![Valmet logo]

Neles™ ValvGuard™
VG9000F
Rev. 2.1

Installation, maintenance and
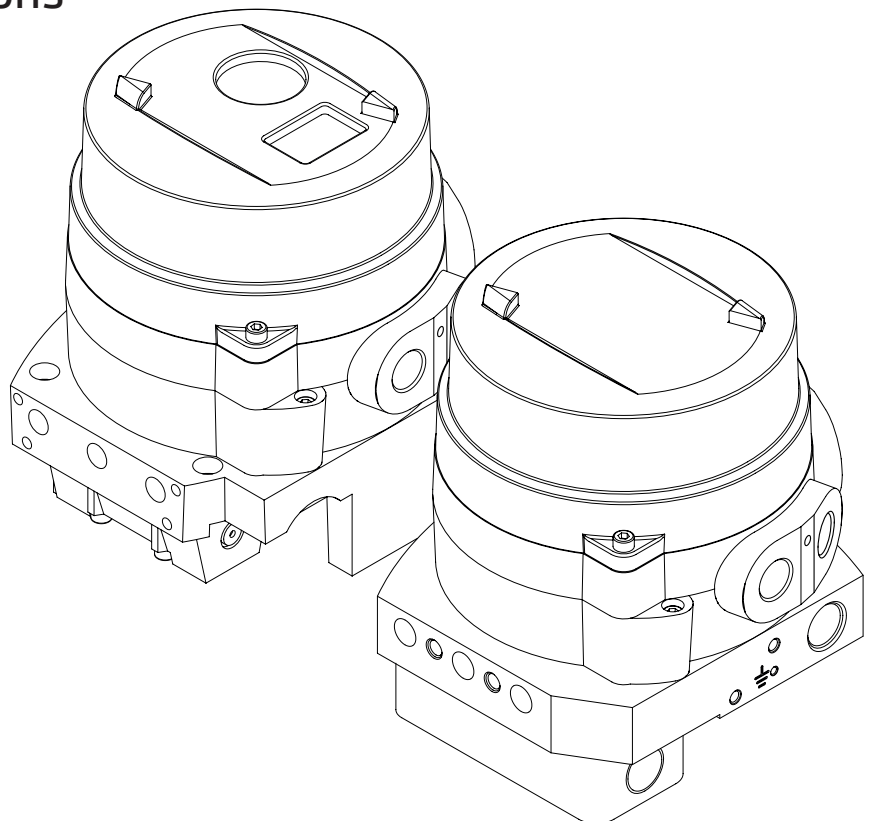operating instructions

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READ THESE INSTRUCTIONS FIRST!

These instructions provide information about safe handling and operation of the valve.

If you require additional assistance, please contact the manufacturer or manufacturer's representative.

SAVE THESE INSTRUCTIONS!

Addresses and phone numbers are printed on the back cover.

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1. NELES VALVGUARD VG9000F INTELLIGENT SAFETY SOLENOID WITH FOUNDATION FIELDBUS COMMUNICATION

1.1 General

This manual incorporates Installation, Maintenance and Operation Instructions for the Neles ValvGuard VG9000F. The VG9000F 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 Valmet for more information.

1.2 Technical description of VG9000F

Neles ValvGuard VG9000F is a microcontroller-based safety solenoid and partial stroke test device with FOUNDATION fieldbus communication. Addition to FOUNDATION fieldbus there is also a separate binary 24 V DC signal needed. It is isolated from the fieldbus and powers the safety part.

Main components of ValvGuard are spool valve (SV), prestage unit (PR) and micro controller (µC). Spool valve and prestage unit are the only components, which takes part of the safety action. Spool valve controls the main airflow between supply-, actuator- and exhaust 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 signal (24 V DC) and controlled by the micro controller. Micro controller cannot prevent the safety action. Pressure sensors (Px) and position sensor (a) are used to getting the measurements for controlling the PST and other tests. Measurements from the sensors are used for the device diagnostics.

The device contains a Local User Interface enabling local configuration. A PC with FieldCare 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:

- Safety 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 if the safety signal is operating correctly. After connections of electric signals (FOUNDATION fieldbus and binary 24 V DC) and pneumatic supply the micro controller (µC) 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 signal is present (24 V DC). Micro controller can never prevent the safety action to happen since safety action is the same as there's no voltage in the safety signal line.
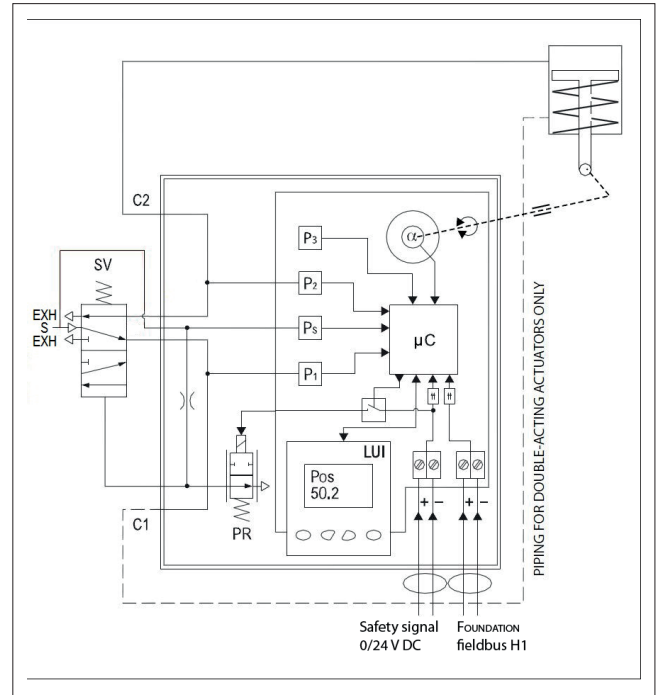
Fig. 1   The principle of operation

1.3 Markings

The ValvGuard is equipped with an identification plate (Fig. 2).

TYPE VG9215FE6   REV 2.1

II 2 G Ex d IIC T6...T4 Gb
II 2 D Ex tb IIIC T80 °C...T105 °C Db IP66
SIRA 11 ATEX 1006X / IECEx SIR 11.0001X

INPUT: FOUNDATION FIELDBUS (IEC 61158-2) Ui: 9 - 32 V DC
BINARY INPUT: Ui: 28 V DC, Ii: 150 mA
Tamb. T6: -20 ... +60 °C, T5: -20 ... +75 °C, T4: -20 ... +85 °C

SUPPLY PRESSURE: 3 - 7.5 bar / 44 - 109 psi
CONDUIT ENTRY M20X1.5
WARNING: DO NOT OPEN WHILE ENERGIZED!

NO: PH11020005
ID: SO519559001POS

CE 0575

VALMET OY   VANHA PORVOONTIE 229, 01380 VANTAA, FINLAND

Fig. 2   Examples of the identification plate

Identification plate markings include:

- Type designation of the safety controller
- Enclosure class
- Revision number
- Input signal (voltage range)
- Input resistance
- Maximum supply voltage
- Supply pressure range
- Operational temperature
- CE mark
- Manufacturing serial number TTYYWWNNNN*)

> **NOTE:**
> When installing the device, mark the applied hazardous area installation method by ticking the applicable box in the product identification plate when applicable.

*) 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.

1.4 Technical specifications

> **Ex NOTE:**
> **This manual contains technical specifications for several types of the ValvGuard. If in doubt, refer to the type approval certficate of the respective version.**
> The certificate is delivered with the field device and is also available from the manufacturer.

VG9000F SAFETY SOLENOID
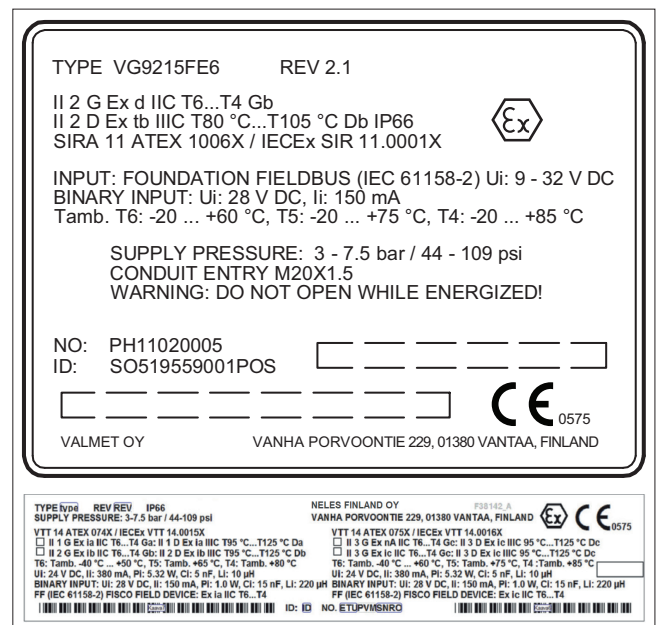
General

FOUNDATION fieldbus powered diagnostics, 24 V DC power from the safety system for the safety part.

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 inpulse 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

Deviation from profile (only with device usage type hybrid):
<10 %

Enclosure

Material (VG92_):	Anodised aluminium alloy, glass window (excluding E2)
Material (VG93_):	Stainless steel (316 or equivalent), no glass window

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
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

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)
Supply media:	Air, nitrogen

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:
actuator pressurized 0.22 Nm^3/h / 0.13 scfm, actuator vented 0.25 Nm^3/h / 0.15 scfm

Electronics

Electrical connections: max. 0.25 - 2.5 mm^2

Safety Signal (Binary input)

Connections:	24 V DC: '+' and '-'
Min voltage:	11 V DC
Max output resistance:	Ro = 285 Ω

FOUNDATION fieldbus

Connections:	H1: '+' and '-'
Power supply:	taken from bus
Bus voltage:	9 to 32 V DC, reverse polarity protection
Max basic current:	14.7 mA
Fault current (FDE):	4.2 mA

FOUNDATION fieldbus function block execution times

MDO	15 ms
MDI	15 ms
AI	20 ms

Local user interface functions

Depends on the usage option selected (see Chapter 4 for details).

- Monitoring of valve position, temperature, supply, actuator pressure difference, device usage option and binary signal (on or off)
- 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

Safety

| **SIL** | IEC 61508 compliant up to and including SIL 3 by TÜV |

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 | VG9000F DTM certified by FDT group |
| FF | DD registered by Fieldbus FOUNDATION |

Table 1   Approvals and electrical values

Certificate	Approval	Electrical values
ATEX		
VG9_X EESF 20 ATEX 027X EN IEC 60079-0:2018, EN 60079-11:2012	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	Safety signal: Ui ≤ 28 V, Ii ≤ 150 mA, Pi ≤ 1.0 W, Ci < 15 nF, Li < 220 µH FF signal: Ui ≤ 24 V, Ii ≤ 380 mA, Pi ≤ 5.32 W, Ci < 5 nF, Li < 10 µH Device conforms to the FISCO field device according to the standard IEC60079-11.
VG9_X_ EESF 20 ATEX 029X EN IEC 60079-0:2018, EN 60079-11:2012, 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	Safety signal: Ui ≤ 28 V, Ii ≤ 150 mA, Pi ≤ 1.0 W, Ci < 15 nF, Li < 220 µH FF signal: Ui ≤ 24 V, Ii ≤ 380 mA, Pi ≤ 5.32 W, Ci < 5 nF, Li < 10 µH Device conforms to the FISCO field device according to the standard IEC60079-11.
VG9_E6_ SIRA 11 ATEX 1006 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	Safety signal: Ui ≤ 28 V, Pi ≤ 1.0 W FF signal: Ui ≤ 32 V, Ii ≤ 380 mA, Pi ≤ 5.32 W
IECEx		
VG9_X_ IECEx EESF 20.0018X IEC 60079-0: 2017, IEC 60079-11: 2011	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	Safety signal: Ui ≤ 28 V, Ii ≤ 150 mA, Pi ≤ 1.0 W, Ci < 15 nF, Li < 220 µH FF signal: Ui ≤ 24 V, Ii ≤ 380 mA, Pi ≤ 5.32 W, Ci < 5 nF, Li < 10 µH Device conforms to the FISCO field device according to the standard IEC60079-11.
VG9_X_ IECEx EESF 20.0019X IEC 60079-0: 2017, IEC 60079-11:2011, IEC 60079-15: 2010	Ex nA IIC T6...T4 Gc Ex ic IIC T6...T4 Gc Ex ic IIIC T95 °C…T125 °C Dc	Safety signal: Ui ≤ 28 V, Ii ≤ 150 mA, Pi ≤ 1.0 W, Ci < 15 nF, Li < 220 µH FF signal: Ui ≤ 24 V, Ii ≤ 380 mA, Pi ≤ 5.32 W, Ci < 5 nF, Li < 10 µH Device conforms to the FISCO field device according to the standard IEC60079-11.
VG9_E6_ IECEx SIR 11.0001X IEC 60079-0:2011, IEC 60079-1:2007, IEC 60079-31:2008	Ex d IIC T6...T4 Gb Ex tb IIIC T80 °C...T105 °C Db IP66	Safety signal: Ui ≤ 28 V, Pi ≤ 1.0 W FF signal: Ui ≤ 32 V, Ii ≤ 380 mA, Pi ≤ 5.32 W
INMETRO		
VG9_E5_ NCC 12.0796 X ABNT NBR IEC 60079-0:2008 versão corrigida 2011 ABNT NBR IEC 60079-1:2009 versão corrigida 2011 ABNT NBR IEC 60079-31:2011 ABNT NBR IEC 60529:2009	Ex d IIC Gb T5 Gb	Safety signal: Ui ≤ 28 V, Pi ≤ 1.0 W FF signal: Ui ≤ 32 V, Ii ≤ 380 mA, Pi ≤ 5.32 W
cCSAus		
VG9_E2_ CSA 1980091	Class I, Div 1, Groups B, C, D Class II, Div 1, Groups E, F, G Class III; T4…T6, 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	Safety signal: Ui ≤ 28 V FF signal: Ui ≤ 32 V

1.5 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.

1.6 Safety precautions

CAUTION:
Opening the cover of VG9000F field device enclosure is allowed for authorized and trained persons only!
Misuse of powered VG9000F 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 WARNING:
Any unused conduit entry shall be plugged with an Ex d rated plug.

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

ELECTRICAL SAFETY WARNING:
Use fuses for limit switch installations with 50 V AC / 75 V DC or higher.

NOTE:
Avoid earthing a welding machine in close proximity to a ValvGuard.
Damage to the equipment may result.

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 Neles actuators are shown in Fig. 4.

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

3.2 Mounting on Neles 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.3.

> **NOTE:**
> Special care must be taken that the shaft position has been set according to marking in VG9000F housing and the pointer in the shaft. Also make sure that the positioner fail action parameter (PFA) is set correctly (Section 4.4.3).
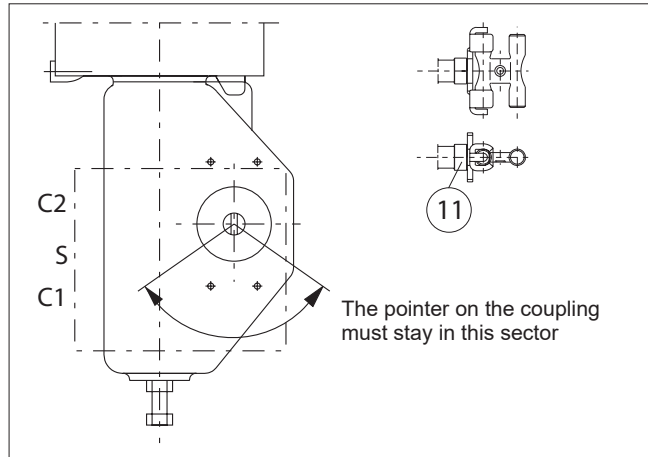
Fig. 3   Mounting on Neles actuator with VDI/VDE mounting face

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 (±45° 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 VG9000F 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 VG9000F.

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 40-41 (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.

> **NOTE:**
> Breathers should not be plugged or restricted.

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.
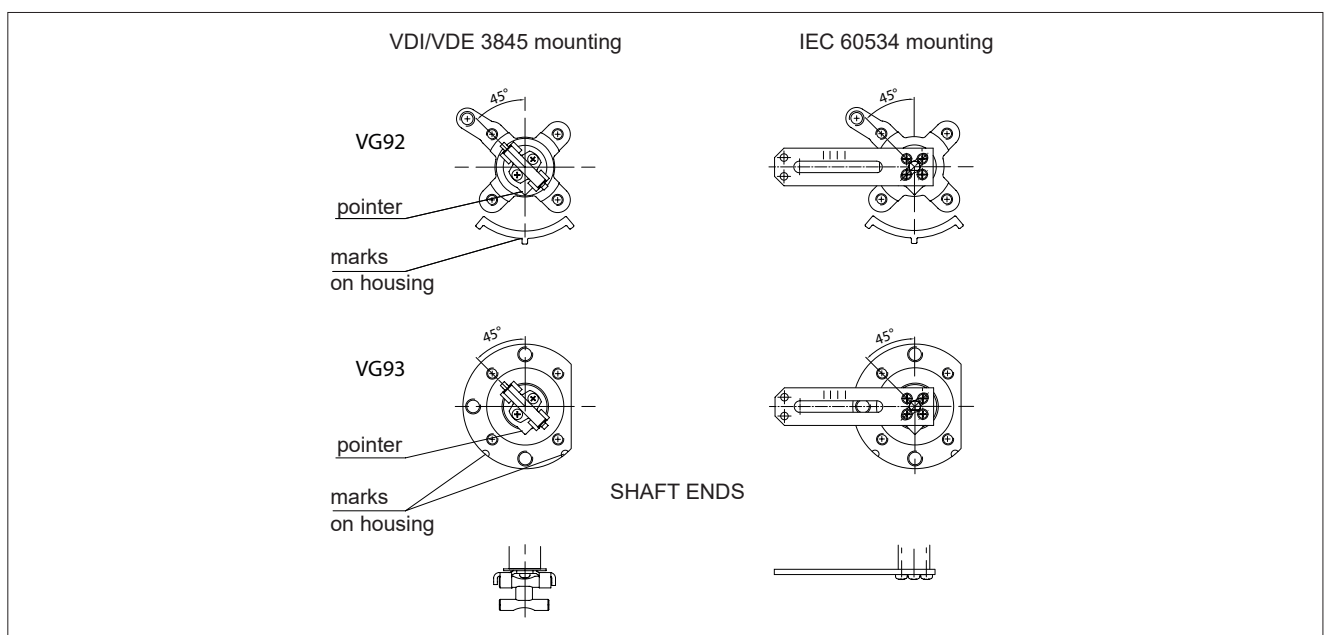- Exhaust adapter piping shall not be connected to the spool valve cover piping!

Fig. 4   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.

> **CAUTION:**
> The stroking times mentioned in Table 3 are trendsetting. They are measured with 5 bar supply air pressure, but may vary significantly due to different factors such as, but not limited to, pressure difference of the valve, the stiction of the actuator, supply air pressure, the capacity of the supply air system and the dimensions of the supply air pipeline.

> **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 Valmet.

> **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 Valmet 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. 5. C1 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. 5.

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

> **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.	

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)
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"	1.4	2.6	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
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

SINGLE-ACTING ACTUATOR, SPRING TO CLOSE
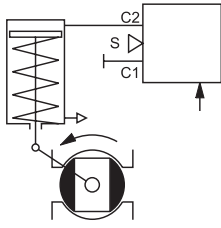
1. Self closing

Default setting:
ATYP = 1-A
PFA = CLO (must be in the spring direction)
VTYP according to valve type

NOTE: Valve shown in trip position

SINGLE-ACTING ACTUATOR, SPRING TO OPEN

2. Self opening

Default setting:
ATYP = 1-A
PFA = OPE (must be in the spring direction)
VTYP according to valve type

NOTE: Valve shown in trip position

DOUBLE-ACTING ACTUATOR

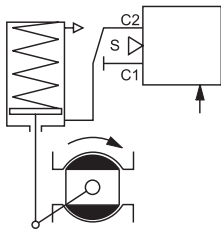3. Self closing

Default setting:
ATYP = 2-A
PFA = CLO
VTYP according to valve type
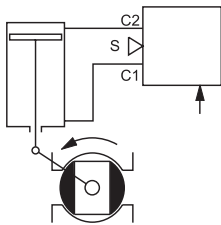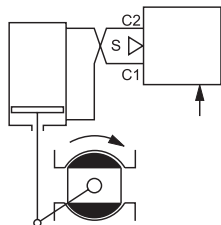
NOTE: Valve shown in trip position

DOUBLE-ACTING ACTUATOR, REVERSED PIPING

4. Self opening

Default setting:
ATYP = 2-A
PFA = OPE
VTYP according to valve type

NOTE: Valve shown in trip position

Fig. 5   Operation directions, air connections and assembly related parameters

3.6 Electrical connections

The VG9000F diagnostics part is powered by FOUNDATION fieldbus (IEC 61158-2). The same bus cable is used also for the fieldbus communication. (Connections H1: '+' and '-', see Section 1.4 for electrical ratings).

Output from the safety system is used to power the safety part. (Connections 24 V DC: '+' and '-').

See Section 11.6. for detailed connections.

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

Conductors to the terminal strip are prewired as shown in Fig. 6. See Section 11.6 for detailed electric connections. The earthing of the cables shall be carried out at both ends.
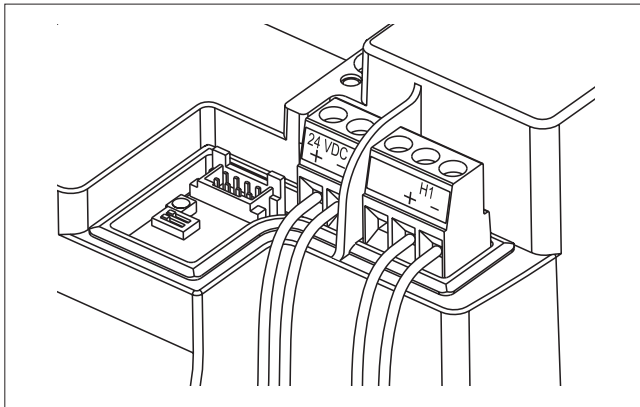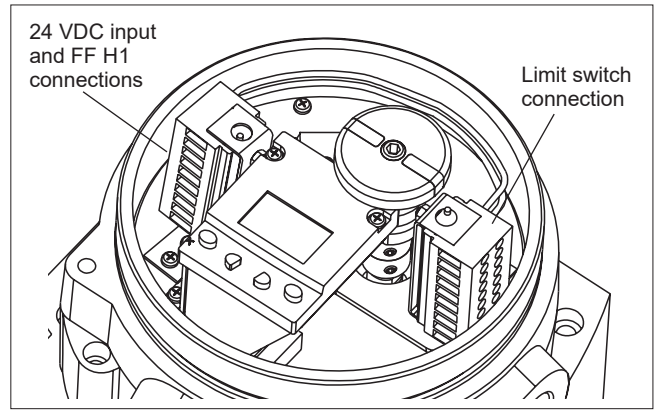
Fig. 7   Wiring terminals when the extension housing is used

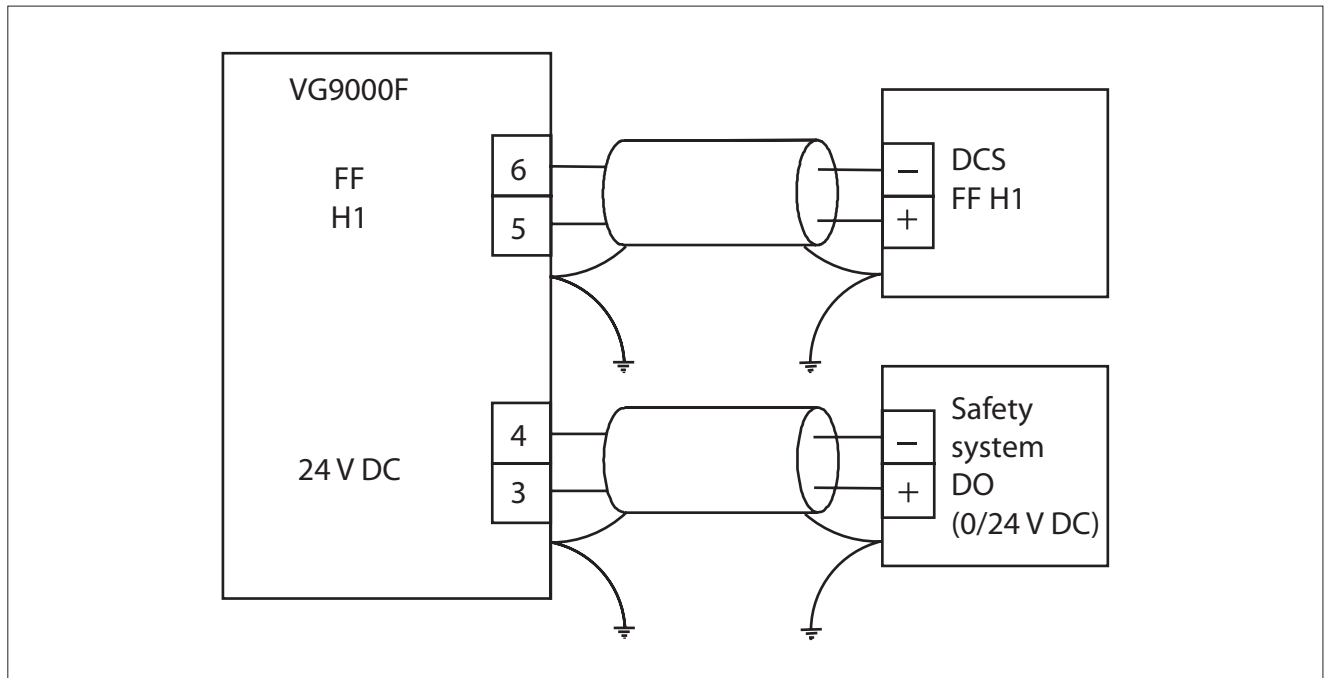Fig. 6   Prewired terminals in the circuit board

Fig. 8   VG9000F Connection diagram. See Section 11.6. for further details.

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.
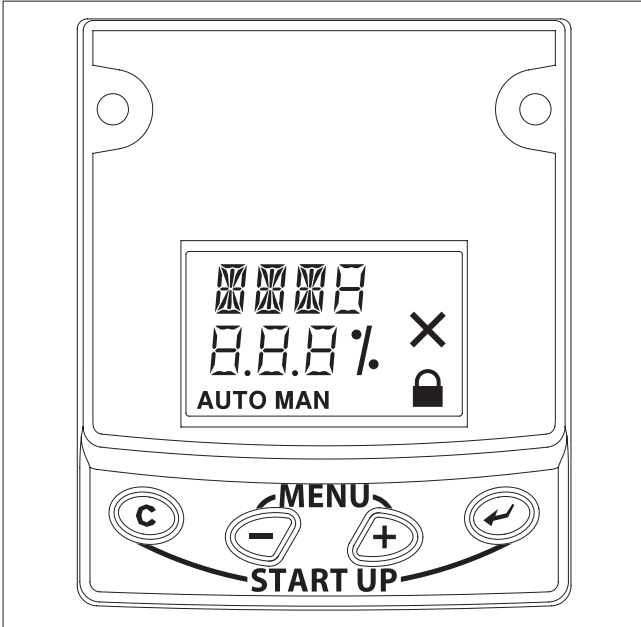

Fig. 9   Local user interface (LUI)

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	Values
Valve position (POS)	Percentage (%) of full scale	Angle (ANG), where 0 % refers to 0 (angle)	–
24 V DC input signal (INP)	–	–	On, OFF
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)	–
Device usage (USAG)	–	–	Safety (SAF), On/Off (Ono), Hybrid (HYb)

* Not in use in rev 1.1

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

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

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

⊘ — continuous push

⊖ ⊕ — brief push
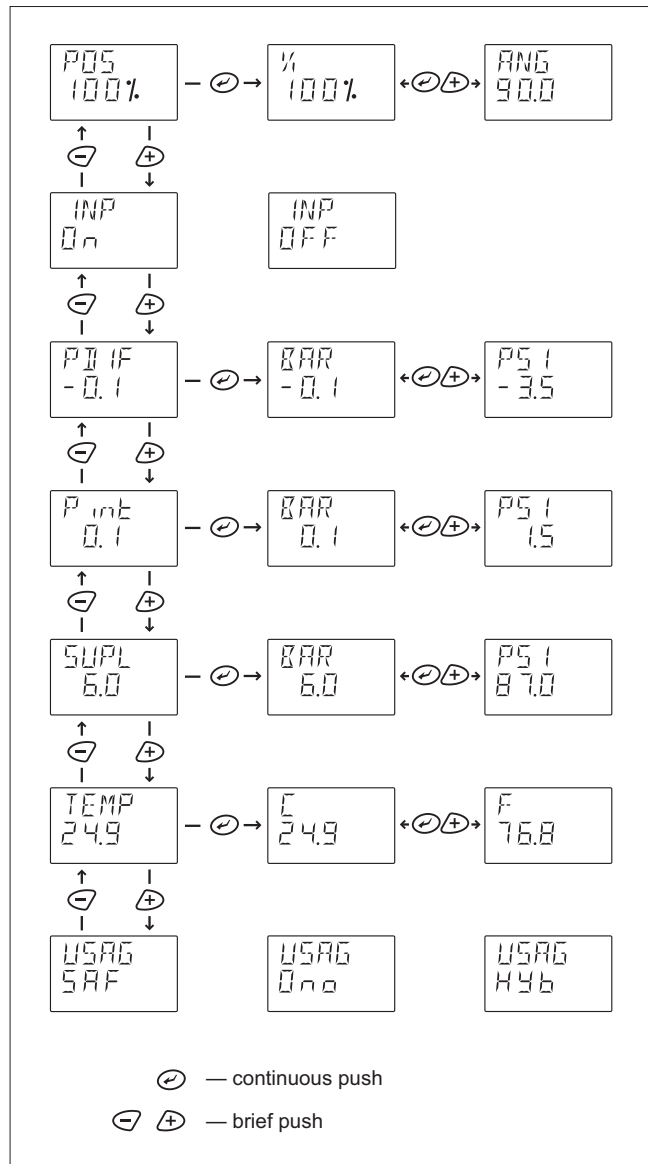
Fig. 10   Measurement monitoring and unit change

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

Input signal (INP) shows if the 24 V DC input signal is connected (On) or not (OFF).

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).

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).

Device usage ($USAG$) shows if the device is set to operate as safety (SAF) device, On/Off (Ono) device or Hybrid (HYb) device.

- Safety usage means that FOUNDATION fieldbus powers up the diagnostic part of the device and emergency action is implemented by the safety system signal.
- On/Off usage means that FOUNDATION fieldbus powers up the diagnostic part of the device, and on/off action is implemented by the 24 V DC signal from the DCS. Device is not intended to be used as a safety device. All closing actions are considered as normal valve operations. However, the SIL certificate is valid even if used in On/Off-mode.
- Hybrid usage means that VG9000F can perform normal on/off valve operation (i.e. closing or opening) or Partial Stroke Test (PST) through FOUNDATION fieldbus communication. In this way the DCS can control the valve opening/closing and PST implementation and the safety system controls the safety action implementation.

NOTE: Default value is safety device.

NOTE: Device usage can only be changed via DD, i.e. using fieldbus configurator.

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 © and ⊘ 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 © button.

Cancelling of operation returns user interface view one level up in menu hierarchy.
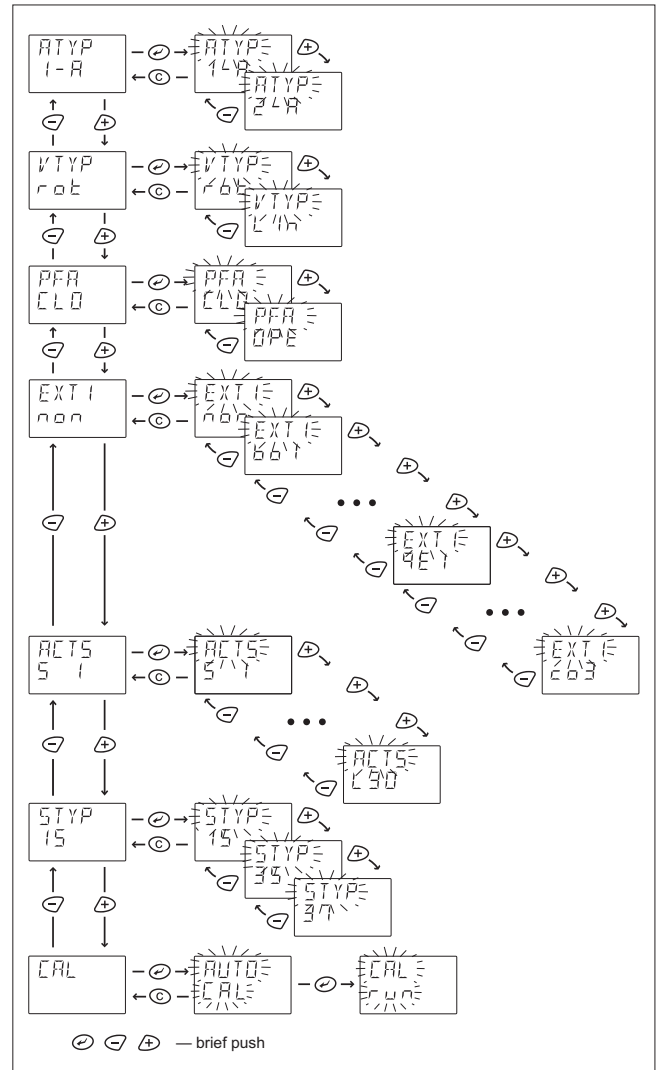
Fig. 11   Guided start-up

4.3 Configuration menu

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

4.4 Configuration parameters

When PAR is on the display you may enter the configuration menu by pressing the ⊘ key. In this menu the most important configuration and signal modification parameters are viewable. Depending on the device usage option selected (safety, on/off, hybrid) the menu has different parameters, see Figures 11–13.
NOTE: Device usage option can not be selected from LUI, only from DD. You may view the current value and edit them by pressing the ⊘ key at the relevant parameter. The name of the parameter will appear on the upper row of the display and the current value is on the lower row. See also table in Chapter 13.

NOTE:
Default values can be restored by using DTM.

Fig. 12   Configuration. Device usage: safety

Fig. 13   Configuration. Device usage: on/off

Fig. 14   Configuration. Device usage: hybrid

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 ⊘ key to enter the edit state and ATYP starts to blink.
- Select between two values 1-A or 2-A using the ⊕ and ⊖ keys. The value 1-A indicates a single acting actuator and 2-A a double acting actuator.
- To conclude press the ⊘ key when the desired value is shown on the display.

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 ⊘ key to enter the edit state and the VTYP starts to blink.
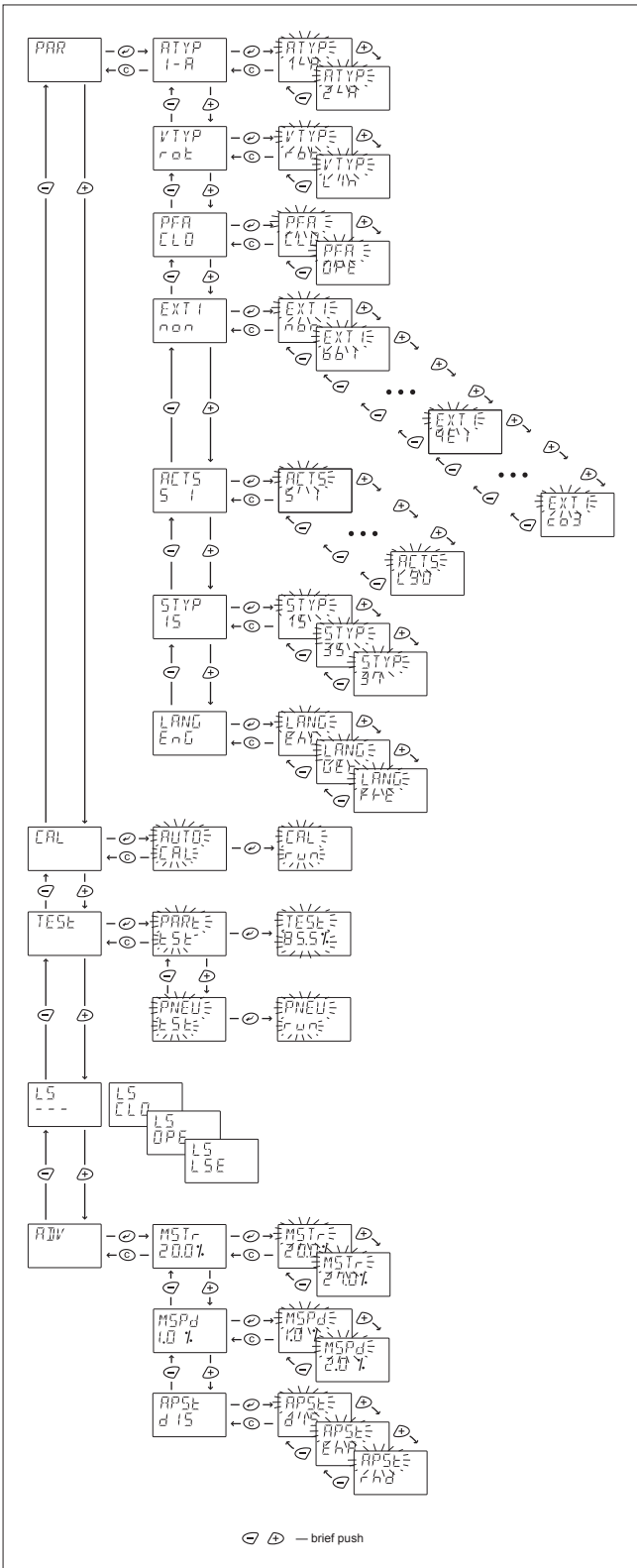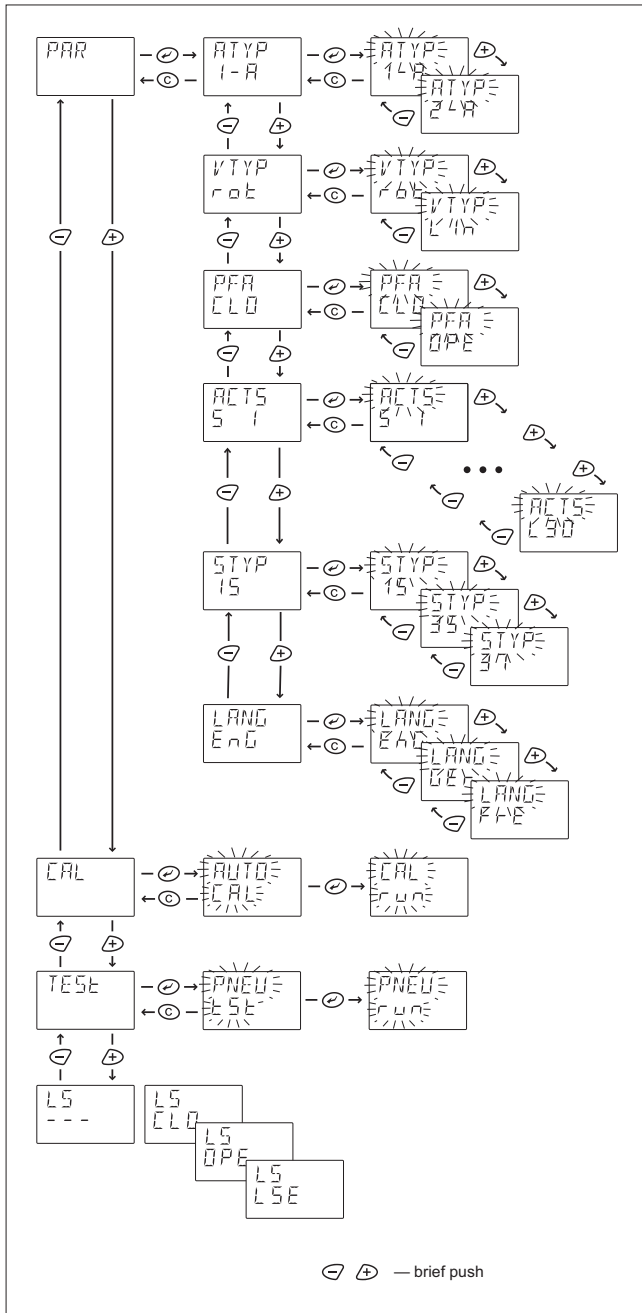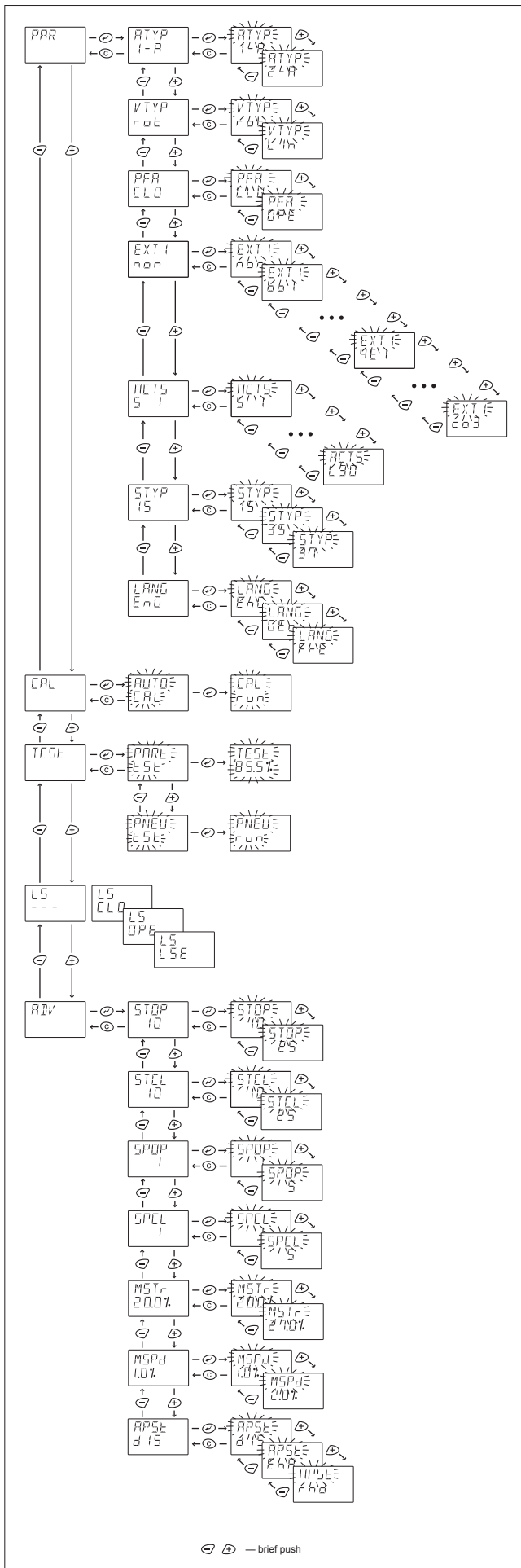- Select between two values rot or Lin using the ⊕ and ⊖ keys. The value rot indicates a rotary valve and Lin a linear valve.

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

Positioner fail action, PFA

This section describes the function of the actuator.

Set value according to Fig. 5 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. 5 for correct settings.

- Once PFA is displayed, press the ⊘ key to enter the edit state and the PFA will start blinking.
- You may select between two values by pressing the ⊕ or ⊖ 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 ⊘ to conclude the operation.

Extra pneumatics instrumentation, EXTI

Only used when device usage type is Safety or Hybrid.

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

- After selecting EXTI on the display, press the ⊘ key to enter the edit state and EXTI starts to blink.
- Select between the following values:

    non = no external instrumentation

    bo1 = booster type 1

    bo2 = booster type 2

    bo3 = 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

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 (𝐸𝑋𝑇𝐼)
Volume booster (VB)	Booster type 1 (𝑏𝑜𝐼)
Quick exhaust (QEV)	Quick exhaust 1 (𝑞𝐸𝐼)
Combination of VB and QEV	Combination type 1 (𝑐𝑜𝐼)

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

Actuator size, 𝐴𝐶𝑇𝑆

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 𝐴𝐶𝑇𝑆 on the display, press the ⊘ key to enter the edit state and 𝐴𝐶𝑇𝑆 starts to blink.
- Select between the following values:
  - 𝑆1   = Neles B1J8 actuator
          (or stroke volume <1 dm^3 / <61 in^3)
  - 𝑆3   = 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   = B1J32- (>30 dm^3 / >1831 in^3)

  Use the ⊕ and ⊖ keys to change the value.
- To conclude press the ⊘ key when the desired value is shown on the display.

Spool type, 𝑆𝑇𝑌𝑃

This parameter defines the spool type and size in VG9000F.

> **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 ⊕ and ⊖ keys to change the value.
- To conclude press the ⊘ key when the desired value is shown on the display.

Language selection, 𝐿𝐴𝑁𝐺

- Select between three languages 𝐸𝑛𝐺, 𝐺𝐸𝑟 or 𝐹𝑟𝐸 (English, German or French) using the ⊕ and ⊖ keys.
- To conclude press the ⊘ key when the desired value is shown on the display.

4.5 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.

> **NOTE:**
> Make sure to run the pneumatics test before the automatic travel calibration.

Select 𝐶𝐴𝐿 from the menu by using ⊕ or ⊖ keys and press the ⊘ key.
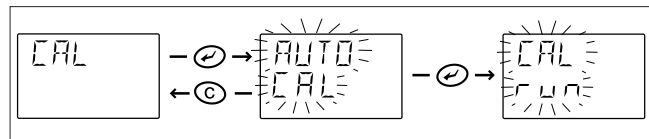
Fig. 15   Calibration selection

NOTE: When device usage is hybrid the valve needs to be in the normal position (not fail safe) for calibration to be started.

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 succesfully before the calibration.

During calibration process a blinking text "𝐶𝐴𝐿 𝑟𝑢𝑛" will be show on the display. If calibration ends successfully, a text "𝐶𝐴𝐿𝐼𝐵𝑅𝐴𝑇𝐼𝑂𝑁 𝑆𝑈𝐶𝐶𝐸𝑆𝑆𝐹𝑈𝐿" will be shown. Calibration can be cancelled with the ⓒ key, which will show a text "𝐶𝐴𝐿𝐼𝐵𝑅𝐴𝑇𝐼𝑂𝑁 𝐶𝐴𝑁𝐶𝐸𝐿𝐿𝐸𝐷". If calibration fails, the reason will be shown, eg. "𝐶𝐴𝐿𝐼𝐵𝑅𝐴𝑇𝐼𝑂𝑁 𝑆𝑇𝐴𝑅𝑇 𝐹𝐴𝐼𝐿𝐸𝐷", "𝑃𝑂𝑆𝐼𝑇𝐼𝑂𝑁 𝑆𝐸𝑁𝑆𝑂𝑅 𝑅𝐴𝑁𝐺𝐸 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 𝑡𝑆𝑡) or Pneumatics test (𝑃𝑁𝐸𝑈 𝑡𝑆𝑡).
- To conclude press the ⊘ key when the desired value is shown on the display.

Partial Stroke Test, 𝑃𝐴𝑅𝑇 𝑡𝑆𝑡

> **WARNING:**
> Partial Stroke Test moves the valve according to the stroke size. Make sure that this procedure can be safely executed.

NOTE: Only used when device usage type is Safety or Hybrid.

Partial stroke test can be run from here. Partial stroke test will be run according to the stroke size (𝑀𝑆𝑡𝑟) described in Section 4.8. Advance parameters.

NOTE: Max speed of the partial stroke test is always restricted to 3 %/s.

- Select *PARt tSt* from the menu by using ⊕ or ⊖ keys and press the ⊘ key.

- Test can be cancelled by pressing ©.

> **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 'Actuator Low Limit Pressure' -parameter needs to be set to negative value, e.g. -2. It can only be changed via FOUNDATION fieldbus, e.g. in the DTM.

> **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. Pneumatics test timeout parameter is valid also in this case.

> **NOTE:**
> PST size total value cannot be smaller than 3%. If randomized test has been selected (available via HART), make sure the PST stroke size is more than 3% bigger than randomizer value.

Pneumatics test, *PNEU tSt*

> **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 tSt* from the menu by using ⊕ or ⊖ keys and press the ⊘ key.

- Test can be cancelled by pressing ©.

> **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 is hardcoded and cannot be changed.

4.7 Limit Switch LS status

LS shows the status of bus powered (VG9_/B_) mechanical limit switches:

---	No limit switch active
CLO	Limit switch "Closed" active
OPE	Limit switch "Open" active
LSE	Limit switch error, both switches activated at the same time

4.8 Advance parameters

Only used when device usage type is Safety or Hybrid.

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

NOTE: Only used when device usage type is Hybrid.

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

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

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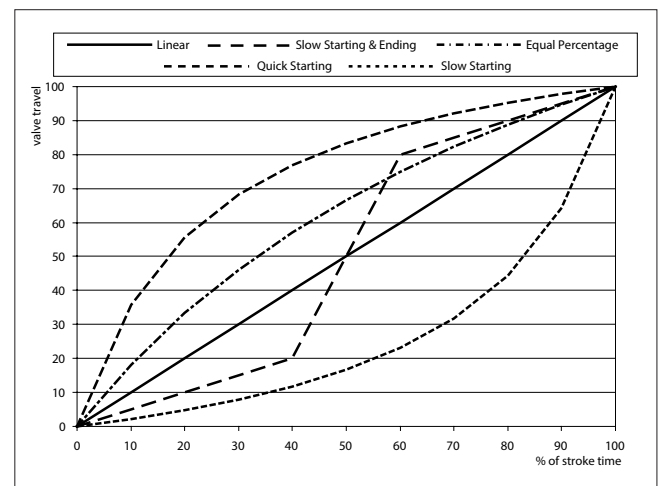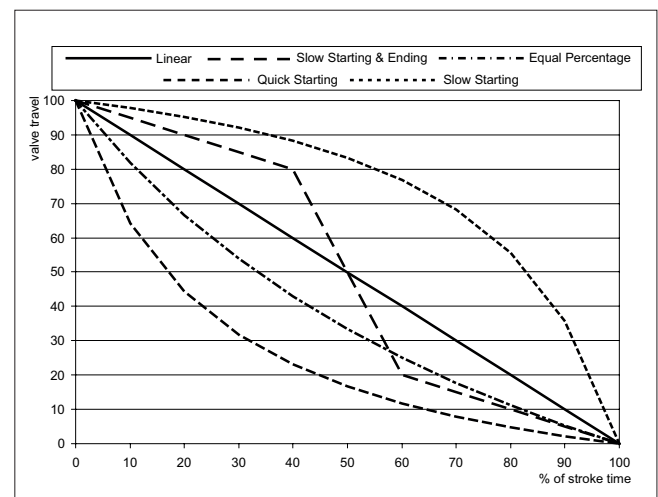

Fig. 16   Stroke profile shapes, opening

Fig. 17   Stroke profile shapes, closing

Manual Stroke Size, MSTr

Targeted manual partial stroke test size. Range is 3.0–100 %.

- Once MSTr is displayed, press the ⊘ key to enter the edit state and the MSTr will start blinking.
- Select values by pressing the ⊕ or ⊝ key. Holding down ⊕ or ⊝ key will start scrolling the value show on the display faster.
- After the desired value is displayed, press the key ⊘ to conclude the operation.

Manual Speed, MSPd

Manual partial stroke test speed. Range is 0.5–3.0 %.

- Once MSPd is displayed, press the ⊘ key to enter the edit state and the MSPd will start blinking.
- Select values by pressing the ⊕ or ⊝ key. Holding down ⊕ or ⊝ key will start scrolling the value show on the display faster.
- After the desired value is displayed, press the key ⊘ to conclude the operation.

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 ⊕ and ⊝ keys.
- To conclude press the ⊘ key when the desired value is shown on the display.

NOTE: Automatic partial stroke test stroke size and other parameters can not be changed from the LUI. They can only be changed via Foundation fieldbus, e.g. in the DTM.

4.9 Special displays

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 Foundation fieldbus DD. When the Local User Interface is locked the lock symbol will be activated on the display.
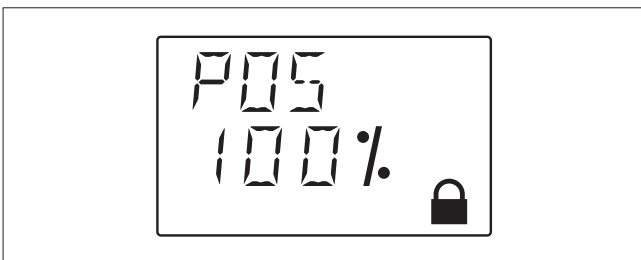
Fig. 18   LUI locked

Alarm or warning state

All failure conditions and statuses in VG9000F 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 ✖ to be shown on the display. In Warning state, the ✖ symbol is steady.
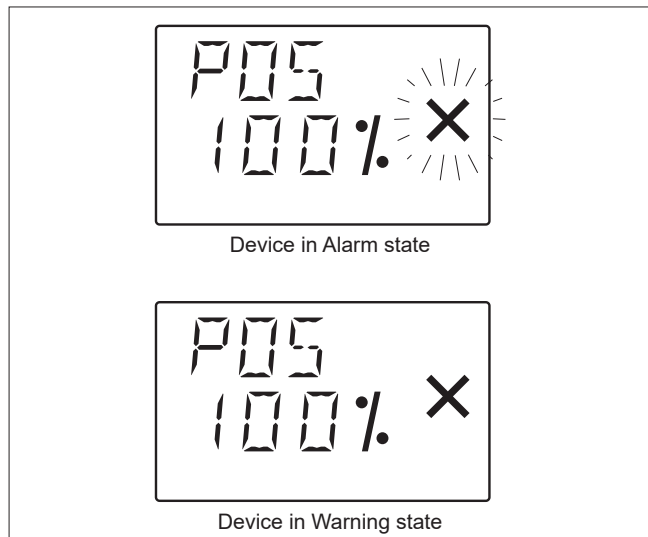
Fig. 19   Alarm and Warning states

Viewing of latest event

You may view the latest event by pressing the ⓒ and ⊝ keys simultaneously in the measurement monitoring view. The message is scrolled on the top row of the display twice. You may stop the scrolling by pressing the ⊘ key. By pressing the ⓒ key, the message will disappear.

For the list of events see Chapter 6.
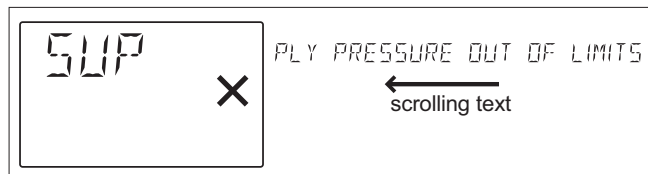
Fig. 20   Online alarm or warning state message

Write protection

The VG9000F is delivered from the factory with HW write protection OFF as the default setting. Reading and changing parameters is thus allowed. Write protection can be enabled with the switch (DIP1) located on the circuit board (see Fig. 20). If you need to change the setting, please contact Valmet for instructions.

Write protection protects all write access to all writeable parameters of the device. Changing the parameters from the LUI, fieldbus configurator or FieldCare is thus not allowed.
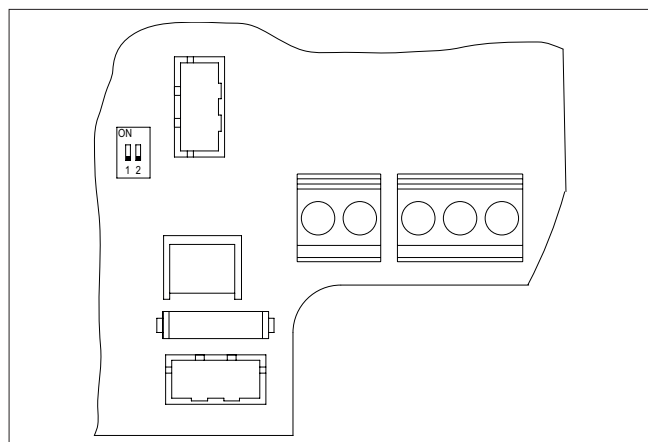
Fig. 21   Write protection / simulation switch

Simulation switch

The VG9000F is delivered from the factory with Simulation switch OFF (disabled). Simulation can be enabled with the switch (DIP2) located on the circuit board (see Fig. 20). If you need to change the setting, please contact Valmet for instructions.

Enable state of Simulation allows user to simulate valve position measurement (via AI block) and field diagnostic conditions (via Resource Block).

5. MAINTENANCE

Ex d NOTE:
Maintenance of the parts of the flameproof enclosure is not allowed!
Device type VG9000F_E6_:
Housing (2), Cover (100), Shaft assembly (11), Limit switch housing (300).

NOTE:
VG9000 maintenance can be done by Valmet 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 VG9000F 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 VG9000F, the device should be calibrated.

5.1 Opening and closing of the cover

*   Open VG9000F cover (100) by opening the M4 screw (107) first until it is not anymore attached to the housing (2). Then turn the cover counterclockwise 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.

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).

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.

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.

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.

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).

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.

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.

Removal

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

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.
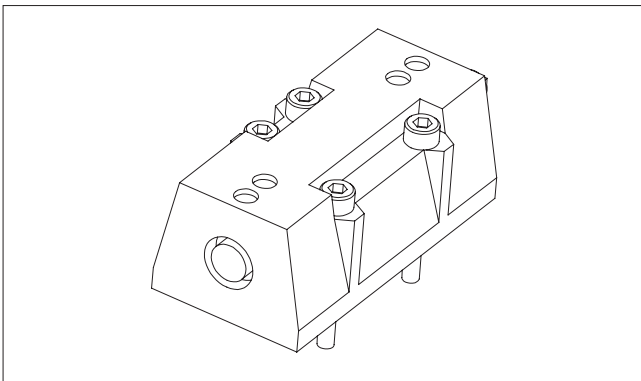
Fig. 22   Spool valve assembly

5.4 Communication circuit board

> **NOTE:**
> Communication circuit board cannot be changed in the field.

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.

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.

215

Fig. 23   Communication board

6. MESSAGES

These messages may appear in the local user interface.

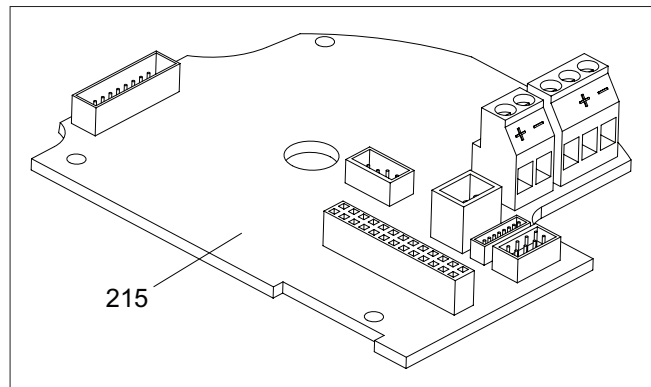| Display message	Description
ACTUATOR FULL STROKES COUNTER LIMIT EXCEEDED	Actuator full stroke counter has exceeded the configurable limit
CALIBRATION CANCELLED	Calibration process has been cancelled
CALIBRATION FAILED	Position calibration process has failed
	Calibration process has failed
	Calibration process has failed
	Coil calibration process has failed
CALIBRATION START FAILED	Calibration process could not be started
CALIBRATION SUCCESSFUL	Position calibration process has ended successfully
	Pressure calibration process has ended successfully
	Coil calibration process has ended successfully
CALIBRATION TIMEOUT	Calibration process has taken too long time
CONTINUED WATCHDOG RESET	Too many consecutive internal resets have been generated
DEVICE USAGE CHANGED - PLEASE REBOOT THE DEVICE	Device usage (Safety/OnOff/Hybrid) was changed
EMERGENCY TRIP ACTIVATED	Emergency trip was activated
ETT CLOSING TIME TOO HIGH	Too high closing time detected in emergency trip test
ETT OPENING TIME TOO HIGH	Too high opening time detected in emergency trip test
FACTORY DEFAULTS ACTIVATED	Device parameters were changed to factory settings
FACTORY SETTINGS CREATE FAILURE DETECTED	Factory settings creation failed
FACTORY SETTINGS RESTORE FAILURE DETECTED	Factory settings restoration failed, i.e. current parameter set could not be loaded with factory settings
FIELDBUS COMMUNICATION FAILURE RATE LIMIT EXCEEDED	Communication with FBI-board was lost
PARAMETERS POOL FAILURE DETECTED	Parameter database initialization failed
PNEUMATICS FAILURE DETECTED	Actuator pressure difference has not changed even it should have been. Spool valve may be jammed
POSITION SENSOR FAILURE DETECTED	Position sensor defect has been detected
POSITION SENSOR RANGE TOO SMALL	Too narrow position sensor range was detected in position calibration process
PRESSURE SENSOR 1 FAILURE DETECTED	Pressure sensor #1 defect has been detected
PRESSURE SENSOR 2 FAILURE DETECTED	Pressure sensor #2 defect has been detected
PRESSURE SENSOR 3 FAILURE DETECTED	Pressure sensor #3 defect has been detected
PST BREAKAWAY PRESSURE TREND HIGH LIMIT EXCEEDED	Too high breakaway pressure detected in manual or automatic partial stroke test
PST BREAKAWAY PRESSURE TREND LOW LIMIT EXCEEDED	Too low breakaway pressure detected in manual or automatic partial stroke test
PST COUNTER LIMIT EXCEEDED	Partial stroke test counter has exceeded the configurable limit
PST LOAD FACTOR TREND HIGH LIMIT EXCEEDED	Too high load factor detected in manual or automatic partial stroke test
PST LOAD FACTOR TREND LOW LIMIT EXCEEDED	Too low load factor detected in manual or automatic partial stroke test
STATISTICS DATABASE ERROR DETECTED	Error occurred when writing statistics to database
STROKE CLOSE TIME TREND LIMIT ECXCEEDED	Too high close stroke time detected in OnOff device
STROKE OPEN TIME TREND LIMIT ECXCEEDED	Too high open stroke time detected in OnOff device
SUPPLY PRESSURE LIMIT EXCEEDED	Supply pressure is out of warning limits
SUPPLY PRESSURE TREND LIMIT EXCEEDED	Supply pressure trend value has exceeded the configurable limits
TEMPERATURE LIMIT EXCEEDED	Temperature is out of warning limits
TEMPERATURE SENSOR FAILURE DETECTED	Temperature sensor defect has been detected
TEMPERATURE TREND LIMIT EXCEEDED	Temperature trend value has exceeded the configurable limits

Display message	Description
TEST CANCELLED	Automatic partial stroke test was cancelled
	Automatic or manual pneumatic test was cancelled
	Emergency trip test was cancelled
	Manual partial stroke test was cancelled
TEST DONE	Automatic Partial Stroke Test has been completed
	Automatic or manual pneumatic test has been completed
	Emergency trip test has been completed
	Manual partial stroke test has been completed
TEST FAILED	Automatic partial stroke test failed
	Automatic or manual pneumatic test failed
	Emergency trip test failed
	Manual partial stroke test failed
TEST OVERSHOOT DETECTED	Overshoot was detected in manual or automatic partial stroke test
TEST PRESSURE DROP DETECTED	Pressure drop was detected in manual or automatic partial stroke test. This applies only for single acting actuators.
TEST START FAILED	Couldn't start automatic partial stroke test
	Couldn't start automatic or manual pneumatic test
	Couldn't start emergency trip test
	Couldn't start manual partial stroke test
TEST START FAILED - DEVICE IN ALARM STATE	Couldn't start test because device was in alarm state
TEST TIMEOUT DETECTED	Test timeout was reached
TOTAL OPERATION TIME COUNTER LIMIT EXCEEDED	Total operating time has exceeded the configurable limit
UNALLOWED VALVE MOVEMENT DETECTED	Valve position has changed but setpoint is still in open or close position
VALVE CLOSE STUCK DETECTED	Over 5 % difference between setpoint and valve position. Valve may be jammed at close position. Difference is a user configurable parameter
VALVE FULL STROKES COUNTER LIMIT EXCEEDED	Valve full stroke count has exceeded the configurable limit
VALVE INTERMEDIATE STUCK DETECTED	Over 5 % difference between setpoint and valve position. Valve may be stuck between open and close positions. Difference is a user configurable parameter
VALVE OPEN STUCK DETECTED	Over 5 % difference between setpoint and valve position. Valve may be jammed at open position. Difference is a user configurable parameter
TEST START FAILED - TEST DISABLED MODE	User has disabled all tests
TEST START FAILED - INVALID START POSITION	Invalid valve position in PST
CALIBRATION FAILED - TOO LOW SUPPLY	Too low supply pressure to perform position calibration
CALIBRATION FAILED - EMERGENCY TRIP ACTIVE	Emergency trip has occurred during position calibration
CALIBRATION FAILED - CALIBRATION ALREADY ACTIVE	Calibration function is already active
CALIBRATION FAILED - ALARM STATE ACTIVE	Alarm state prevents calibration
HOUSING PRESSURE LIMIT ECXCEEDED	Housing pressure has exceeded the detection limit

NOTE:
Parameter limits can only be changed via FF. See DTM manual or VG9000F User Guide for setting the parameter limits.

7. TROUBLE SHOOTING

Mechanical/electrical defects

1. Any request to change the valve position has no affect to the position
- Supply pressure too low
- 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 valve sticks

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

8. VG9_F/D_, VG9_F/R_, VG9_F/I_, VG9_F/K_, VG9_F/B_ (WITH LIMIT SWITCHES)

8.1 Introduction

General description

VG9000F can be equipped with limit switches. VG9000F/D_ has a Dual Module sensor with two inductive proximity switches, VG9000F/R_ has two reed type proximity switches, VG9000F/I__ has two or four inductive proximity switches, VG9000F/K2_ has two microswitches, VG9000F/K4_ has four microswitches and VG9000F/B_ has two bus powered mechanical micro switches. Limit switches are used for electrical position indication of the valves and other devices.

The switching points may be chosen freely.
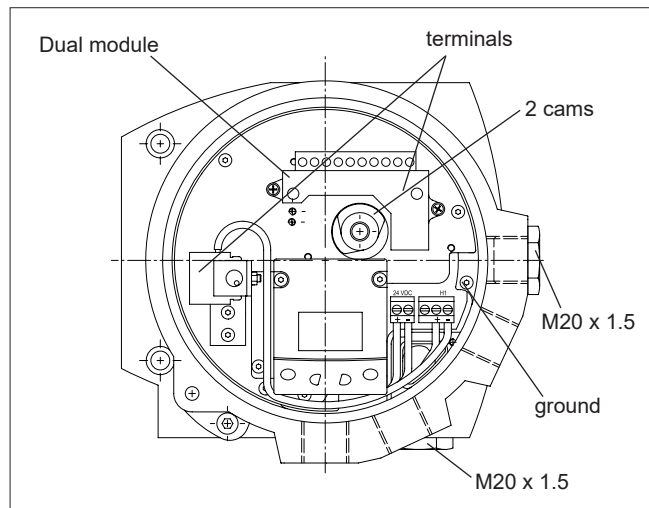

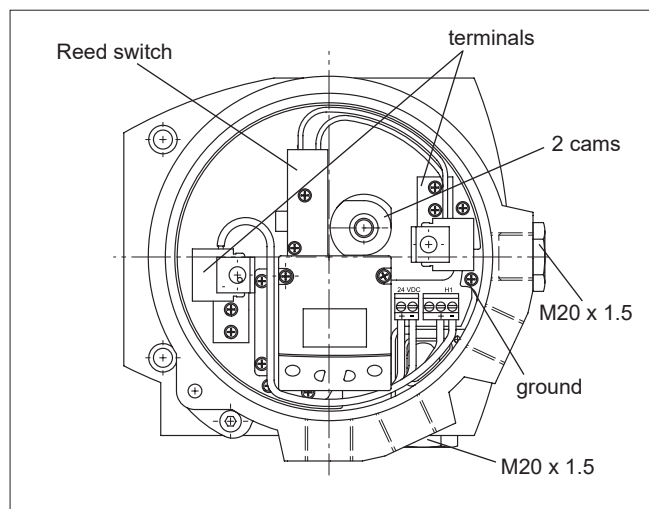Fig. 24   VG9_F/D_ layout

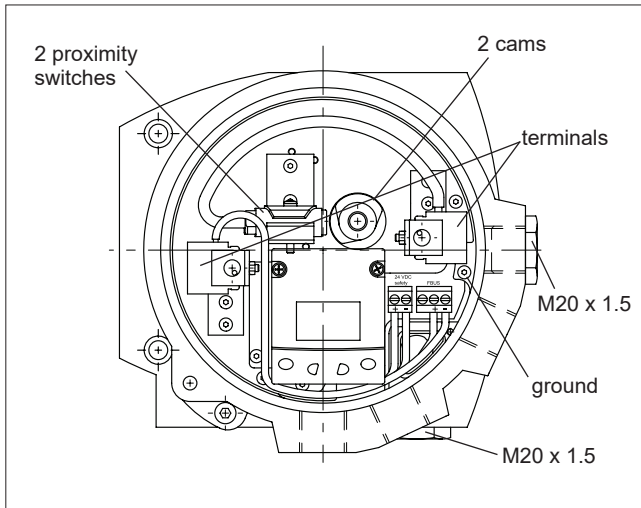Fig. 25   VG9_F/R_ layout
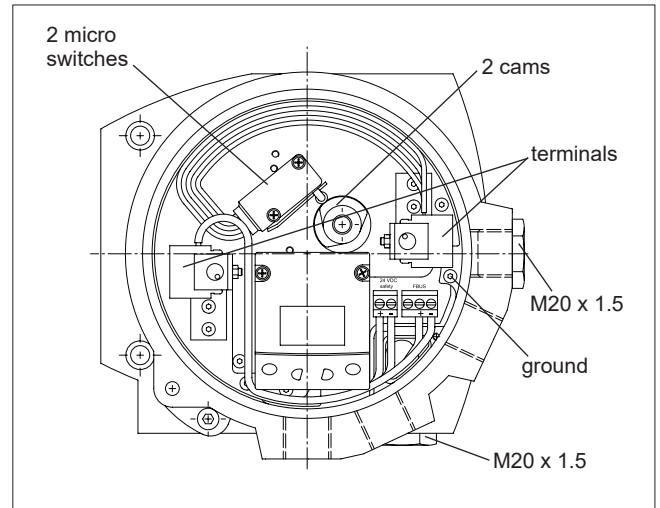
Fig. 26   VG9_F/I_ (I02, I09, I56) layout

Fig. 29   VG9_F/K2_ layout
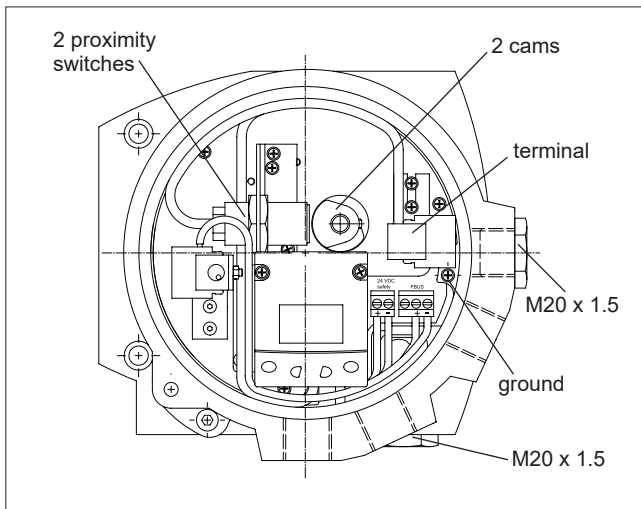
Fig. 27   VG9_F/I45 layout
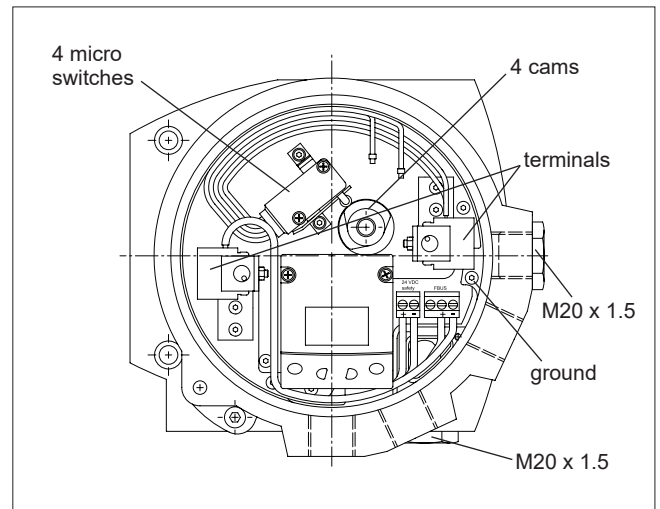
Fig. 30   VG9_F/K4_ layout
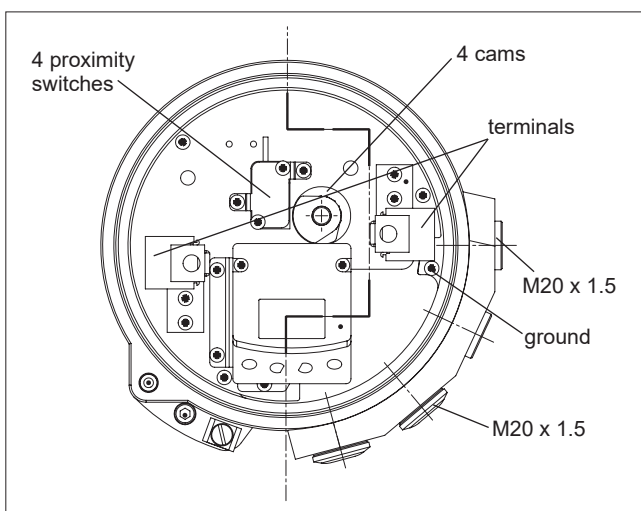
Fig. 28   VG9_F/I57, I58 layout
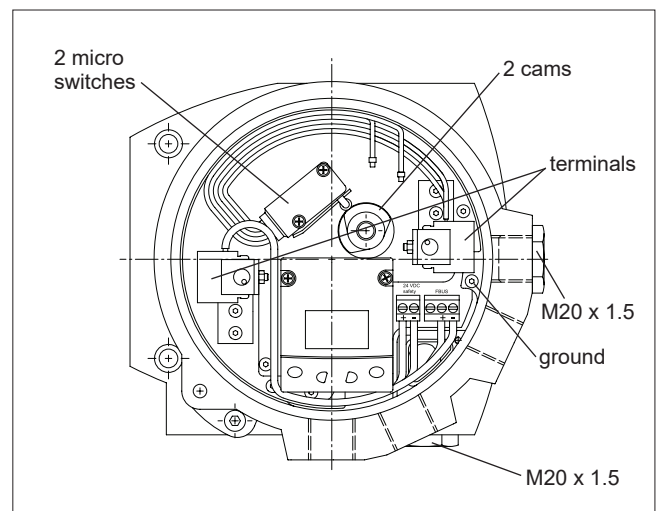
Fig. 31   VG9_F/B_ layout

Markings

The limit switch is provided with an identification plate, see Fig. 29. Identification plate markings are:

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

The type designation is described in Chapter 15.


```
LIMIT SWITCH TYPE VG9200E6/K25   WARNING: DO NOT OPEN WHILE ENERGIZED!
OMRON D2VW-5: 3 A - 250 V AC, 0,4 A - 125 V DC, 5 A - 30 V DC
ENCLOSURE: IP66 / NEMA 4X, CONDUIT ENTRY: M20x1,5 OR ☐ 1/2 NPT
VALMET OY, VANHA PORVOONTIE 229, 01380 VANTAA, FINLAND
                          NO. PH11150002
                          ID: SO580345001RAJ
```
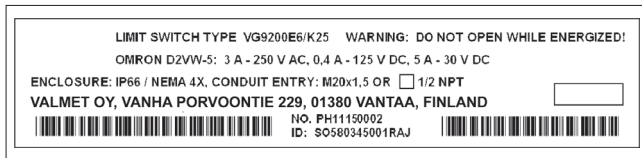
Fig. 32   Example of identification plate

Technical specifications

VG9_F/R_

Reed switch type:	Valmet MaxxGuard G	(01)
	Valmet MaxxGuard H	(04)
Electrical rating:	300 mA / 24 V DC	(01)
	200 mA / 125 V AC	(01)
	3 A / 240V	(04)
Max. voltage drop:	0.1 V at 10 mA	(01)
	0.5 V at 100 mA	(01)
Contact:	Rhodium	(01, 04)
Number of switches:	2	(01, 04)
Ambient temperature:	-40 °C to +85 °C / -40°F to +185 °F	(01)
	-40 °C to +80 °C / -40°F to +176 °F	(04)

VG9_F/I_

Proximity switch:	Inductive	
Diameter	12–18 mm	(02, 09, 45, 56)
Size	28 x 16 x 10 mm	(LxWxH) (57, 58)
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)
Ambient temperature:	-40° to +85 °C /-40° to +185 °F	(02)
	-25° to +85 °C /-13° to +185 °F	(09, 45, 57, 58)
	-40° to +80 °C / -40° to +176 °F	(56)

VG9_F/K_

Microswitch type:	OMRON D2VW-5	(25 or 45)
	OMRON D2VW-01 (gold-plated contacts)	(26 or 46)
Resistive load:	3A: 250 V AC	(25 or 45)
	5A: 30 V DC	
	0.4A: 125 V DC	
	100 mA: 30 V DC / 125 V AC	(26 or 46)
Switch accuracy:	< 2°	
Number of switches:	2 (K25 or K26), 4	(45 or 46)
Ambient temperature:	-40° to +80 °C / -40° to +176 °F	

VG9_F/B_

Microswitch type:	OMRON D2VW-01 (gold-plated contacts)	(06)
Resistive load:	100 mA: 30 V DC/125 V AC	(06)
Switch accuracy:	< 2°	
Number of switches:	2	
Ambient temperature:	40° to +80 °C / -40° to +176 °F	
Materials:		
Internal parts:	Stainless steel and polymer	
Sealing:	Nitrile and neoprene rubber	

Electric data and ambient temperatures

See the certificates.

8.2 Installing limit switches on ValvGuard

The limit switch may be installed on an existing 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

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.
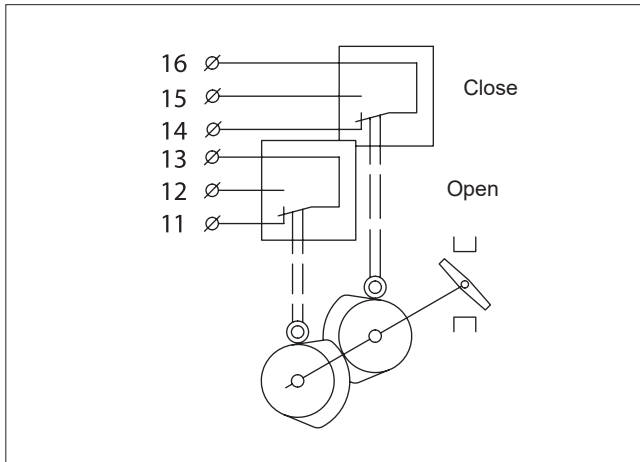
Fig. 33   Limit switch adjustment, 2 switches
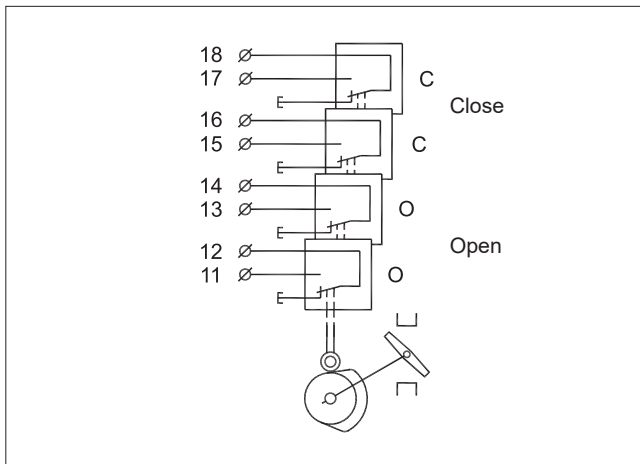
Fig. 34   Limit switch adjustment, 4 switches

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

8.5 Removal of the limit switches VG9_F/D_, VG9_F/R_, VG9_F/I_, VG9_F/K_ or VG9_F/B_ 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.

8.6 Circuit diagrams

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

8.7 Maintenance

Regular maintenance of the limit switch is not necessary.

9. TOOLS

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.

11. DRAWINGS AND PARTS LISTS

11.1 Exploded view and parts list, VG9000F
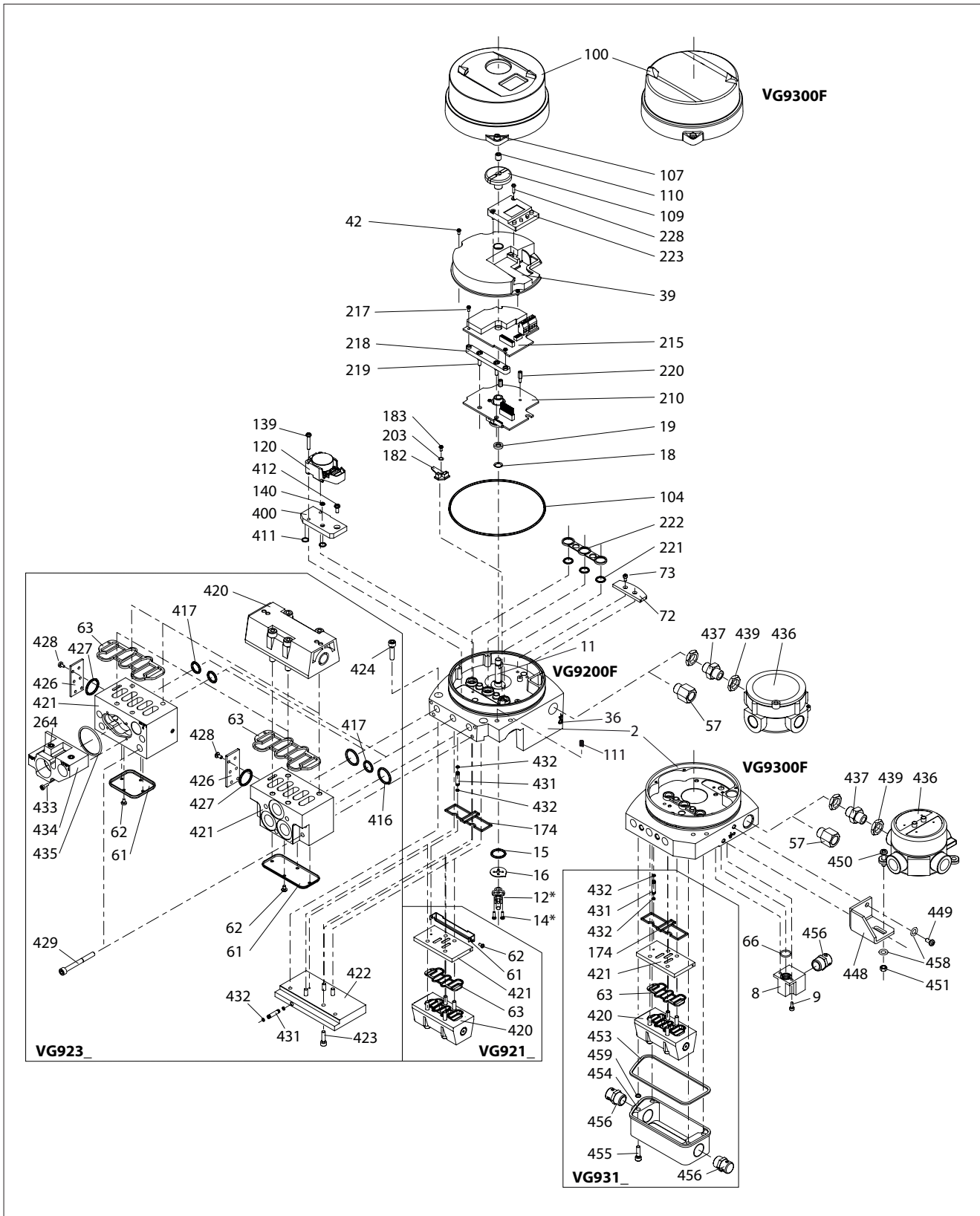
Item	Qty	Description	
2	1	Housing	
8	1	Exhaust adapter	
9	1	Screw	
11	1	Shaft assembly	
15	1	O-ring	
16	1	Washer	
18	1	Wave spring	
19	1	Bushing	
36	1	Grounding screw	
39	1	Protection cover	
42	3	Screw	
57	1	Conduit entry adapter	
61	1	Exhaust cover	
62	2	Screw (VG921_)	
	4	Screw (VG923_)	
63	1	Gasket	
66	1	O-ring	
72	1	Cooling plate	
73	2	Screw	
100	1	Cover	
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

11.2 Exploded view and parts list, VG9_F/D_, VG9_F/R_, VG9_F/I_,VG9_F/K_,VG9_F/B_
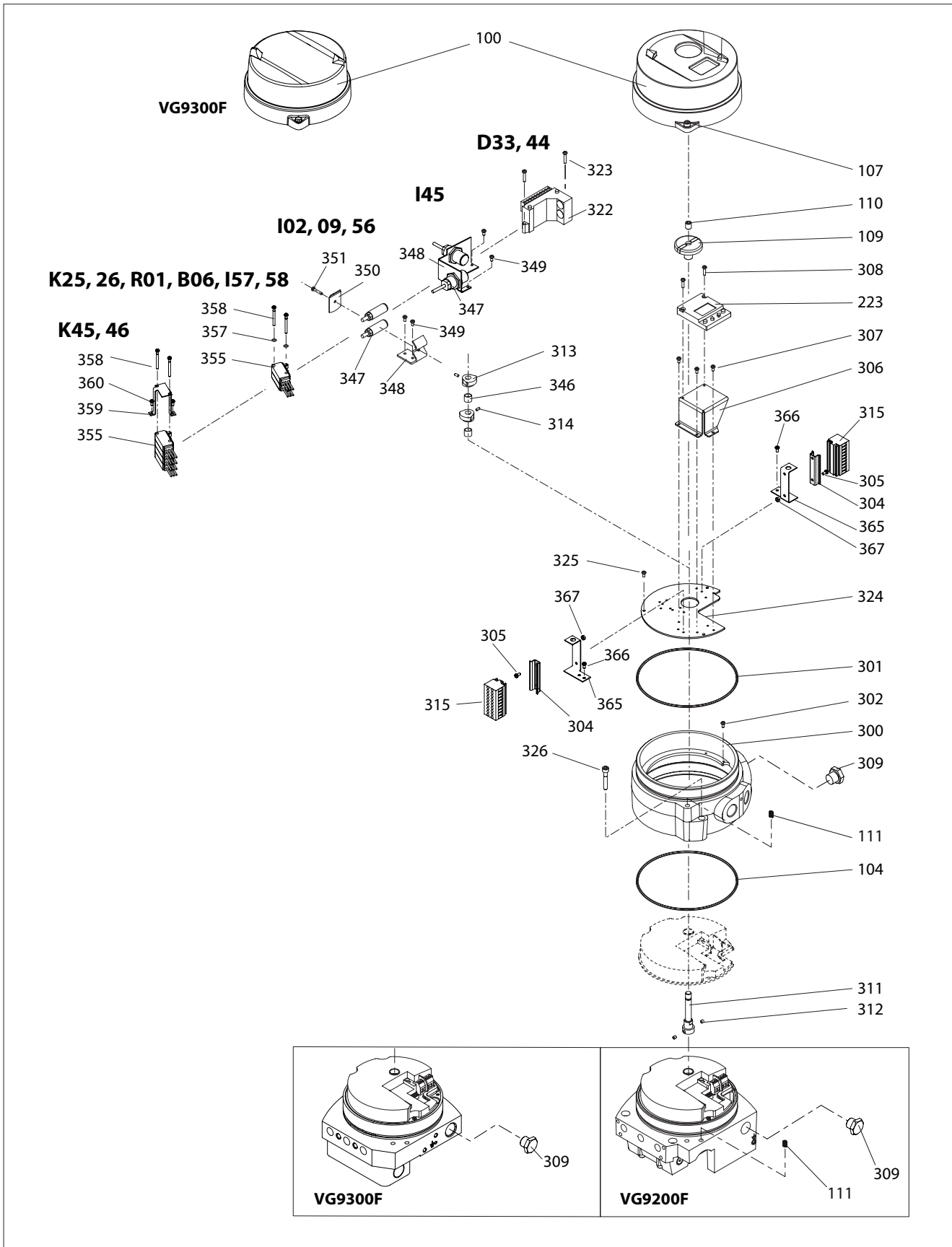
Item	Qty	Description	
100	1	Cover	
107	1	Screw	
109	1	Pointer	
110	1	Stop screw	
111	2	Spring	
223	1	Local user interface (LUI)	
300	1	Housing	
301	1	O-ring	
302	1	Screw	
304	2	Bracket	
305	4	Screw	
306	1	Bracket	
307	3	Screw	
308	2	Screw	
309	2	Plug	
311	1	Extension shaft	
312	2	Screw	
313	2 or 4	Cam 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	Micro-, Reed- or Proximity switch	
357	2	Spring washer	
358	2	Screw	
359	1	Support band	
360	2	Screw	
365	2	Bracket	
366	4	Screw	
367	4	Hex nut	
449	2	Screw	
450	1	Screw	
451	1	Hexagon nut	

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

B_U8-20

B_U25-502

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

QPII (1, 2, 3, 4, 5, 6)
Valv-Powr
DRIVE: FEMALE SPLINE

QPII (1, 2, 3, 4, 5)
ST
SP
DRIVE: MALE

VG9200

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

Feedback lever in horizontal position at mid travel of stroke.

Stroke 10 - 80 mm

Stroke 60 - 120 mm

45°
45°

Maximum stroke 80 mm

45°
45°

Maximum stroke 120 mm

Allowed travel range 45–90°

Plane in the shaft in this position with feedback lever

Scale on this side

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.

FOUNDATION fieldbus and Safety Signal (Binary Input) connections

Detail A

* Optional resistor (min. 500 ohm, 2 W) installed to terminals 3-4, if customer safety system requires it for line integrity diagnosis. Possible for E6 type code option only.
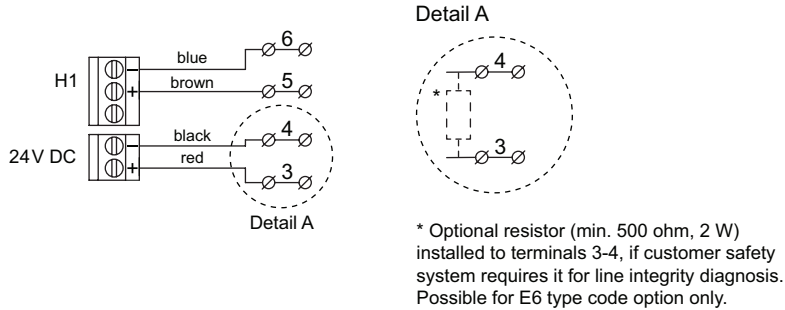
Note: Cable colors are valid only when separate junction box (type code option J) is used.

VG9_F/R01, R02, R04
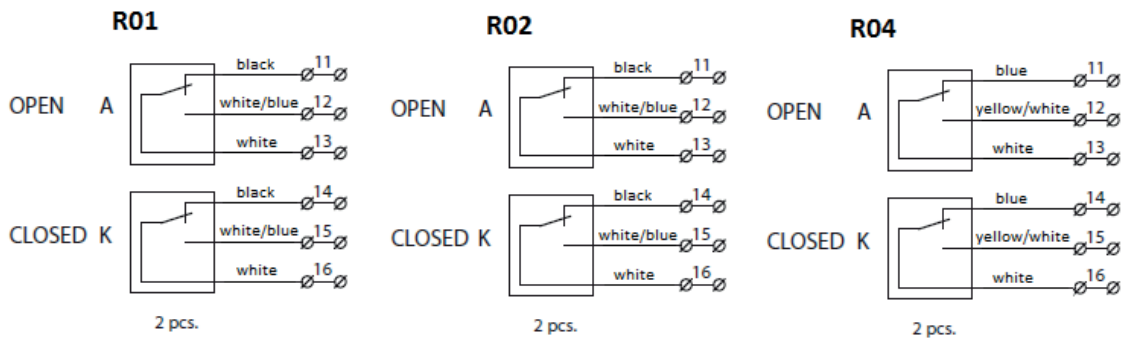
Connection diagram shows limit switch when actuator is in intermediate position.
Switch A (upper) is activated at the open limit of the travel and switch K (lower) at the closed limit.
See Section 8.1.3.2 for electrical ratings.

VG9_H/R35

```
                                                    GND    Green   17
                                                           Black   16
                                    CLOSED   C              Blue    15
                                                           Red     14

                                                           Black   13
                                    OPEN     O              Blue    12
                                                           Red     11
```
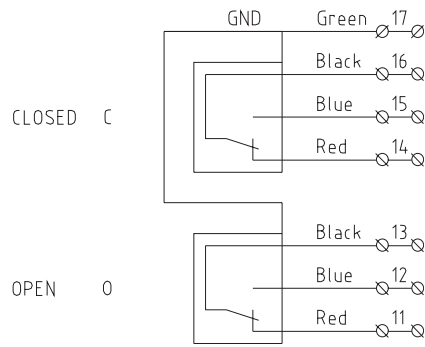
ND/SG/VG9000/R35
Connection diagram shows limit switch when actuator is in intermediate position.
Switch C (upper) is activated at the closed limit of the travel and switch 0 (lower) at the open limit.

Electrical characteristics:
4 A - 120 V AC, 2 A - 240 V AC, 3 A - 24 V DC, 0.5 A - 125 V DC
Ambient temperature: -40 ... +85 °C

VG9_F/I02, I09   ## VG9_F/I45
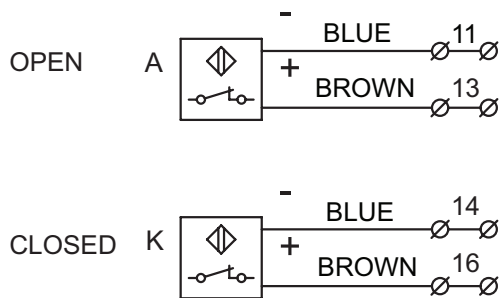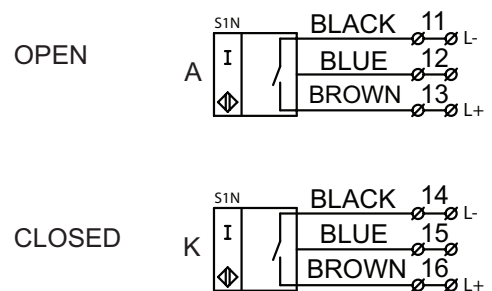
```
                    -                                                      S1N
OPEN     A          BLUE    11              OPEN          A        I   BLACK  11  L-
                    +                                                          BLUE   12
                    BROWN   13                                              BROWN  13  L+

                    -                                                      S1N
CLOSED   K          BLUE    14              CLOSED        K        I   BLACK  14  L-
                    +                                                          BLUE   15
                    BROWN   16                                              BROWN  16  L+
```

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_F/I56
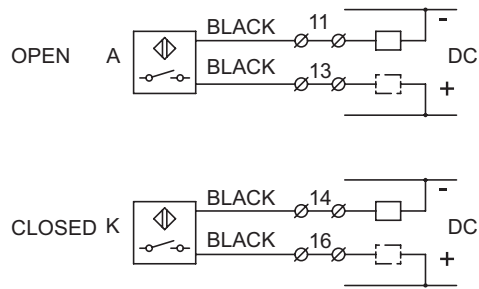
Factory adjustment:

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

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

Connections: Load can be connected to + or -.

VG9_F/I57, I58
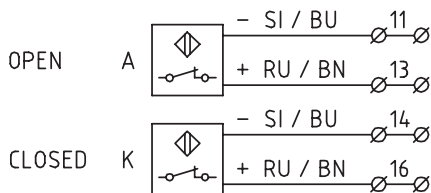
Switch types I02, I09, I41, I57, I58 (2 pcs)
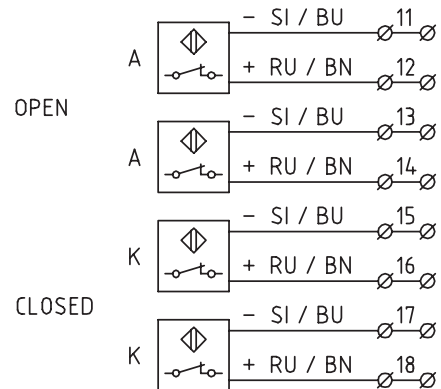
Switch type I58 (4 pcs)

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_F/K25, K26, K45, K46

OPEN A

	RED	11
	BLUE	12
	BLACK	13

CLOSED K

	RED	14
	BLUE	15
	BLACK	16

2 pcs.

OPEN

A

	RED	
	BLUE	11
	BLACK	12

A

	RED	
	BLUE	13
	BLACK	14

CLOSED

K

	RED	
	BLUE	15
	BLACK	16

K

	RED	
	BLUE	17
	BLACK	18

4 pcs.

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

VG9_F/B06

LS1   O

	12
	13

LS2   C

	15
	16

1   2   3

1: LS1 (open)
2: LS2 (closed)
3: GND

Bus powered switches, no external connections.

12. DIMENSIONS

VG921_ or VG921_/_

VG921_E6: M20x1.5

VDI/VDE 3845

1/4NPT

5/16UNCx13

M6x10

(35.4)
F05-

VG923_ or VG923_/_

VG923_E6: M20x1.5

VDI/VDE 3845

1/2NPT

5/16UNCx13

M6x10

(35.4)
F05-
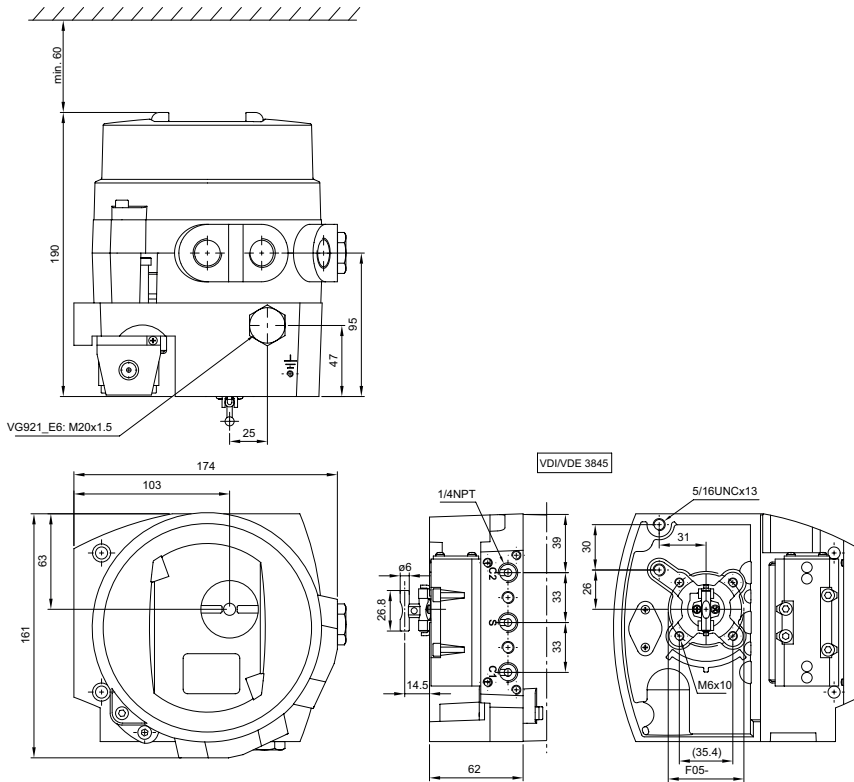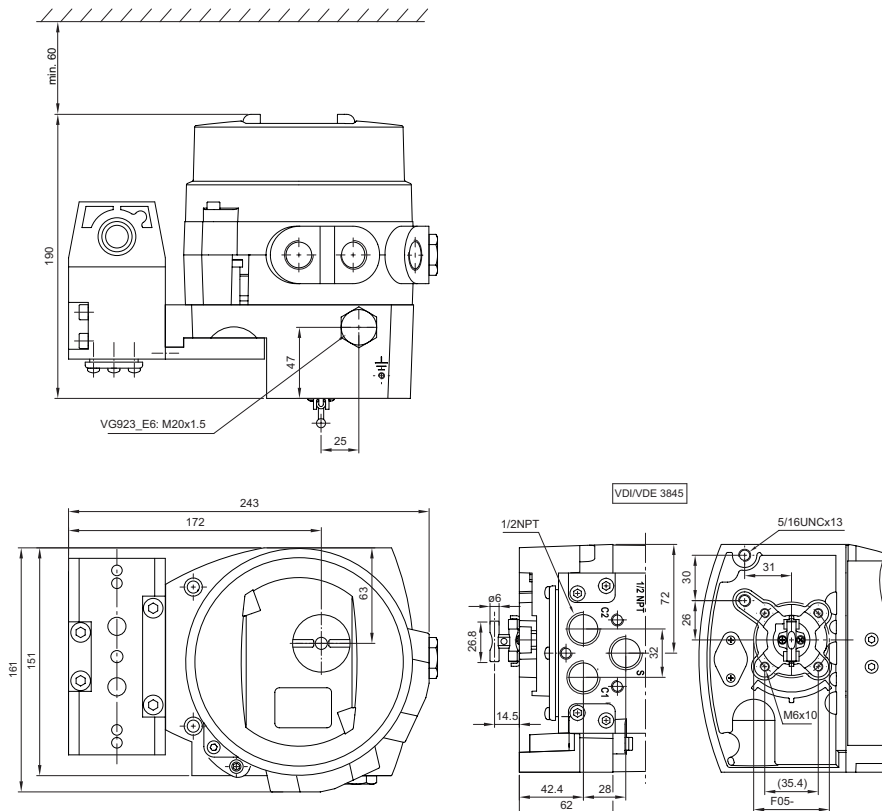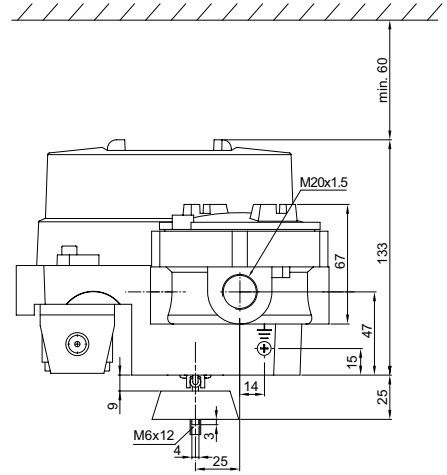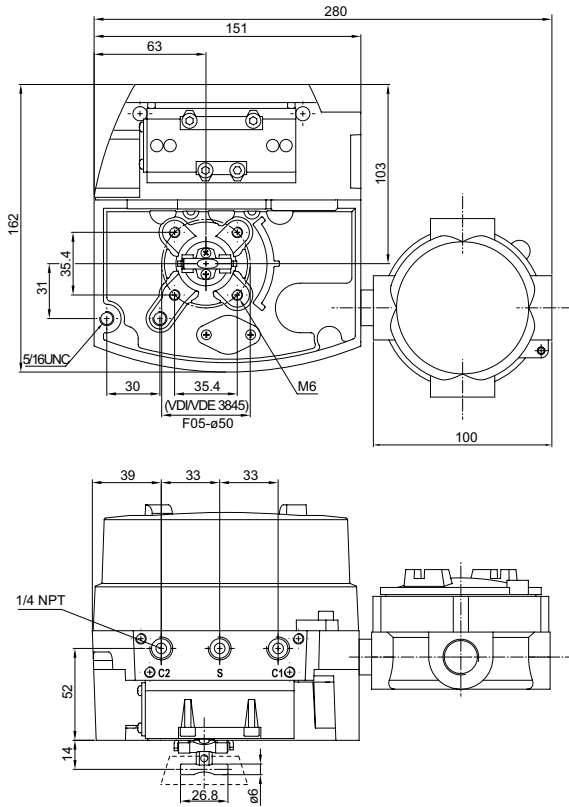
VG921_J

VG923_J

VG921_J/_

VG923_J/_

VG931_J
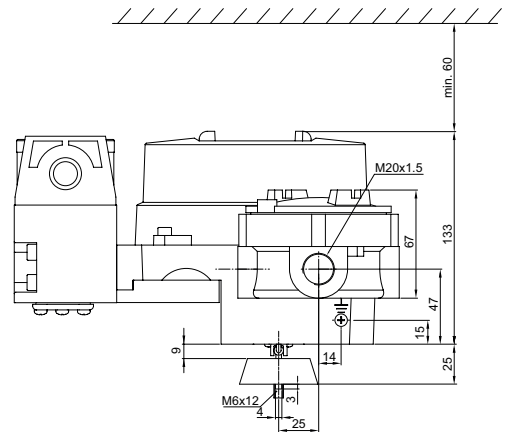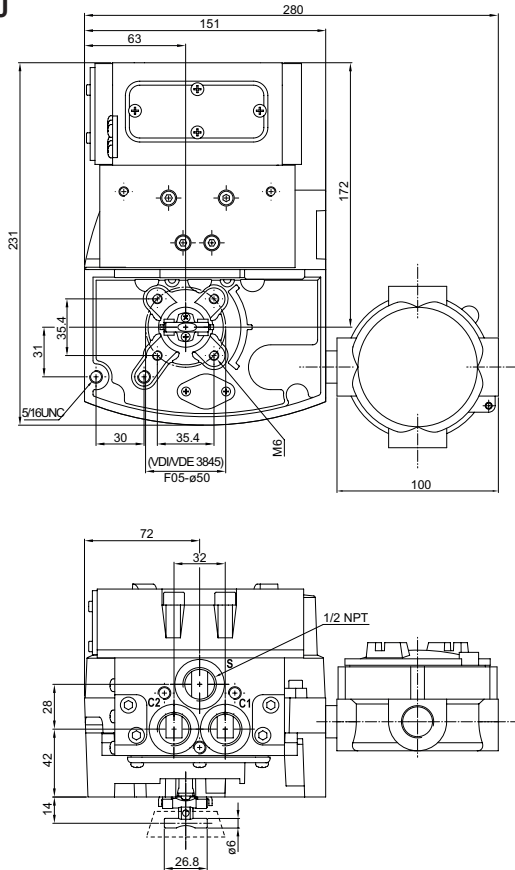
VG931_ with extension housing
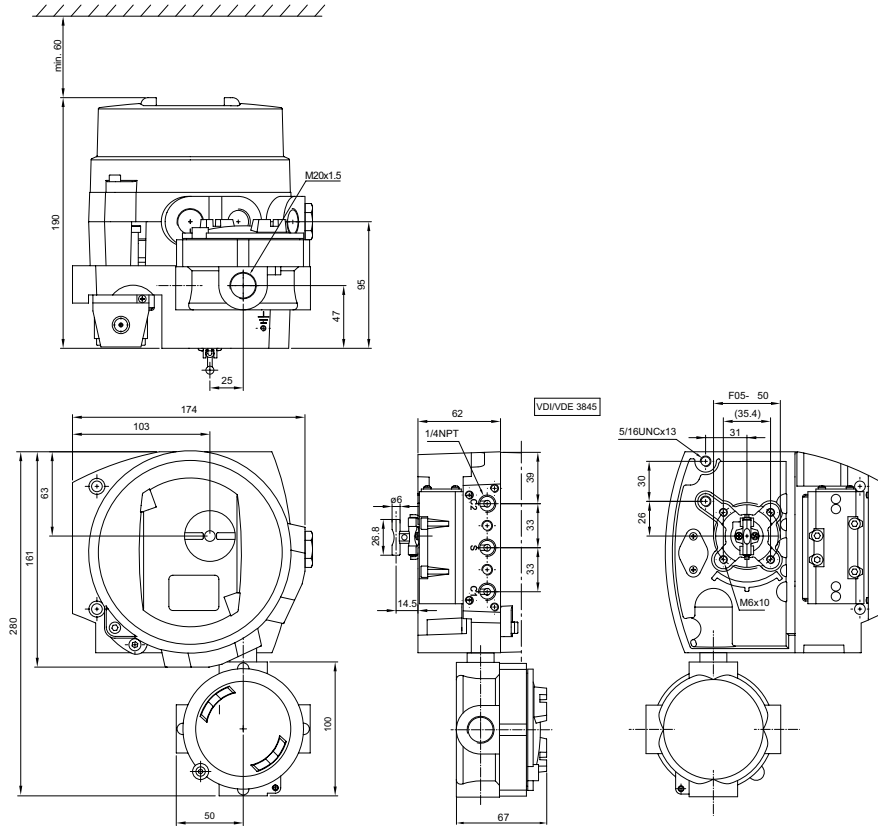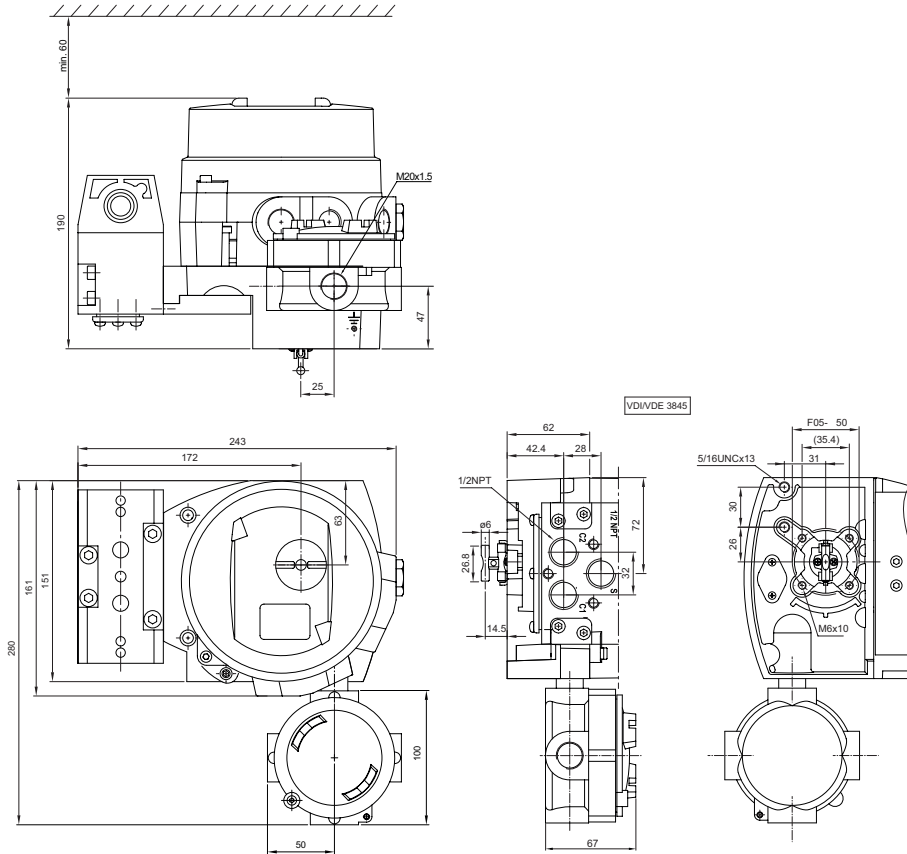
VG931_J with extension housing
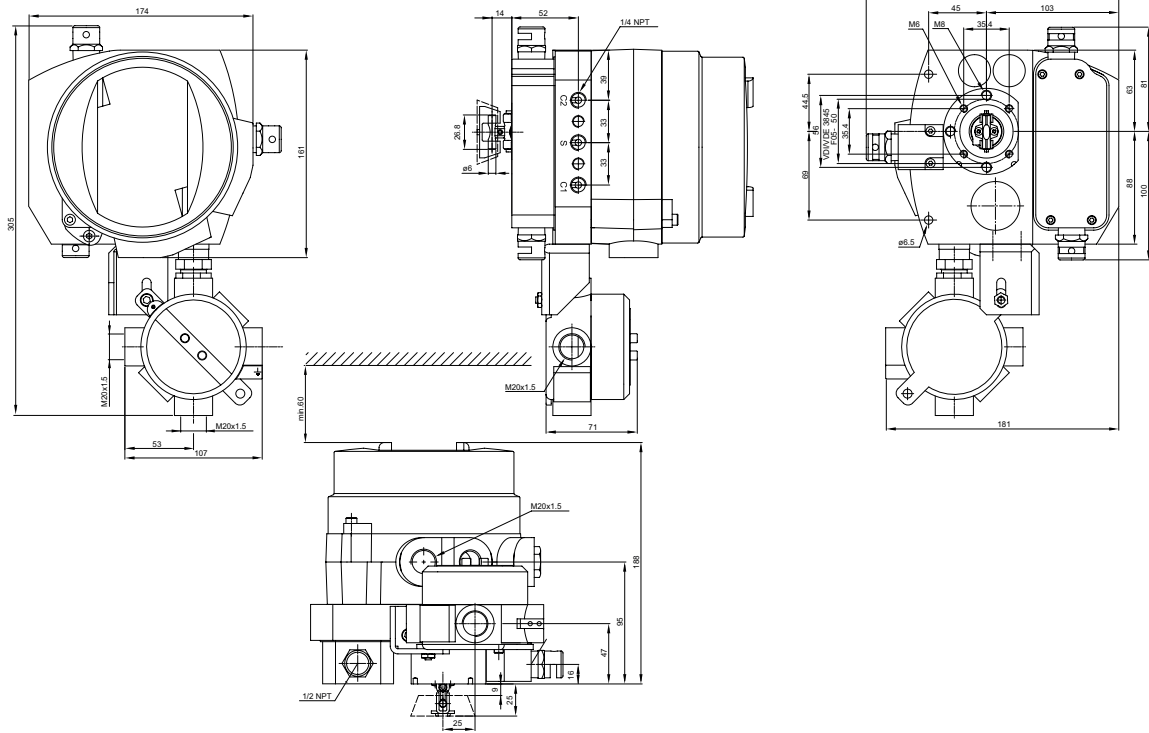
13. CONFIGURATION PARAMETERS

Parameter Name	Values	Visibility by Device Usage			Default value	Valid range	Unit
		Safety	Hybrid	On/Off			
Actuator Type (Atyp)	Single acting actuator (1-A) Double acting actuator (2-A)	x	x	x	1-A		
Valve Type (Vtyp)	Rotary (rot) Linear (Lin)	x	x	x	rot		
Positioner Fail Action (PFA)	Close (CLO) Open (OPE)	x	x	x	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	x	x		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 = B1J32- (>30 dm^3 / >1831 in^3)	x	x	x	S 1		
Spool type (STYP)	15 = VG9_12 or VG9_15 35 = VG9235 37 = VG9237	x	x	x	15		
Stroke Profile Open (SPOP)	1 = linear 2 = slow starting 3 = slow starting and ending 4 = equal percentage 5 = quick starting 0 = undefined profile (cannot be selected from LUI)		x		1 (linear)		
Stroke Profile Close (SPCL)	1 = linear 2 = slow starting 3 = slow starting and ending 4 = equal percentage 5 = quick starting 0 = undefined profile (cannot be selected from LUI)		x		1 (linear)		
Stroke Time Open (STOP)			x		10	0–999	s
Stroke Time Close (STCL)			x		10	0–999	s
Automatic Partial Stroke Test (APSt)	dis = auto PST disabled EnA = auto PST enabled rnd = auto PST enabled with randomized range	x			dIS		
Manual Partial Stroke Test Size (MSTr)		x	x		10.0	3.0–100.0	%
Manual Stroke Speed (MSPd)		x	x		1.0	0.5-3.0	%
Language (LANG)	English (EnG) German (GEr) French (FrE)	x	x	x	EnG		

14. EC DECLARATION OF CONFORMITY

Valmet ◆

EU DECLARATION OF CONFORMITY

Manufacturer:
Neles Finland Oy
01301 Vantaa
Finland

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

Approvals:

Type	Approval	EC Type examination Certificate
VG9_FX_/_ (ATEX)	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	EESF 20 ATEX 027X EN IEC 60079-0:2018, EN 60079-11:2012
	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	EESF 20 ATEX 029X EN IEC 60079-0:2018, EN 60079-11:2012, EN 60079-15: 2010
VG9_E6_/_	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 2014/34/EU   Approved and Ex marked types

ATEX Notified Bodies for EC Type Examination Certificates:

CSA (Notified body number 2813)
CSA Group Netherlands B.V.
Utrechtseweg 310,
6812 AR, Arnhem,
Netherlands

EESF (Notified body number 0537)
Eurofins Electric & Electronics Finland Oy
Kivimiehentie 4
FI-02150 Espoo
Finland

ATEX Notified Body for Quality Assurance:

ISO 9001:2015	DNV-GL	73538-2010-AQ-FIN-FINAS
ATEX 2014/34/EU Annex IV	Presafe 2460	Presafe 18 ATEX 91983Q

Det Norske Veritas AS (Presafe Notified body number 2460)
Veritasveien 1
1322 Høvik, Oslo
Norway

Vantaa 15th November 2022

Janne Jussila, Quality Manager
Authorized person of the manufacturer within the European Community and UK

15. TYPE CODING

VALVGUARD VG9000F								
1.	2.	3.	4.	5.	6.	7.		8.
VG	9	2	15	F	E6		/	R01

1.	PRODUCT GROUP
VG	Neles ValvGuard VG9000F, Intelligent Safety Solenoid. TÜV Rheinland SIL 3 certified according to IEC 61508.

2.	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.	ENCLOSURE
	IP66 / NEMA 4X. Standard temperature range -40 °C to +85 °C / -40 °C to +185 °F. M20 x 1.5 conduit entry; 2 pcs
2	Standard epoxy coated anodized aluminium enclosure.
3	Full 316 stainless steel enclosure, no glass window. Glass window available as an option (use 7. sign "Y").

4.	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. 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.	COMMUNICATION / INPUT SIGNAL RANGE
F	Foundation fieldbus, physical layer according to IEC 61158-2

6.	APPROVALS FOR HAZARDOUS AREAS
X	**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 with or without limit switches. See 9. sign for available options.
X8	**CCC (Chinese) certification:** Ex ia IIC T4~T6 Ga Ex iaD 20 T95/T110/T125 Ex ib IIC T4~T6 Gb Ex ibD 21 T95/T110/T125 Ex ic IIC T4~T6 Gc Ex icD 22 T95/T110/T125 Ex nA IIC T4~T6 Gc Available with or without limit switches. See 9. sign for available options.
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 °C to +85 °C; T5: <+75 °C; T6: <+60 °C. Available with or without limit switches. See 9. sign for available options. 1/2" NPT conduit entries. No glass window.
E5	**INMETRO certifications:** Ex db IIC T6...T4 Gb Ex tb IIIC T80 °C... T105 °C Db IP66 Available with or without limit switches. See 9. sign for available options.
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: Ta according to separate table (see certificate). Available with or without limit switches. See 9. sign for available options.
E8	**CCC (Chinese) certification:** Ex d IIC T4~T6 Gb Ex tD A21 IP66 T80°C/T95°C/T105°C Available with or without limit switches. See 9. sign for available options.

7.	OPTIONS
J	External junction box, 2 pcs M20x1.5 conduit entries. 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.
Y	Special construction, to be specified.

8.	LIMIT SWITCH TYPE
	Extension housing with additional conduit entries, 4 pcs. M20 x 1.5.
	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 W. Potentiometer Contelec GL60, transmitter electronics Neles. Temperature range -40 to +85 °C / -40 to +185 °F. Applicable to 6. sign "X" or "E6". Not applicable with limit switches.
	Inductive proximity sensors, 2 pcs.
D33	Obsolete Select R01 option instead.
D44	Obsolete Select replacement from other NAMUR switch options, e.g. I02.
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.
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.
I45	P+F; NJ3-18GK-S1N, 2-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.
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.
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.
	Reed or Leverless Type Proximity Switches, 2 pcs. Temperature range -40° to +80 °C / -40° to +176 °F.
R01	Neles; Maxx-Guard G, Reed, SPDT, 300 mA, 24 V DC; 200 mA, 125 V AC. Temperature range -40° to +80 °C / -40° to +176 °F. Usable up to SIL 3acc. to IEC61508. Applicable to 6. sign "E2", "E5", "E6", "E7"or "E8"
R02	Neles; 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.
R04	Neles; Maxx-Guard H, Reed, SPDT, V_{max} 240 v, I_{max} 3A, V_{max} 100W. Temperature range -40° to +80 °C / -40° to +176 °F. Usable up to SIL 3 acc. to IEC61508. Applicable to 6. sign"E2", "E5", "E6" or "E8".
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° to +85°C / -40° to +185 °F. Applicable to 6. sign"E2", "E5", "E6" or "E8". **NOTE:** Not for general use, only for projects with product management approval.

8.	LIMIT SWITCH TYPE
	Mechanical micro switches Temperature range -40° to +85 °C / -40° to +185 °F.
K25	2 pcs. Omron D2VW-5L2A-1MS; 3 A – 250 V AC, 0.4 A – 125 V DC, 5 A – 30 V DC. Applicable to 6. sign "E2", "E5", "E6" or "E8".
K26	2 pcs. Omron D2VW-01L2A-1MS; gold plated contacts, 100 mA - 30 V DC / 125 V AC. Applicable to 6. sign "E2", "E5", "E6" or "E8".
K45	4 pcs. Omron D2VW-5L2A-1MS; 3 A – 250 V AC, 0.4 A – 125 V DC, 5 A – 30 V DC. Applicable to 6. sign "E2", "E5", "E6" or "E8".
K46	4 pcs. Omron D2VW-01L2A-1MS; gold plated contacts, 100 mA - 30 V DC / 125 V AC. Applicable to 6. sign "E2", "E5", "E6" or "E8".
	Bus powered mechanical micro switches Temperature range -40° to +85 °C / -40° to +185 °F.
B06	2 pcs. Omron D2VW-01L2A-1MS; gold plated contacts; Bus Powered, no external power needed. Applicable to 6. sign "E2", "E5", "E6" or "E8".

Valmet