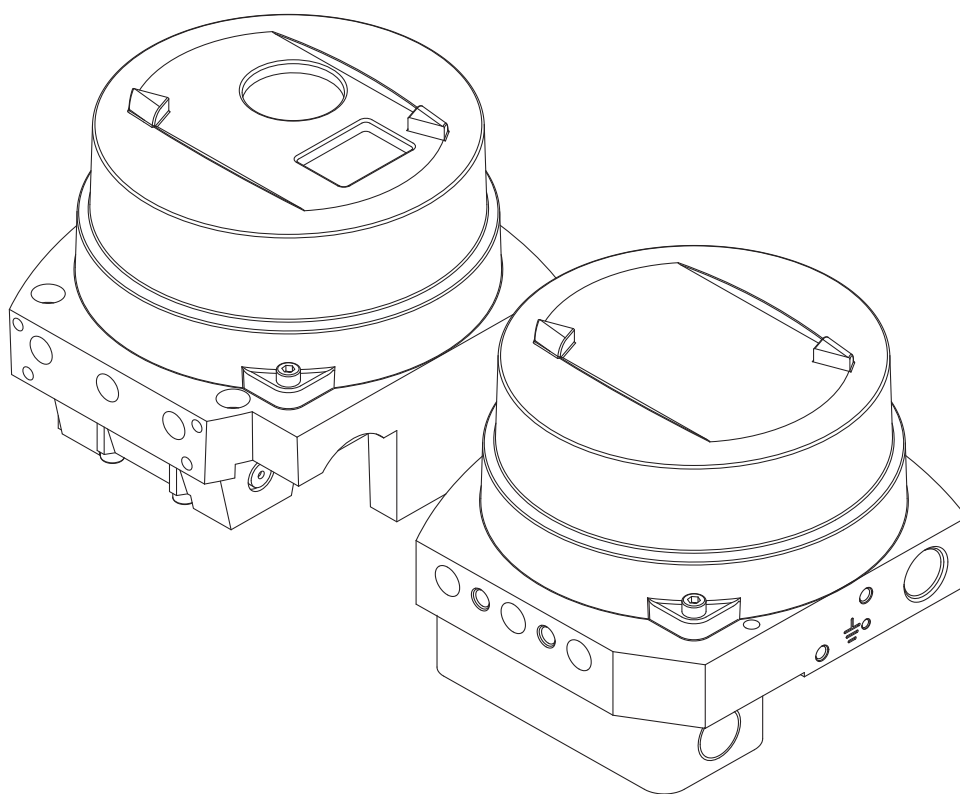


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READ THESE INSTRUCTIONS FIRST!

These instructions provide information about the safe handling and operation of the ValvGuard.
If you require additional assistance, please contact the manufacturer or manufacturer's representative.
Addresses and phone numbers are printed on the back cover.
See also www.metso.com/valves for the latest documentation.

SAVE THESE INSTRUCTIONS!

Subject to change without notice.

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1 NELES VALVGUARD VG9000H INTELLIGENT SAFETY SOLENOID WITH HART COMMUNICATION

1.1 General

This manual incorporates Installation, Maintenance and Operation Instructions for the Metso's Neles ValvGuard VG9000H. The VG9000H may be used with either cylinder or diaphragm type pneumatic actuators for rotary or linear valves.

NOTE:

The selection and use of the ValvGuard 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 ValvGuard. If you are uncertain about the use of the controller or its suitability for your intended use, please contact local Metso office for more information.

1.2 Technical description of VG9000H

Neles ValvGuard VG9000H is a 4–20 mA loop-powered microcontroller-based intelligent safety solenoid and partial stroke test device with HART communication. Device is suitable to be used in safety related application up to and including SIL 3 acc. to IEC 61508.

See Safety Manual for functional safety figures and other safety related details.

NOTE:

HART communication can be used for informational purposes, but is not safety certified for diagnostic annunciation.

The device safety position is 6.0 mA or below. When VG9_L3 version is used, the safety position is 10.0 mA or below. The device stays alive even at 3.7 mA input signal (at 7.7 mA when VG9_L3 is used) and communicates via HART. Optional Remote Communication Interface RCI9H2 is required if the safety system output is binary (DO) 24 V DC. See separate RCI9H2 technical bulletin (9RCI21EN) for detailed instructions.

NOTE:

RCI9H2 includes the Ex-isolator, so there is no need for separate Ex-isolator in intrinsically safe installations.

Main components of ValvGuard are spool valve (SV), prestage unit (PR) and micro controller (μ C). Spool valve and prestage unit are the only components, which takes part of the safety action. Spool valve controls the main air-flow between supply- (S), actuator- (C1, C2) and exhaust (EXH) connections. The spool is operated by spring force to fail safe position and by pneumatic force generated by the prestage valve to the normal position. The prestage valve is coil operated flapper valve (normally open). Coil of the prestage is energized with the safety control part and it is controlled by the micro controller. Micro controller cannot prevent the safety action. Pressure sensors (Px) and position sensor (α) are used to getting the measurements for controlling the PST and other tests. Measurements from the sensors are used for the device diagnostics.

The VG9000H contains a Local User Interface enabling local configuration. A PC with Metso Valve Manager™ software together with Metso's FieldCare or any other FDT frame software can be used for advanced configuration and diagnostics.

The powerful 32-bit microcontroller controls the valve position during partial stroke and other special testing. The measurements include:

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

Advanced self-diagnostics guarantees that all measurements operate correctly. Failure of any measurement does not cause the valve to go to fail-safe position. After connections of electric signal and pneumatic supply the micro controller (μ C) reads the input signal, position sensor (α) and pressure sensors (Ps, P1, P2 and P3). This information is used to run the partial stroke tests and other tests.

NOTE:

Micro controller is only able to control the prestage if safety control part is energized. Micro controller can never prevent the safety action to happen since safety action is the same as there's no voltage in the safety control part.

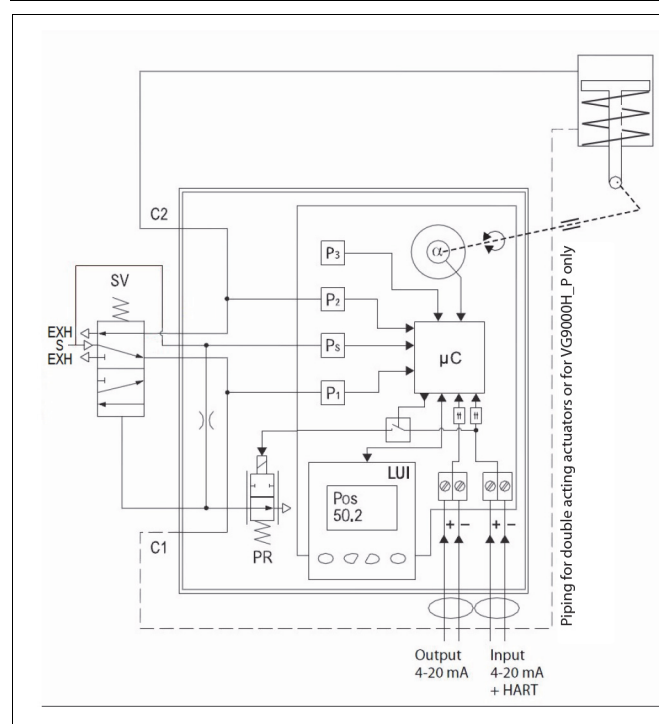


Fig. 1 The principle of operation

1.2.1 Technical description of VG9000H_P

NOTE:

VG9000H_P version has fundamentally different functionality to other VG9000H versions. This version can be identified by the green cover.

Neles ValvGuard VG9000H with P-option (VG9000H_P) is a 4–20 mA loop-powered microcontroller-based partial stroke test device with HART communication. This device is for partial stroke test (PST) only and must be used together with an additional solenoid valve for the safety action.

The prestage valve of the device is coil operated flapper valve (normally open). Coil of the prestage is normally de-energized and it is controlled by the micro controller for testing and calibration. Signal failure does not affect to the valve position.

The device stays alive even at 3.7 mA input signal and communicates via HART. 4 mA is a normal state of the device. When input signal is 6 mA and above, PST is possible. When input signal is 8 mA and above, PST and travel calibration are possible. The valve cannot be driven from the normal position by any input signal. Thus the safety action needs to be done with an additional solenoid valve.

1.3 System architecture

VG9000H can be connected directly to safety system analog output module (AO, 4-20 mA). See Fig. 2 for the general wiring principle.

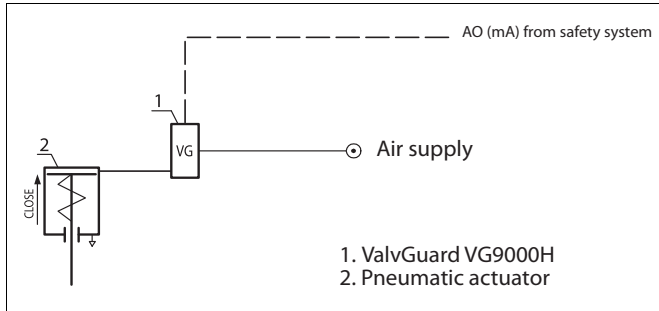


Fig. 2 General wiring principle of VG9000H

VG9000H can also be connected to safety system digital output module (DO, 0/24 V DC) via RCI unit. See Fig. 3 for the wiring principle with RCI unit.

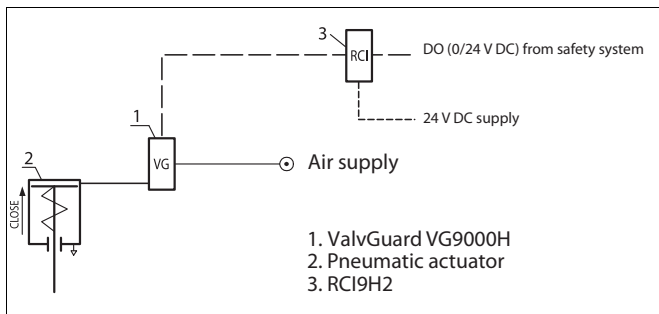


Fig. 3 VG9000H wiring principle with RCI unit

There is also a Local Control Panel option (LCP9H_). It can be used together with VG9000H or VG9000H with RCI unit. See Fig. 4. for the wiring principles with Local Control Panel.

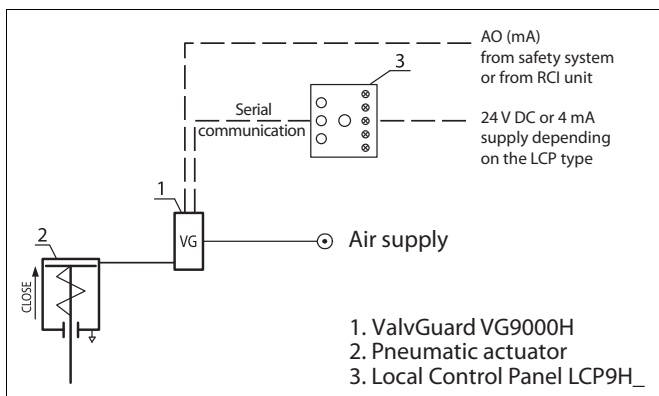


Fig. 4 VG9000H wiring with Local Control Panel

See Section 3.5 for wiring details. See LCP manual (7LCP9H70en) for further LCP details. See RCI bulletin (9RCI21en) for further RCI details.

VG9000H_P must be used together with an additional solenoid valve (SOV). See Fig. 5 for the general wiring principle.

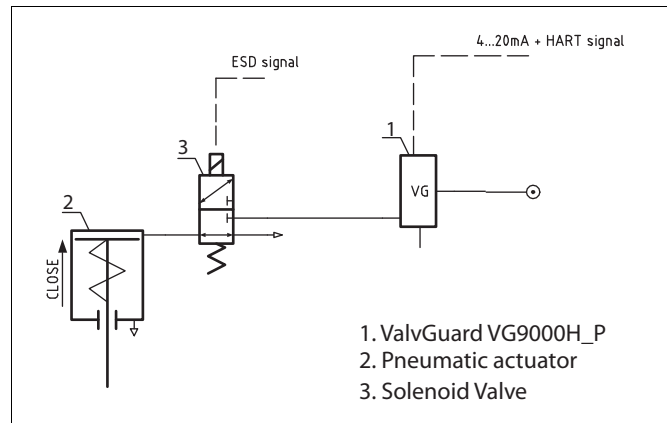


Fig. 5 VG9000H_P wiring with additional solenoid valve

1.4 Markings

The ValvGuard is equipped with an identification plate (Fig. 6).

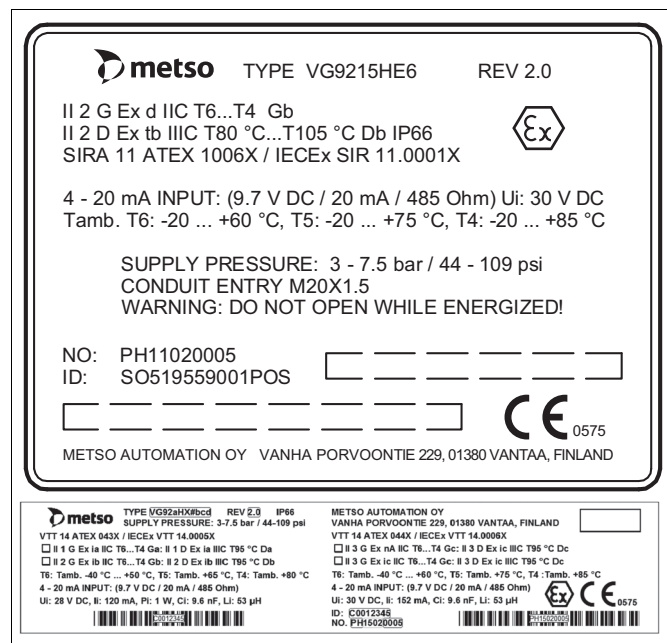


Fig. 6 Examples of identification plates

Identification plate markings include:

- ☐ Type designation of the ValvGuard
- ☐ Enclosure class
- ☐ Revision number
- ☐ Input signal (voltage range)
- ☐ Input resistance
- ☐ Maximum supply voltage
- ☐ Supply pressure range
- ☐ Operational temperature
- ☐ CE mark
- ☐ 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: PH13011234 = controller, year 2013, week 1, consecutive number 1234.

NOTE:

There may have two identification plates, if there is double approval (VG9_XE6_) asked. When the device is installed, remove the identification plate which is not valid. If device is installed to Ex d area, it can't be installed to Ex i area any more even if identification plate is changed.

1.5 Technical specifications

Ex NOTE:

This manual contains technical specifications for several types of the ValvGuard. 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.

VG9000H INTELLIGENT SAFETY SOLENOID

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:

-40°...+85 °C / -40° to +185 °F

Influence of temperature on valve position:

< 0.5 % / 10 °C

Influence of vibration on valve position

No effect when measured in pulse

2g 5–150 Hz, 1g 150–300 Hz,

0.5g 300–2000 Hz.

No effect on PST if max. response 4g measured at housing.

No unintended valve movements if max. response 15g measured at housing

Enclosure

Material (VG92_): Epoxy coated anodised aluminium alloy, glass window (excluding E2)

Material (VG93_): Stainless steel (316 or equivalent), glass window as an option

Mechanical position indicator and LUI visible through the main cover (VG92_)

Protection class: IP66, NEMA 4X

Pneumatic ports:	VG9_1_	1/4 NPT
	VG9235	1/2 NPT
	VG9237	1 NPT (1/2 NPT supply) (single acting only)

Conduit entry thread:

M20 x 1.5 or 1/2" NPT (VG9_U_ or VG9_E2_)

Weight:	VG921_	3.0 kg / 6.6 lb
	VG9235	4.6 kg / 10.1 lb
	VG9237	5.0 kg / 11 lb
	VG931_	9.0 kg / 19.8 lb

VG92_ with extension housing plus 1.0 kg / 2.2 lb

VG93_ with extension housing plus 3.0 kg / 6.6 lb

Pneumatics

Spool material:	Hard anodized aluminium with special teflon coating
Supply pressure:	3.0–7.5 bar / 44–109 psi
Output pressure:	3.0–7.5 bar / 44–109 psi
Air quality:	According to ISO 8573-1:2001
	Solid particles: Class 6

Humidity: Class 1

(dew point 10 °C / 18 °F below minimum temperature is recommended)

Oil class: 3 (or <1 ppm)

Capacity with 4 bar / 60 psi supply:

VG9_12	7 Nm ³ /h / 4.1 scfm (Cv = 0.06)
VG9_15	90 Nm ³ /h / 53 scfm (Cv = 0.7)
VG9235	380 Nm ³ /h / 223 scfm (Cv = 3.2)
VG9237	feed 380 Nm ³ /h / 223 scfm (Cv = 3.2) exhaust 700 Nm ³ /h / 412 scfm (Cv = 6.4)

Consumption with 4 bar / 60 psi supply (VG9000H):

actuator pressurized 0.22 Nm³/h / 0.13 scfm,

actuator vented 0.25 Nm³/h / 0.15 scfm

Consumption with 4 bar / 60 psi supply (VG9000H_P):
0.25 Nm³/h / 0.15 scfm

Electronics (input)

Electrical connections: 0.25–2.5 mm²

Supply power: Loop powered, 4–20 mA

Signal range: 3.7–22 mA

Signal details (VG9000H):

0.0–3.7 mA (trip state,
diagnostics not available)

3.7–6.0 mA (trip state,
diagnostics available)

6.0–16.0 mA (hysteresis range)

16.0–22.0 mA (normal state,
diagnostics available)

Signal details (VG9000H_L3):

0.0–7.7 mA (trip state,
diagnostics not available)

7.7–10.0 mA (trip state,
diagnostics available)

10.0–16.0 mA (hysteresis range)

16.0–22.0 mA (normal state,
diagnostics available)

Signal details (VG9000H_P):

0.0–3.7 mA (de-energized state,
diagnostics not available)

3.7–6.0 mA (normal state,
diagnostics available)

6.0–8.0 mA (normal state,
PST available)

8.0–22.0 mA (normal state, PST and
calibration available)

Load voltage: up to 9.7 V DC / 20 mA
(corresponding 485 Ω)

Voltage: max 30 V DC

Polarity protection: -30 V DC

Over current protection:

active over 35 mA

Electronics (output)

Usage:	Position transmitter (T) / device status output (S)
Electrical connections:	0.25–2.5 mm ²
Output signal:	Defined by type code option T or S T: 4–20 mA = 0–100 % position S: 4 mA = OK 5 mA = Pneumatics test 6 mA = PST test 7 mA = ETT test 8 mA = Warning 10 mA = Alarm 12 mA = Safety position requested by LCP Fault modes indicated by levels 3.5 and 22 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

NOTE:

See chapter 8.1.3.5 for SIL certified position transmitter (T01) details. See Safety Manual for functional safety information.

LCP9H interface

Electrical connections: 0.25–2.5 mm²

Local user interface functions

- ☐ Monitoring of valve position, temperature, supply pressure, actuator pressure difference, housing pressure, input signal and safety signal status
- ☐ Guided start-up function
- ☐ LUI may be locked remotely to prevent unauthorised access
- ☐ Calibration
- ☐ Parameter selection
- ☐ Testing
- ☐ Language selection
- ☐ Alarm and warning state indications
- ☐ Latest event view

See Chapter 4 for details of LUI functions.

APPROVALS

Table 1 Approvals and electrical values

Certificate	Approval	Electrical values
ATEX		
VG9_X VTT 14 ATEX 043X EN 60079-0:2012, EN 60079-11:2012, EN 60079-26:2007	II 1 G Ex ia IIC T6...T4 Ga II 1 D Ex ia IIIC T95 °C...T125 °C Da II 2 G Ex ib IIC T6...T4 Gb II 2 D Ex ib IIIC T95 °C...T125 °C Db	Input: $U_i \leq 28 \text{ V}$, $I_i \leq 120 \text{ mA}$, $P_i \leq 1.0 \text{ W}$, $C_i \leq 9.6 \text{ nF}$, $L_i \leq 53 \mu\text{H}$ PT: $U_i \leq 28 \text{ V}$, $I_i \leq 120 \text{ mA}$, $P_i \leq 1.0 \text{ W}$, $C_i \leq 8 \text{ nF}$, $L_i \leq 53 \mu\text{H}$ LCP: $U_i \leq 10 \text{ V}$, $I_i \leq 100 \text{ mA}$, $P_i \leq 0.25 \text{ W}$, $C_i \leq 5 \text{ nF}$, $L_i \leq 1 \mu\text{H}$
VG9_X VTT 14 ATEX 044X EN 60079-0:2012, EN 60079-15:2010	II 3 G Ex nA IIC T6...T4 Gc II 3 G Ex ic IIC T6...T4 Gc II 3 D Ex ic IIIC T95 °C...T125 °C Dc	Input: $U_i \leq 30 \text{ V}$ PT: $U_i \leq 30 \text{ V}$ LCP: $U_i \leq 15 \text{ V}$
VG9_E6 SIRA 11ATEX1006 EN 60079-0:2012, EN 60079-1:2007, EN 60079-31:2009	II 2 G Ex d IIC T6...T4 Gb II 2 D Ex tb IIIC T80 °C...T105 °C Db IP66	Input: $U_i \leq 30 \text{ V}$, $P_i \leq 1080 \text{ mW}$ PT: $U_i \leq 30 \text{ V}$, $I_i \leq 20 \text{ mA}$, $P_i \leq 1050 \text{ mW}$
IECEx		
VG9_X IECEx VTT 14.0005X IEC 60079-0:2011, IEC 60079-11:2011, IEC 60079-26:2006	Ex ia IIC T6...T4 Ga Ex ia IIIC T95 °C...T125 °C Da Ex ib IIC T6...T4 Gb Ex ib IIIC T95 °C...T125 °C Db	Input: $U_i \leq 28 \text{ V}$, $I_i \leq 120 \text{ mA}$, $P_i \leq 1.0 \text{ W}$, $C_i \leq 9.6 \text{ nF}$, $L_i \leq 53 \mu\text{H}$ PT: $U_i \leq 28 \text{ V}$, $I_i \leq 120 \text{ mA}$, $P_i \leq 1.0 \text{ W}$, $L_i \leq 53 \mu\text{H}$, $C_i \leq 8 \text{ nF}$ LCP: $U_i \leq 10 \text{ V}$, $I_i \leq 100 \text{ mA}$, $P_i \leq 0.25 \text{ W}$, $C_i \leq 5 \text{ nF}$, $L_i \leq 1 \mu\text{H}$
VG9_X IECEx VTT 14.0006X IEC 60079-0:2011, IEC 60079-15: 2010	Ex ic IIC T6...T4 Gc Ex nA IIC T6...T4 Gc Ex ic IIIC T95 °C...T125 °C Dc	Input: $U_i \leq 30 \text{ V}$ PT: $U_i \leq 30 \text{ V}$ LCP: $U_i \leq 15 \text{ V}$
VG9_E6 IECEx SIR 11.0001X IEC 60079-0:2011, IEC 60079-1:2007-04, IEC 60079-31:2008	Ex d IIC T6...T4 Gb Ex tb IIIC T80 °C...T105 °C Db IP66	Input: $U_i \leq 30 \text{ V}$, $P_i \leq 1080 \text{ mW}$ PT: $U_i \leq 30 \text{ V}$, $I_i \leq 20 \text{ mA}$, $P_i \leq 1050 \text{ mW}$
INMETRO		
VG9_Z1, VG9_Z2 NCC 12.0797 X, Issue 0 ABNT NBR IEC 60079-0:2013 ABNT NBR IEC 60079-11:2009 ABNT NBR IEC 60079-26:2008	Ex ia IIC T6...T4 Ga Ex ia IIC T6...T4 Gb	Input: $U_i \leq 28 \text{ V}$, $I_i \leq 120 \text{ mA}$, $P_i \leq 1.0 \text{ W}$, $C_i \leq 9.6 \text{ nF}$, $L_i \leq 53 \mu\text{H}$ PT: $U_i \leq 28 \text{ V}$, $I_i \leq 120 \text{ mA}$, $P_i \leq 1.0 \text{ W}$, $L_i \leq 53 \mu\text{H}$, $C_i \leq 8 \text{ nF}$ LCP: $U_i \leq 10 \text{ V}$, $I_i \leq 100 \text{ mA}$, $P_i \leq 0.25 \text{ W}$, $C_i \leq 5 \text{ nF}$, $L_i \leq 1 \mu\text{H}$
VG9_Z3 NCC 12.0798, Issue 0 ABNT NBR IEC 60079-0:2013 versão corrigida 2011 ABNT NBR IEC 60079-11:2009 ABNT NBR IEC 60079-15:2012 ABNT NBR IEC 60529:2005	Ex ic nA IIC T6...T4 Gc	Input: $U_i \leq 30 \text{ V}$, $I_i \leq 152 \text{ mA}$, $C_i \leq 9.6 \text{ nF}$, $L_i \leq 53 \mu\text{H}$ PT: $U_i \leq 30 \text{ V}$, $I_i \leq 152 \text{ mA}$, $C_i \leq 8 \text{ nF}$, $L_i \leq 53 \mu\text{H}$ LCP: $U_i \leq 15 \text{ V}$, $I_i \leq 1.35 \text{ A}$, $C_i \leq 5 \text{ nF}$, $L_i < 1 \mu\text{H}$
VG9_E5 NCC 12.0796 X, Issue 0 ABNT NBR IEC 60079-0:2013 versão corrigida 2011 ABNT NBR IEC 60079-1:2009 versão corrigida 2011 ABNT NBR IEC 60079-31:2011 ABNT NBR IEC 60529:2005	Ex d IIC Gb T5 Gb	Input: $U_i \leq 30 \text{ V}$, $P_i \leq 1080 \text{ mW}$ PT: $U_i \leq 30 \text{ V}$, $I_i \leq 20 \text{ mA}$, $P_i \leq 1050 \text{ mW}$
cCSAus		
VG9_E2 CSA 1980091	Class I, Div 1, Groups B, C, D Class II, Div 1, Groups E, F, G Class III; T6...T4, Enclosure type 4X Ex d IIC T6...T4 AEx d IIC T6...T4 Ex tb IIIC T100 °C IP66 AEx tb IIIC T100 °C IP66	Input: $U_i \leq 30 \text{ V}$ PT: $U_i \leq 30 \text{ V}$
VG9_HU CSA 70043951	Class I, Div 1, Groups A, B, C, DT4/T5/ T6Ex ia IIC T4/T5/T6 GaClass I, Zone 0 AEx ia IIC T4/T5/T6 Ga	Input: $U_i (V_{\text{max}}) = 28 \text{ V}$, $I_i (I_{\text{max}}) = 120 \text{ mA}$, $P_i = 1.0 \text{ W}$, $C_i = 9.6 \text{ nF}$, $L_i = 53 \mu\text{H}$ PT: $U_i (V_{\text{max}}) = 28 \text{ V}$, $I_i (I_{\text{max}}) = 120 \text{ mA}$, $P_i = 1.0 \text{ W}$, $C_i = 8 \text{ nF}$, $L_i = 53 \mu\text{H}$

Safety

SIL

IEC 61508 compliant up to and including SIL 3 by TUV Rheinland.
Position transmitter option (T01)
up to and including SIL 2.
For device variant specific SIL certification coverage and exceptions see chapter 15 Type Coding.

Electromagnetic protection

Electromagnetic compatibility
Emission acc. to EN 61000-6-4
Immunity acc. to EN 61000-6-2

CE marking

89/336/EEC
Electromagnetic compatibility

94/9/EC
ATEX

Interoperability

FDT/DTM VG9000H DTM certified by FDT group
HART DD registered by HCF

1.6 Recycling and disposal

Most ValvGuard parts can be recycled if sorted according to material.

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

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

1.7 Safety precautions

Ex i WARNING:

Installation conductors must be rated greater than 83 °C

CAUTION:

Opening the cover of VG9000H field device enclosure is allowed for authorized and trained persons only!

Misuse of powered VG9000H field device may cause a dangerous situation.

CAUTION:

Cover should be opened only in dry places, not when the device is vulnerable to e.g. salt water.

CAUTION:

Do not exceed the permitted values!

Exceeding the permitted values marked on the ValvGuard 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 ValvGuard 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:

Make sure the enclosure exhaust port will not be clogged!

It may prevent the device to do the safety action.

CAUTION:

Make sure that during the maintenance or commissioning when the device cover is open, water does not go inside the enclosure.

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.

Ex 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.

Ex WARNING:

Spark hazard!

Protect the aluminium housing and cover from impacts.

Ex WARNING:

Electrostatic charge hazard!

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

Ex 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 (part 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 and Ex n WARNING:

Use a cable gland with suitable Ex d and Ex n 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 ValvGuard. Damage to the equipment may result.

CAUTION:

Make sure that the ventilation output of the housing is not blocked!

This can prevent the safety function of the device.

2 TRANSPORTATION, RECEPTION AND STORAGE

The safety 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 ValvGuard meets the IP66 protection class according to EN 60529. Cable entry needs to be plugged according to IP66 and it is not allowed to mount the ValvGuard in a position where the cable entry is pointing upwards.

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 ValvGuard or other electrical instrumentation, our warranty is not valid.

If the ValvGuard is supplied with valve and actuator, the tubes are mounted and the ValvGuard adjusted in accordance with the customer's specifications.

The controller is equipped for connection according to VDI/VDE 3845.

Shaft coupling alternatives for the controller for Metso actuators are shown in Fig. 7.

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

3.2 Mounting on Metso actuators with VDI/VDE mounting face

See figures 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.
- ❑ **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 ValvGuard.
- ❑ Attach the bracket (1) to the actuator. The shaft coupling of the ValvGuard must fit into the ear (2) so that the pointer is located in the position shown in Fig. 7.

NOTE:

Special care must be taken that the shaft position has been set according to marking in VG9000H housing and the pointer in the shaft. Also make sure that the positioner fail action parameter (PFA) is set correctly (Section 4.4.3).

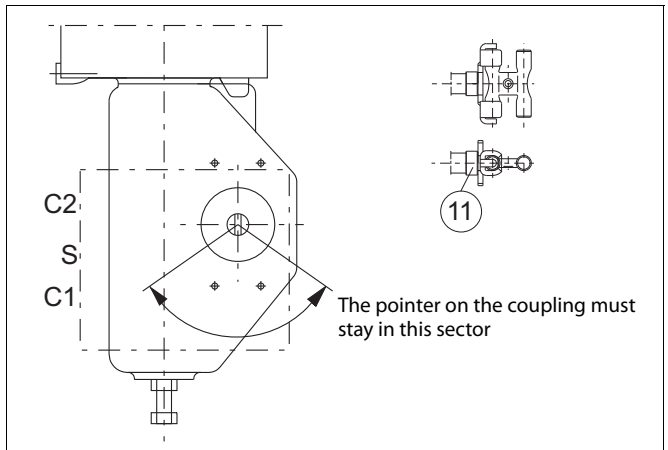


Fig. 7 Mounting on Metso actuator with VDI/VDE mounting face

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.
- ❑ 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.

NOTE:

Special care must be taken that the shaft position has been set according to marking in VG9000H housing and the pointer in the shaft. Also make sure that the positioner fail action parameter (PFA) is set correctly (Section 4.4.3).

3.4 Mounting and installation of VG9300

NOTE:

These instructions are only for the mounting and installation of VG9300, i.e. stainless steel version of VG9000H.

Mounting bracket

- ❑ Make sure the mounting bracket is suitable for the weight of the device. See detailed weight information in Section 1.5.
- ❑ Three extra M8 mounting holes exist in the standard mounting face of the housing for additional support. See dimension drawings for VG9300 in pages 42-43 (Chapter 12). The use of this extra support is mandatory in addition to the standard mounting face.
- ❑ There are also two 6.5 mm holes for additional support when needed. See dimension drawings for VG9300 in Chapter 12.

Pipeline support

- ❑ Due to the extra weight of stainless steel version and/or possible heavy vibration, make sure there are proper supports in the pipeline to hold the weight of the valve assembly.

Spool valve protective cover

- ❑ The spool valve protective cover (454) has 2 pcs. of 1/2" NPT threaded openings.
- ❑ Openings allow an adequate exhaust capacity and breathing of the spool valve.
- ❑ Openings have breathers (456) installed, but they can be replaced with protective piping if needed and when necessary.
- ❑ If VG is installed vertically, it is recommended to replace the breather with protective piping in the opening pointing upwards.

Exhaust adapter

- ❑ The exhaust adapter (8) has a 1/2" NPT threaded opening.
- ❑ Opening allows an excess air to be released from the housing and to prevent overpressurization.
- ❑ Exhaust adapter has a breather (456) installed, but it can be replaced with protective piping if needed and when necessary.
- ❑ Opening in the exhaust adapter shall not be plugged!

Protective piping

- ❑ Piping of the spool valve cover and/or exhaust adapter shall be done in cases where it is assumed that water can go inside the spool valve cover or into the exhaust adapter in spite of breathers.
- ❑ Piping shall be done so that the blowing of the exhaust air is downwards and to prevent water to go inside the protective cover or the exhaust adapter.
- ❑ Minimum inside diameter of the piping is 13 mm.
- ❑ Exhaust adapter piping shall not be connected to the spool valve cover piping!

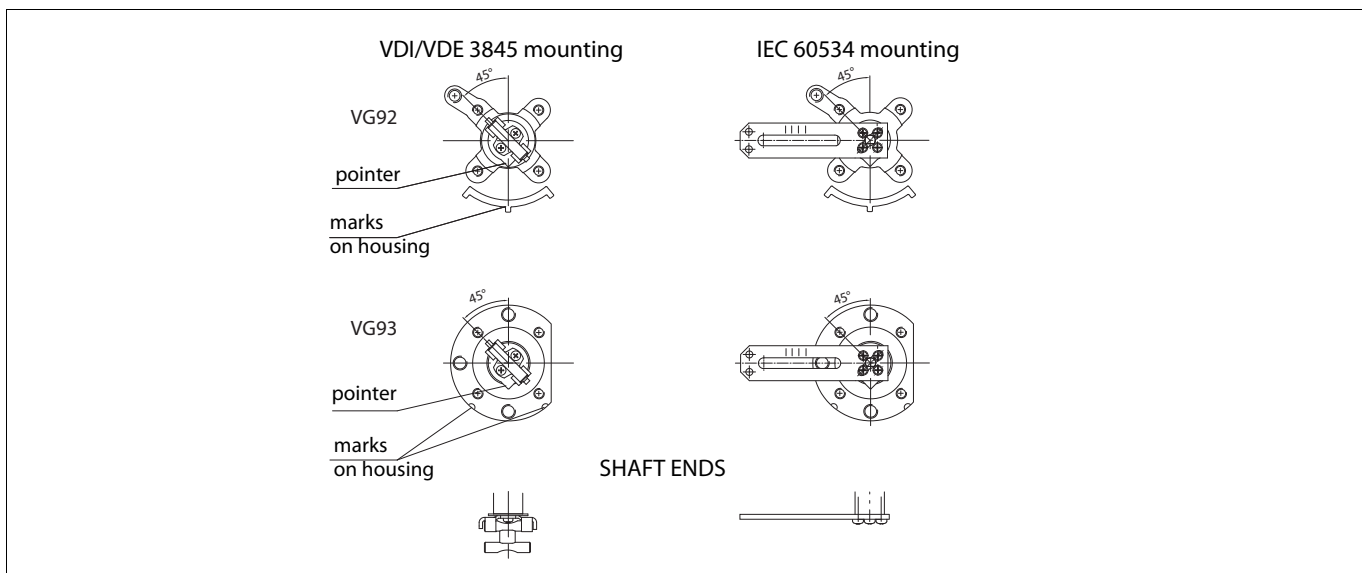


Fig. 8 Shaft coupling alternatives

3.5 Piping

CAUTION:
Do not exceed the permitted supply pressure of the ValvGuard!

Table 3 provides the recommended tube sizes in accordance with actuator sizes. Tube sizes are the minimum values allowed. For supply air choose a tube one size bigger. Supply air and actuator conduit sizes can be seen also in figure 9 below.

CAUTION:
The stroking times mentioned in Table 3 are trendsetting. They are measured with 5 bar supply air pressure with actuator only and without a valve. They 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.

NOTE:
When opening/closing times are defined in the Table 3, the specified spool valve size can be used with that actuator size. If there is '-' sign in the table or if smaller actuators than shown in the table are used, please contact Metso.

NOTE:
When faster speeds are needed than shown in the table, QEV or volume booster can be used. Bypass valve is mandatory with volume boosters and QEV. Contact Metso for separate instrumentation diagrams and instructions.

NOTE:
When QEV or volume booster is used, VG with standard spool valve (VG9_15_) is required.

Connect the air supply to S. Connect C1 and C2 to the actuator, see Fig. 10. C1 must be plugged if single-acting actuator.

NOTE:
When VG9000H_P type is used the actuator piping is reversed! C2 must be plugged if single-acting actuator.

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

NOTE:
An excess of sealant may result in faulty operation of the controller.
Sealing tape is not recommended.
Do not exceed torque of 30 Nm/22 lbf ft when fitting 1/4" NPT connectors to C1, C2 and S (VG921_).
Ensure that the air piping is clean.

NOTE:
A ValvGuard mounted on a spring actuator must be connected only as single-acting. See Fig. 10.

The air supply must be clean, dry and oil-free instrument air, see Section 1.5.

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 ValvGuard must not fall below 3 bar. Also note that if the air supply system allows the pressure at the ValvGuard to fall below the actuator minimum supply pressure during valve movement the stroke speed will be affected

Table 2 Spring rates

Actuator type	Spring rate (bar/psi)
B1JK	3 / 43
B1J	4.2 / 61
B1JV	5.5 / 80
QPX_A	1.4 / 20
QPX_B	2.8 / 41
QPX_C	4.1 / 60
QPX_D	5.5 / 80
Adjust regulator pressure to a level that is max 1 bar (14.5 psi) + spring rate.	

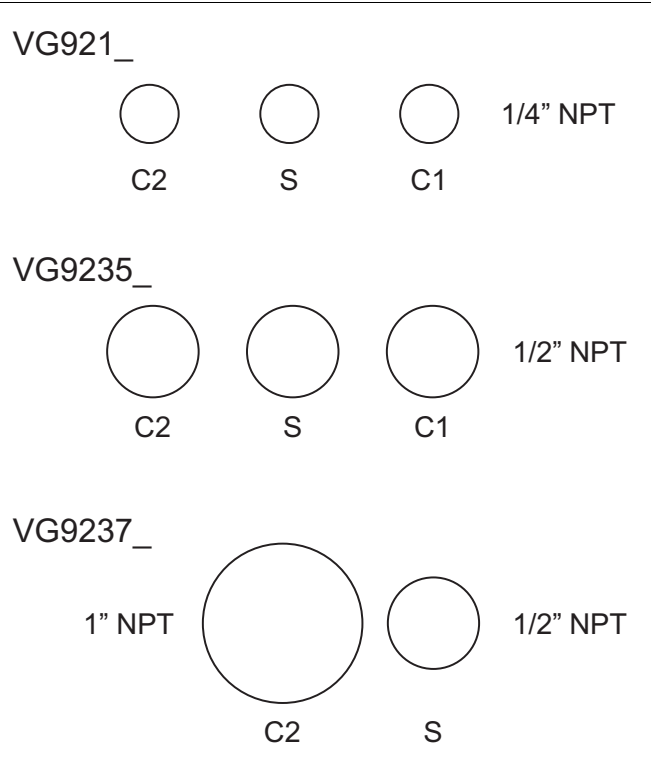


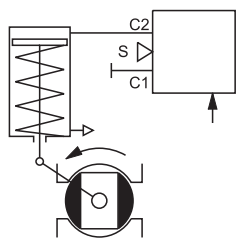
Fig. 9 Air supply and actuator conduits

Table 3 Piping and stroke times

Actuator				VG_12 Supply 1/4" NPT Actuator 1/4" NPT			VG_15 Supply 1/4" NPT Actuator 1/4" NPT			VG_35 Supply 1/2" NPT Actuator 1/2" NPT			VG_37_ (Single acting only) Supply 1/2" NPT Actuator 1" NPT		
B1C	Stroke vol. dm ³ / in ³		NPT	Piping	Open (s)	Close (s)	Piping	Open (s)	Close (s)	Piping	Open (s)	Close (s)	Piping	Open (s)	Close (s)
40	43	2624	3/4	-	-	-	10 mm or 3/8"	19	19	16 mm or 5/8"	4.9	5.6	-	-	-
50	84	5126	1	-	-	-	10 mm or 3/8"	38	38	16 mm or 5/8"	9.6	11	-	-	-
60	121	7380	1	-	-	-	10 mm or 3/8"	54	54	16 mm or 5/8"	14	16	-	-	-
75	189	11500	1	-	-	-	10 mm or 3/8"	85	85	16 mm or 5/8"	22	25	-	-	-
502	195	11900	1	-	-	-	10 mm or 3/8"	87	87	16 mm or 5/8"	22	25	-	-	-
602	282	17200	1	-	-	-	10 mm or 3/8"	126	126	16 mm or 5/8"	32	37	-	-	-
752	441	26900	1	-	-	-	10 mm or 3/8"	197	197	16 mm or 5/8"	50	57	-	-	-
B1J B1JA	Stroke vol. dm ³ / in ³		NPT	Piping	Air (s)	Spring (s)	Piping	Air (s)	Spring (s)	Piping	Air (s)	Spring (s)	Piping	Air (s)	Spring (s)
6	0.47	28.3	3/8	10 mm or 3/8"	See Note 1	See Note 1	-	-	-	-	-	-	-	-	-
8	0.9	55	3/8	10 mm or 3/8"	See Note 1	See Note 1	10 mm or 3/8"	0.5	1.0	-	-	-	-	-	-
10	1.8	110	3/8	10 mm or 3/8"	See Note 1	See Note 1	10 mm or 3/8"	0.7	1.4	-	-	-	-	-	-
12	3.6	220	1/2	10 mm or 3/8"	See Note 1	See Note 1	10 mm or 3/8"	1.2	2.7	16 mm or 5/8"	See Note 1	See Note 1	-	-	-
16	6.7	409	1/2	10 mm or 3/8"	See Note 1	See Note 1	10 mm or 3/8"	3.2	4.8	16 mm or 5/8"	0.7	1.3	25 mm or 1"	See Note 1	See Note 1
20	13	793	3/4	-	-	-	10 mm or 3/8"	4.6	9.3	16 mm or 5/8"	2.5	3.0	25 mm or 1"	See Note 1	See Note 1
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
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
40	97	5919	1	-	-	-	10 mm or 3/8"	See Note 1	See Note 1	16 mm or 5/8"	See Note 1	See Note 1	25 mm or 1"	See Note 1	See Note 1
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
QPX	Stroke vol. dm ³ / in ³		NPT	Piping	Air (s)	Spring (s)	Piping	Air (s)	Spring (s)	Piping	Air (s)	Spring (s)	Piping	Air (s)	Spring (s)
1	0.62	38	3/8	10 mm or 3/8"	See Note 1	See Note 1	10 mm or 3/8"	See Note 1	See Note 1	-	-	-	-	-	-
2	1.08	66	3/8	10 mm or 3/8"	See Note 1	See Note 1	10 mm or 3/8"	See Note 1	See Note 1	-	-	-	-	-	-
3	2.18	133	3/8	10 mm or 3/8"	See Note 1	See Note 1	10 mm or 3/8"	See Note 1	See Note 1	-	-	-	-	-	-
4	4.34	265	3/8	10 mm or 3/8"	See Note 1	See Note 1	10 mm or 3/8"	See Note 1	See Note 1	-	-	-	-	-	-
5	8.7	531	3/8	-	-	-	10 mm or 3/8"	See Note 1	See Note 1	16 mm or 5/8"	See Note 1	See Note 1	16 mm or 5/8"	See Note 1	See Note 1
VPVL	Stroke vol. dm ³ / in ³		NPT	Piping	Air (s)	Spring (s)	Piping	Air (s)	Spring (s)	Piping	Air (s)	Spring (s)	Piping	Air (s)	Spring (s)
300	0.44	27.1	1/4	10 mm or 3/8"	See Note 1	See Note 1	-	-	-	-	-	-	-	-	-
350	0.72	43.8	1/4	10 mm or 3/8"	See Note 1	See Note 1	10 mm or 3/8"	See Note 1	See Note 1	-	-	-	-	-	-
400	0.92	56	1/4	10 mm or 3/8"	See Note 1	See Note 1	10 mm or 3/8"	See Note 1	See Note 1	-	-	-	-	-	-
450	1.5	89	1/4	10 mm or 3/8"	See Note 1	See Note 1	10 mm or 3/8"	See Note 1	See Note 1	-	-	-	-	-	-
500	1.9	116	1/4	10 mm or 3/8"	See Note 1	See Note 1	10 mm or 3/8"	See Note 1	See Note 1	-	-	-	-	-	-
550	2.6	156	1/4	10 mm or 3/8"	See Note 1	See Note 1	10 mm or 3/8"	See Note 1	See Note 1	-	-	-	-	-	-
600	3.5	217	1/4	10 mm or 3/8"	See Note 1	See Note 1	10 mm or 3/8"	See Note 1	See Note 1	16 mm or 5/8"	See Note 1	See Note 1	-	-	-
650	6.0	364	1/8	10 mm or 3/8"	See Note 1	See Note 1	10 mm or 3/8"	See Note 1	See Note 1	16 mm or 5/8"	See Note 1	See Note 1	-	-	-
700	8.7	528	1/2	-	-	-	10 mm or 3/8"	See Note 1	See Note 1	16 mm or 5/8"	See Note 1	See Note 1	25 mm or 1"	See Note 1	See Note 1
800	15	917	1/2	-	-	-	10 mm or 3/8"	See Note 1	See Note 1	16 mm or 5/8"	See Note 1	See Note 1	25 mm or 1"	See Note 1	See Note 1
Note 1: Times to be defined later "- " means not applicable															

Note 1: Times to be defined later
 "-" means not applicable

SINGLE-ACTING ACTUATOR, SPRING TO CLOSE



NOTE: Valve shown in trip position

1. Self closing

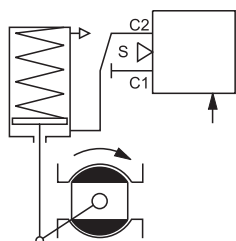
Default setting:

ATYP = 1-A

PFA = CLO (must be in the spring direction)

VTYP according to valve type

SINGLE-ACTING ACTUATOR, SPRING TO OPEN



NOTE: Valve shown in trip position

2. Self opening

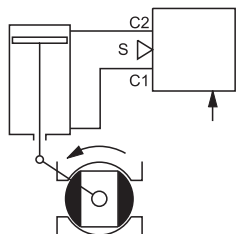
Default setting:

ATYP = 1-A

PFA = OPE (must be in the spring direction)

VTYP according to valve type

DOUBLE-ACTING ACTUATOR



NOTE: Valve shown in trip position

3. Self closing

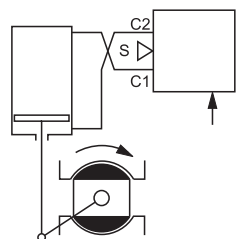
Default setting:

ATYP = 2-A

PFA = CLO

VTYP according to valve type

DOUBLE-ACTING ACTUATOR, REVERSED PIPING



NOTE: Valve shown in trip position

4. Self opening

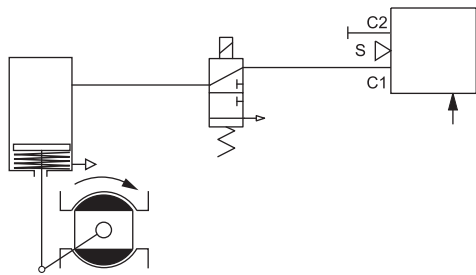
Default setting:

ATYP = 2-A

PFA = OPE

VTYP according to valve type

Fig. 10 Operation directions, air connections and assembly related parameters for VG9000H



SINGLE-ACTING ACTUATOR, SPRING TO CLOSE

1. Self closing

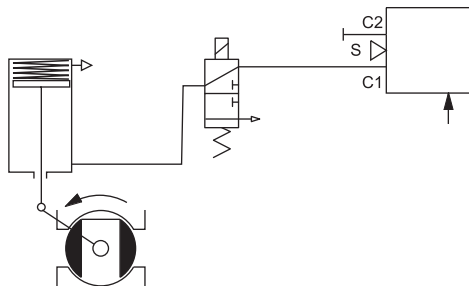
Default setting:

ATYP = 1-A

PFA = OPE

VTYP according to valve type

NOTE: SOV shown in energized condition, valve in normal position



SINGLE-ACTING ACTUATOR, SPRING TO OPEN

2. Self opening

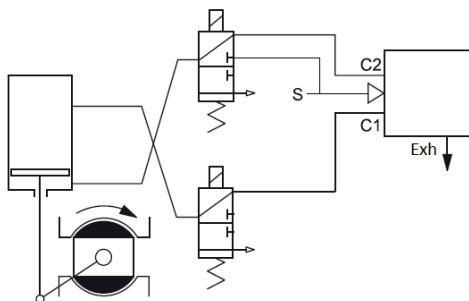
Default setting:

ATYP = 1-A

PFA = CLO

VTYP according to valve type

NOTE: SOV shown in energized condition, valve in normal position



DOUBLE-ACTING ACTUATOR

3. Self closing

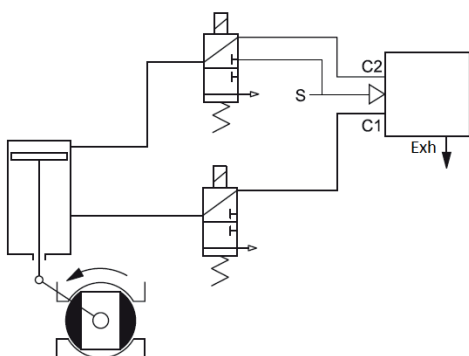
Default setting:

ATYP = 2-A

PFA = OPE

VTYP according to valve type

NOTE: SOV shown in energized condition, valve in normal position



DOUBLE-ACTING ACTUATOR

4. Self opening

Default setting:

ATYP = 2-A

PFA = CLO

VTYP according to valve type

NOTE: SOV shown in energized condition, valve in normal position

Fig. 11 Operation directions, air connections and assembly related parameters for VG9000H_P

3.6 Electrical connections

The VG9000H is powered by a 4–20 mA current loop from the safety system that also functions as a carrier to the HART communication.

The input signal cable is led through a M20 x 1.5 or 1/2" NPT cable gland. Additional conduit entries are available with extension housing or junction box. See type coding for details.

Connect the conductors to the terminal strip as shown in Fig. 12. It is recommended that the earthing of the input cable shield be carried out from the DCS end only.

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 or functions of the safety valve controller.

The (optional) position transmitter / status output is connected to 2-pole terminal PT as shown in Fig. 12. The position transmitter / status output needs an external power supply. The VG9000H and the position transmitter / status output circuits are galvanically isolated and withstand a 30 V DC voltage.

For SIL certified position transmitter, please see Sections 8, 11.1 and 11.6.

NOTE:

The VG9000H equals a load of 485 Ω in the current loop.

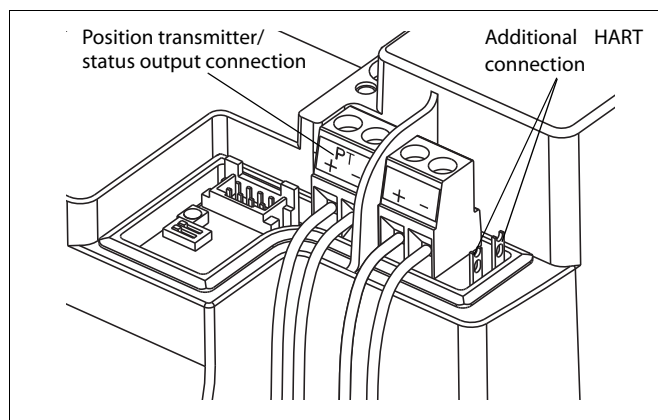


Fig. 12 Prewired terminals in the circuit board

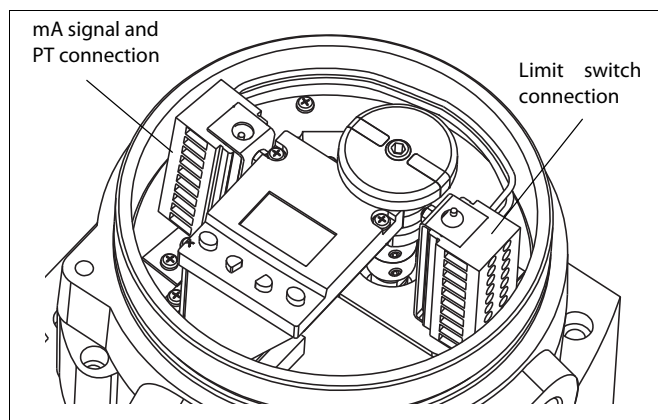


Fig. 13 Wiring terminals when the extension housing is used

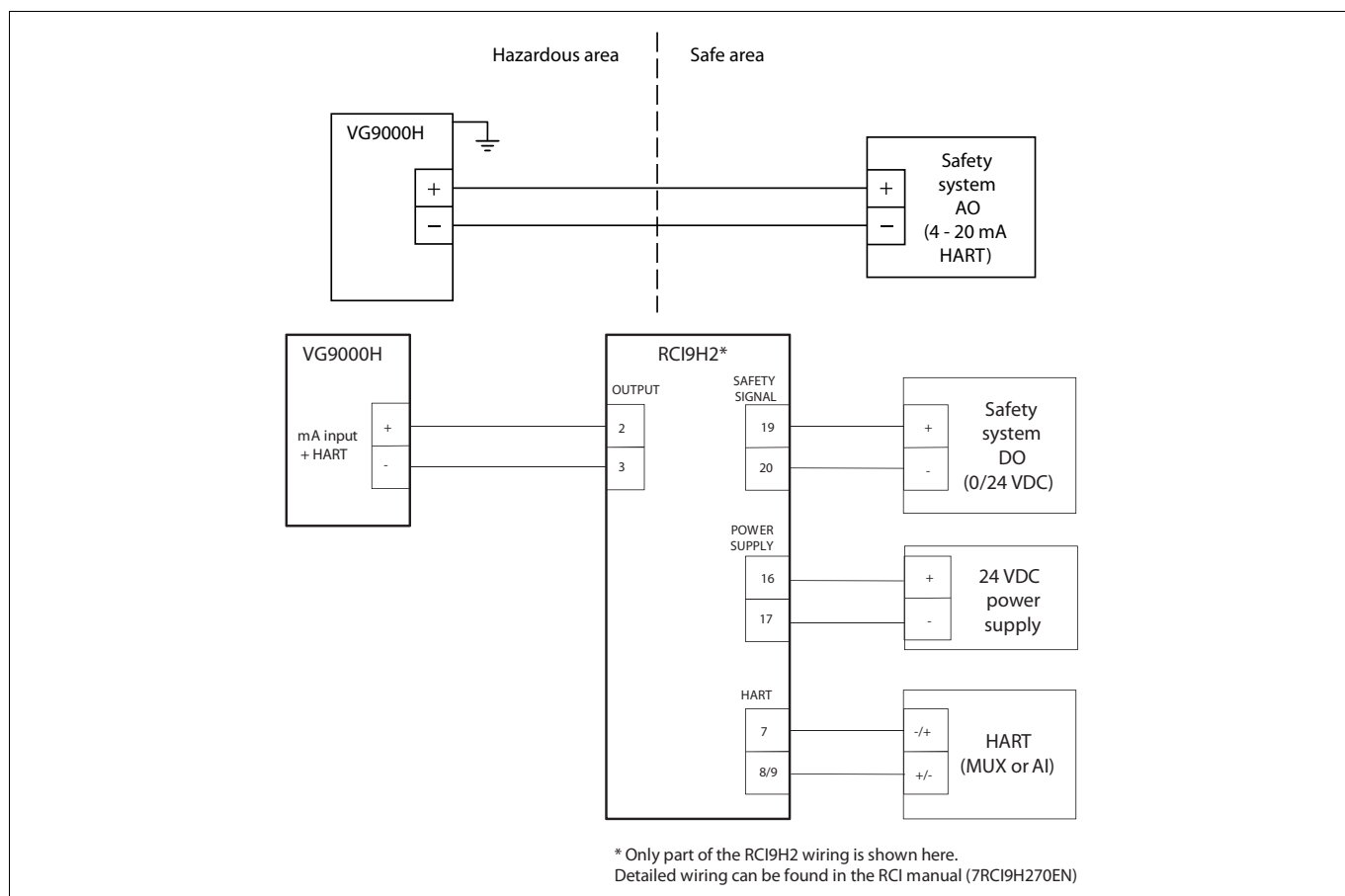


Fig. 14 VG9000H electrical connections with and without RCI9H2.
See Section 11.6. for other installations.

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.

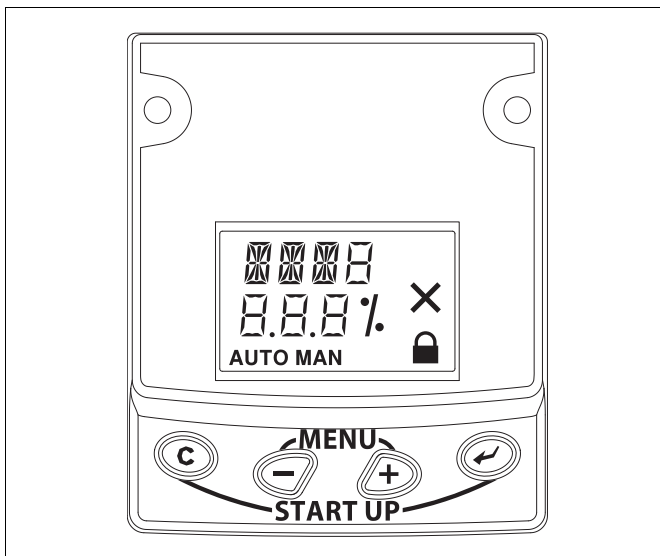


Fig. 15 Local user interface (LUI)

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 4 identifies the default unit and also optional unit of the measurement.

Table 4 Default / optional units of measurements

Measurement	Default unit	Optional unit
Valve position (POS)	Percentage (%) of full scale	Angle (ANG), where 0 % refers to 0 (angle)
Input signal (LOOP)	mA	%
Safety input signal (INP)	-	-
Actuator pressure difference (PDIF)	bar (BAR)	psi (PSI)
Housing pressure (Pint)	bar (BAR)	psi (PSI)
Supply pressure (SUPL)	bar (BAR)	psi (PSI)
Device temperature (TEMP)	°Celsius (C)	°Fahrenheit (F)

If the unit selection is altered via HART 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 $\odot$ key constantly. The display shows the current unit selection on the top row of the display. You may change the selection by pressing $\triangleleft$ or $\triangleright$ while keeping the $\odot$ 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.

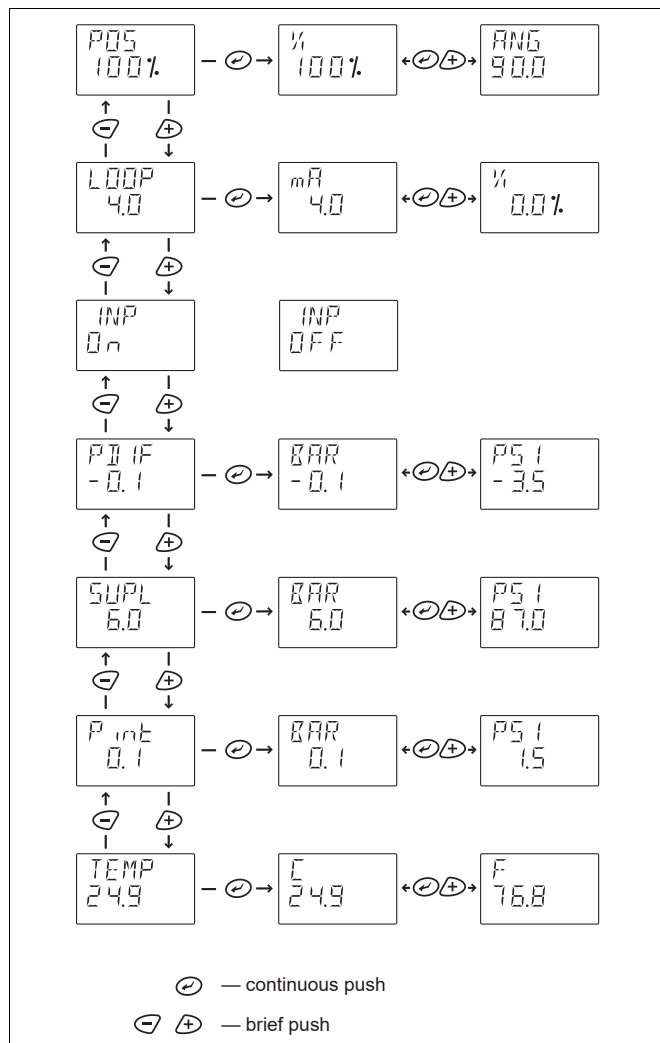


Fig. 16 Measurement monitoring and unit change

Valve position (POS) shows the valve travel position in percentage (%) of full scale. Optional unit is angle.

Input signal (LOOP) shows the input signal value in mA.

Safety input signal (INP) shows if the mA signal is below trip state threshold 6.0 mA (OFF) or in the normal level, above 16.0 mA (ON). Between 6.0 and 16.0 mA it can be either ON or OFF depending on the direction of the signal change.

Actuator pressure difference (PDIF) shows the actuator pressure in single acting actuators or pressure difference in double acting actuators in bars (BAR). Optional unit is psi (PSI).

Housing pressure (Pint) shows the pressure inside the enclosure in bars (BAR). Optional unit is psi (PSI). Too high housing pressure may prevent VG9000 to perform the safety action. There is alarm limit for this. It is set for 0.2 bar as default.

Supply pressure (SUPL) shows the air supply pressure value in bars (BAR). Optional unit is psi (PSI).

Device temperature (TEMP) shows the temperature inside the device in degree Celsius (C). Optional unit is degree Fahrenheit (F).

4.2 Guided start-up

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

The configuration parameters are listed in following order, see explanation from 4.4:

Actuator type	ATYP
Valve type	VTYP
Positioner fail action	PFA
Extra pneumatics instrumentation	EXTI
Actuator size	ACTS
Spool valve type	STYP
Automatic travel calibration	CAL

If you modify any of the parameters you will also need to calibrate the device. See 4.5 for detailed description.

NOTE:

You may cancel any action by pressing the $\odot$ button. Cancelling of operation returns user interface view one level up in menu hierarchy.

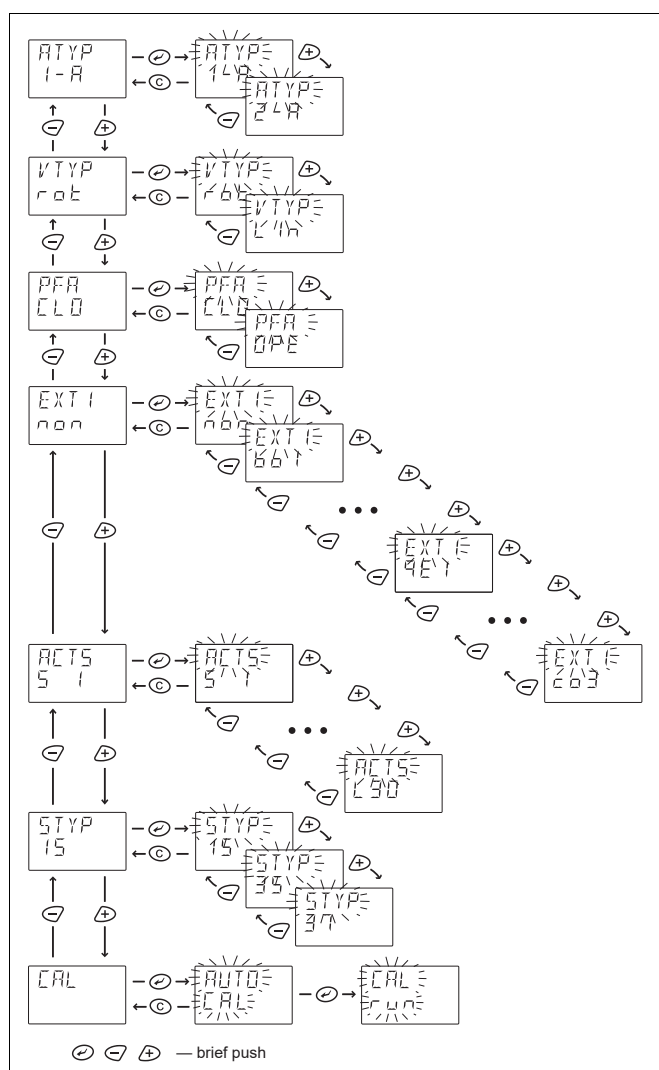


Fig. 17 Guided start-up

4.3 Configuration menu

The local user interface is organised in a menu structure. To enter the menus press $\oplus$ and $\ominus$ simultaneously in the measurement monitoring view panel. To move to the next or previous selection by pressing $\oplus$ or $\ominus$ accordingly (see Fig. 18.)

4.4 Configuration parameters

When *PFA* is on the display you may enter the configuration menu by pressing the $\ominus$ 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 $\ominus$ 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. Default parameters and parameter ranges can be seen in table in Chapter 13.

NOTE:

Default values can be restored by using DTM.

4.4.1 Actuator type, ATYP

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

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

4.4.2 Valve type, VTYP

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 *VTYP* display.

- ❑ After selecting *VTYP* on the display, press the $\ominus$ key to enter the edit state and the *VTYP* 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 $\ominus$ key when the desired value is shown on the display.

4.4.3 Positioner fail action, PFA

This section describes the function of the actuator.

Set value according to Fig. 10 for double acting actuators. Generally set value according to the valve fail safe position. 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. 10 for correct settings.

- ❑ Once *PFA* is displayed, press the $\ominus$ 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 *CLO* 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 $\ominus$ to conclude the operation.

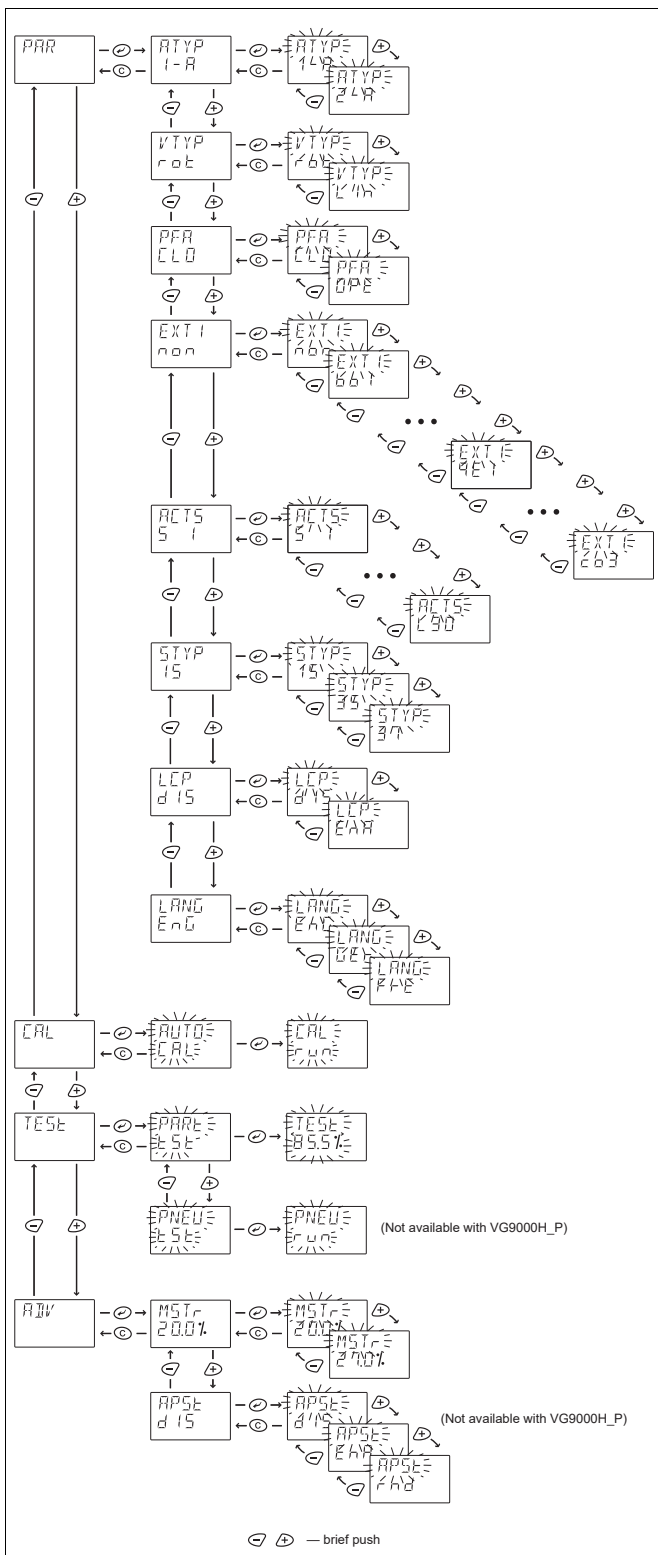


Fig. 18 Configuration.

4.4.4 Extra pneumatics instrumentation, EXT1

In order to optimise the control performance the device needs to be informed about the extra pneumatics instrumentation, if any.

- ❑ After selecting **EXT1** on the display, press the key to enter the edit state and **EXT1** starts to blink.
- ❑ Select between the following values:
 non = no external instrumentation
 b01 = booster type 1
 b02 = booster type 2
 b03 = booster type 3
 qE1 = quick exhaust type 1

qE2 = quick exhaust type 2

qE3 = quick exhaust type 3

c01 = combination type 1

c02 = combination type 2

c03 = combination type 3

Use the and keys to change the value.

- ❑ To conclude press the key when the desired value is shown on the display.

NOTE: If nothing else is defined, please select type 1 in any class.

- ❑ Select parameters as follows:

Table 5 Selecting extra pneumatics instrumentation parameters

Instrumentation type	Parameter (EXT1)
Volume booster (VB)	Booster type 1 (b01)
Quick exhaust (QEV)	Quick exhaust 1 (qE1)
Combination of VB and QEV	Combination type 1 (c01)

NOTE:

Bypass valve is mandatory with volume boosters and QEV. Contact Metso for separate instrumentation diagrams and instructions.

NOTE:

When QEV or volume booster is used, VG with standard spool valve (VG_15_) is required.

4.4.5 Actuator size, ACT5

This parameter defines the actuator size.

CAUTION:

It is important to select the correct actuator size because this parameter is used in device control. Erroneous value may cause instability.

- ❑ Look at e.g. the type code on the machine plate in the Neles B1-series actuators to check the size. If 3rd party actuator is used, please check the actuator stroke volume.
- ❑ After selecting **ACT5** on the display, press the key to enter the edit state and **ACT5** starts to blink.
- ❑ Select between the following values:
 51 = Neles B1J8 actuator
 (or stroke volume <1 dm³ / <61 in³)
 53 = B1J10 (1–3 dm³ / 61–183 in³)
 510 = B1J12–16 (3–10 dm³ / 183–610 in³)
 530 = B1J20–25 (10–30 dm³ / 610–1831 in³)
 L30 = B1C40–, B1J32– (>30 dm³ / >1831 in³)
 Use the and keys to change the value.
- ❑ To conclude press the key when the desired value is shown on the display.

4.4.6 Spool type, STYP

This parameter defines the spool type and size in VG9000H.

CAUTION:

It is important to select the correct spool type because this parameter is used in device control. Erroneous value may cause instability.

- ❑ Look at the machine plate in the device to check the typecode.
- ❑ After selecting **STYP** on the display, press the key to enter the edit state and **STYP** starts to blink.

- ❑ Select between the following values:
 15 = VG9_12 or VG9_15
 35 = VG9235
 37 = VG9237
 Use the $\oplus$ and $\ominus$ keys to change the value.
- ❑ To conclude press the $\odot$ key when the desired value is shown on the display.

4.4.7 Local Control Panel, LCP

Selection if Local Control Panel (LCP9H) is connected and enabled (*EnA*) or not connected and disabled (*dis*).

- ❑ Select between two options *dis* or *EnA* using the $\oplus$ and $\ominus$ keys.
- ❑ To conclude press the $\odot$ key when the desired value is shown on the display.

4.4.8 Language selection, LANG

- ❑ Select between three languages *EnG*, *GEr* or *FrE* (English, German or French) using the $\oplus$ and $\ominus$ keys.
- ❑ To conclude press the $\odot$ key when the desired value is shown on the display.

4.5 Valve travel calibration

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.

Select *CAL* from the menu by using $\oplus$ or $\ominus$ keys and press the $\odot$ key.

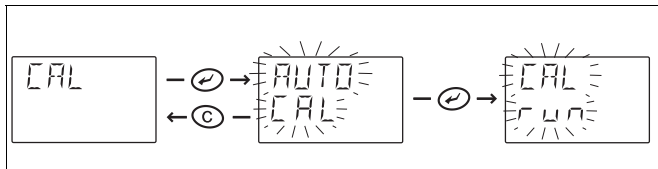


Fig. 19 Calibration selection

4.5.1 AUTO CAL calibration function

NOTE:

Valve position needs to be in the normal operating position, supply pressure needs to be in valid range, no supply pressure drop is allowed and any test cannot be active when calibration is started.

Pneumatics test needs to be performed successfully before the calibration.

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 $\odot$ key, which will show a text "*CALIBRATION CANCELLED*". If calibration fails, the reason will be shown, eg. "*CALIBRATION START FAILED*", "*POSITION SENSOR RANGE TOO SMALL*", "*CALIBRATION TIMEOUT*" or "*CALIBRATION FAILED*". After calibration the device will return to the main menu (measurement monitoring).

4.6 Testing, TEST

- ❑ Select between two tests Partial Stroke Test (*PART TEST*) or Pneumatics test (*PNEU TEST*).
- ❑ To conclude press the $\odot$ key when the desired value is shown on the display.

4.6.1 Partial Stroke Test, PART TEST

WARNING:

Partial Stroke Test moves the valve according to the stroke size and speed parameters set. Make sure that this procedure can be safely executed.

Partial stroke test can be run from here. Partial stroke test will be run according to the stroke size (*MSLr*) described in Section 4.7. Advance parameters.

- ❑ Select *PART TEST* from the menu by using $\oplus$ or $\ominus$ keys and press the $\odot$ key.
- ❑ Test can be cancelled by pressing $\odot$.

NOTE:

Valve position needs to be in the normal operating position, supply pressure needs to be in valid range, no supply pressure drop is allowed and any other test or calibration cannot be active when testing is started.

NOTE:

When double acting actuator is used, DTM or other HART user interface is needed to set 'Actuator Low Limit Pressure' -parameter to negative value, e.g. -2.

NOTE:

Pneumatics test (Section 4.6.2.) will be run automatically before the partial stroke test in some cases, e.g. when supply pressure has changed.

With the VG9000H_P version the pneumatics test will be run always before the partial stroke test.

Pneumatics test timeout parameter is valid also in this case.

4.6.2 Pneumatics test, PNEU TEST

NOTE:

Pneumatics test will check the pneumatics function of the device by moving the spool valve only and not moving the actuator or the valve.

Pneumatics test can be run from here.

- ❑ Select *PNEU TEST* from the menu by using $\oplus$ or $\ominus$ keys and press the $\odot$ key.
- ❑ Test can be cancelled by pressing $\odot$.

NOTE:

Valve position needs to be in the normal operating position, supply pressure needs to be in valid range and any other test or calibration cannot be active when testing is started.

NOTE:

Pneumatics test timeout parameter is 600 s. The value cannot be changed.

NOTE:

Separate pneumatics test is not available in VG9000H_P version. It will be run automatically always before the partial stroke test.

4.7 Advance parameters

4.7.1 Manual Stroke Size, $MSTr$

Targeted manual partial stroke test size. Range is 3.0–100 %. In VG9000H_P version the range is 3.0-50%.

- ☐ Once $MSTr$ is displayed, press the $\odot$ key to enter the edit state and the $MSTr$ will start blinking.
- ☐ Select values by pressing the $\oplus$ or $\ominus$ key. Holding down $\oplus$ or $\ominus$ key will start scrolling the value shown on the display faster.
- ☐ After the desired value is displayed, press the key $\odot$ to conclude the operation.

4.7.2 Automatic Partial Stroke Test, $APSt$

Selection if automatic partial stroke test is disabled (dis), enabled (EnA) or enabled with randomized range (rnd).

- ☐ Select between three options dis , EnA or rnd using the $\oplus$ and $\ominus$ keys.
- ☐ To conclude press the $\odot$ key when the desired value is shown on the display.

NOTE:

Automatic partial stroke test is not available in the VG9000H_P version.

4.8 Special displays

4.8.1 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.

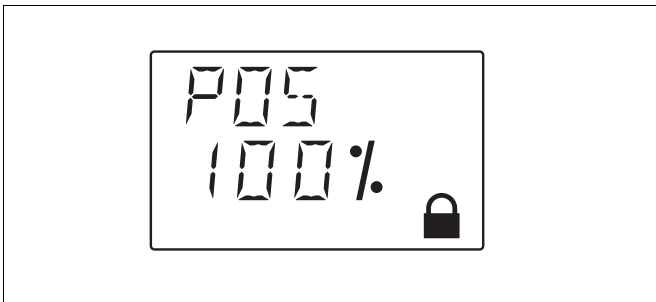


Fig. 20 LUI locked

4.8.2 Alarm or warning state

All failure conditions and statuses in VG9000H can be individually configured to three different classes: Alarm, Warning or Info, or they can be ignored. This configuration can be done with DTM (see separate DTM manual). Alarm state causes a blinking $\times$ to be shown on the display. In Warning state, the $\times$ symbol is steady.

4.8.3 Viewing of latest event

You may view the latest event by pressing the $\odot$ and $\ominus$ 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 $\odot$ key. By pressing the $\odot$ key, the message will disappear.

For the list of events see Chapter 6.

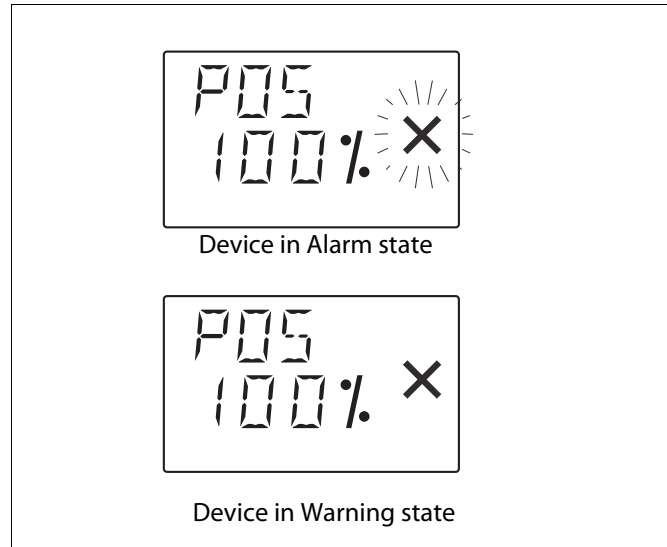


Fig. 21 Alarm and Warning states

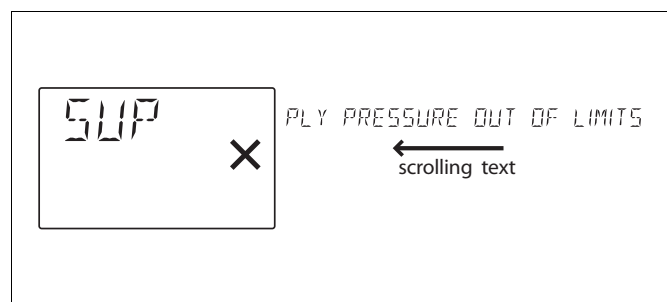


Fig. 22 Online alarm or warning state message

4.8.4 HART Communication active

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

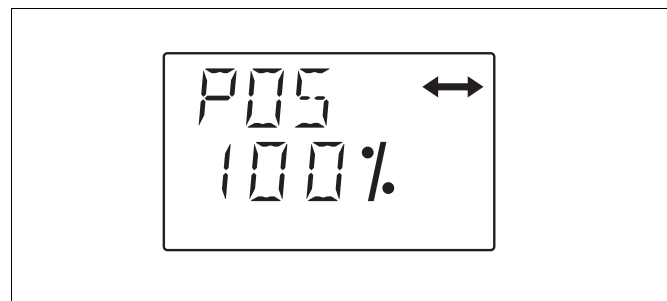


Fig. 23 HART communication activated

4.8.5 Write protection

The VG9000H can be write protected via HART. When device is write protected, following actions are prevented:

- ☐ all calibrations
- ☐ configuration parameter changes

When device is write protected, following actions are allowed:

- ☐ read events
 - ☐ read statistics
 - ☐ read parameters
 - ☐ test start
 - ☐ man/auto PST
 - ☐ man/auto Pneumatics test
 - ☐ ETT, if correct keying exists*
 - ☐ internal safety diagnostics test
- * Keying means that the passcode has been entered.

When the HART write protection is on, the lock symbol will be activated on the display, see Fig 21.

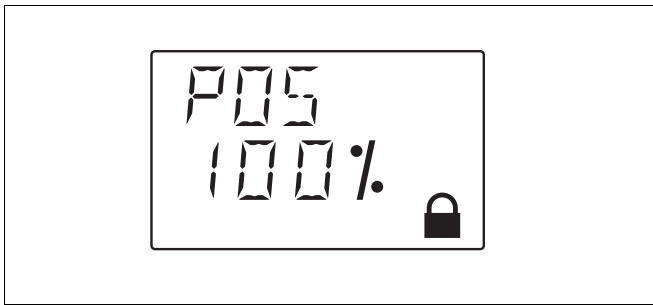


Fig. 24 Device write protected

4.9 HART burst mode

In burst mode, a device can send a HART reply repeatedly without repeated command. This can be used for sending e.g. device status information.

NOTE:

Burst mode can only be set and configured remotely via HART (DTM).

4.9.1 Burst mode control

Set burst mode control parameter to On for activating the burst mode. Default is Off.

4.9.2 Burst mode command

The command number sent in burst mode in HART communication. Allowed commands are as follows:

- ☐ 3: Read dynamic variables and loop current
- ☐ 9: Read device variables with status
- ☐ 33: Read device variables
- ☐ 169: Read short status

4.9.3 1st, 2nd, 3rd and 4th burst variable codes

Following device variables can be selected to the burst variables:

- ☐ Valve position
- ☐ Input signal
- ☐ Safety signal state
- ☐ Actuator pressure difference
- ☐ Supply pressure
- ☐ Housing pressure
- ☐ Device temperature

5 MAINTENANCE

Ex d NOTE:

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

Device type VG9_E6_:
Housing (2), Cover (100), Shaft assembly (11), Limit switch housing (300).

NOTE:

VG9000 maintenance can be done by Metso certified service personnel only.

The maintenance requirements of the ValvGuard 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 ValvGuard 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 ValvGuard VG9000H includes the following modules: prestage unit (120), spool valve (420), communication circuit board 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 VG9000H, the device should be calibrated.

5.1 Opening and closing of the cover

- ☐ Open VG9000H cover (100) by opening the M4 screw (107) first until it is not anymore attached to the housing (2). Then turn the cover counter-clockwise until it can be removed.
- ☐ Close the cover (100) in reverse order. Mount it first on top of the housing (2) and then turn it clockwise until threads are tight and the screw (107) is facing the spring (111) in the housing (2). Tighten the M4 screw (107).

5.2 Prestage

NOTE:

Prestage cannot be changed in the field.

NOTE:

The prestage and adapted plate 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. Make sure the prestage and adapter plate are kept clean during the maintenance.

5.2.1 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).

5.2.2 Adapter plate removal

- ☐ Remove the screw (412) and remove the adapter plate. Adapter plate is only needed to be removed when replaced with new one.

5.2.3 Installation

- ☐ Install the new adapter plate, if it has been removed. Make sure the O-rings (411) are properly installed. Tighten the screw (412).
- ☐ 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.

5.3 Spool valve

NOTE:

Spool valve cannot be changed in the field.

NOTE:

If the maintenance operations are needed for the spool valve, it is advised to replace the whole spool valve assembly with a spare unit.

5.3.1 Restricted and standard capacities

Restricted capacity means the spool valve option 12 and standard capacity means the spool valve option 15 in VG type coding. See type coding in the machine plate for details.

5.3.1.1 Removal

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

- ❑ Before removing the spool valve assembly in VG931_, the spool valve cover (454) needs to be removed. Unscrew the M4 screws (4 pcs.).
- ❑ Working from the bottom side of the ValvGuard, unscrew the M5 screws (4 pcs.). Remove the spool valve (420) with gasket (63). Do not remove the spool valve adapter plate (421).

5.3.1.2 Installation

- ❑ Mount the spool valve (420) to the housing, and tighten the four M5 screws evenly.
- ❑ Mount the spool valve cover (454) (only in VG931_). Tighten the four M4 screws evenly.

NOTE:

If adapter plate (421) is lifted away from its place, special attention must be paid to ensure that gasket (174) and pipe (431) are properly attached to the housing. O-rings of the pipe must be handled carefully in order to avoid breakage.

5.3.2 High capacity

High capacity spool valve means the spool valve options 35 or 37 in VG type coding. See type coding in the machine plate for details.

5.3.2.1 Removal

- ❑ Unscrew the M5 screws (4 pcs.). Remove the spool valve (420) with gasket from the mounting block (421).

5.3.2.2 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.

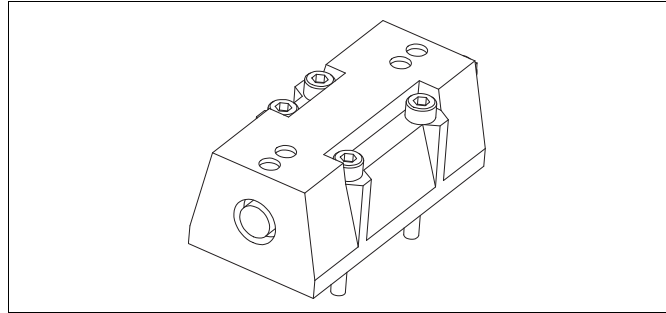


Fig. 25 Spool valve assembly

5.4 Communication circuit board

NOTE:

Communication circuit board cannot be changed in the field.

5.4.1 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.

5.4.2 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 ValvGuard to the actuator.

Ex 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.

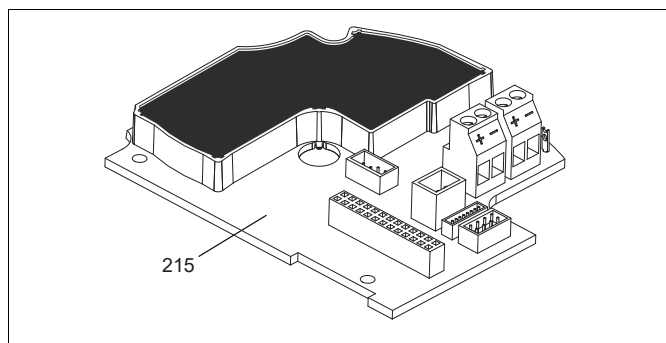


Fig. 26 Communication board

6 MESSAGES

These messages may appear in the local user interface.

NOTE:

Parameter limits can only be changed via HART.
See DTM manual for setting the parameter limits.

Display message	Description
ACTUATOR FULL STROKES COUNTER LIMIT EXCEEDED	Generated when actuator full stroke count exceeds the warning limit.
CALIBRATION CANCELLED	Generated when activated calibration routine is cancelled, by user or other process.
CALIBRATION FAILED	Generated when activated position, current, pressure or position transmitter calibration process failed.
CALIBRATION FAILED - ALARM STATE ACTIVE	Generated if alarm state becomes active during calibration process.
CALIBRATION FAILED - CALIBRATION ALREADY ACTIVE	Generated if another calibration process is active and a new request for calibration is done.
CALIBRATION FAILED - EMERGENCY TRIP ACTIVE	Generated if calibration process is called when Emergency Trip is active.
CALIBRATION FAILED - TOO LOW SUPPLY	Generated if supply pressure drop is detected during calibration process.
CALIBRATION START FAILED	Generated when calibration routine can not be started.
CALIBRATION START FAILED - MA LOOP CURRENT TOO LOW	Generated if the input signal is less than 8mA when starting the calibration. Valid for VG900H_P only.
CALIBRATION SUCCESSFUL	Generated when activated position, current, pressure or position transmitter calibration process ended successfully.
CALIBRATION TIMEOUT	Generated when calibration routine has lasted too long time.
CONTINUED WATCHDOG RESET	Generated when too many consecutive internal resets has been generated.
CONTINUED WATCHDOG RESET	Generated when software has lost the control, and internal watchdog generates reset.
EMERGENCY TRIP ACTIVATED	Generated when Emergency Trip has been activated.
ETT CLOSING TIME TOO HIGH	Generated if ETT closing time was detected too slow.
ETT OPENING TIME TOO HIGH	Generated if ETT opening time was detected too slow.
FACTORY DEFAULTS ACTIVATED	Generated every time when parameters are loaded with factory settings.
FACTORY SETTINGS CREATE FAILURE DETECTED	Generated when factory settings creation fails.
FACTORY SETTINGS RESTORE FAILURE DETECTED	Generated when factory settings restoration fails, i.e. current parameter set can not be loaded with factory settings.
HOUSING PRESSURE LIMIT EXCEEDED	Generated when housing pressure is larger than user definable limit.
LOOP CURRENT LOW LIMIT EXCEEDED	This event is generated if loop current drops below user configurable limit. Detection has also a latch time parameter.
none	Generated if comparator proof test fails.
none	Generated if FET #1 proof test fails.
none	Generated if FET #2 proof test fails.
PNEUMATICS FAILURE DETECTED	Generated when actuator pressure difference does not change even it should. This detection has a latch time parameter.
POSITION SENSOR FAILURE DETECTED	Generated when position sensor defect detected.
POSITION SENSOR RANGE TOO SMALL	Generated during calibration when position sensor range is too narrow, i.e. there is not enough dynamics in those measurements.
POSITION TRANSMITTER NOT ACTIVATED	Generated when communication with position transmitter / status output is lost.
PRESSURE SENSOR 1 FAILURE DETECTED	Generated when pressure sensor #1 defect detected.
PRESSURE SENSOR 2 FAILURE DETECTED	Generated when pressure sensor #2 defect detected.
PRESSURE SENSOR 3 FAILURE DETECTED	Generated when pressure sensor #3 defect detected.
PST BREAKAWAY PRESSURE TREND HIGH LIMIT EXCEEDED	Generated when PST breakaway pressure trend high limit is exceeded.
PST BREAKAWAY PRESSURE TREND LOW LIMIT EXCEEDED	Generated when PST breakaway pressure trend low limit is exceeded.
PST COUNTER LIMIT EXCEEDED	Generated when PST (automatic or manual) count exceeds the warning limit.
PST LOAD FACTOR TREND HIGH LIMIT EXCEEDED	Generated when PST loadfactor trend high limit is exceeded.
PST LOAD FACTOR TREND LOW LIMIT EXCEEDED	Generated when PST loadfactor trend low limit is exceeded.
SETPOINT SENSOR FAILURE DETECTED	Generated when setpoint sensor defect detected.
SPOOL VALVE STUCK DETECTED	Generated if no spool movement was detected during pneumatics test. This could be caused by: 1. broken prestage unit 2. jammed spool valve 3. leakages in pipings
STATISTICS DATABASE ERROR DETECTED	Generated when statistics database write fails.
SUPPLY PRESSURE LIMIT EXCEEDED	Generated when supply pressure is out of warning limits. This detection has also a latch time parameter.
SUPPLY PRESSURE TREND LIMIT EXCEEDED	Generated if supply pressure trend low or high limit is exceeded.
TEMPERATURE LIMIT EXCEEDED	Generated when temperature is out of warning limits. This detection has also a latch time parameter.
TEMPERATURE TREND LIMIT EXCEEDED	Generated if temperature trend low or high limit is exceeded.
TEST CANCELLED	Generated when activated automatic or manual PST, Emergency Trip Test or pneumatics test is cancelled.
TEST DONE	Generated when activated automatic or manual PST, Emergency Trip Test or pneumatics test ended successfully.
TEST DONE	Generated when activated pneumatic test ended successfully.
TEST FAILED	Generated when requested automatic or manual PST, Emergency Trip Test or pneumatics test ended abnormally.
TEST OVERSHOOT DETECTED	This event is generated after manual or automatic PST if valve moves more than defined in user configurable parameter.
TEST PRESSURE DROP DETECTED	This event is generated during manual or automatic PST with single acting actuators only if actuator pressure drops below user configurable limit.
TEST START FAILED	Scheduled PST start was failed due to: 1. testing disabled 2. device in alarm state (only in automatic PST) 3. no supply pressure 4. trip detected 5. other test or calibration active
TEST START FAILED	ETT or pneumatics test start was failed due to: 1. testing disabled 2. device in alarm state 3. no supply pressure 4. trip detected 5. other test or calibration active
TEST START FAILED - DEVICE IN ALARM STATE	Generated if any test, excluding MAN PST, was requested and alarm state activated before request.
TEST START FAILED - INVALID START POSITION	Generated if test start position was not normal operation position (= other than safety position)
TEST START FAILED - MA LOOP CURRENT TOO LOW	Generated if the input signal is less than 6mA when starting the PST. Valid for VG900H_P only.
TEST START FAILED - TEST DISABLED MODE	Generated if one of following is met: 1. Scheduled Pneumatics test was requested, but Pneumatics testing was disabled. 2. ETT was requested, but key was not entered.
TEST TIMEOUT DETECTED	Generated if test-specific time for test execution was expired. Warning time is not included to time-out time.
TOTAL OPERATION TIME COUNTER LIMIT EXCEEDED	Generated when total operating time exceeds the warning limit.
UNINTENDED VALVE MOVEMENT DETECTED	Generated when unintended valve movement is detected.
VALVE CLOSE STUCK DETECTED	Generated if valve stays at closed position though it shouldn't.
VALVE FULL STROKES COUNTER LIMIT EXCEEDED	Generated when valve full stroke count exceeds the warning limit.
VALVE INTERMEDIATE STUCK DETECTED	Generated if valve stays at intermediate position (between open and closed position) though it shouldn't.
VALVE OPEN STUCK DETECTED	Generated if valve stays at open position though it shouldn't.
WRITE PROTECTION DISABLED	Generated when Total Write Protection has been removed.
WRITE PROTECTION ENABLED	Generated when Total Write Protection has been activated.

7 TROUBLE SHOOTING

Mechanical/electrical defects

1. Any request to change the valve position has no effect to the position

- ☐ 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
- ☐ Prestage is defective
- ☐ Spool mounted backwards into spool valve
- ☐ Supply pressure too low

2. Inaccurate positioning

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

3. Overshooting or positioning too slow

- ☐ 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
- ☐ Spool valve dirty

4. Error during valve travel calibration

- ☐ The parameter setting PFR incorrectly selected
- ☐ Check the coupling alignment with the pointer, see Fig. 7.
- ☐ The actuator or valve did not move or was stuck during calibration
- ☐ Supply pressure too low
- ☐ Spool valve dirty

8 VG9_H/D_, VG9_H/R_, VG9_H/I_, VG9_H/K_, VG9_H/T01 (WITH LIMIT SWITCHES OR SIL PT)

8.1 Introduction

8.1.1 General description

VG9000H can be equipped with limit switches or external SIL certified position transmitter. VG9000H/D_ has a Dual Module sensor with two inductive proximity switches, VG9000H/R_ has two reed type proximity switches, VG9000H/I_ has two inductive proximity switches, VG9000H/K2_ has two microswitches and VG9000H/K4_ has four microswitches. VG9000H/T01 has SIL certified position transmitter. Limit switches and position transmitter are used for electrical position indication of the valves.

The switching points for limit switches may be chosen freely.

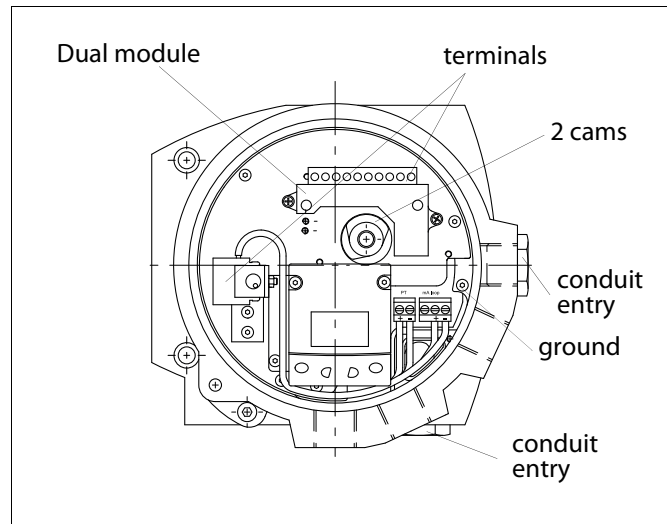


Fig. 27 VG9_H/D_ layout

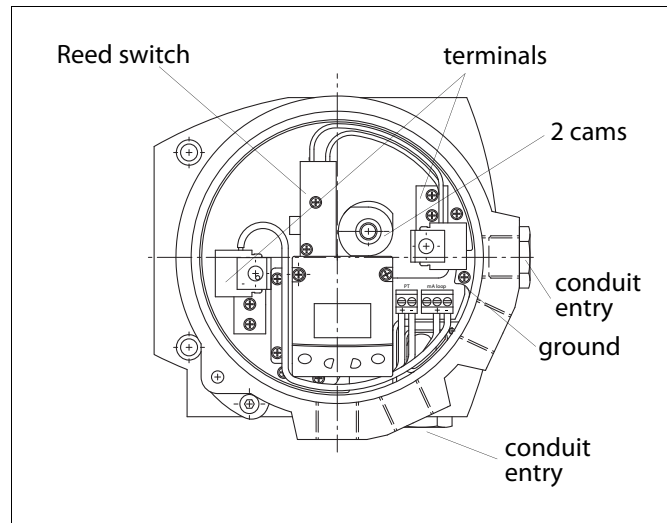


Fig. 28 VG9_H/R_ layout

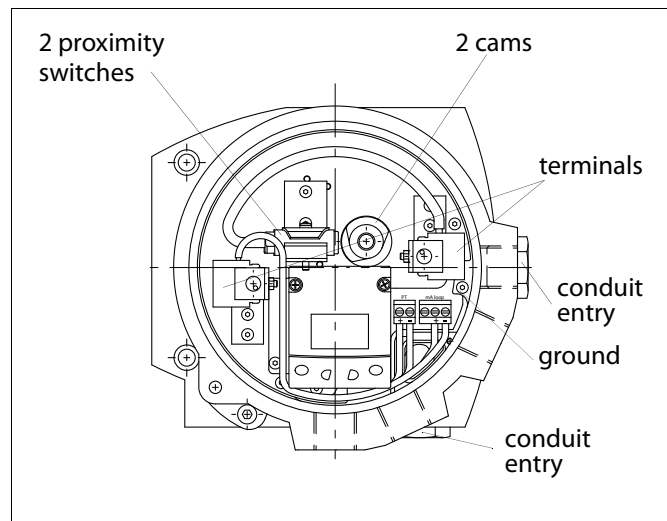


Fig. 29 VG9_H/I_ (I02, I09, I32, I56) layout

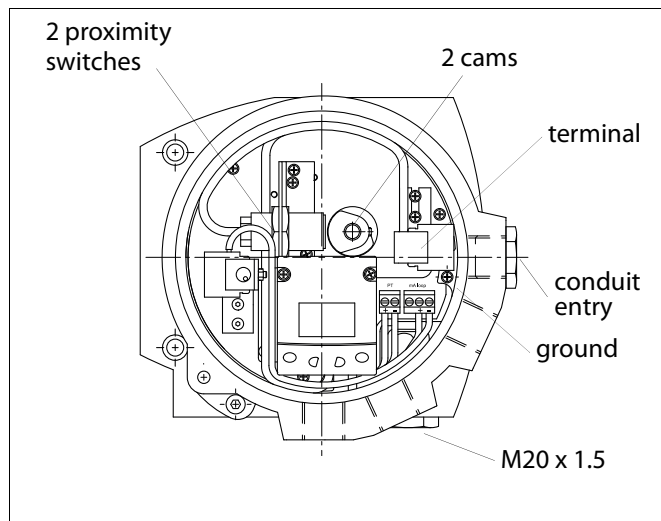


Fig. 30 VG9_H/I45 layout

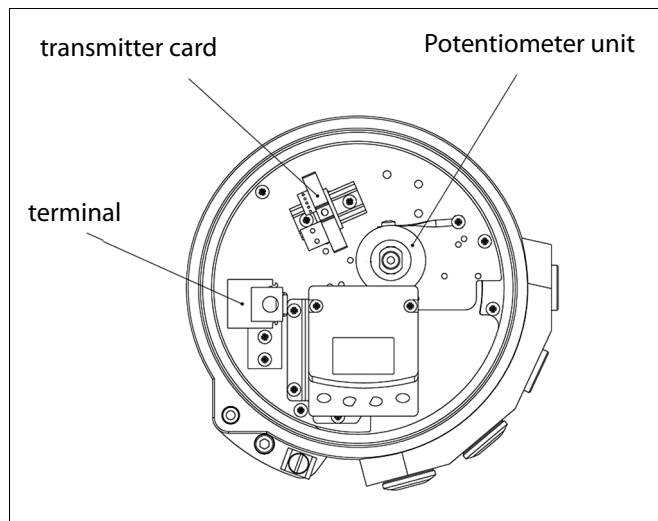


Fig. 33 VG9_/T01 layout

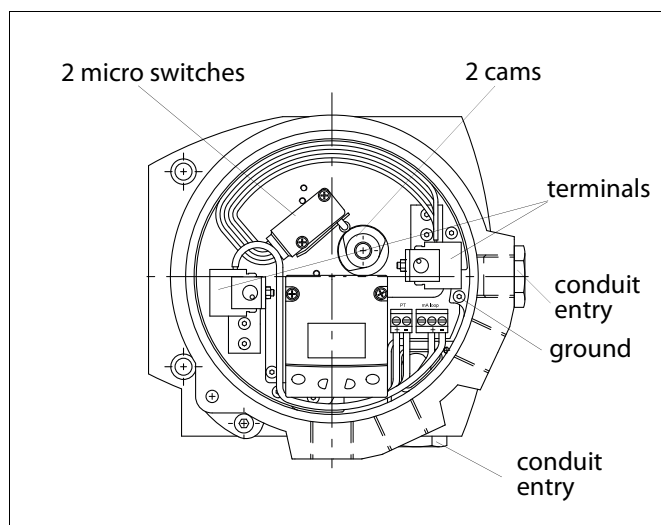


Fig. 31 VG9_H/K2_ layout

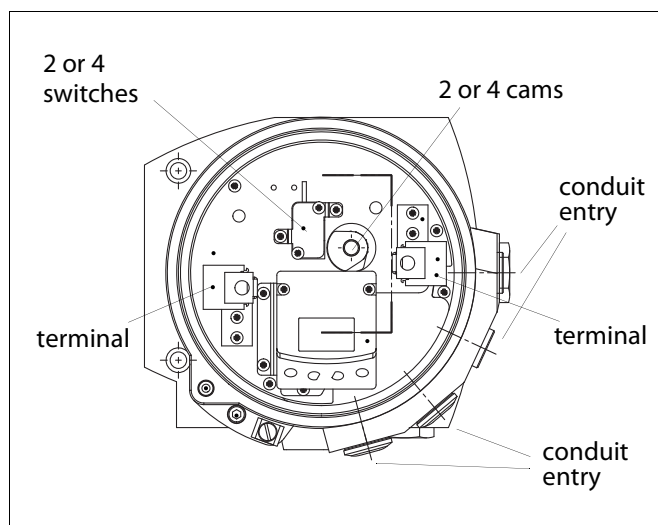


Fig. 34 VG9_/I57 and _/I58 layout.

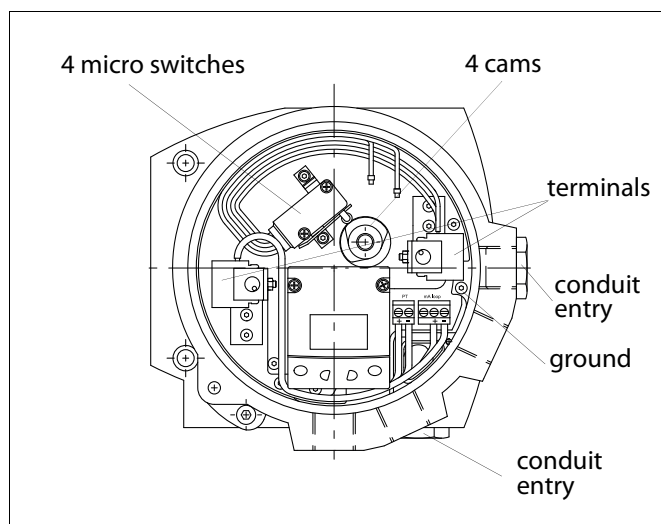


Fig. 32 VG9_H/K4_ layout

Detailed connection diagrams are shown in Section 11.6.

8.1.2 Markings

The limit switch is provided with an identification plate, see Fig. 35. Identification plate markings include:

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

The type designation is described in Chapter 15.



Fig. 35 Example of identification plate

8.1.3 Technical specifications

8.1.3.1 VG92_H/D_

Proximity switch: Inductive, Dual Module
2 sensors,
Normally Open (33)
Normally Closed (44)

Electrical values:

Metso SST Dual Module (33)

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

Metso Dual Module (44)

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

SIL: Usable up to SIL3 acc. to IEC61508

8.1.3.2 VG9_/R_

Reed switch type: Metso MaxxGuard G (01)

Metso MaxxGuard M (02)

Metso MaxxGuard H (04)

Type: SPDT (01, 02, 04)

Passive, intrinsically safe (02, 04)

Electrical rating: 300 mA / 24 V DC (01, 02)

200 mA / 125 V AC (01)

3 A / 240 V (04)

Max. voltage drop: 0.1 V at 10 mA

0.5 V at 100 mA

Contact: Rhodium

Number of switches: 2 (01, 02)

SIL: Usable up to SIL3 acc. to IEC61508

8.1.3.3 VG9_H/I_

Proximity switch: Inductive, diameter 8–18 mm
Sensing range 2 mm (02, 09, 56, 57, 58)

3 mm (45)

P+F NJ2-12GK-SN (02)

P+F NCB2-12GM35-N0 (09)

P+F NJ3-18GK-S1N (45)

ifm IFC2002-ARKG/UP (56)

P+F NJ2-V3-N (57, 58)

Electrical values: According to switch type

Switch accuracy: < 1°

Number of switches: 2 (02, 09, 45, 56, 57)

4 (58)

SIL: Usable up to SIL3 acc. to IEC61508(02, 45)

Usable up to SIL2 acc. to IEC 61508 (09, 57, 58)

8.1.3.4 VG9_H/K_

Microswitch type: OMRON D2VW-5 (25 or 45)
OMRON D2VW-01 (26 or 46)

(gold-plated contacts)

Protection class IP67

Resistive load: 3A: 250 V AC (25 or 45)

5A: 30 V DC

0.4A: 125 V DC

100 mA: 30 VDC / 125 V AC (26 or 46)

Switch accuracy: < 2°

Number of switches: 2 (25 or 26)

4 (45 or 46)

8.1.3.5 VG9_/T01

Output: 4–20 mA

Voltage range: 10 to 40 VDC

Recommended

voltage: 24 VDC, 50 mA min.

Max Load: 700 ohm @ 24VDC

Span: Adjustable from 20° to 355°

Max Linearity Error: +–0.35°

SIL: Usable up to SIL 2 acc. to IEC61508

8.1.4 Electric data and ambient temperatures

Table 6 Electric data

Limit switch code	Electric data	No. of switches	Ambient Range
Inductive proximity switches			
D33	2 A - 8-125 V DC, 24-125 V AC	1	See tables 7, 8 and 9
D44	3 mA; 1 mA, 6-29 V DC	1	
I02	Ui: 16 V, li: 52 mA, Pi: 169 mW	2	
I09	Ui: 16 V, li: 52 mA, Pi: 169 mW	2	
I45	Ui: 16 V DC, li: 52 mA, Pi: 169 mW	2	
I56	10-36 V DC, < 150 mA	2	
I57	Ui: 16 V DC, li: 52 mA, Pi: 169 mW	2	
I58	Ui: 16 V DC, li: 52 mA, Pi: 169 mW	4	
Reed type proximity switches			
R01	300 mA, 24 V DC; 200 mA, 125 V AC	2	See table 7
R02	passive, intrinsically safe, 300 mA, 24 VDC; 200 mA, 125 VAC	2	
R04	passive, V _{max} 240 V, I _{max} 3 A, W _{max} 100W	2	
Mechanical micro switches			
K25	3 A - 250 V AC, 0.4 A - 125 V DC, 5 A - 30 V DC	2	See table 7
K26	100 mA - 30 V DC / 125 V AC	2	
K45	3 A - 250 V AC, 0.4 A - 125 V DC, 5 A - 30 V DC	4	
K46	100 mA - 30 V DC / 125 V AC	4	

Table 7 Ambient temperatures, Ex d

Variant type	Ambient temperature ranges		
VG9000	T6 T80 °C	T5 T95 °C	T4 T105 °C
VG9abHE6c VG9abHE6c/I02 VG9abHE6c/K25 VG9abHE6c/K45 VG9abHE6c/K46 VG9abHE6c/B06 VG9abHE6c/R35	-40°C - +60 °C	-40...+75 °C	-40...+85 °C
VG9abHE6c/D33 VG9abHE6c/D44	-40...+60 °C	-40...+75 °C	-40...+82 °C
VG9abHE6c/R01 VG9abHE6c/R04	-40...+60 °C	-40...+75 °C	-40...+80 °C
VG9abHE6c/I09 VG9abHE6c/I45 VG9abHE6c/I57 VG9abHE6c/I58	-25...+60 °C	-25...+75 °C	-25...+85 °C
VG9abHE6c/I56	-25...+60 °C	-25...+75 °C	-25...+80 °C

Table 8 Ambient temperatures, Ex ia/ib

Variant type	II 1 G Ex ia IIC T6...T4 Ga / II 2 G Ex ib IIC T6...T4 Gb		
	Ambient temperature ranges		
	T6	T5	T4
VG9_X_ VG9_X_/102	-40...+50 °C	-40...+65 °C -40...+64 °C	-40...+80 °C
VG9_X_/109 VG9_X_/145 VG9_X_/157 VG9_X_/158	-25...+50 °C	-25...+65 °C -25...+64 °C	-25...+80 °C

Table 9 Ambient temperatures, Ex nA/ic

Variant type	II 3 G Ex nA IIC T6...T4 Gc / II 3 G Ex ic IIC T6...T4 Gc		
	Ambient temperature ranges		
	T6	T5	T4
VG9_X_ VG9_X_/102	-40...+60 °C	-40...+75 °C	-40...+85 °C
VG9_X_/109 VG9_X_/145 VG9_X_/157 VG9_X_/158	25...+60 °C	-25...+75 °C	-25...+85 °C

8.2 Installing limit switches on ValvGuard

- ❑ If the ValvGuard 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 ValvGuard. 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 bushings (346) to the shaft.
- ❑ Mount the LUI (223) on the holder (306).
- ❑ Replace the plastic plugs with metal ones in conduit entries which will not be used.
- ❑ 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.

VG9_/D_ or VG9_/I_: Observe the functioning of the proximity switch; activated when the active face is either covered or free.

8.4 Adjustment of limit switches

The pointer (109) need not be removed for adjustment.

When the limit switch is ordered together with the valve and the actuator, the 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.
- ❑ **VG9_/D_ or VG9_/I_:** 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 ValvGuard, and finally the limit switch.

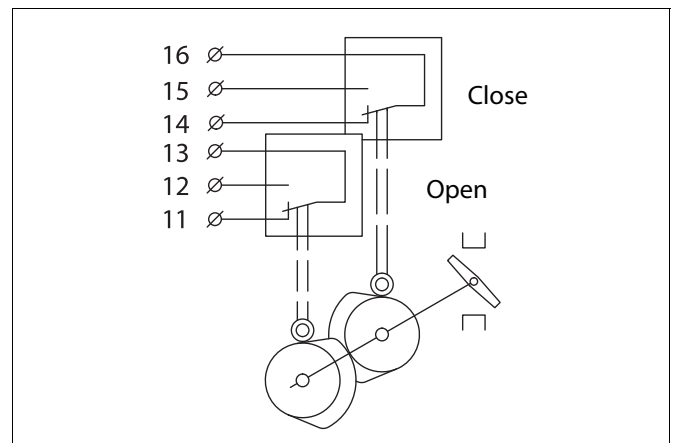


Fig. 36 Limit switch adjustment, 2 switches

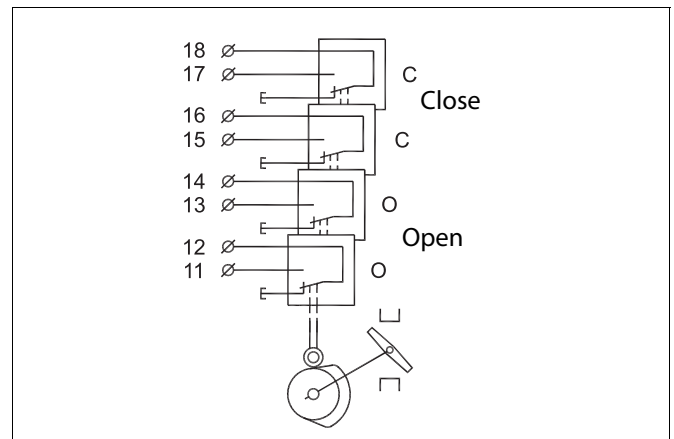


Fig. 37 Limit switch adjustment, 4 switches

- ❑ When adjustment is completed, turn the pointer (109) so that the yellow line is parallel with the valve closure member.

8.5 Position transmitter (T01) calibration instructions

The position transmitter (T01) needs to be calibrated according to the valve operation direction; clockwise (CW) to open or counter clockwise (CCW) to open. The calibration is carried out once VG9000 is connected to the actuator and the valve is in closed position (when using rising signal to open configuration). For correct calibration of the position transmitter follow these instructions:

- ❑ Loosen the potentiometer set screw located on the potentiometer outer surface and disconnect the potentiometer cable plug from the transmitter board terminal pins.
- ❑ Adjust the potentiometer unit to correct angle by rotating the inner section of the potentiometer (smaller diameter cylindrical part on top side of the potentiometer unit). The correct angle depends on the valve operation orientation; CCW or CW to open (see Fig. 38). The centerline mark on the potentiometer side helps aligning the potentiometer for initial position. Make sure that the valve and axis stay stationary in closed position when adjusting the potentiometer orientation.
- ❑ For closed position the resistance value of the potentiometer should be adjusted between 400–600 ohms. Measure the resistance by connecting an ohm meter to terminal connector at potentiometer cable. For CW to open applications measure the resistance between the yellow and red leads, for CCW to open applications measure the resistance between green and red leads.

- ❑ Once you have the potentiometer inner section aligned to correct resistance value, tighten the potentiometer set screw to connect the potentiometer firmly to the valve controller axis. Verify that the resistance values stays between 400-600 ohms after the tightening.
- ❑ The potentiometer cable can now be connected back to the transmitter board terminal pins. The positioning of the terminal plug is done according to valve operation orientation (see Fig. 39). The plug must always be aligned to one end or the other of the five pin terminal on the transmitter board.
- ❑ Connect DC power to the correct positive and negative terminals in the terminal strip (see chapter 11.6 for wiring details).
- ❑ Make sure the valve is stationary in closed position and adjust the zero trimpot to give 4 mA output.
- ❑ Operate the valve to desired open position.
- ❑ Make sure the valve is stationary in open position and adjust the span trimpot to give 20 mA output. The zero and span adjustments are non-interactive.

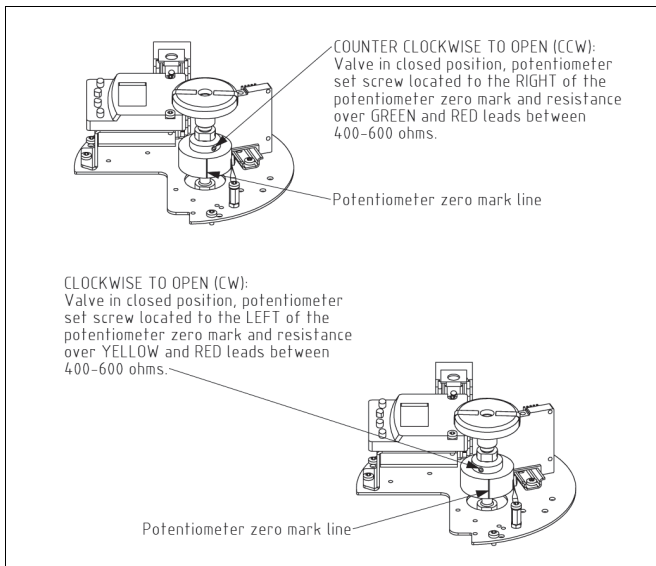


Fig. 38 Potentiometer operation.

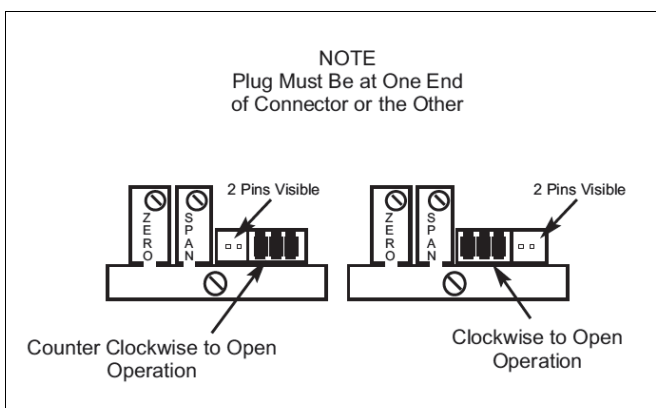


Fig. 39 Plug setting for transmitter operation.

8.6 Removal of the limit switches and position transmitter for accessing the ValvGuard

- ❑ Remove the cover (100) and the pointer (109).
- ❑ Loosen the screws (314) in the cam disks (313) and remove the cam disks and bushings (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 ValvGuard as applicable.
- ❑ Re-install the limit switch according to 8.2 and check the adjustment according to 8.4.

Ex 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 ValvGuard.

8.7 Circuit diagrams

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

8.8 Maintenance

Regular maintenance of the limit switch is not necessary.

9 TOOLS

Following tools are needed for the product installation and service:

- ❑ Flat screwdriver
 - ❑ 0.5 x 3.0 x 75 mm
- ❑ Torx screwdriver
 - ❑ T10
 - ❑ T20
- ❑ Hexagon screwdrivers
 - ❑ 3 mm
 - ❑ 6 mm

10 ORDERING SPARE PARTS

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

When ordering spare parts, always include the following information:

- ❑ type code, sales order number, serial number
- ❑ number of the parts list, part number, name of the part and quantity required

This information can be found from the identification plate or documents.

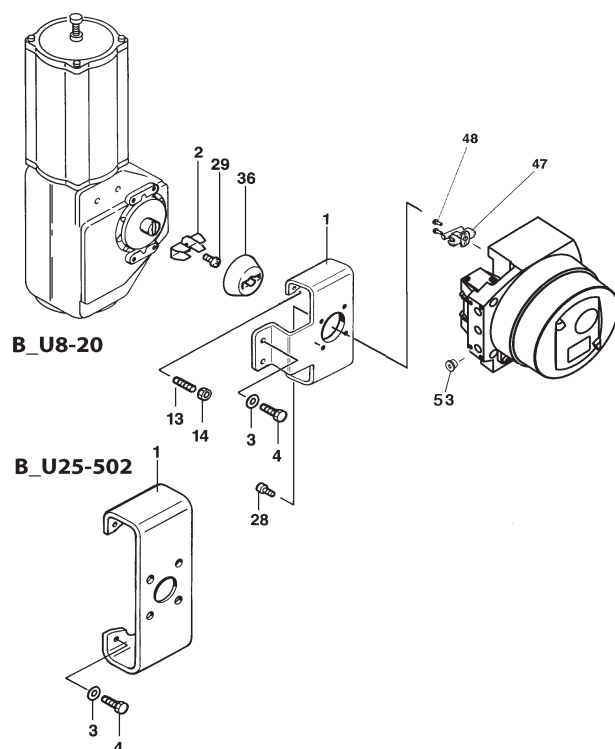
Item	Qty	Description
2	1	Housing
8	1	Exhaust adapter
9	1	Screw
11	1	Shaft assembly
15	1	O-ring
16	1	Washer
18	1	Wave spring
19	1	Bushing
36	1	Grounding screw
39	1	Protection cover
42	3	Screw
57	1	Conduit entry adapter
61	1	Exhaust cover
62	2	Screw (VG921_)
	4	Screw (VG923_)
63	1	Gasket
66	1	O-ring
72	1	Cooling plate
73	2	Screw
100	1	Cover (VG9000H red, VG9000H_P green)
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
264	2	Plug
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	Gauge block
435	1	O-ring
436	1	Connection box
437	1	Nipple
439	2	Nut
448	1	Bracket
449	2	Screw
450	1	Screw
451	1	Hexagon nut
453	1	Gasket
454	1	Protection cover
455	4	Screw
456	2 or 3	Breather
458	3	Washer
459	4	O-ring

AVAILABLE SPARE PART SETS:

- LUI (Local User Interface)
- Pointer
- Cover
- Limit switches
- Breather

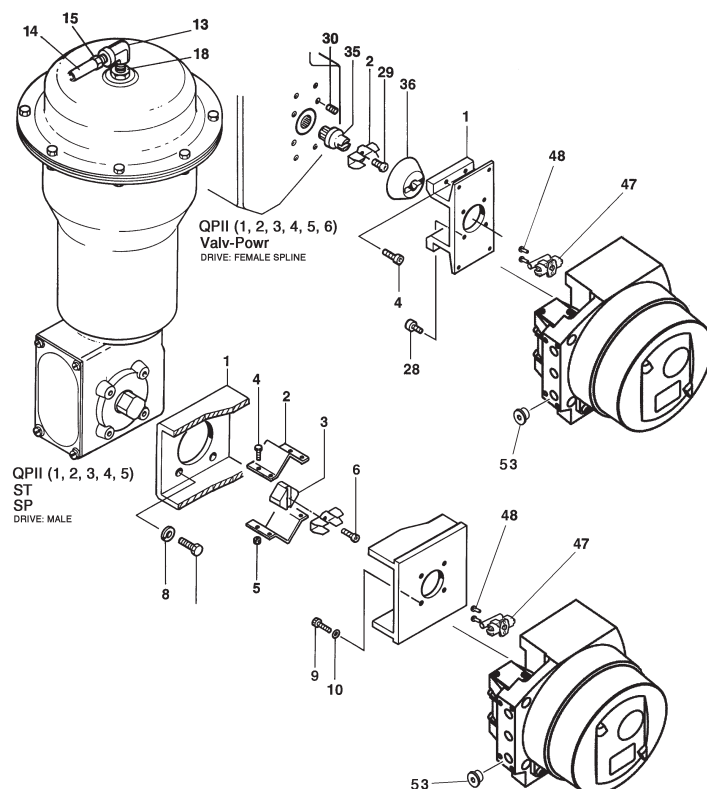
Item	Qty	Description
100	1	Cover
107	1	Screw
109	1	Pointer
110	1	Stop screw
111	2	Spring
223	1	Local user interface (LUI)
300	1	Housing
301	1	O-ring
302	1	Screw
304	2	Bracket
305	4	Screw
306	1	Bracket
307	3	Screw
308	2	Screw
309	2	Plug
311	1	Extension shaft
312	2 or 4	Screw
313	2 or 4	Cam disc
314	2 or 4	Screw
315	2	Terminal block
322	1	Proximity switch
323	2	Screw
324	1	Base plate
325	2	Screw
326	1	Screw
346	1 or 2	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	2	Bracket
366	4 or 6	Screw
367	4	Hex nut
377	1	Potentiometer unit
378	1	Visual indicator adapter
379	1	Nut
380	1	Bracket mounting screw
381	1	Screw
382	1	Potentiometer bracket
383	1	PT card bracket
384	1	Position transmitter card
449	2	Screw
450	1	Screw
451	1	Hexagon nut

11.3 Mounting parts for Metso B_U-series actuators



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)

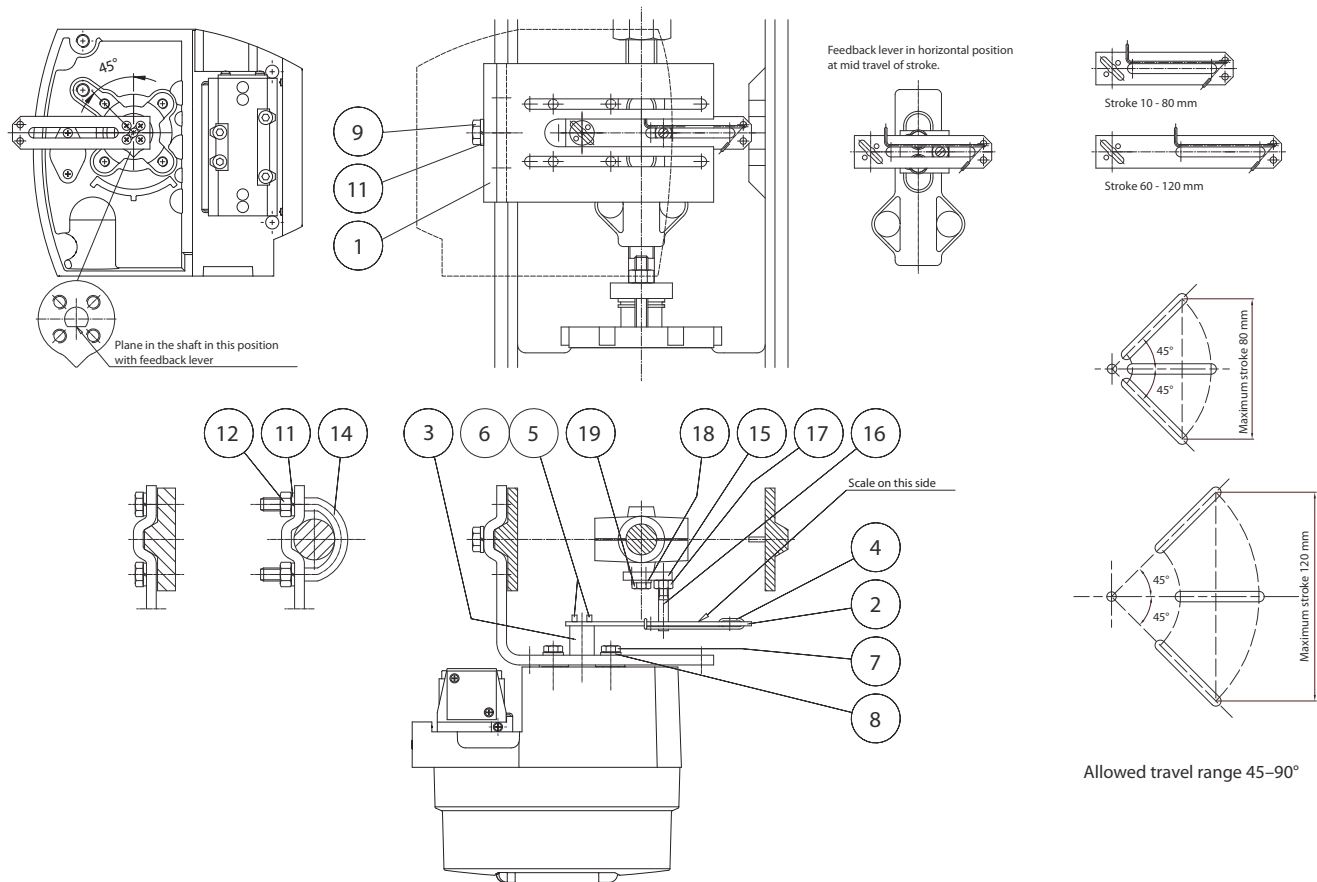
11.4 Mounting parts for Quadra-Powr® actuators



Item	Qty	Description
1	1	Mounting bracket
2	1	Ear
4	4	Screw
28	4	Screw
29	1	Screw
30	4	Screw
35	1	Adapter plug (QP II 1/S- 6/S only)
35	1	Adapter plate (QP II 2B/K thr. 6_/K)
36	1	Couplings jacket
47	1	Coupler socket
48	2	Screw
53	1	Plug

Item	Qty	Description
1	1	Mounting bracket
2	2	Coupling half
3	1	Adapter
4	4	Screw
5	4	Hex nut
6	1	Screw
7	4	Screw
8	4	Washer
9	4	Screw
10	4	Washer
47	1	Coupler socket
48	2	Screw
53	1	Plug

11.5 Mounting parts for linear actuators

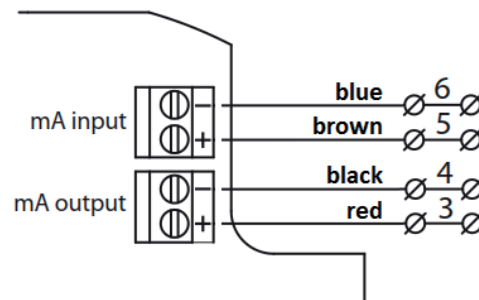


Item	Qty	Description
1	1	Bracket
2	1	Feedback lever
3	1	Filling piece
4	1	Clearance remove spring
5	4	Cross rec head screw
6	4	Washer
7	4	Hexagon screw
8	4	Washer
9	4	Hexagon screw
11	4	Spring washer
12	2	Hexagon nut
14	2	Clamp
15	1	Fixing plate
16	1	Special screw
17	1	Hexagon nut
18	2	Washer
19	2	Hexagon screw
54	2	Plug

11.6 Connection diagrams

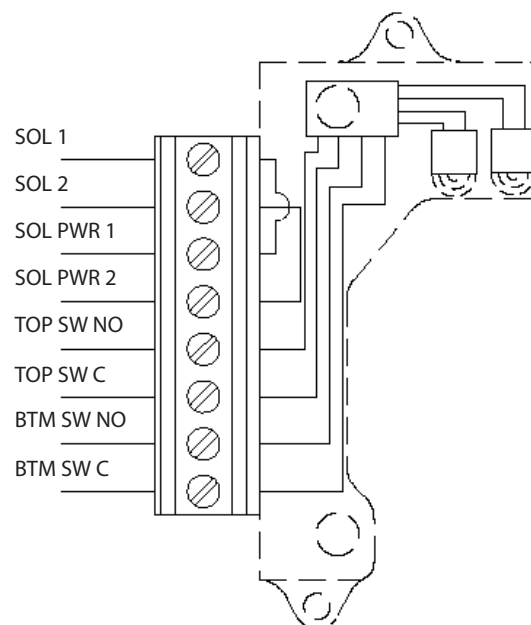
See Section 8.1.3 for additional limit switch data.

mA input and output (position transmitter / device status output) signal connections



Note: Terminal numbers are valid only when extension housing or junction box are used.

VG9_H/D33



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

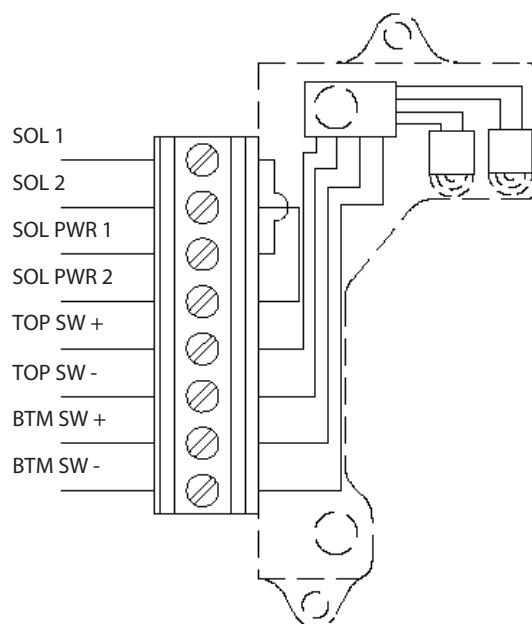
TOP SW NO: Positive connection for top switch

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 8.1.3.1 for electrical ratings.

VG9_H/D44

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

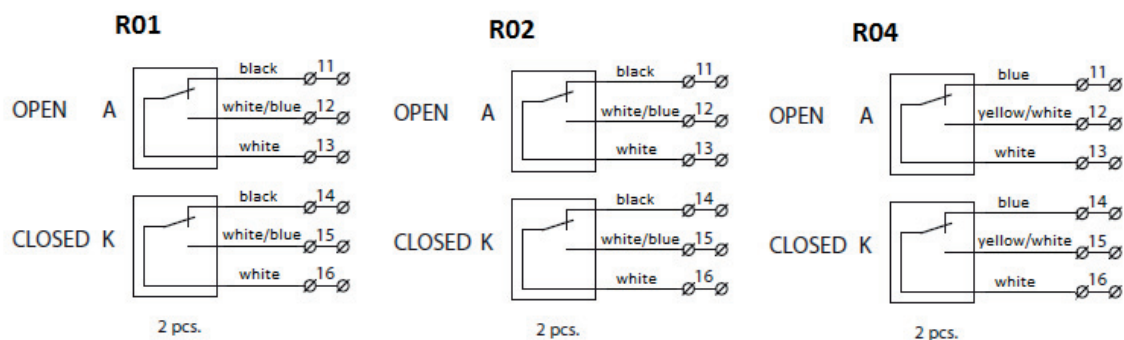
TOP SW +: Positive connection for top switch

TOP SW -: Negative connection for top switch

BTM SW +: Positive connection for bottom switch

BTM SW -: Negative connection for bottom switch

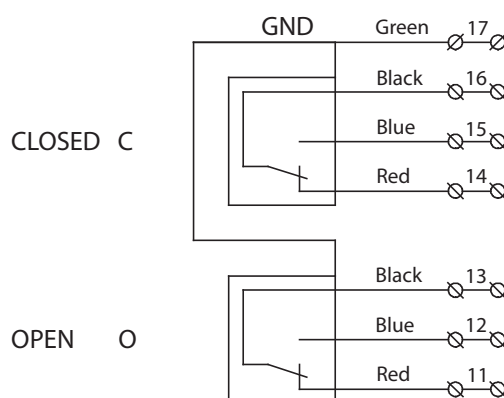
See Section 8.1.3.1 for electrical ratings.

VG9_H/R01, R02, R04

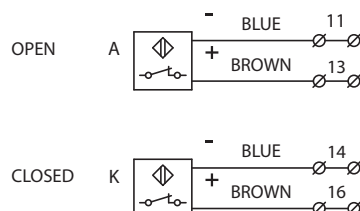
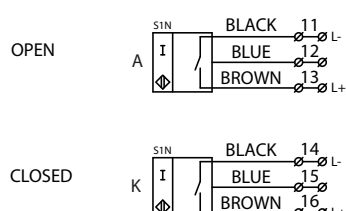
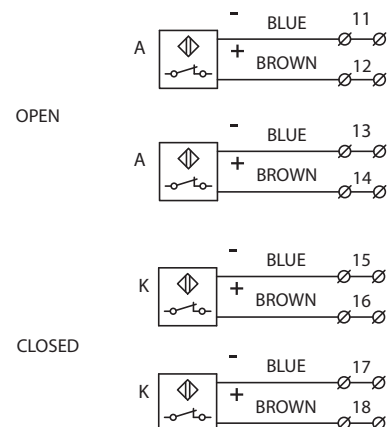
Connection diagram shows limit switch when actuator is in intermediate position.

Switch A (upper) is activated at the open limit of the travel and switch K (lower) at the closed limit.

See Section 8.1.3.2 for electrical ratings.

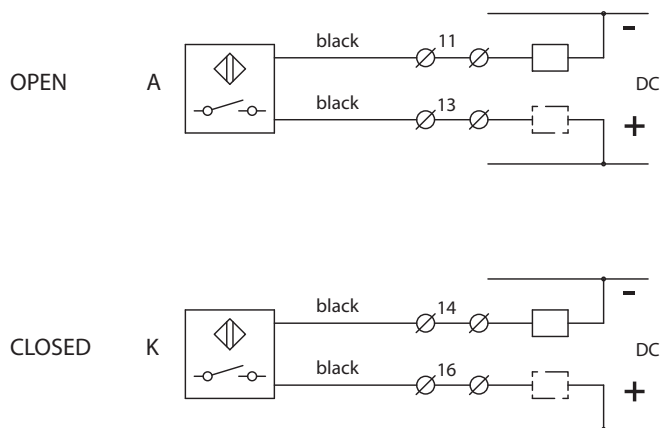
VG9_H/R35

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

VG9_H/I02, I09, I57**VG9_H/I45****VG9_H/I58****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.

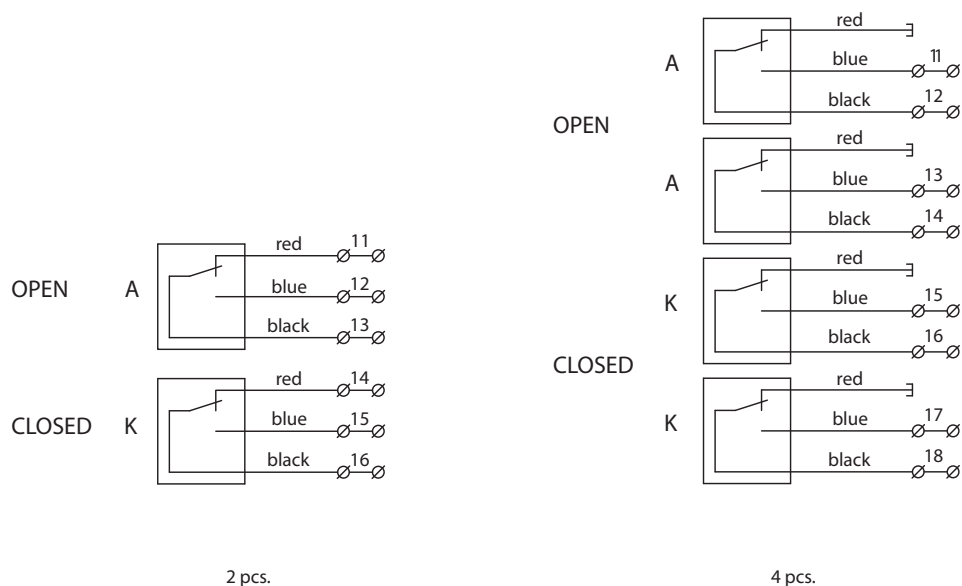
VG9_H/I56**Factory adjustment:**

Active faces of proximity switches are free when actuator is in intermediate position.

Active face A (upper switch) becomes covered at open limit of travel and face K (lower switch) at closed limit.

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

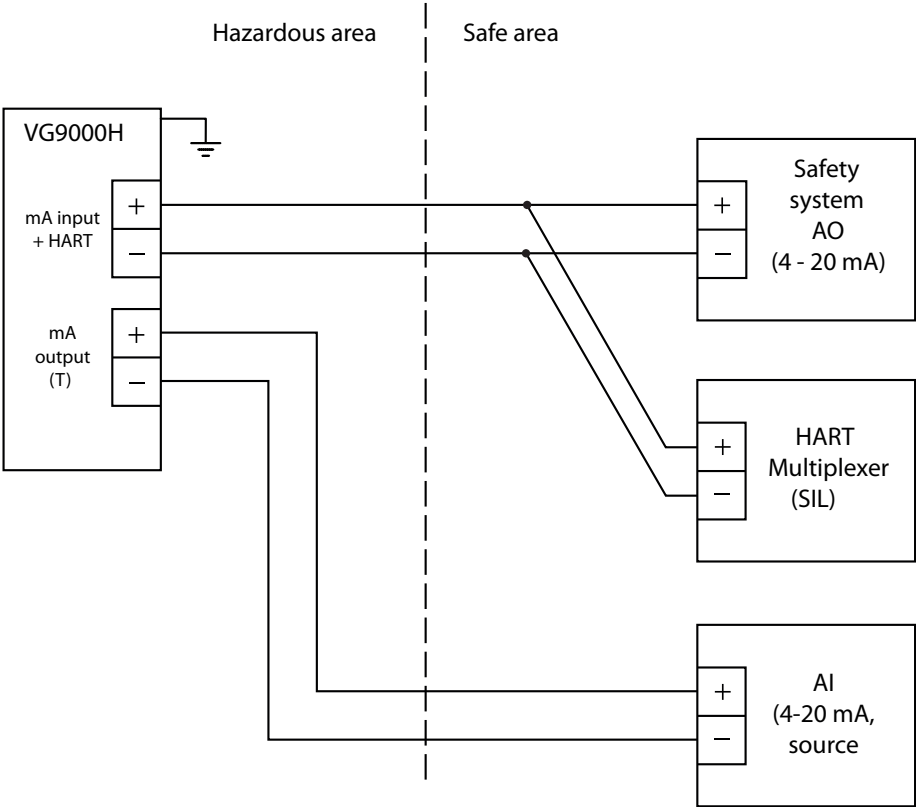
Connections: Load can be connected to + or -.

VG9_H/K25, K26, K45, K46

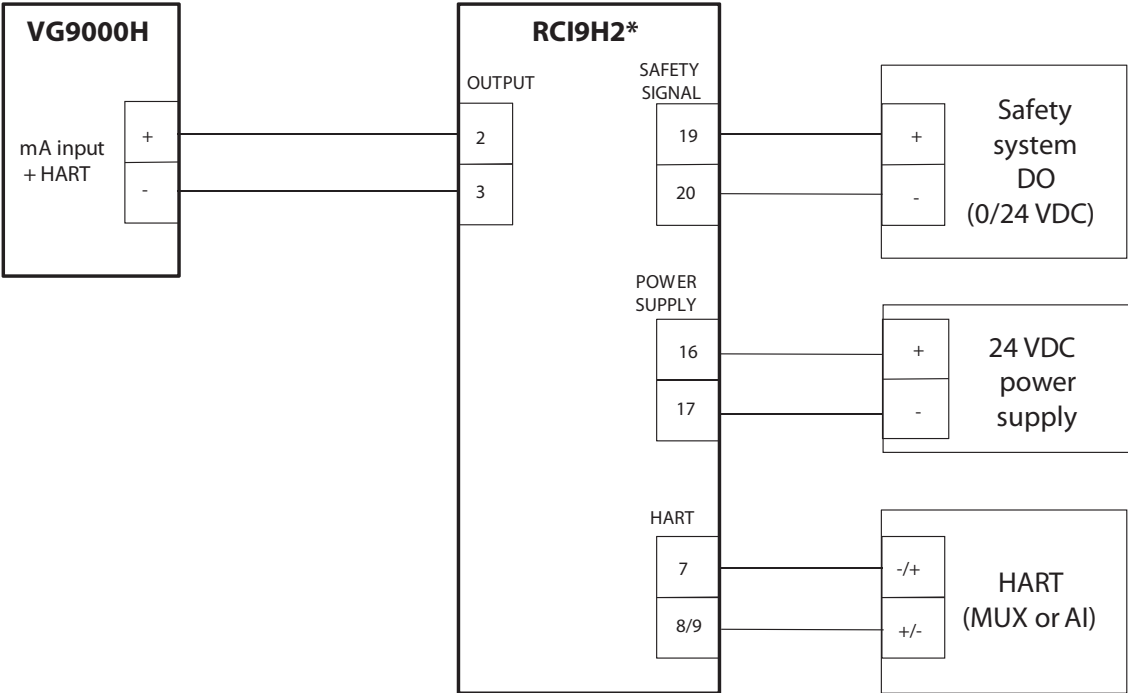
Connection diagram shows limit switch when actuator is in intermediate position.

Switch A (upper) is activated at the open limit of the travel and switch K (lower) at the closed limit.

AO, HART multiplexer

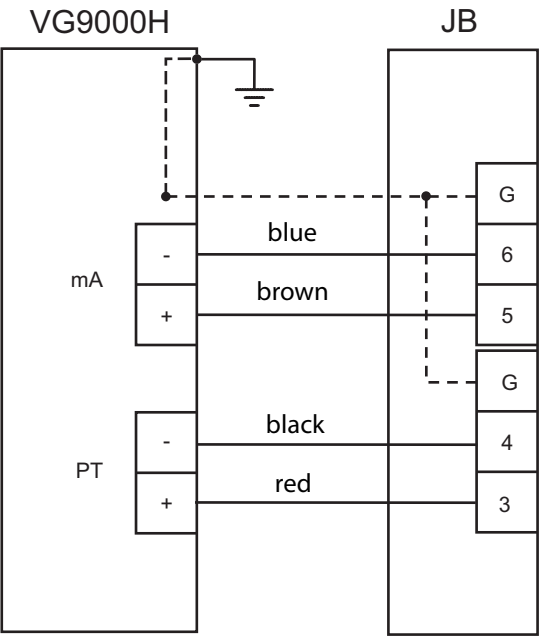


DO, RCI, HART AI

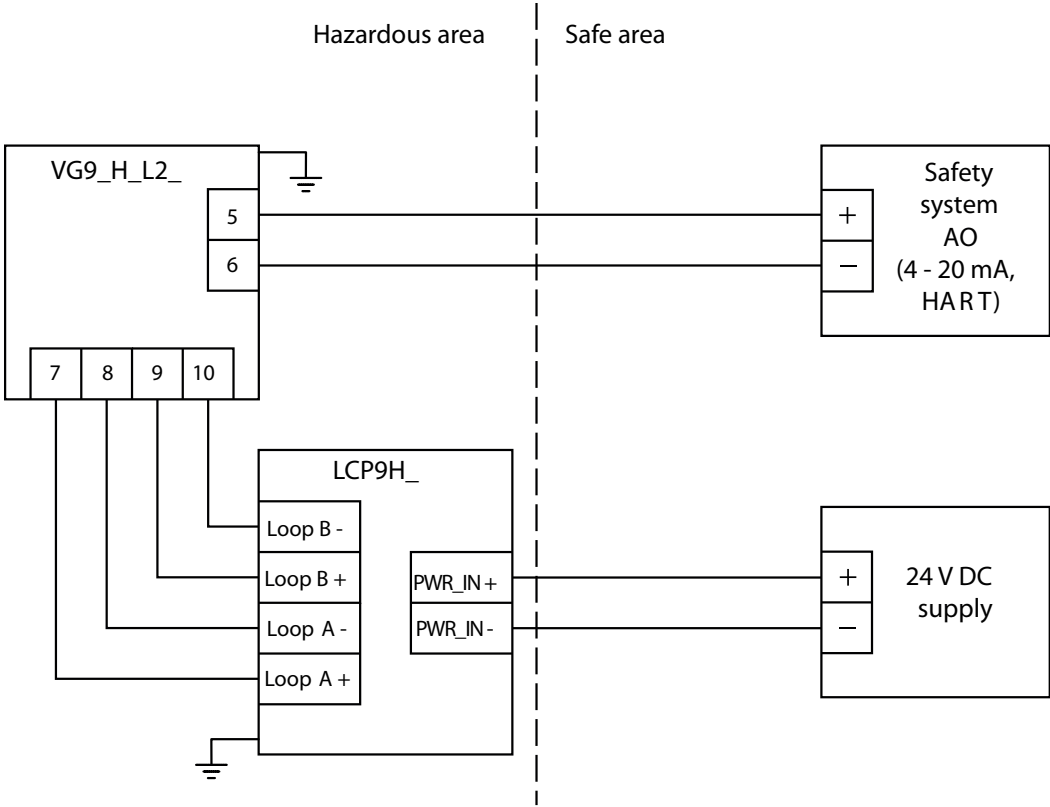


* Only part of the RCI9H2 wiring is shown here.
 Detailed wiring can be found in the RCI manual (7RCI9H270EN)

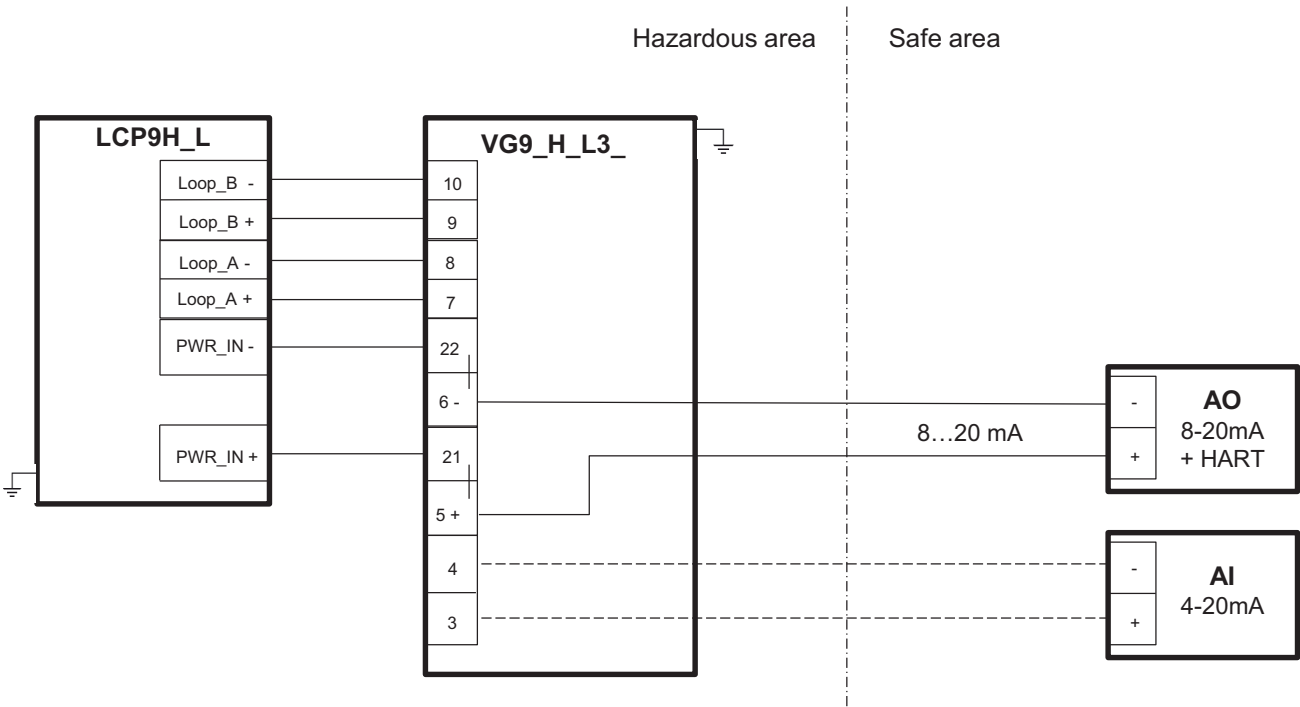
VG9_H_J



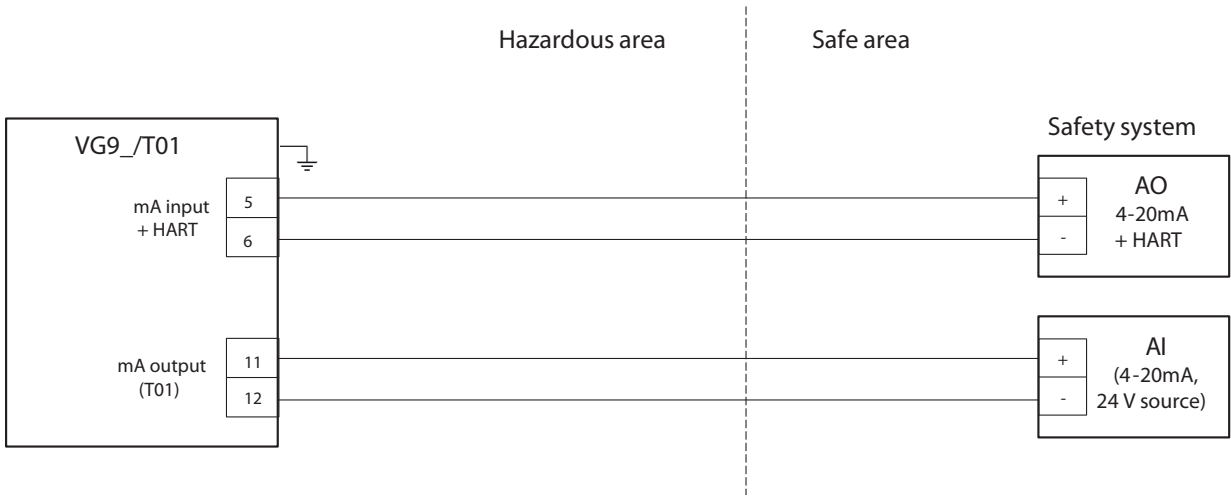
VG9_H_L2_ + LCP9H_

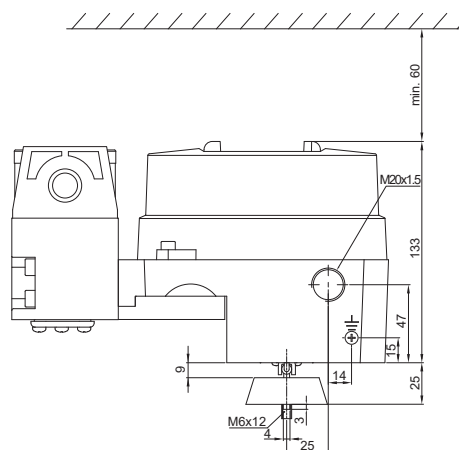


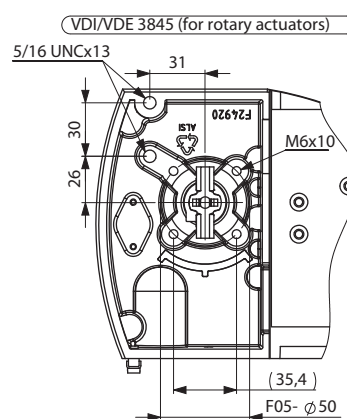
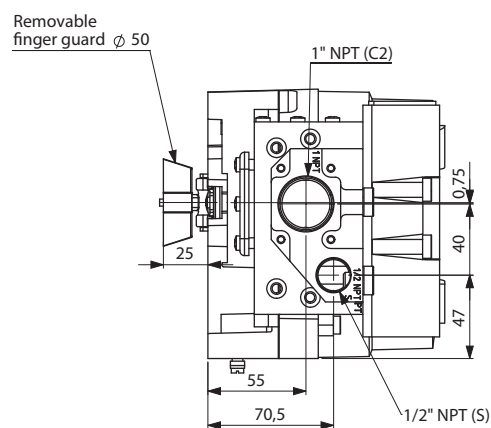
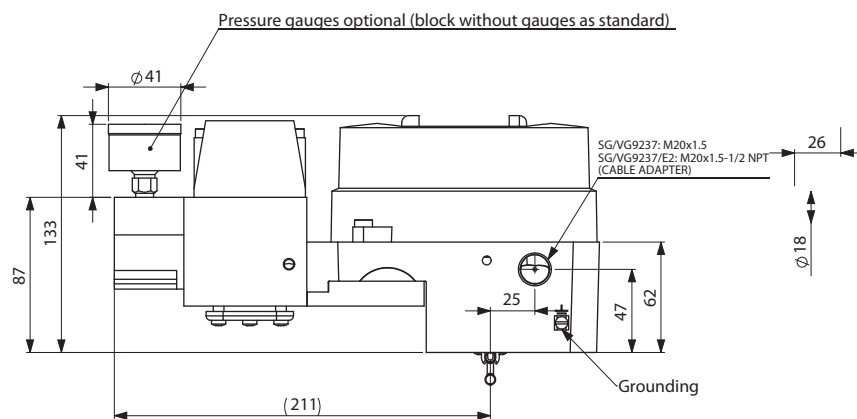
VG9_H_L3_ + LCP9H_L



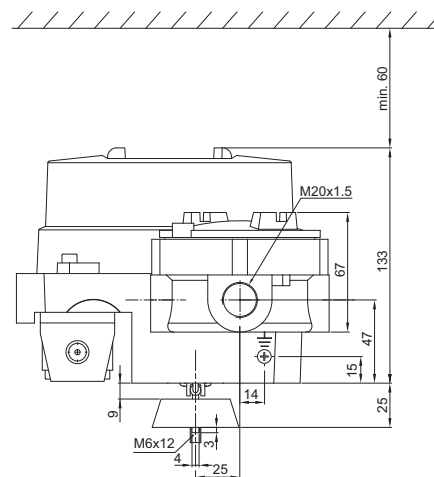
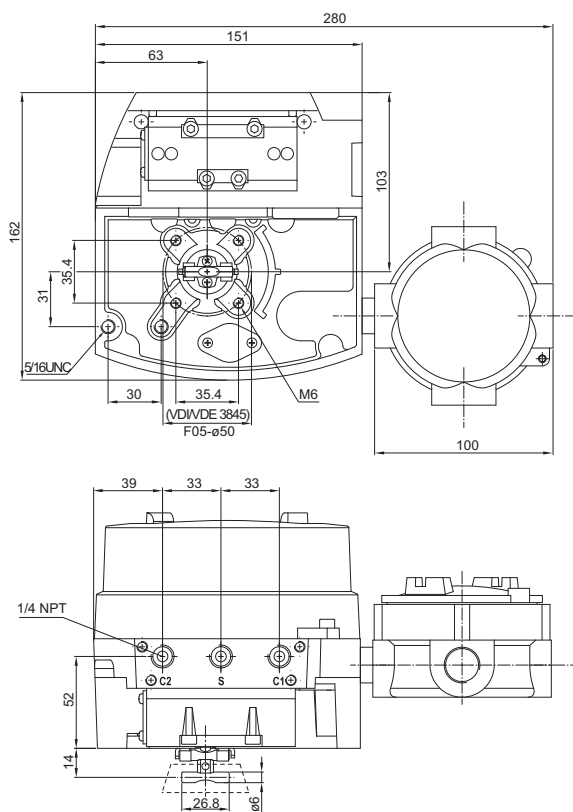
VG9_T01





VG9237_

VG921_J_



Technical drawing of the 3000 Series Solenoid Valve, showing front, top, and side views with dimensions.

Front View Dimensions:

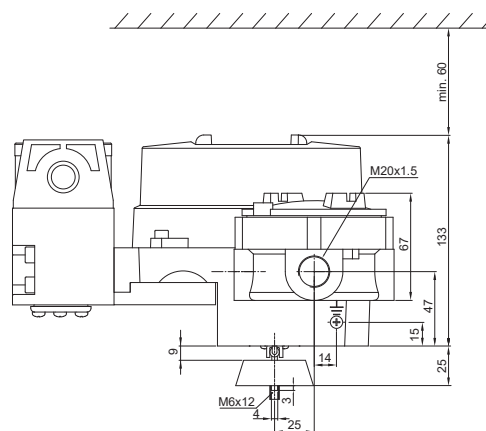
- Overall width: 151
- Top flange width: 63
- Overall height: 172
- Bottom flange width: 100
- Mounting hole spacing (center-to-center): 30, 35.4
- Mounting hole diameter: $\varnothing 5$
- Coil voltage: (VDIVDE 3845)
- Coil current: F05- $\varnothing 50$
- Coil thread: M6
- Bottom flange thread: 5/16 UNC

Top View Dimensions:

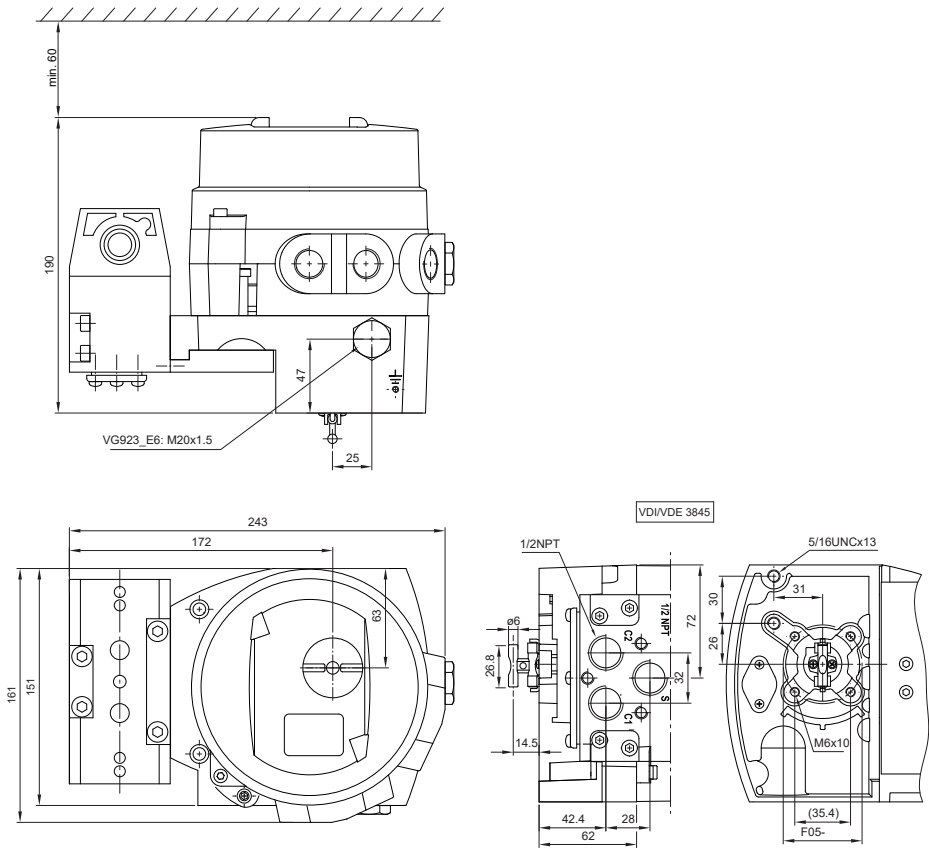
- Overall width: 280
- Overall height: 72
- Mounting hole spacing (center-to-center): 32
- Mounting hole diameter: $\varnothing 6$
- Coil thread: 1/2 NPT

Side View Dimensions:

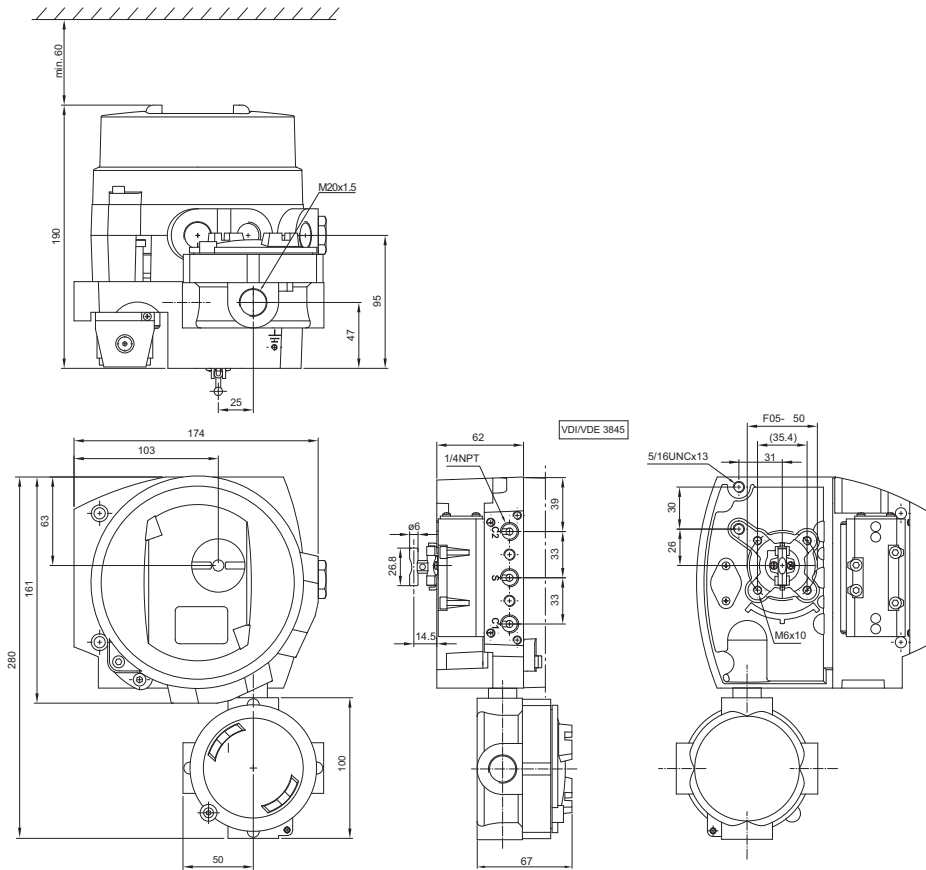
- Overall height: 28
- Mounting hole spacing (center-to-center): 42
- Mounting hole diameter: $\varnothing 6$
- Coil thread: 1/2 NPT



VG923_/_ or VG923_L_



VG921_J_/_ or VG921_JL_



Technical drawing of the F05-50 valve, showing three views: front, top, and side.

Front View: Shows the valve body with a central handle and a side port. Dimensions include a total height of 180 mm, a base width of 47 mm, and a mounting hole diameter of $\varnothing 25$. A note indicates a minimum distance of 60 mm from the top surface.

Top View: Shows the valve's footprint. Dimensions include a total width of 243 mm, a central port diameter of $\varnothing 63$, and a mounting hole diameter of $\varnothing 50$. The distance between the mounting holes is 172 mm.

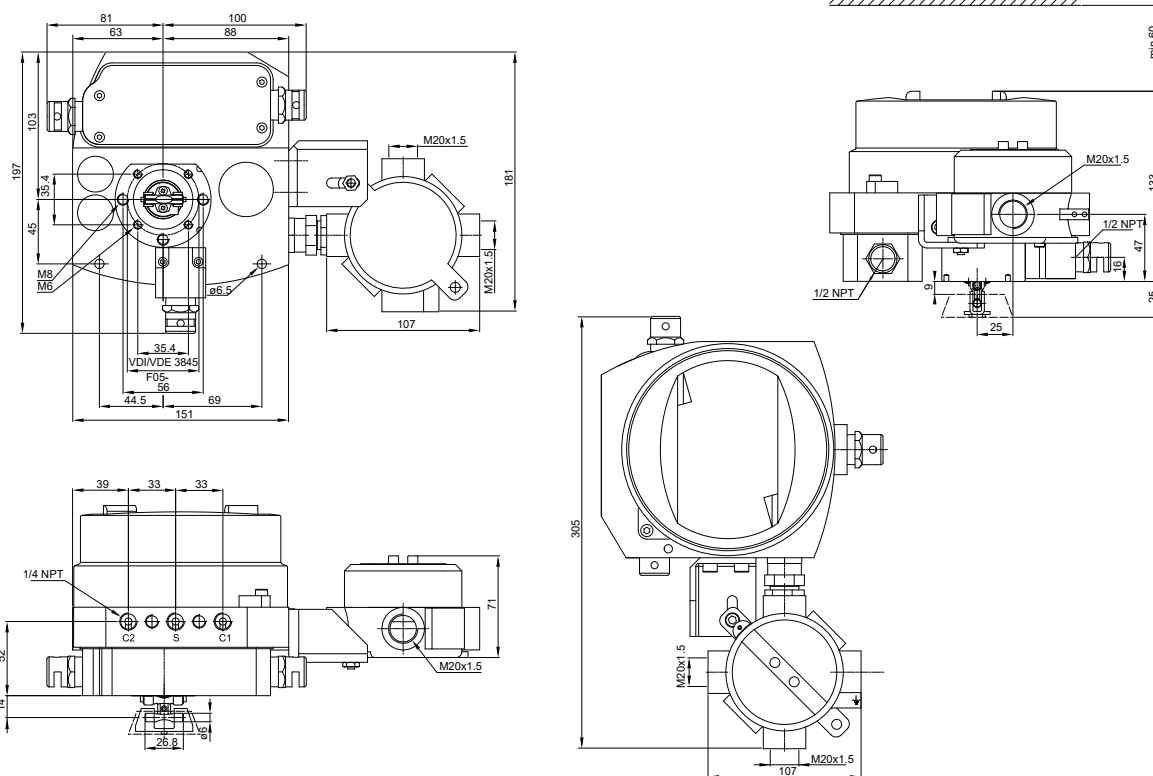
Side View: Shows the valve's profile. Dimensions include a total width of 62 mm, a central port diameter of $\varnothing 28$, and a mounting hole diameter of $\varnothing 14.5$. The distance between the mounting holes is 42.4 mm. A note indicates a minimum distance of 60 mm from the top surface.

Technical Specifications:

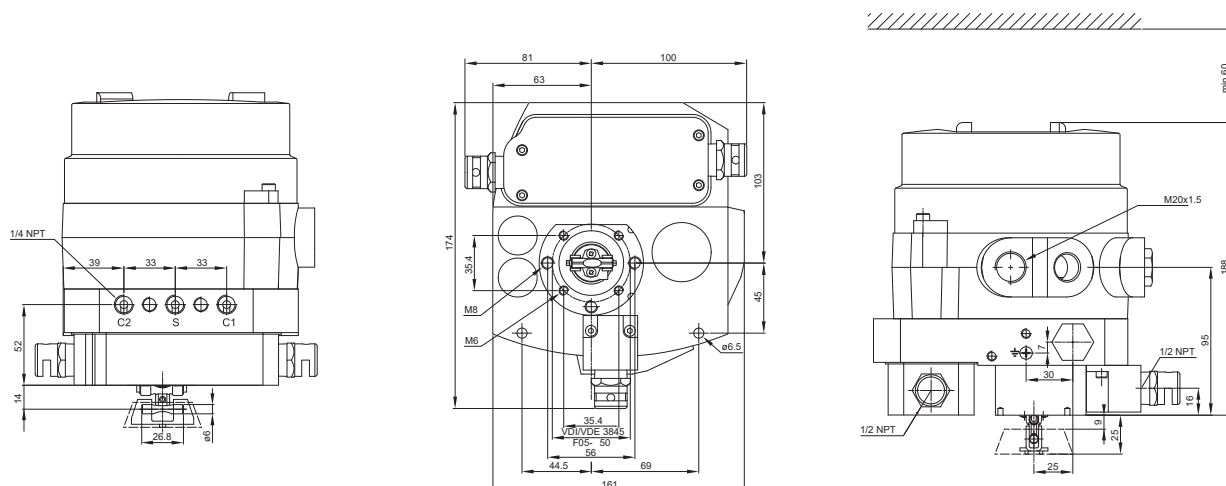
- Mounting: M20x1.5
- Port: 1/2NPT
- Valve Type: F05- 50
- Thread: 5/16UNCx13
- Mounting Hole: M6x10
- Standard: VDI/VE 3845

[illegible]

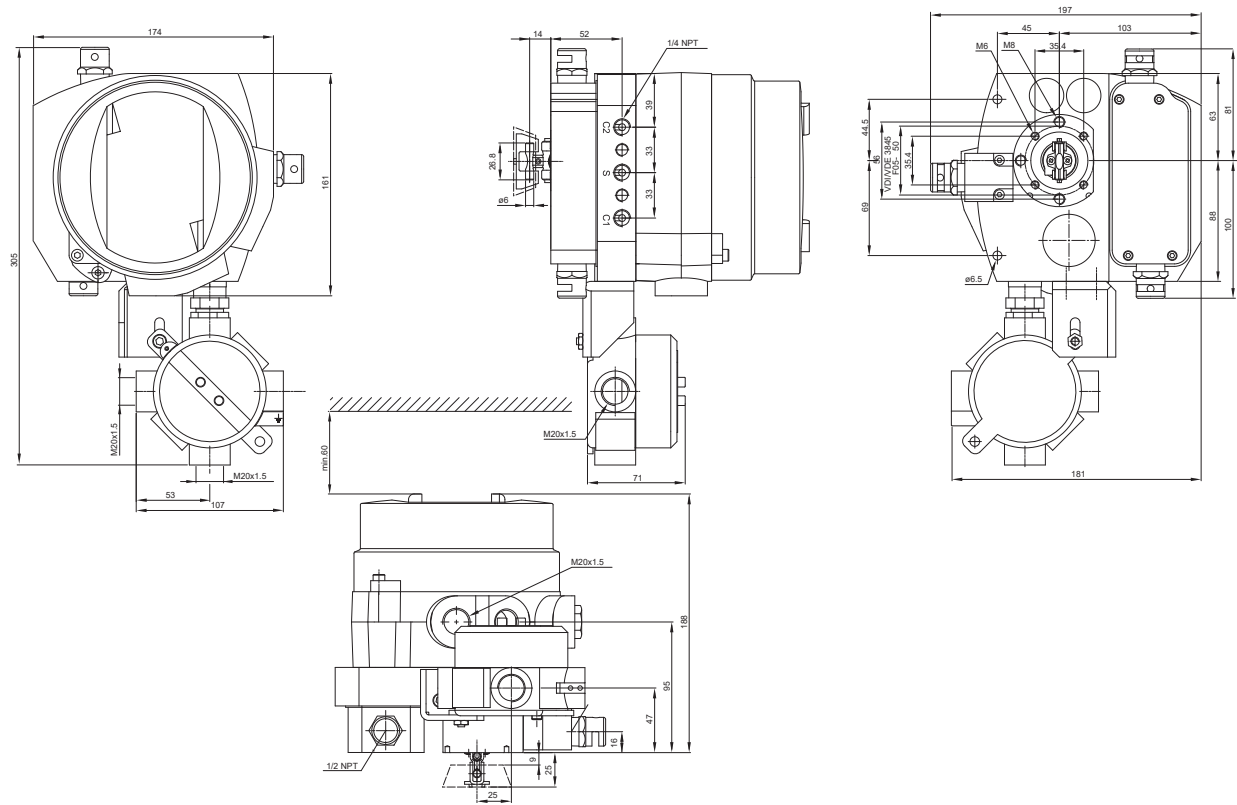
VG931_J_



VG931_/_ or VG931_L_



VG931_J/_ or VG921_JL_



13 CONFIGURATION PARAMETERS

Parameter Name	Values	Default value
Actuator Type (Atyp)	Single acting actuator (1-A) Double acting actuator (2-A) NOTE: See 4.6.1. Partial Stroke Test	1-A
Valve Type (Vtyp)	Rotary (rot) Linear (Lin)	rot
Positioner Fail Action (PFA)	Close (CLO) Open (OPE)	CLO
Extra Pneumatics Instrumentation (EXTI)	non = none bo1 = Volume Booster type 1 bo2 = Volume Booster type 2 bo3 = Volume Booster type 3 qE1 = Quick Exhaust type 1 qE2 = Quick Exhaust type 2 qE3 = Quick Exhaust type 3 co1 = Combination type 1 co2 = Combination type 2 co3 = Combination type 3	non
Actuator size (ACTS)	S 1 = B1J8 (<1 dm ³ / <61 in ³) S 3 = B1J10 (1-3 dm ³ / 61-183 in ³) S10 = B1J12-16 (3-10 dm ³ / 183-610 in ³) S30 = B1J20-25 (10-30 dm ³ / 610-1831 in ³) L30 = B1C40-, B1J32- (>30 dm ³ / >1831 in ³)	S 1
Spool type (STYP)	15 = VG9_12 or VG9_15 35 = VG9235 37 = VG9237	15
Automatic Partial Stroke Test (APSt) (Not available with VG9000H_P)	dIS = auto PST disabled EnA = auto PST enabled rnd = auto PST enabled with randomized range	dIS
Manual Partial Stroke Test Size (MSTr)	3.0 - 100.0	10.0 %
Language (LANG)	English (EnG) German (GEr) French (FrE)	EnG
Local Control Panel (LCP)	Enabled (EnA) Disabled (dIS)	dIS

14 EC DECLARATION OF CONFORMITY



EC DECLARATION OF CONFORMITY

Manufacturer:
Metso Automation Oy
01301 Vantaa
Finland

Product: **Intelligent Safety Solenoid Neles ValvGuard VG9000-series**

Approvals:

Type	Approval	EC Type examination Certificate
VG9_HX_/_	ATEX II 1 G Ex ia IIC T6...T4 Ga ATEX II 1 D Ex ia IIIC T95 °C...T125 °C Da ATEX II 2 G Ex ib IIC T6...T4 Gb ATEX II 2 D Ex ib IIIC T95 °C...T125 °C Db ATEX II 3 G Ex nA IIC T6...T4 Gc ATEX II 3 G Ex ic IIC T6...T4 Gc ATEX II 3 D Ex ic IIIC T95 °C...T125 °C Dc	VTT 14 ATEX 043X EN 60079-0: 2012, EN 60079-11:2012, EN 60079-26:2007 VTT 14 ATEX 044X EN 60079-0: 2012, EN 60079-15: 2010
VG9_FX_/_	ATEX II 1 G Ex ia IIC T6...T4 Ga ATEX II 1 D Ex ia IIIC T95 °C...T125 °C Da ATEX II 2 G Ex ib IIC T6...T4 Gb ATEX II 2 D Ex ib IIIC T95 °C...T125 °C Db ATEX II 3 G Ex nA IIC T6...T4 Gc ATEX II 3 G Ex ic IIC T6...T4 Gc ATEX II 3 D Ex ic IIIC T95 °C...T125 °C Dc	VTT 14 ATEX 074X EN 60079-0:2012, EN 60079-11:2012, EN 60079-26:2007 VTT 14 ATEX 075X EN 60079-0: 2012, EN 60079-11: 2012, EN 60079-15: 2010
VG9_E6_/_ VG9_E7_/_	ATEX II 2 G Ex d IIC T6...T4 Gb ATEX II 2 D Ex tb IIIC T80 °C...T105 °C Db IP66	SIRA 11ATEX1006X EN 60079-0:2012, EN 60079-1:2007, EN 60079-31:2009

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

Applicable directives:

EMC 2004/108/EC Electrical
 ATEX 94/9/EC (until 19 April 2016) Approved and Ex marked types
 ATEX 2014/34/EU (from 20 April 2016)

ATEX Notified Bodies for EC Type Examination Certificates:

SIRA (Notified body number 0518)
 Sira Certification Service
 CSA Group
 Unit 6, Hawarden Industrial Park
 Hawarden, Deeside, CHs 3US
 United Kingdom

VTT (Notified body number 0537)
 VTT, Expert Services
 Otakaari 7B, Espoo
 P.O.Box 1000, FI-02044 VTT
 Finland

ATEX Notified Body for Quality Assurance:

ISO 9001:2008 Certificate No: 73538-2010-AQ-FIN-FINAS
 ATEX 94/9/EC Annex IV Certificate No: DNV-2006-OSL-ATEX-0260Q

Det Norske Veritas AS (Notified body number 0575)
 Veritasveien 1
 1322 Høvik, Oslo
 Norway

Vantaa 23rd May 2017

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

15 TYPE CODING

NELES VALVGUARD VG9000

1.	2.	3.	4.	5.	6.	7.	8.
VG	9	2	15	H	E6		D33

*) Slash shall always be marked in places shown above.

1. sign	PRODUCT GROUP
VG	Neles ValvGuard VG9000, intelligent safety solenoid. TÜV SIL 3 certified according to IEC 61508.

2. sign	SERIES CODE
9	Series 9000 intelligent safety solenoid with universal shaft and attachment face according to standard VDI/VDE 3845. Relevant shaft adapter included in mounting kits. When VG9000 is separate delivery, shaft adapter kit needs to be ordered separately (see type coding for accessories).

3. sign	ENCLOSURE
	IP66 / NEMA 4X. Standard temperature range -40° to +85 °C / -40° to +185 °F. M20 x 1.5 conduit entry; 1 pcs (VG9_H), 2 pcs (VG9_F) in extension housing.
2	Standard epoxy coated anodized aluminium enclosure.
3	Full 316 stainless steel enclosure, no glass window.

4. sign	SPOOL VALVE	CONNECTIONS
12	Restricted capacity Stroke volume of actuator 0.3 - 6.7 dm ³	S, C1, C2 = 1/4 NPT
15	Standard capacity Stroke volume of actuator > 0.6 dm ³	S, C1, C2 = 1/4 NPT
35	High capacity Stroke volume of actuator > 3.5 dm ³ Not applicable to 3. sign "3"	S, C1, C2 = 1/2 NPT
37	Extended capacity, for single acting actuators. Stroke volume of actuator > 6.5 dm ³ Not applicable to 3. sign "3"	S = 1/2 NPT, C2 = 1 NPT

5. sign	COMMUNICATION / INPUT SIGNAL RANGE
H	4-20 mA, HART communication.

6. sign	APPROVALS FOR HAZARDOUS AREAS
X	ATEX and IECEx certifications: ATEX and IECEx certifications: II 1 G Ex ia IIC T6...T4 Ga II 1 D Ex ia IIIC T95 °C...T125 °C Da II 2 G Ex ib IIC T6...T4 Gb II 2 D Ex ib IIIC T95 °C...T125 °C Db Temperature range: T4 or T125 °C: < +80 °C; T5 or T110 °C: < +65 °C; T6 or T95 °C: < +50 °C. II 3 G Ex nA IIC T6...T4 Gc II 3 G Ex ic IIC T6...T4 Gc II 3 D Ex ic IIIC T95 °C...T125 °C Dc Temperature range: T4 or T125 °C: < +85 °C; T5 or T110 °C: < +75 °C; T6 or T95 °C: < +60 °C. Available without limit switches or with certified inductive limit switches.
U	cCSAus certification: IS Class I, Division 1, Groups A, B, C, and D; T4/T5/T6 Ex ia IIC T4/T5/T6 Ga IS Class I, Zone 0 AEx ia IIC T4/T5/T6 Ga Temperature range: T4: -40° to +80 °C; T5: ≤+65 °C; T6: ≤ +50 °C 1/2" NPT conduit entries. No glass window.
Z1	INMETRO certification: Ex ia IIC T6...T4 Ga T4: -40° to +80 °C; T5: < +65 °C; T6: < +50 °C. Not available with limit switches.
Z2	INMETRO certification: Ex ia IIC T6...T4 Gb T4: -40° to +80 °C; T5: < +65 °C; T6: < +50 °C. Only available with ATEX or IECEx certified inductive limit switches.
Z3	INMETRO certification: Ex ic nA IIC T6...T4 Gc T4: -40° to +85 °C; T5: < +75 °C; T6: < +60 °C. Available without limit switches or with ATEX or IECEx certified inductive limit switches.

6. sign	APPROVALS FOR HAZARDOUS AREAS
E2	cCSAus certification: Class I, Div 1, Groups B, C, D; Class II, Div 1, Groups E, F, G; Class III; T6...T4, Enclosure type 4X Ex d IIC T6...T4 AEx d IIC T6...T4 Ex tb IIIC T100 °C IP66 AEx tb IIIC T100 °C IP66 T4: -40° to +85 °C; T5: <+75 °C; T6: <+60 °C. Available with or without limit switches. 1/2" NPT conduit entries. No glass window.
E5	INMETRO certification: Ex d IIC T5 Gb (-40°C or -25 °C Ta +85 °C) Ex d IIC T6 Gb (-40°C or -25 °C Ta +70 °C) Available with or without limit switches.
E6	ATEX and IECEx certifications: II 2 GD Ex d IIC T6...T4 Gb Ex tb IIIC T80 °C...T105 °C Db IP66 Temperature range: a separate table Available with or without limit switches
E7	ATEX and IECEx certifications with Russian machine plate: II 2 GD Ex d IIC T6...T4 Gb Ex tb IIIC T80 °C...T105 °C Db IP66 Temperature range: a separate table Available with or without limit switches

7. sign	OPTIONS
	Several options can be selected, but the order shown below needs to be maintained.
T	Internal 2-wire (passive) position transmitter output. Analog position feedback signal, output 4-20 mA, supply voltage 12 - 30 VDC, external load resistance 0 – 780 Ω. Not applicable to 5. sign "F" or 7. sign "S". NOTE: This option is not SIL certified. For SIL certified PT option use 8. sign "T01"
S	Internal 2-wire (passive) device status output. Analog device status feedback signal, output 4-20 mA. Output mA value is based on the device status, supply voltage 12 - 30 VDC, external load resistance 0 – 780 Ω. Not applicable to 5. sign "F" or 7. sign "T". NOTE: This option is not SIL certified.
P	For partial stroke test (PST) only. To be used together with additional solenoid valve for safety action. 4 mA normal state, signal failure does not affect to the valve position. Applicable to 5. sign "H" and 6. sign "X", "U", "E6" or "E7"(other approvals pending). Not applicable to 7. sign "S". NOTE: SIL certification pending.
J	External junction box, 2 pcs M20x1.5 conduit entries. VG9_H_J : Junction box for all 4-20 mA wirings, including position transmitter, if applicable. Junction box is attached to the standard enclosure. Not applicable to 7. sign "L1" NOTE: This option should be selected if both 7. sign "L2" (for Local Control Panel LCP9H_) and 8. sign (limit switches) are specified. VG9_F_J : Junction box for FF and 24 VDC wiring. Junction box is attached to the standard enclosure. If limit switches (8. sign) are not specified, extension housing is excluded.
L1	Extension housing with additional conduit entries, 2 pcs M20x1.5. Applicable to 5. sign "H" and 7. sign "T" or "S", if additional conduit entry is required. Not applicable to 7. sign "J" or "L2" or limit switches (8.sign).
L2	Extension housing with additional conduit entries and terminal strip for externally 24 VDC powered Local Control Panel (LCP9H_), 4 pcs M20x1.5. Applicable to 5. sign "H". Not applicable to 7. sign "L1" or "L3". NOTE: 7. sign "J" should be selected, if 8. sign (limit switches) is specified. NOTE: Local Control Panel LCP9H_ needs to be ordered separately!
L3	Extension housing with additional conduit entries and terminal strip for loop powered Local Control Panel (LCP9H_L), 4 pcs M20x1.5. Applicable to 5. sign "H". Not applicable to 7. sign "L1 or L2". NOTE: 7. sign "J" should be selected, if 8. sign (limit switches) is specified. NOTE: Local Control Panel LCP9H_L need to be ordered separately!
Y	Special construction, to be specified.

8. sign	LIMIT SWITCHES & POSITION TRANSMITTERS
	Extension housing with additional conduit entries, 4 pcs M20x1.5.
	Position transmitters
T01	SIL certified 2-wire (passive) position transmitter. Usable up to SIL2 acc. to IEC61508. Analog position feedback signal, output 4-20 mA, supply voltage 12 - 30 VDC, external load resistance 0 - 700 Ω. Potentiometer Contelec GL60, transmitter electronics Metso. Temperature range -40° to +85 °C / -40° to +185 °F. Applicable to 6. sign "E6", "E7" or "X". Not applicable with limit switches.
	Inductive proximity sensors, 2 pcs.
D33	Metso; SST Sensor Dual Module, NO, 8-125 VDC / 24 - 125 VAC Temperature range -40° to +80 °C / -40° to +176 °F. Applicable to 6. sign "E2", "E5", "E6" or "E7".
D44	Metso; Namur Sensor Dual Module, 6 - 29 VDC, > 3 mA; < 1 mA, NAMUR NC. Temperature range -40° to +80 °C / -40° to +176 °F. Applicable to 6. sign "E2", "E5", "E6" or "E7".
I02	P+F; NJ2-12GK-SN, 2-wire type, DC; > 3 mA; < 1 mA, NAMUR NC. Intrinsically safe according to ATEX II 1 G Ex ia IIC T6 Ga. Temperature range -40° to +85 °C / -40° to +185 °F. Usable up to SIL3 acc. to IEC61508. NOTE: In safety-related applications the sensor must be operated with a qualified fail safe interface, such as P+F KFD2-SH-EX1. Not applicable to 6. sign "Z1".
I09	P+F; NCB2-12GM35-N0, 2-wire type, DC; > 3 mA; < 1 mA, NAMUR NC. Intrinsically safe according to ATEX II 1 G Ex ia IIC T6 Ga. Temperature range -25° to +85 °C / -13° to +185 °F. Usable up to SIL2 acc. to IEC61508. Not applicable to 6. sign "Z1".
I45	P+F; NJ3-18GK-S1N, 3-wire type, DC; > 3 mA; < 1 mA, NAMUR NO. Intrinsically safe according to ATEX II 1 G Ex ia IIC T6 Ga. Temperature range -25° to +85 °C / -13° to +185 °F. Usable up to SIL3 acc. to IEC61508. NOTE: In safety-related applications the sensor must be operated with a qualified fail safe interface, such as P+F KFD2-SH-EX1. Not applicable to 6. sign "Z1".
I56	ifm; IFC2002-ARKG/UP, 2-wire type, DC; 150 mA, 10-36 VDC, leakage current <0.6 mA. Temperature range -40° to +80 °C / -40° to +176 °F. Applicable to 6. sign "E5", "E6" or "E7".
I57	P+F; NJ2-V3-N, 2-wire type, DC; > 3 mA; < 1 mA, NAMUR NC. Temperature range: -25° to +85 °C / -13° to +185 °F. Intrinsically safe according to ATEX and IECEx. Usable up to SIL2 acc. to IEC61508. Applicable to 6. sign "E6" or "E7".
I58	4 pcs of P+F; NJ2-V3-N, 2-wire type, DC; > 3 mA; < 1 mA, NAMUR NC. Temperature range: -25° to +85 °C / -13° to +185 °F. Intrinsically safe according to ATEX and IECEx. Usable up to SIL2 acc. to IEC61508. Applicable to 6. sign "E6" or "E7".
	Reed or leverless type proximity switches, 2 pcs.
R01	Metso; Maxx-Guard G, Reed, SPDT, 300 mA, 24 VDC; 200 mA, 125 VAC Temperature range -40° to +80 °C / -40° to +176 °F. Usable up to SIL 3 acc. to IEC61508. Applicable to 6. sign "E5", "E6" or "E7".
R02	Metso; Maxx-Guard M, Reed, SPDT, passive, intrinsically safe, 300 mA, 24 VDC Temperature range -40° to +80 °C / -40° to +176 °F. Usable up to SIL 3 acc. to IEC61508. Applicable to 6. sign "X"
R04	Metso; Maxx-Guard H, Reed, SPDT, Vmax 240 v, Imax 3A, Vmax 100W. Temperature range. -40° to +80 °C / -40° to +176 °F. Usable up to SIL 3 acc. to IEC61508. Applicable to 6. sign "E6" or "E7".
R35	Topworx; GO35, Leverless, SPDT, 3 A, 24 VDC; 0.5 A, 125 VDC; 4 A, 120 VAC; 2 A, 240 VAC Temperature range -40...+85 °C / -40...+185 °F. Applicable to 6. sign "E6" or "E7".

8. sign	LIMIT SWITCHES & POSITION TRANSMITTERS
	Mechanical micro switches Temperature range -40 to +85 °C / -40 to +185 °F
K25	2 pcs, OMRON D2VW-5L2A-1MS, SPDT, 3 A - 250 V AC, 0.4 A - 125 V DC, 5 A - 30 V DC. Applicable to 6. sign "E2", "E5", "E6" or "E7".
K26	2 pcs, OMRON D2VW-01L2A-1MS, gold plated contacts, SPDT, 100 mA - 30 V DC / 125 V AC. Applicable to 6. sign "E2", "E5", "E6" or "E7".
K45	4 pcs, OMRON D2VW-5L2A-1MS, SPDT, 3 A - 250 V AC, 0.4 A - 125 V DC, 5 A - 30 V DC. Applicable to 6. sign "E2", "E5", "E6" or "E7".
K46	4 pcs, OMRON D2VW-01L2A-1MS, gold plated contacts, SPDT, 100 mA - 30 V DC / 125 V AC. Applicable to 6. sign "E2", "E5" or "E6".

NOTE: These following optional devices for VG9000H need to be ordered separately.

-	OPTIONAL DEVICES FOR VG9000H
RCI9H2	Remote Communication Interface with Status Relays TUV Rheinland SIL 3 certified according to IEC61508 Safety input: 0/24/48 VDC; Output: 4/20 mA + HART; Power supply: 24/48 VDC Temperature range: -20 to +60 °C IP20 Includes integrated isolated barrier for intrinsic safe applications. ATEX certification: II (1) G [Ex ia Ga] IIC IECEx certification: [Ex ia Ga] IIC NOTE: RCI9H2 is needed if 4/20mA is NOT available from the safety system to VG9000H.
LCP9H_	Externally powered Local Control Panel (LCP) Versions for Ex i, e: LCP9H, LCP9HW. Stainless steel 316L, IP66. Versions for Ex d: LCP9HE, LCP9HEW. Anodized aluminum, IP66. All versions include LEDs, Manual Reset and PST buttons. Trip button removed in W versions. Buttons are lockable in all versions. Power consumption 400 mW. Power supply 11-30 V DC, 50mA ATEX and IECEx certifications: LCP9H, LCP9HW: II 2 G Ex ia IIC T6...T4 Gb II 3 G Ex ic IIC T6...T4 Gc Temperature range: T4: -20° to +85 °C, T5: < +80 °C, T6: < +65 °C. II 2 G Ex eb mb [Ib] IIC T6...T4 Gb Temperature range: T4: -20° to +65 °C, T5: < +65 °C, T6: < +60 °C. LCP9EH, LCP9HEW: II 2 GD Ex d IIB + H2 T6 Gb Ex tb IIIC T85°C Db IP66 Ta -20° to +65 °C NOTE: 7. sign "L2" needs to be selected in VG9000H type coding.
LCP9H_L	Loop powered Local Control Panel (LCP) Versions for Ex i, e: LCP9HL, LCP9HWL. Stainless steel 316L, IP66. Versions for Ex d: LCP9HEL, LCP9HEWL. Anodized aluminum, IP66. All versions include LEDs, Manual Reset and PST buttons. Trip button removed in W versions. Buttons are lockable in all versions. Power taken from VG input signal (min. 8mA). ATEX and IECEx certifications: LCP9HL, LCP9HWL: II 2 G Ex ia IIC T6...T4 Gb II 3 G Ex ic IIC T6...T4 Gc Temperature range: T4: -20° to +65 °C, T5: < +65 °C, T6: < +50 °C. II 2 G Ex eb mb [Ib] IIC T6...T4 Gb Temperature range: T4: -20° to +65 °C, T5: < +65 °C, T6: < +60 °C. II 2 G Ex eb mb [Ib] IIC T6...T4 Gb Temperature range: T4: -20° to +65 °C, T5: < +63 °C, T6: < +48 °C. LCP9HEL, LCP9HEWL: II 2 GD Ex d IIB + H2 T6 Gb Ex tb IIIC T85°C Db IP66 Ta -20° to +65 °C NOTE: 7. sign "L3" needs to be selected in VG9000H type coding NOTE: Minimum input signal for VG9000H is 8 mA.

Metso Flow Control Inc.

Europe, Vanha Porvoontie 229, P.O. Box 304, FI-01301 Vantaa, Finland. Tel. +358 20 483 150. Fax +358 20 483 151

North America, 44 Bowditch Drive, P.O. Box 8044, Shrewsbury, MA 01545, USA. Tel. +1 508 852 0200. Fax +1 508 852 8172

South America, Av. Independência, 2500-Iporanga, 18087-101, Sorocaba-São Paulo, Brazil. Tel. +55 15 2102 9700. Fax +55 15 2102 9748

Asia Pacific, 238B Thomson Road, #17-01 Novena Square Tower B, Singapore 307685. Tel. +65 6511 1011. Fax +65 6250 0830

China, 11/F, China Youth Plaza, No.19 North Rd of East 3rd Ring Rd, Chaoyang District, Beijing 100020, China. Tel. +86 10 6566 6600. Fax +86 10 6566 2583

Middle East, Roundabout 8, Unit AB-07, P.O. Box 17175, Jebel Ali Freezone, Dubai, United Arab Emirates. Tel. +971 4 883 6974. Fax +971 4 883 6836

www.metso.com/valves

