

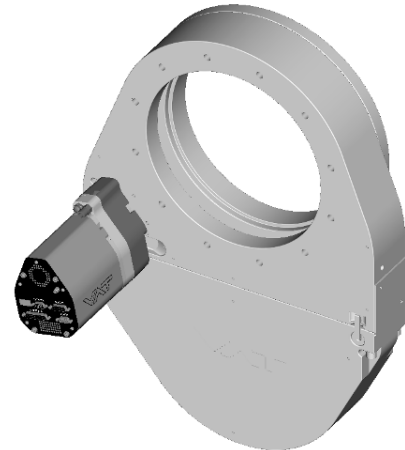
## Pendulum control & isolation valve with Logic interface

This manual is valid for the valve ordering number(s):

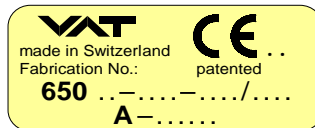
<b>650</b> . . . . <b>GC</b> - . . . .	(1 sensor input)
<b>650</b> . . . . <b>GE</b> - . . . .	(2 sensor inputs)
<b>650</b> . . . . <b>AC</b> - . . . .	(1 sensor input / ±15V SPS)
<b>650</b> . . . . <b>AE</b> - . . . .	(2 sensor inputs / ±15V SPS)
<b>650</b> . . . . <b>HC</b> - . . . .	(1 sensor input / PFO)
<b>650</b> . . . . <b>HE</b> - . . . .	(2 sensor inputs / PFO)
<b>650</b> . . . . <b>CC</b> - . . . .	(1 sensor input / ±15V SPS / PFO)
<b>650</b> . . . . <b>CE</b> - . . . .	(2 sensor inputs / ±15V SPS / PFO)

SPS = Sensor Power Supply      PFO = Power Failure Option  
 configured with firmware    **650P.1E.05, 650P.1E.32, 650P.1E.36**

The fabrication number is indicated on each product as per the label below (or similar):



sample picture



← Fabrication number

### Explanation of symbols:



Read declaration carefully before you start any other action!



Keep body parts and objects away from the valve opening!



Attention!



Hot surfaces; do not touch!



Product is in conformity with EC guidelines, if applicable!



Loaded springs and/or air cushions are potential hazards!



Disconnect electrical power and compressed air lines. Do not touch parts under voltage!



Wear gloves!



Read these «**Installation, Operating & Maintenance Instructions**» and the enclosed «**General Safety Instructions**» carefully before you start any other action!



## Imprint

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## 1 Use of product

This product is a throttling pendulum valve with isolation functionality. It is intended to use for downstream pressure control applications.

Use product for clean and dry indoor vacuum applications under the conditions indicated in chapter «Technical data» only! Other applications are only allowed with the written permission of VAT.

### 1.1 Technical data

Control and actuating unit	
Power input <sup>1)</sup> ( $\alpha$ ) [650 . . . . . A . . . . . / 650 . . . . . G . . . . .] [650 . . . . . C . . . . . / 650 . . . . . H . . . . .]	+24 VDC ( $\pm 10\%$ ) @ 0.5 V pk-pk max. [connector: POWER] 50 W max. (operation of valve with max. load) without PFO <sup>4)</sup> 50 W plus 10 W for PFO <sup>4)</sup>
Sensor power supply <sup>2)</sup> ( $\beta$ ) [650 . . . . . A . . . . . / 650 . . . . . C . . . . .] Input Output	+24 VDC / 1500 mA max. [connector: POWER] $\pm 15$ VDC ( $\pm 5\%$ ) / 1000 mA max. [connector: SENSOR]
Sensor power supply <sup>2)</sup> ( $\beta$ ) [650 . . . . . G . . . . . / 650 . . . . . H . . . . .] Input Output	+ 24 VDC resp. $\pm 15$ VDC [connector: POWER] same as input but: [connector: SENSOR] 2.0 A max. at $\pm 15$ VDC 1.5 A max. at + 24 VDC

Calculation of complete power consumption:

$$P_{\text{tot}} = \alpha + \beta$$

whereas  $\beta$  depends on sensor supply concept and sensor power consumption.



Control and actuating unit (continuation)			
Sensor input Signal input ADC resolution Sampling time	0-10 VDC / Ri>100 kΩ [connector: SENSOR] 0.23 mV 10 ms		
Digital inputs <sup>3)</sup>	±24 VDC max. [connector: INTERFACE]		
Digital outputs <sup>3)</sup> Input voltage Input current Breaking capacity	70 VDC or 70 V peak max. [connector: INTERFACE] 0.5 ADC or 0.5 A peak max. 10 W max.		
Analog outputs <sup>3)</sup>	0-10 VDC / 1 mA max. [connector: INTERFACE]		
PFO <sup>4)</sup> battery pack [650 . . . . . C . . . . . / 650 . . . . . H . . . . .] Charging time Durability	2 minutes max. up to 10 years @ 25°C ambient; refer to «Durability of power fail battery» for details		
Compressed air supply	4 - 7 bar / 55 - 100 psi (above ATM)		
Ambient temperature	0 °C to +50 °C max. (<35 °C recommended)		
Pressure control accuracy	0.1% of sensor full scale		
	<b>DN 320</b> <b>12"</b> (65050 - ....)	<b>DN 350</b> <b>14"</b> (65051 - ....)	<b>DN 400</b> <b>16"</b> (65052 - ....)
Position resolution / position control capability	13333 steps (full stroke)	13422 steps (full stroke)	13511 steps (full stroke)
Closing time throttling only	1.1 s typ. (full stroke)	1.3 s typ. (full stroke)	1.5 s typ. (full stroke)
Opening time throttling only	1.1 s typ. (full stroke)	1.3 s typ. (full stroke)	1.5 s typ. (full stroke)
Closing time throttling & isolation	5 s typ. (full stroke)	5 s typ. (full stroke)	5 s typ. (full stroke)
Opening time throttling & isolation	6 s typ. (full stroke)	6 s typ. (full stroke)	6 s typ. (full stroke)

- 1) Internal overcurrent protection by a PTC device.
- 2) Refer to chapter «Sensor supply concepts» for details.
- 3) Refer to chapter «Schematics» for details.
- 4) PFO = Power Failure Option. Refer to «Behavior in case of power failure» for details.



Valve unit			
Pressure range at 20°C			
- Aluminum (650 . . . . A . . . . .)	1 x 10E-8 mbar to 1.2 bar (abs)		
- Aluminum hard anodized (650 . . . . H . . . . .)	1 x 10E-6 mbar to 1.2 bar (abs)		
- Aluminum nickel coated (650 . . . . I . . . . .)	1 x 10E-8 mbar to 1.2 bar (abs)		
Leak rate to outside at 20°C			
- Aluminum (650 . . . . A . . . . .)	1 x 10E-9 mbar l/s		
- Aluminum hard anodized (650 . . . . H . . . . .)	1 x 10E-5 mbar l/s		
- Aluminum nickel coated (650 . . . . I . . . . .)	1 x 10E-9 mbar l/s		
Leak rate valve seat at 20°C			
- Aluminum (650 . . . . A . . . . .)	1 x 10E-9 mbar l/s		
- Aluminum hard anodized (650 . . . . H . . . . .)	1 x 10E-4 mbar l/s		
- Aluminum nickel coated (650 . . . . I . . . . .)	1 x 10E-9 mbar l/s		
Cycles until first service			
- Isolation cycles (open - closed - open)	200'000 (unheated and under clean conditions)		
- Throttling cycles (open - max. throttle - open)	1'000'000 (unheated and under clean conditions)		
Admissible operating temperature	10°C to +150°C		
Mounting position	horizontally only (valve seat to face chamber is recommended)		
Wetted materials			
- Body (650 . . . . A . . . . .)	Aluminum 3.2315 (AA6082)		
- Body (650 . . . . H . . . . .)	Aluminum 3.2315 (AA6082) hard anodized		
- Body (650 . . . . I . . . . .)	Aluminum 3.2315 (AA6082) nickel coated		
- Pendulum plate (650 . . . . A . . . . .)	Aluminum 3.2315 (AA6082)		
- Pendulum plate (650 . . . . H . . . . .)	Aluminum 3.2315 (AA6082) hard anodized		
- Pendulum plate (650 . . . . I . . . . .)	Aluminum 3.2315 (AA6082) nickel coated		
- Sealing ring (650 . . . . A . . . . .)	Aluminum 3.2315 (AA6082), 1.4306 (304L)		
- Sealing ring (650 . . . . H . . . . .)	Aluminum 3.2315 (AA6082) hard anodized, 1.4306 (304L)		
- Sealing ring (650 . . . . I . . . . .)	Aluminum 3.2315 (AA6082) nickel coated, 1.4306 (304L)		
- Other parts	Stainless steel 316L (1.4404 or 1.4435), 1.4122, 1.4310 (301), 1.4303 (304), 1.4571, A2 (304)		
- Seals	Viton® (standard). Other materials available. Seal materials are declared on dimensional drawing of specific valve ordering number.		
	<b>DN 320</b> <b>12"</b> (65050 - ....)	<b>DN 350</b> <b>14"</b> (65051 - ....)	<b>DN 400</b> <b>16"</b> (65052 - ....)
Max. differential pressure on plate during isolation	1200 mbar in either direction	1200 mbar in either direction	1200 mbar in either direction
Max. differential pressure on plate during opening and throttling	5 mbar	5 mbar	5 mbar
Min. controllable conductance (N <sub>2</sub> molecular flow)	22 l/s	25 l/s	30 l/s
Dimensions	Refer to dimensional drawing of specific valve ordering number (available on request)		

## 2 Installation

### 2.1 Unpacking

As this valve is a heavy component you should lift it with adequate equipment to prevent any injury to humans.



Valves DN200 (8") and larger are equipped with attachment points (tapped holes). Add eyebolts to these attachment points for lifting. The attachment points are indicated on the dimensional drawing of the specific valve part number (available on request).

Never lay the valve down with control and actuating unit downwards as it may be damaged.

### 2.2 Installation into the system



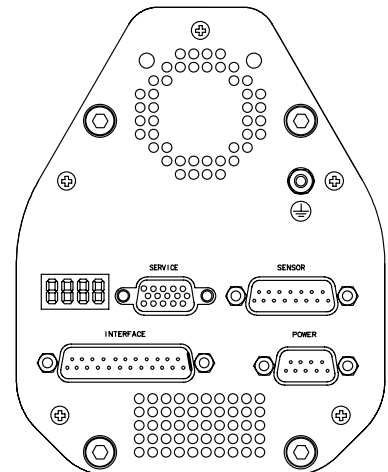
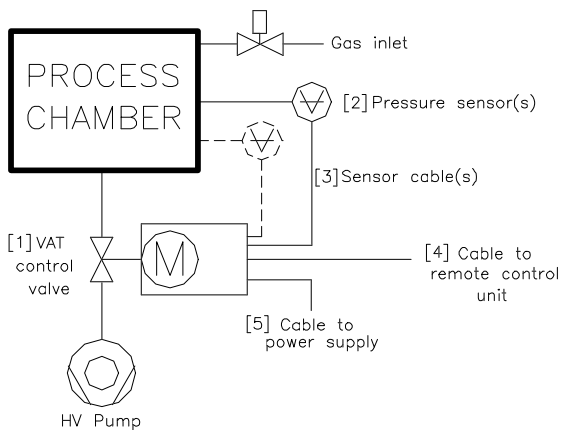
Fingers and objects must be kept out of the valve opening and away from moving parts. The valve plate starts to move just after power is supplied.



Do not connect or disconnect sensor cable when device is under power.



Do not disconnect air supply when device is under power. Compressed air pressure must be in the range of: 4 - 7 bar / 55 - 100 psi (above ATM). Use only clean, dry or slightly oiled air.



1. Install valve [1] into the vacuum system. Valve seat side should face process chamber. The valve seat side is indicated by the symbol "∇" on the valve flange.  
**Caution:** Do not tighten the flange screws stronger than indicated under «Tightening torque».  
**Caution:** Do not admit higher forces to the valve than indicated under «Admissible forces».  
**Note:** Make sure that enough space is kept free to do preventive maintenance work. The required space is indicated on the dimensional drawing.
2. Connect compressed air supply to connection labeled 'IN' located at actuator, see Figure 1 below.  
 Connect compressed air return line connection labeled 'OUT' located at actuator, see Figure 1 below.  
**Caution:** Compressed air pressure must be in the range of: **4 - 7 bar / 55 - 100 psi (above ATM)**.  
**Note:** Use only clean, dry or slightly oiled air. IN / OUT connections are 1/8" ISO/NPT internal threads.
3. Install pressure sensor(s) [2] according to the recommendations of the sensor manufacturer and directives given under «Requirements to sensor connection».
4. Connect sensor cable [3] to sensor(s) and then to valve (connector: SENSOR).  
 Refer to chapter «Electrical connection» for correct wiring.  
**Note:** Input for second sensor is available on 650 . . . . . E - . . . . . versions only.
5. Connect valve to Logic [4] (connector: INTERFACE). Refer to «Logic schematics» for correct wiring.
6. Connect power supply [5] to valve (connector: POWER). Refer to chapter «Electrical connection» for correct wiring.  
**Note:** To provide power to the valve motor pins 4 and 8 must be bridged, otherwise motor interlock is active and the valve enters the safety mode and is not operative. Refer also to «Safety mode».
7. This valve has a double sealed rotary feedthrough and optionally an intermediate pumping port for the actuator shaft. This port (1/8" ISO/NPT) could be connected to the vacuum line, see Figure 2 below.
8. This valve may optionally be equipped with a heating device. Connect VAT heating device according to manual of respective heating device.
9. Perform «Setup procedure» to prepare valve for operation.  
**Note:** Without performing the setup procedure the valve will not be able to do pressure control.

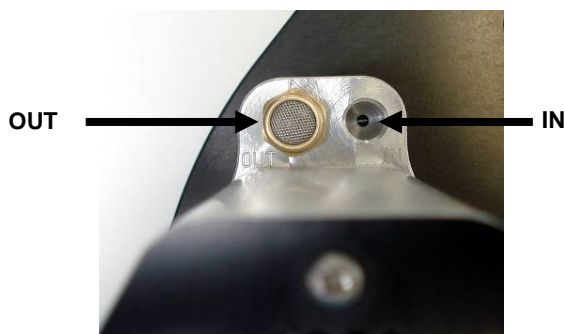


Fig. 1

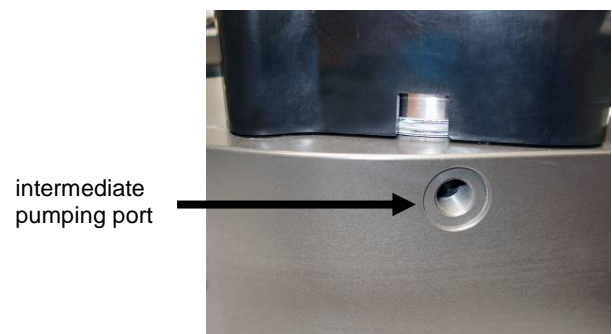


Fig. 2



## 2.3 Tightening torque

**Note:**

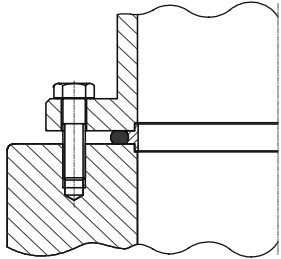
The torque values below are dependent on many factors, such as materials involved, surface quality, surface treatment, and lubrication.

The torques below are valid if immersion depth of the mounting screws is at least once the thread diameter (min. 1d), and the friction coefficient of the screw-flange connection ( $\mu_{total} = (\mu_{screw\ thread-helicoil} + \mu_{under\ screw\ head})/2$ ) is bigger than 0.12. Lower friction coefficients may damage the valve, as the resulting preload force gets too high. Therefore for other friction coefficients the torque needs to be adapted. Please review design guidelines for Helicoil-Screw connections and make sure that screws in use are capable to withstand applied torques, are appropriate for the application and are not too long. Too long screws may damage the valve, the immersion depth should not exceed (hole depth – 1 mm).

Tighten mounting screws of the flanges uniformly in crosswise order. Observe the maximum torque levels in the following tables.

### 2.3.1 Mounting with centering rings

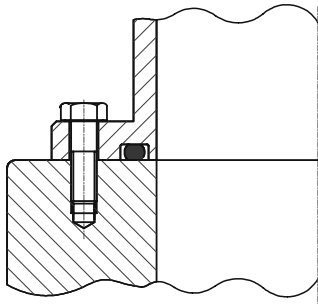
Valve size	ISO-F	ISO-F
	max. tightening torque (Nm)	max. tightening torque (lbs . ft)
DN320 / 12" (65050 - . . . . .)	17-20	13-15
DN350 / 14" (65051 - . . . . .)	–	–
DN400 / 16" (65052 - . . . . .)	17-20	13-15
	hole depth (mm)	hole depth (inch)
DN320 / 12" (65050 - . . . . .)	18	0.71
DN350 / 14" (65051 - . . . . .)	–	–
DN400 / 16" (65052 - . . . . .)	20	0.79



Refer to «Spare parts and accessories» for centering rings ordering numbers.

**2.3.2 Mounting with O-ring in grooves**

Valve size	ISO-F	JIS	ASA-LP	ISO-F	JIS	ASA-LP
	max. tightening torque (Nm)			max. tightening torque (lbs . ft)		
DN320 / 12" (65050 - .....)	65-70	65-70	80-90	48-52	48-52	59-67
DN350 / 14" (65051 - .....)	-	65-70	-	-	48-52	-
DN400 / 16" (65052 - .....)	65-70	115-120	230-240	48-52	85-89	170-178
	hole depth (mm)			hole depth (inch)		
DN320 / 12" (65050 - .....)	18	18	18	0.71	0.71	0.71
DN350 / 14" (65051 - .....)	-	18	-	-	0.71	-
DN400 / 16" (65052 - .....)	20	25	25	0.79	0.98	0.98

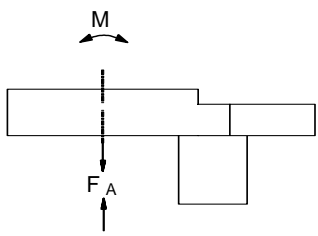


**2.4 Admissible forces**

Forces from evacuating the system, from the weight of other components, and from baking can lead to deformation and malfunctioning of the valve. Stress has to be relieved by suitable means, e.g. bellows sections.

Valve size	Axial tensile or compressive force «F <sub>A</sub> »		Bending moment «M»	
	N	lb.	Nm	lbf.
DN320 / 12" (65050 - .....)	3000	660	120	90
DN350 / 14" (65051 - .....)	3500	770	140	105
DN400 / 16" (65052 - .....)	4000	880	160	120

For a combination of both forces (F<sub>A</sub> and M) the values are invalid.  
Verify that the depth of the mounting screws is min. 1 x thread diameter.  
Please contact VAT for more information.



## 2.5 Requirements to sensor connection

To achieve fast and accurate pressure control a fast sensor response is required.

Sensor response time: < 50ms

The sensor is normally connected to the chamber by a pipe. To maintain that the response time is not degraded by this connection it needs to meet the following requirements:

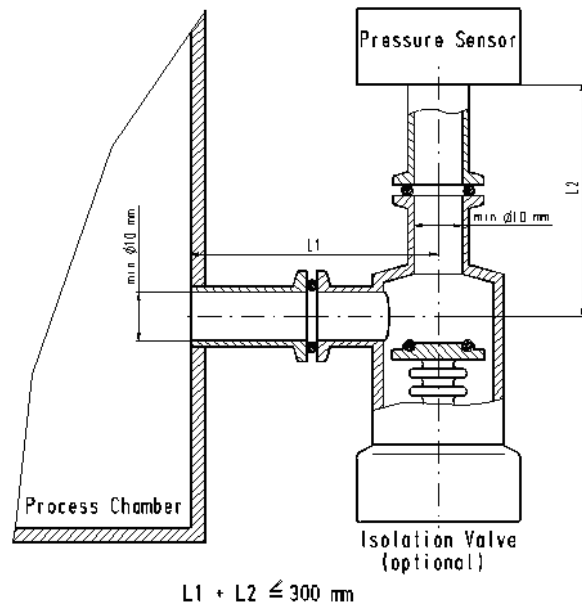
Inner diameter of connection pipe:  $\geq 10 \text{ mm}$   
 Length of connection pipe:  $\leq 300 \text{ mm}$

These conductance guidelines must include all valves and limiting orifices that may also be present.

Make also sure that there is no obstruction in front of sensor connection port inside the chamber.

The sensor should also be mounted free of mechanical shock and vibration.

Dynamic stray magnetic fields may introduce noise to sensor output and should be avoided or shielded.



## 2.6 Electrical connection

### 2.6.1 Sensor supply concepts

This valve offers 3 alternative concepts to supply the sensor(s) with power. This depends on the sensor type and valve version that is used. This valve is available with an optional sensor power supply module (SPS) that converts  $\pm 15 \text{ VDC}$  from the  $24 \text{ VDC}$ .

Concepts:

- External  $+ 24 \text{ VDC}$  supplied to POWER connector is feed through to SENSOR connector to supply  $24 \text{ VDC}$  sensors. Refer to chapter «2.6.2 Power and sensor connection ( $+24 \text{ VDC}$  sensors)» for schematic and correct wiring.
- External  $\pm 15 \text{ VDC}$  supplied to POWER connector is feed through to SENSOR connector to supply  $\pm 15 \text{ VDC}$  sensors. Refer to chapter «2.6.3 Power and sensor connection ( $\pm 15 \text{ VDC}$  sensors) without optional SPS module» for schematic and correct wiring.
- External  $+ 24 \text{ VDC}$  supplied to POWER connector is converted into  $\pm 15 \text{ VDC}$  by the valve internal SPS and supplied to SENSOR connector to supply  $\pm 15 \text{ VDC}$  sensors. Refer to chapter «2.6.4 Power and sensor connection ( $\pm 15 \text{ VDC}$  sensors) with optional SPS module» for schematic and correct wiring.

Valve versions:

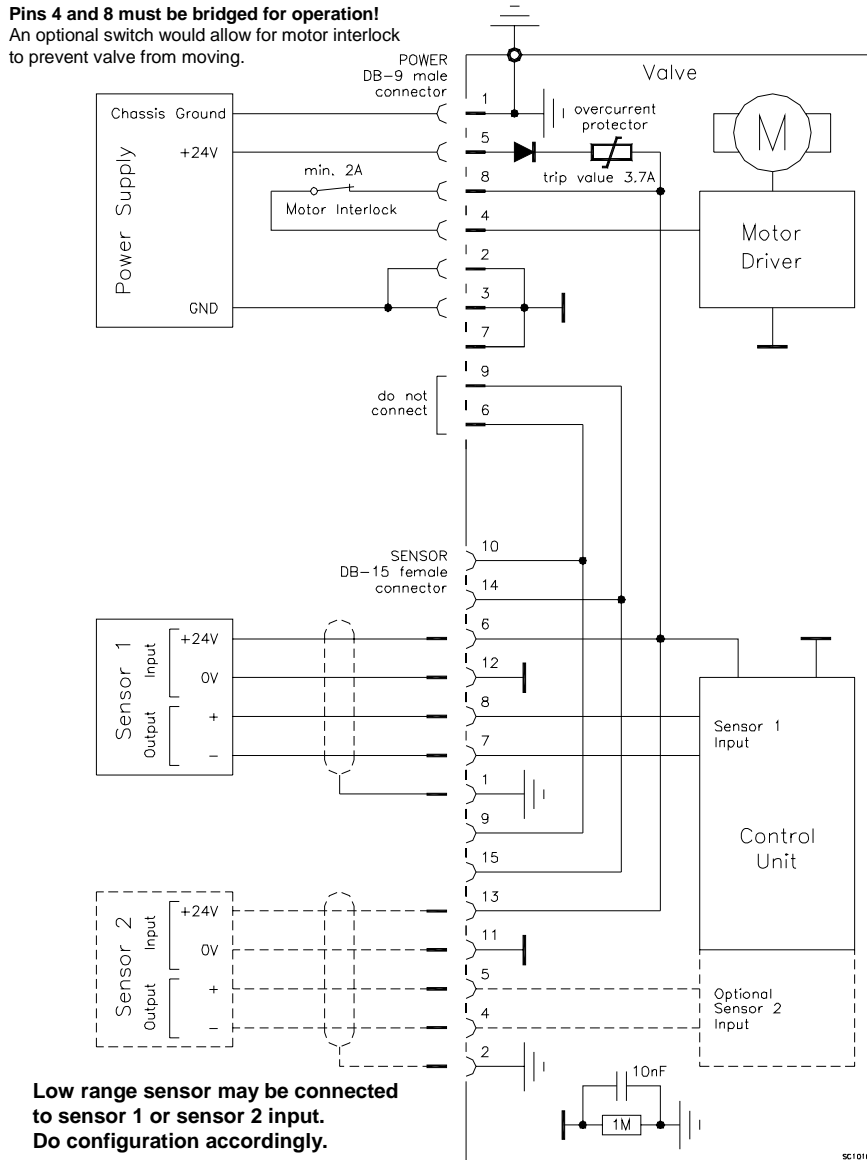
- 650 . . . . **G** . . . . / 650 . . . . **H** . . . .                      SPS module not included
- 650 . . . . **A** . . . . / 650 . . . . **C** . . . .                              SPS module included

**Note:** The SPS module can be retrofitted. Refer to chapter «Retrofit / replacement procedure» for instruction.

**2.6.2 Power and sensor connection (+24 VDC sensors)**

[650 . . . . . G . . . . . / 650 . . . . . H . . . . . versions recommended]

**2.6.2.1 Sensor power wiring via controller**

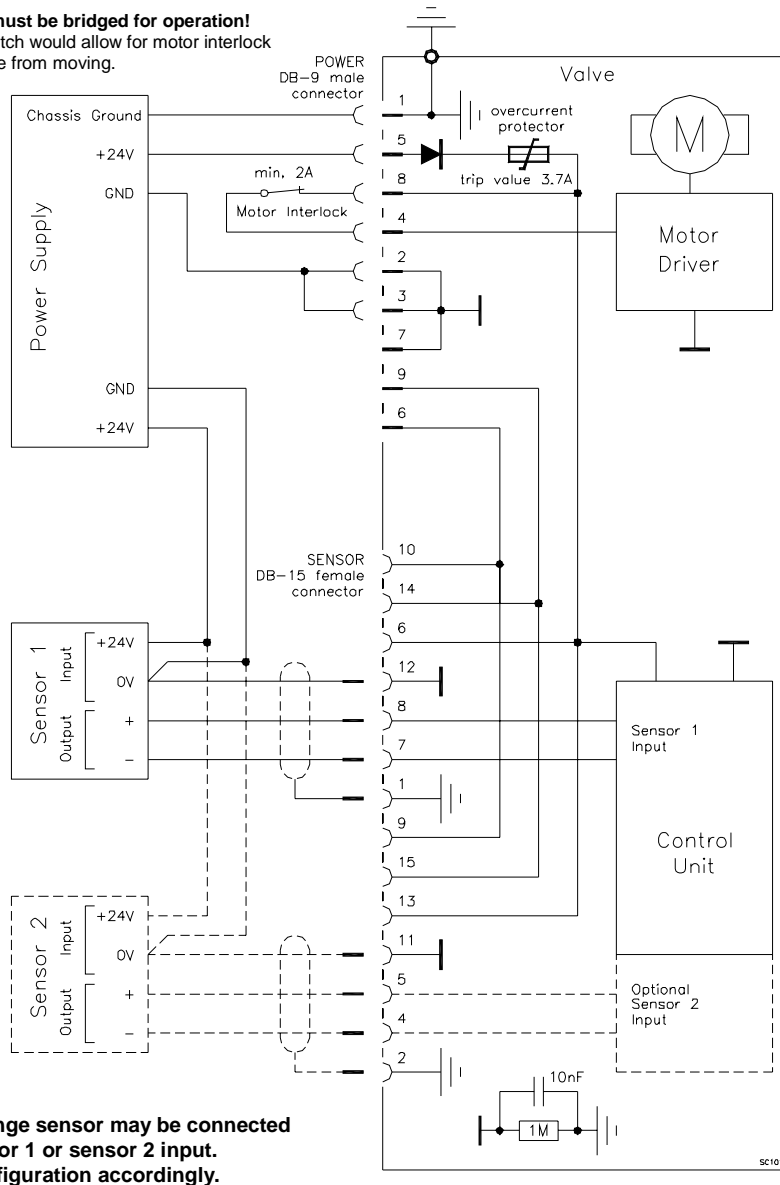


**Note:**

- Use shielded sensor cable(s). Keep cable as short as possible, but locate it away from noise sources.
- Connect the +24 VDC sensors at DB-15 female sensor connector exactly as shown in the drawing above. Do not connect other pins, that may damage power supply or controller!
- Connector: Use only screws with 4-40UNC thread for fastening the connectors!

### 2.6.2.2 Sensor power wiring external

**Pins 4 and 8 must be bridged for operation!**  
 An optional switch would allow for motor interlock to prevent valve from moving.



**Note:**

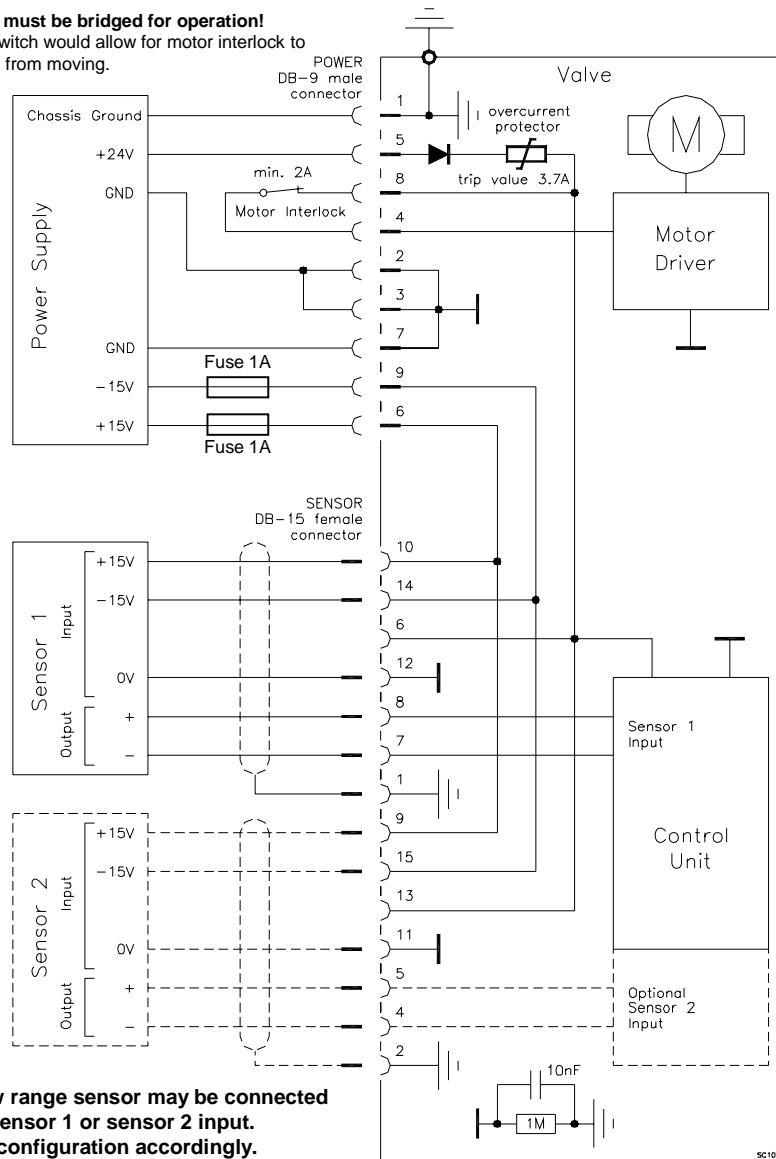
- Use shielded sensor cable(s). Keep cable as short as possible, but locate it away from noise sources.
- Connect the +24 VDC sensors at DB-15 female sensor connector exactly as shown in the drawing above. Do not connect other pins, that may damage power supply or controller!
- Connector: Use only screws with 4-40UNC thread for fastening the connectors!

**2.6.3 Power and sensor connection ( $\pm 15$  VDC sensors) without optional SPS module**  
 [650 . . . . G . . . . / 650 . . . . H . . . . versions only]

**2.6.3.1 Sensor power wiring via controller**

**Pins 4 and 8 must be bridged for operation!**

An optional switch would allow for motor interlock to prevent valve from moving.



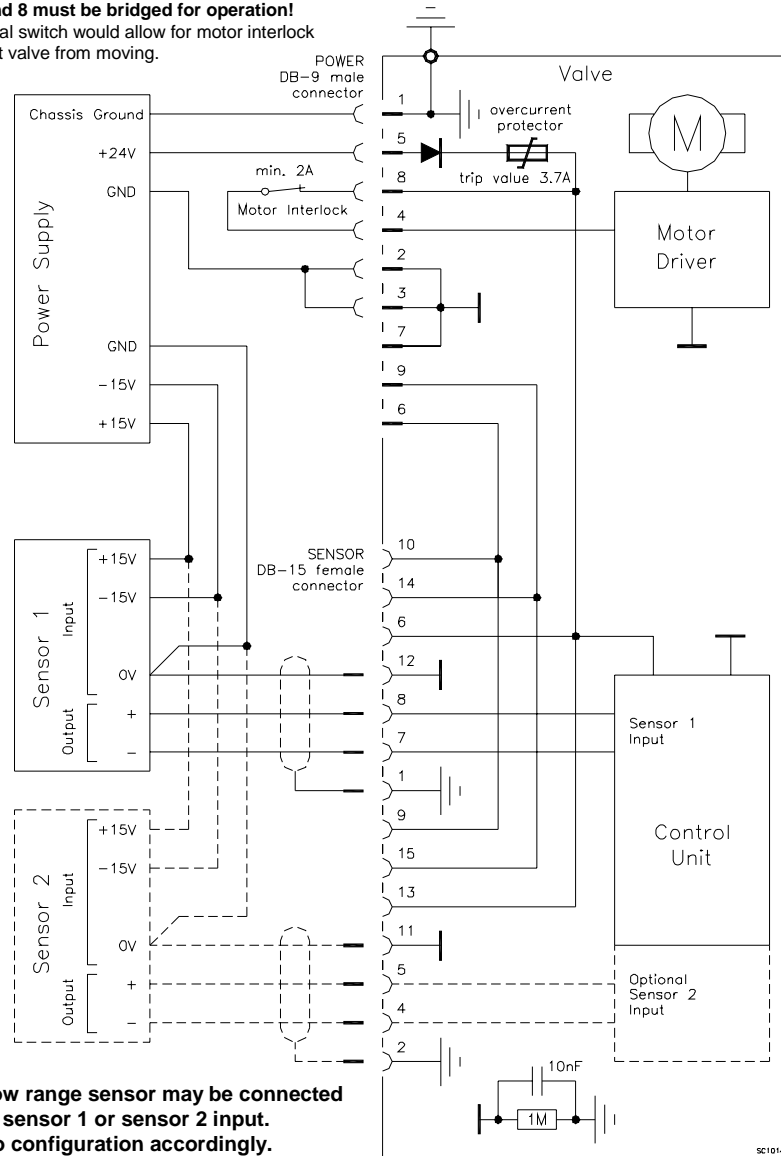
**Note:**

- Use shielded sensor cable(s). Keep cable as short as possible, but locate it away from noise sources.
- Connect the  $\pm 15$  VDC sensors at DB-15 female sensor connector exactly as shown in the drawing above. Do not connect other pins, that may damage power supply or controller!
- Connector: Use only screws with 4-40UNC thread for fastening the connectors!

### 2.6.3.2 Sensor power wiring external

**Pins 4 and 8 must be bridged for operation!**

An optional switch would allow for motor interlock to prevent valve from moving.



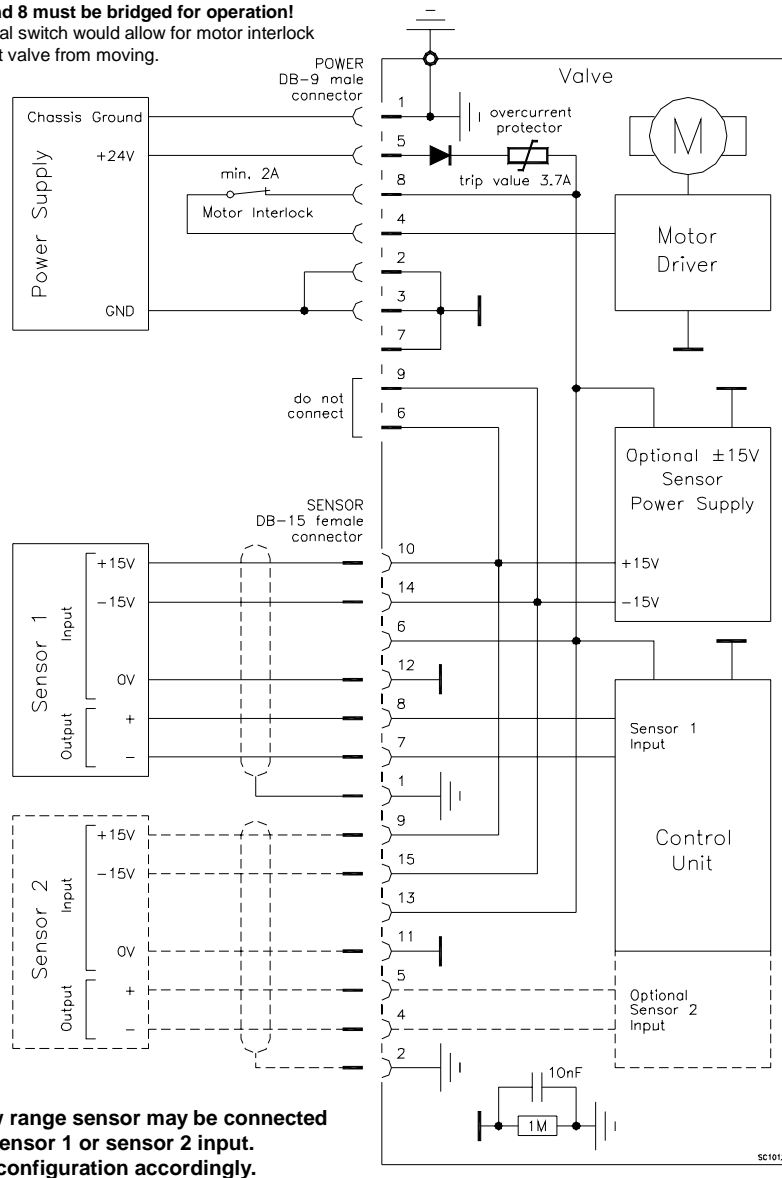
**Note:**

- Use shielded sensor cable(s). Keep cable as short as possible, but locate it away from noise sources.
- Connect the  $\pm 15$  VDC sensors at DB-15 female sensor connector exactly as shown in the drawing above. Do not connect other pins, that may damage power supply or controller!
- Connector: Use only screws with 4-40UNC thread for fastening the connectors!

**2.6.4 Power and sensor connection ( $\pm 15$  VDC sensors) with optional SPS module**  
 [650 . . . . A . . . . / 650 . . . . C . . . . versions only]

**Pins 4 and 8 must be bridged for operation!**

An optional switch would allow for motor interlock to prevent valve from moving.



**Low range sensor may be connected to sensor 1 or sensor 2 input. Do configuration accordingly.**

**Note:**

- Use shielded sensor cable(s). Keep cable as short as possible, but locate it away from noise sources.
- Connect the  $\pm 15$  VDC sensors at DB-15 female sensor connector exactly as shown in the drawing above. Do not connect other pins, that may damage power supply or controller!
- Connector: Use only screws with 4-40UNC thread for fastening the connectors!





### 2.6.5 Logic interface connection

Refer to «Schematics» for wiring information.

### 2.6.6 Service port connection

The service port (connector: SERVICE) allows to connect the valve to a RS232 port of a computer.

This requires a service cable and software from VAT. You can either use our freeware 'Control View', which can be downloaded from [www.vatvalve.com](http://www.vatvalve.com) or purchase our 'Control Performance Analyzer'.

Alternatively the VAT Service Box 2 can be connected to the service port for setup and local operation.

The service port is not galvanic isolated. Therefore we recommend using this only for setup, testing and maintenance and not for permanent control.

Refer also to «Local Operation» for details and to «Spare parts / Accessories» for ordering numbers of service cable, software and Service Box 2.

**Connector:** Use only screws with 4-40UNC thread for fastening the service port connector!



### 3 Operation



Operation is allowed after completion of the installation procedure only.

#### 3.1 Introduction

This valve is designed for downstream pressure control in vacuum chambers. It can be employed in a pressure control mode or a position control mode. In both cases local or remote operation is possible.

##### 3.1.1 Local operation

Local operation means that the valve is operated via the service port using a computer or the Service Box 2. When using a computer, a service cable and a software from VAT are required. You can either download our freeware 'Control View' from [www.vatvalve.com](http://www.vatvalve.com) or purchase our 'Control Performance Analyzer'. These software are beneficial especially for setup, testing and maintenance.

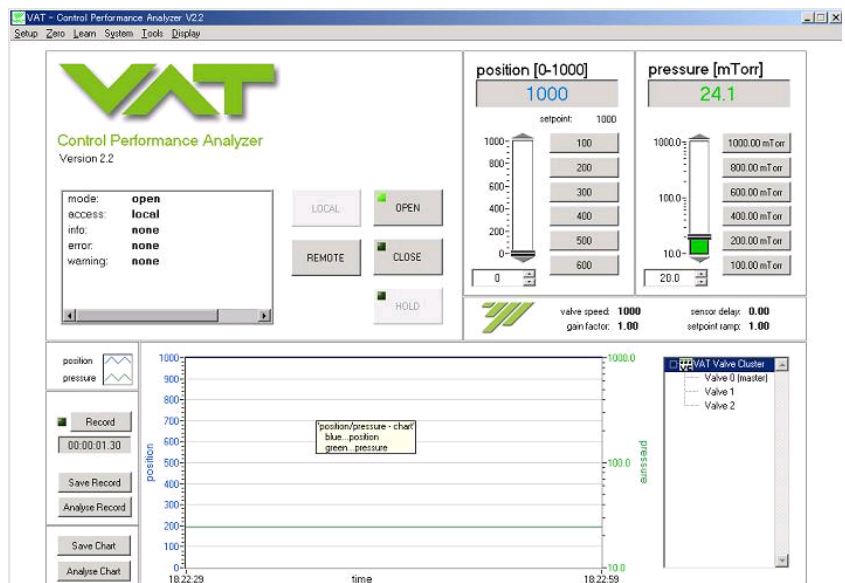
**How to start:** Connect service cable, start software and push button 'LOCAL' to enable for operation. Then enter menu Setup/Sensor and do sensor configuration according to your application to make sure that you get the correct pressure displayed.

'Control view' supports:

- parameter setup
- manual control
- numeric monitoring
- basic diagnostic

'Control Performance Analyzer' supports:

- parameter setup
- manual control
- sequence control
- numeric and graphical monitoring
- data recording
- data analysis
- advanced diagnostic



When communication to service port is interrupted the valve will change to remote operation. So when service cable will be disconnected or software will be shut down, the valve returns automatically to remote operation. This may result in an immediate movement of the valve depending on remote control.

Refer to «Spare parts / Accessories» for ordering numbers of service cable, software and Service Box 2.



### 3.1.2 Remote operation

This product is equipped with a Logic interface to allow for remote operation. See section «Logic Interface» for details. 'Control View' software, 'Control Performance Analyzer' software or 'Service Box 2' may be used for monitoring during remote control.

**Note:** In case 'Control View' or 'Control Performance Analyzer' software is connected to valve make sure 'REMOTE' button is pushed to enable for remote operation. In case Service Box 2 is connected to valve make sure the LED on button 'LOCAL' is OFF for remote operation.

### 3.1.3 Safety mode

By means of an external switch (see connection diagrams «Electrical connection») the motor power supply can be interrupted. In this case the valve enters the 'safety mode'. This motor interlock prevents the valve from moving (e.g. maintenance work). Data reading from the control unit remains possible.

When motor interlock is active during power up the valve directly enters the 'safety mode' and is not able to synchronize. Display shows 'D C' or 'D999'. In this case synchronization cycle will be done when motor interlock is deactivated. Then Display shows 'INIT' for a moment followed by 'SYNC'.

When 'safety mode' is entered from operation (i.e. pressure control mode), the unit will automatically switch to position control mode and remain at current position. Once motor interlock is deactivated the unit remains in position control mode.

### 3.1.4 Service indication

This product is able to indicate that the valve unit needs to be cleaned, or an obstruction is present.

A service request is indicated when the control unit detects that motor steps are apparently not effective. This may happen when the valve unit is heavily contaminated. These 'lost' steps are recognized and will be repeated to attempt target position in the short term. But in the medium term the valve unit requires cleaning or inspection.

'Service request' (SR) would be indicated on the display or could be read via remote operation. Refer to «Display information» for details.

## 3.2 Operation under increased temperature

This valve may be operated in the temperature range mentioned in chapter «Technical data».

## 3.3 Behavior during power up

Valve position before power up:	Reaction of valve:	
	Valve power up configuration = closed (default)	Valve power up configuration = open
Closed (isolated)	Valve remains closed. Display shows alternately 'C C' and 'INIT'. Synchronization will be done when first movement command is received.	Valve runs to max. throttle position to detect the limit stops to synchronize. Display shows configuration of product resp. 'SYNC' until synchronization is done. Valve position after power up is open.
All other than closed (not isolated)	Valve runs to max. throttle position to detect limit stop for synchronization. Display shows configuration of product resp. 'SYNC' until synchronization is done. Valve position after power up is closed	Valve position after power up is open

Refer also to chapter «Display information».

### 3.4 Behavior in case of power failure

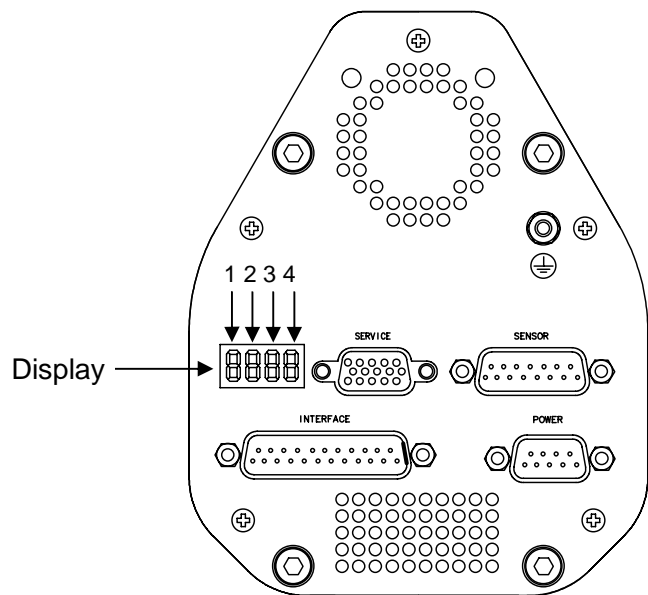
Valve position before power failure:	Reaction of valve:	
	Without Power Failure Option (PFO)	With Power Failure Option (PFO)
	650 . . . . <b>G</b> . . . . .	650 . . . . <b>H</b> . . . . .
	650 . . . . <b>A</b> . . . . .	650 . . . . <b>C</b> . . . . .
	650 . . . . <b>T</b> . . . . .	650 . . . . <b>U</b> . . . . .
	650 . . . . <b>V</b> . . . . .	650 . . . . <b>W</b> . . . . .
Closed (isolated)	Valve remains closed.	Valve will close or open depending on valve configuration *).
Valve open or in any intermediate position	Sealing ring moves down and blocks the pendulum plate at the current position.	Default is not defined. Display indicates <b>F</b> .

\*) Provided that battery pack of the VAT controller is charged. Charging time after power up is 2 minutes max..

All parameters are stored in a power fail save memory.

### 3.5 Display information

There is a 4 digit display located on the panel. It displays configuration, status and position information. For details refer to following tables.





**Power up:**

Description	Digit 1	Digit 2	Digit 3	Digit 4
At first all dots are illuminated then configuration is displayed:	<b>1</b>	<b>E</b>	<b>0</b>	<b>0</b>
<ul style="list-style-type: none"> <li>Firmware version [e.g. 1E00] (1<sup>st</sup> information for about 2s)</li> <li>Controller configuration (2<sup>nd</sup> information for about 2s)</li> </ul>				
In case <b>D C</b> or <b>D999</b> is displayed, motor interlock is active. Refer to «Safety mode» for details.		<b>1</b> = Logic interface	<b>0</b> = basic	<b>1</b> = 1 sensor version
If valve is closed (isolated) display shows alternately <b>C C</b> and <b>INIT</b> . Synchronization will be done when first movement command is received.			<b>1</b> = with SPS <sup>1)</sup>	<b>2</b> = 2 sensor version
			<b>2</b> = with PFO <sup>2)</sup>	
		<b>3</b> = with SPS <sup>1)</sup> and PFO <sup>2)</sup>		
<b>SYNC</b> indicates that synchronization is running.	<b>S</b>	<b>Y</b>	<b>N</b>	<b>C</b>

1) SPS = optional ±15 VDC Sensor Power Supply module

2) PFO = optional Power Failure Option

**Operation:**

Description / Mode	Digit 1	Digit 2	Digit 3	Digit 4
PRESSURE CONTROL mode	<b>P</b>			
POSITION CONTROL mode	<b>V</b>			
Valve closed	<b>C</b>			
Valve open	<b>O</b>			
HOLD (position frozen) activated	<b>H</b>			
ZERO running	<b>Z</b>			
LEARN running	<b>L</b>			
Safety mode established. Refer to «Safety mode» for details.	<b>D</b>			
Power failure	<b>F</b>			
Service request <sup>1)</sup>				

<sup>1)</sup> If SR is blinking alternatively with the actual mode display (e.g. P.11 ⇔ ..SR) the valve requires cleaning.

**Errors:**

Description	Digit 1	Digit 2	Digit 3	Digit 4
Compressed air failure (< 4 bar / 55 psi)	A	I	R	f
Compressed air on exhaust	A	I	R	x
Fatal error occurred	E	Error code. Refer to «Trouble shooting» for details		

**3.6 Setup procedure**



To enable this valve for **pressure control** setup **steps 1 to 5 must be performed**. In case position control is required only it's sufficient to perform steps 1 and 2.

Setup step	Description
1 <b>POWER UP</b>	Turn on external + 24VDC power supply (and external ±15 VDC for sensor power supply if required). Refer to chapter «Behavior during power up» for details.
2 <b>INTERFACE CONFIGURATION</b>	Refer to chapter «Interface configuration» for details.
3 <b>VALVE CONFIGURATION</b>	Basic configurations of the valve must be adapted according to application needs. Refer to chapter «Valve configuration» for details.
4 <b>ZERO</b>	Compensation of the sensor offset voltage. Refer to chapter «ZERO» for details.
5 <b>LEARN</b>	Determination of the vacuum system characteristic to accommodate the PID controller. Refer to chapter «LEARN» for details. <b>Note:</b> Without LEARN the valve is not able to run pressure control

**3.6.1 Interface configuration**

Interface configuration must be adapted according to application needs.

- Functionality of digital inputs CLOSE VALVE and OPEN VALVE must be selected. These may be configured as 'not inverted' or 'inverted'. Default is 'not inverted'.
- LEARN range configuration for remote operation must be selected. This may either be 'full range' or pressure limit according of analog SETPOINT input. Default is 'full range'.

<b>Local operation:</b> ('Control View', 'Control Performance Analyzer' or 'Service Box 2')	<b>Remote operation:</b>
Do configuration in menu 'Setup / Interface'.	<b>Note:</b> It's not possible to do 'Interface configuration' via remote operation.



### 3.6.2 Valve and sensor configuration

Basic valve configuration must be adapted according to application needs.

- Definition of valve plate position (CLOSE or OPEN) after power up sequence. Default is 'close'.
- Definition of valve plate position (CLOSE or OPEN) in case of a power failure. Default is 'not defined'. Only for versions that have Power Fail Option equipped [650 . . . . . **C** . . . . . or 650 . . . . . **H** . . . . .].
- ZERO function. This may be 'disabled' or 'enabled'. Default is 'enabled'. Refer also to «ZERO».
- Sensor configuration for 2 sensor version [650 . . . . . **E** . . . . .]. Refer also to «Pressure control operation with 2 sensors».

<b>Local operation:</b> (‘Control View’, ‘Control Performance Analyzer’ or ‘Service Box 2’)	<b>Remote operation:</b>
1. Do power up configuration in menu ‘Setup / Valve’.	<b>Note:</b> It’s not possible to do ‘Valve and sensor configuration’ via remote operation.
2. Do power fail configuration in menu ‘Setup / Valve’.	
3. Enable or disable ZERO function in menu ‘Setup / Sensor’.	
4. Do 2 sensor configuration in menu ‘Setup / Sensor’.	

### 3.6.3 ZERO

ZERO allows for the compensation of the sensor offset voltage.

When ZERO is performed the current value at the sensor input is equated to pressure zero. In case of a 2 sensor system both sensor inputs will be adjusted. A max. offset voltage of +/-1.4V can be compensated. The offset value can be read via local and remote operation.

<b>Local operation:</b> (‘Control View’, ‘Control Performance Analyzer’ or ‘Service Box 2’)	<b>Remote operation:</b> (Refer to chapter «Digital inputs» for details)
Go to menu ‘Zero / ZERO’ and follow instructions.	1. Send OPEN VALVE
	2. Wait until process chamber is evacuated and sensor signal is not shifting anymore.
	3. Send ZERO

**Note:** Do not perform ZERO as long as pressure gauge voltage is shifting otherwise incorrect pressure reading is the result. Refer to manual of sensor manufacturer for warm up time.

**Note:** Do not perform ZERO, if the base pressure of your vacuum system is higher than 1‰ of sensor full scale. We recommend disabling ZERO function in this case; refer to «Valve configuration» of the setup procedure. Otherwise incorrect pressure reading is the result.



### 3.6.4 LEARN

LEARN adapts the PID controller of the valve to the vacuum system and its operating conditions. LEARN must be executed only once during system setup.

The LEARN routine determines the characteristic of the vacuum system. Based on this, the PID controller is able to run fast and accurate pressure control cycles.

This characteristic depends on various parameters such as chamber volume, conductance and flow regime. Therefore it must be performed with a specific gas flow according to instruction below.

The result of LEARN is a pressure versus valve position data table. This table is used to adapt the PID parameters. The data table is stored in the device memory which is power fail save. The data table can be up-/downloaded via 'Control Performance Analyzer' software or remote interface. Due to encoding the data may not be interpreted directly.

By an OPEN VALVE, CLOSE VALVE, POSITION CONTROL or PRESSURE CONTROL command the routine will be interrupted.

Local operation: (‘Control View’, ‘Control Performance Analyzer’ or ‘Service Box 2’)	Remote operation: (Refer to chapter «Digital inputs» for details)
Go to ‘Learn / LEARN’ menu and follow instructions.  <b>Note:</b> Gasflow calculation according to recommendation below is done automatically based on inputs.	1. Set OPEN VALVE
	2. Set specific gas flow according to calculation below and wait until flow is stable. Autolearn does not need to be performed with the process gas. Instead N <sub>2</sub> or Ar may be used.
	3. Set SETPOINT (= pressure limit for learn) to p <sub>max</sub> (max. pressure to control during process)
	4. Set LEARN <b>Note:</b> Alarm is set as long learn is performed, if alarm is off, learn is finished.
	5. Reset LEARN
	6. Reset OPEN VALVE

**Note:** Sensor signal must not shift during LEARN. Wait until sensor signal is stable before LEARN is performed.

**Note:** Learn may take several minutes. Do not interrupt the routine as a **single full run is required to ensure fast and accurate pressure control**. The PID controller covers 5% to 5000% of the gas flow which was used for learn.



**Gasflow calculation for LEARN:**



Do not apply a different gasflow for learn than determined below. Otherwise pressure control performance may be insufficient.

Choose the applicable formula depending on units you are familiar with.

$$q_L = \frac{p_{SFS} \cdot C_{min}}{2000}$$

$q_L$  gasflow for learn [**Pa m<sup>3</sup>/s**]  
 $p_{SFS}$  sensor full scale pressure [**Pa**]  
 $C_{min}$  min. controllable conductance of valve [l/s], (refer to «Technical data»)

$$q_L = \frac{p_{SFS} \cdot C_{min}}{2}$$

$q_L$  gasflow for learn [**mbar l/s**]  
 $p_{SFS}$  sensor full scale pressure [**mbar**]  
 $C_{min}$  min. controllable conductance of valve [l/s], (refer to «Technical data»)

$$q_L = 39.4 \cdot p_{SFS} \cdot C_{min}$$

$q_L$  gasflow for learn [**sccm**]  
 $p_{SFS}$  sensor full scale pressure [**Torr**]  
 $C_{min}$  min. controllable conductance of valve [l/s], (refer to «Technical data»)

**3.7 Close valve**

<b>Local operation:</b> ('Control View', 'Control Performance Analyzer' or 'Service Box 2')	<b>Remote operation:</b> (Refer to chapter «Digital inputs» for details)
Push CLOSE button	Send CLOSE VALVE

**3.8 Open valve**

<b>Local operation:</b> ('Control View', 'Control Performance Analyzer' or 'Service Box 2')	<b>Remote operation:</b> (Refer to chapter «Digital inputs» for details)
Push OPEN button	Send OPEN VALVE

**3.9 Position control**

The valve position is directly controlled according to the position setpoint.

<b>Local operation:</b> ('Control View', 'Control Performance Analyzer' or 'Service Box 2')	<b>Remote operation:</b> (Refer to chapter «Digital inputs» and «Analog inputs and outputs» for details)
Select or enter position setpoint	1. Set CONTROL MODE to POSITION CONTROL 2. Set position SETPOINT

**Note:** In case CLOSE VALVE, OPEN VALVE or HOLD is also set these have higher priority.

### 3.10 Pressure control



To **prepare valve for PRESSURE CONTROL** perform complete «**Setup procedure**».

The valve has parameters that may be modified to tune **pressure control performance**. Refer to «**Tuning of control performance**».

The included PID controller controls the chamber pressure according to the pressure setpoint by means of the valve position. The PID controller works with an adaptive algorithm to achieve best results under altering conditions (gasflow, gas type).

Local operation: (‘Control View’, ‘Control Performance Analyzer’ or ‘Service Box 2’)	Remote operation: (Refer to chapter «Digital inputs» and «Analog inputs and outputs» for details)
Select or enter pressure setpoint	<ol style="list-style-type: none"> <li>1. Set CONTROL MODE to PRESSURE CONTROL</li> <li>2. Set pressure SETPOINT</li> </ol>

**Note:** In case CLOSE VALVE, OPEN VALVE or HOLD is also set these have higher priority.

#### 3.10.1 Operation with 2 sensors

[applicable with 650 . . . . . E - . . . . version only]

If 2 sensor operation is enabled, changeover between the sensors is done automatically during pressure control. For configuration refer to chapter «Setup procedure». We recommend a ratio of 10:1 between the pressure gauges. Max. ratio is 100:1. It is required that the high range pressure gauge is connected to sensor 1 input and the low range pressure gauge to the sensor 2 input.

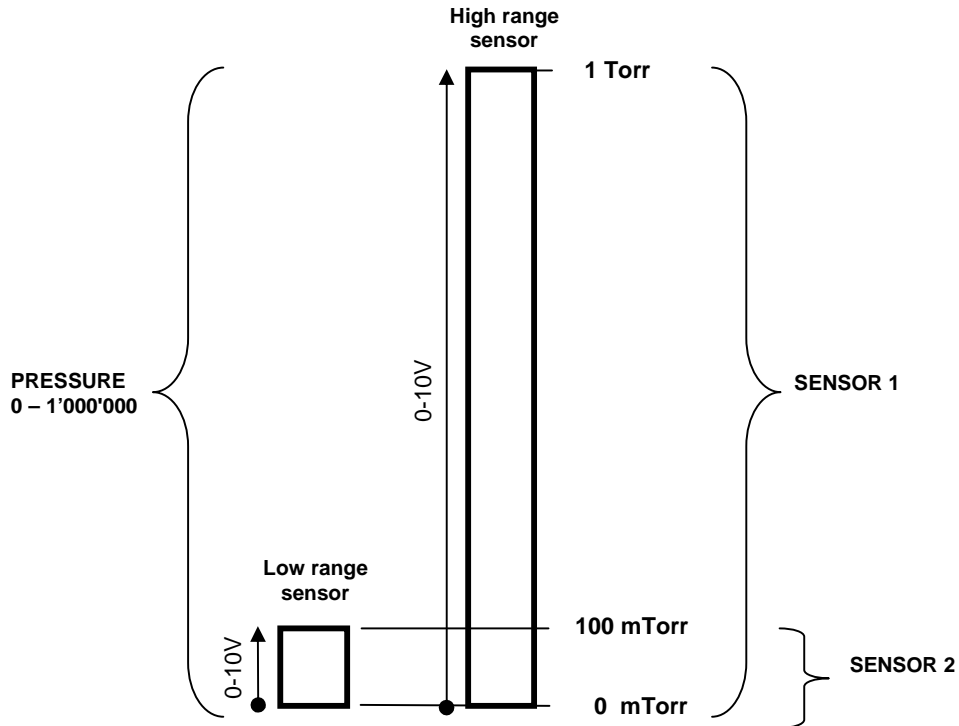
Between 90 and 100% of the low range sensor full scale, the low range sensor is phased out while high range sensor is phased in. This maintains a functional response behavior in case of small calibration errors between the two sensors. The pressure output in this range is a blend between both sensors.

For monitoring purpose each sensor signal may be read out individually.

**Note:** Make sure that both sensors are calibrated.

**Note:** Do not close optional gauge isolation valves during the transition phase between the sensors.

Example of PRESSURE and SENSOR READING allocation:

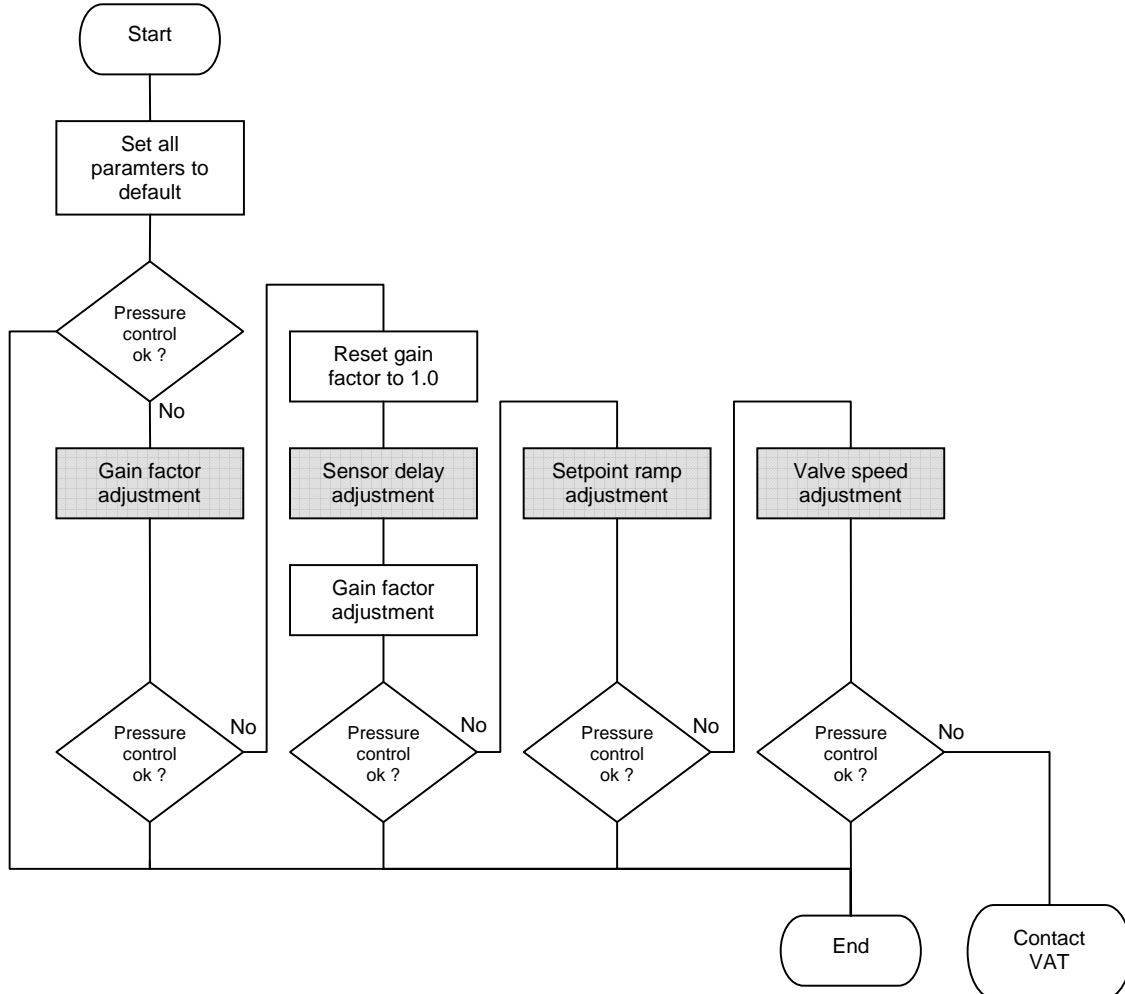


Above picture shows a 2 sensor system. In this configuration sensor 2 covers low range (100 mTorr) and sensor 1 covers high range (1 Torr). Switchover between sensors is done automatically according to «Pressure control operation with 2 sensors».

### 3.10.2 Tuning of control performance

Normally the default settings will result in good pressure control performance. For some applications tuning may be required to improve performance.

The tuning procedures for each parameter (grey boxes) and its default values are described separately below. Strictly keep the procedure order.



Required information for support:

- Go to 'Tools / Create Diagnostic File' in 'Control View' resp. 'Control Performance Analyzer' and save file
- Pressure / flow / gas conditions to be controlled
- Chamber volume
- Pumping speed (l/s) and pump type (e.g. turbo pump)
- System description
- Problem description

Send diagnostic file with and all required information to [tuning-support@vat.ch](mailto:tuning-support@vat.ch)



### 3.10.2.1 Gain factor adjustment

The gain factor effects:

- **Stability**
- **Response time**

Default value is 1. Adjustment range is from 0.0001 to 7.5.

Higher gain results in:	faster response	higher over- / undershoot of pressure
Lower gain results in:	slower response	lower over- / undershoot of pressure

Adjustment procedure:

1. Start with gain factor 1.0
2. Open valve.
3. Control a typical pressure / flow situation.
4. Repeat from step 2 with lower (higher) gain factors until optimal pressure response is achieved and stability is ok.

**Note:** Normally adjustments down to gain factors of 0.42 should lead to good results. Otherwise you may need to improve sensor connection. Refer to «Requirements to sensor connection».

<b>Local operation:</b> (‘Control View’, ‘Control Performance Analyzer’ or ‘Service Box 2’)	<b>Remote operation:</b>
Do configuration in menu ‘Setup / Control Parameter’.	<b>Note:</b> It’s not possible to do ‘Interface configuration’ via remote operation.

### 3.10.2.2 Sensor delay adjustment

Sensor delay adjustment effects:

- **Stability**

Default value is 0. Adjustment range is from 0 to 1.0s.

Pipes and orifices for sensor attachment delay response time and so badly impact pressure control stability. By adapting this parameter to the approximate delay time stability problems can be reduced. But control response time will be slowed down by this measure.

**Note:** Whenever possible sensors should be attached to the chamber according to «Requirements to sensor connection». This is the most effective measure against stability issues. If your gauge attachment fulfills these criteria do not use this parameter.

Adjustment procedure:

1. Start with gain factor 1.0 and sensor delay 0s.
2. Open valve.
3. Control a typical pressure / flow situation.
4. Repeat from step 2 with higher sensor delays until best possible stability is achieved.
5. Adjustment gain factor again. Refer to «Gain factor adjustment».

<b>Local operation:</b> (‘Control View’, ‘Control Performance Analyzer’ or ‘Service Box 2’)	<b>Remote operation:</b>
Do configuration in menu ‘Setup / Control Parameter’.	<b>Note:</b> It’s not possible to do ‘Interface configuration’ via remote operation.

### 3.10.2.3 Setpoint ramp adjustment

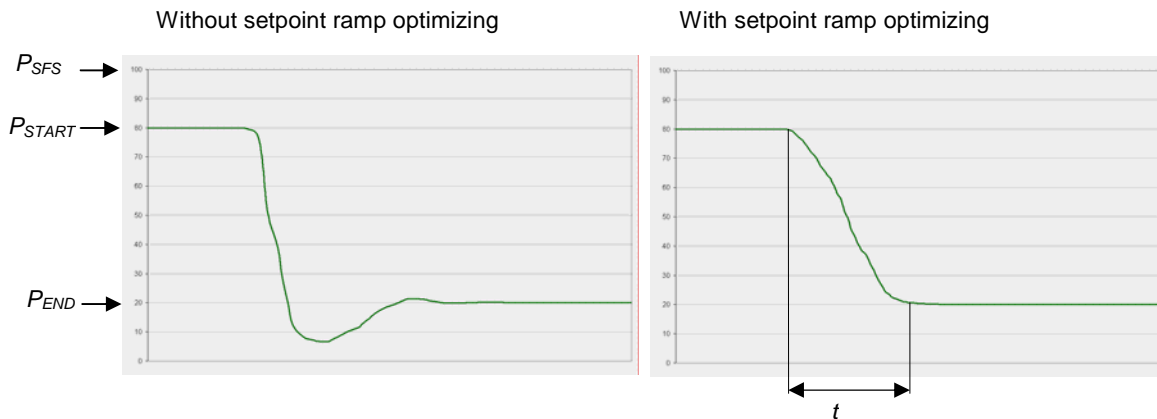
Setpoint ramp effects:

- Undershoot of pressure
- Response time

Default value for  $S_{RAMP}$  is 1. Adjustment range for  $S_{RAMP}$  is from 0 to 10 s.

This parameter affects the time that is used to decrease / raise pressure between 2 setpoints. Especially in pressure decrease situations at low flows pressure response can be improved much by adapting setpoint ramp time.

#### Pressure chart



Choose the applicable formula depending on units you are familiar with.

$$t = \frac{S_{RAMP}}{P_{SFS}} \cdot |P_{START} - P_{END}|$$

t	ramptime [s]
$P_{SFS}$	sensor full scale pressure
$S_{RAMP}$	setpoint ramp [s]
$P_{START}$	pressure start
$P_{END}$	pressure end

Adjustment procedure:

1. Start with optimal gain factor and sensor delay time according to preceding tuning steps.
2. Control a typical pressure / flow situation.
3. Control a lower pressure.
4. Repeat from step 2 with longer setpoint ramps until best response is achieved.
5. Verify pressure control response for a setpoint raise situation.

<p style="text-align: center;"><b>Local operation:</b> (‘Control View’, ‘Control Performance Analyzer’ or ‘Service Box 2’)</p>	<p style="text-align: center;"><b>Remote operation:</b></p>
<p>Do configuration in menu ‘Setup / Control Parameter’.</p>	<p><b>Note:</b> It’s not possible to do ‘Interface configuration’ via remote operation.</p>



### 3.10.2.4 Valve speed adjustment

Valve speed effects:

- **Response time**

Default value is 1000. Adjustment range is from 1 to 1000.

This parameter effects valve plate actuating speed.

Speed adjustment is effective for PRESSURE CONTROL and POSITION CONTROL.

**Note:** Normally best pressure control response is achieved with max. valve speed. In particular applications it may be of advantage to have a slower valve response.

**Note:** OPEN and CLOSE are always done with max. speed.

Adjustment procedure:

1. Use optimal gain factor, sensor delay time and setpoint ramp according to preceding tuning steps.
2. Open valve.
3. Control a typical pressure / flow situation.
4. Repeat from step 2 with slower valve speed until required response is achieved.

<b>Local operation:</b> (‘Control View’, ‘Control Performance Analyzer’ or ‘Service Box 2’)	<b>Remote operation:</b>
Do configuration in menu ‘Setup / Control Parameter’.	<b>Note:</b> It’s not possible to do ‘Interface configuration’ via remote operation.

### 3.11 Logic interface

Default configuration:

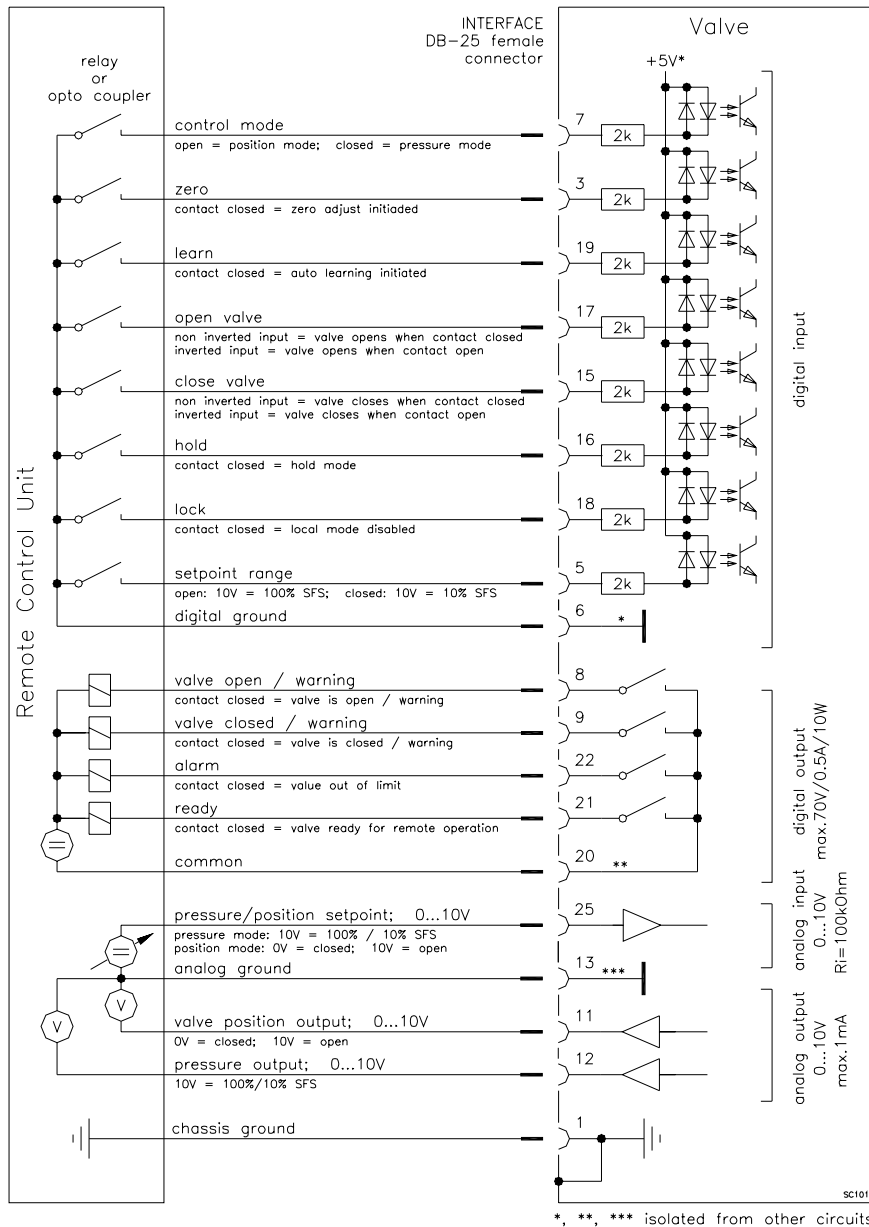
OPEN input	CLOSE input	OPEN output	CLOSE output
not inverted	not inverted	open	close

### 3.11.1 Functions and Wiring

**Note:**

Logic interface allows for remote operation by means of digital and analog signals. Digital inputs may be operated either by switches or by voltage sources.

**a) Configuration with switches for digital inputs:**

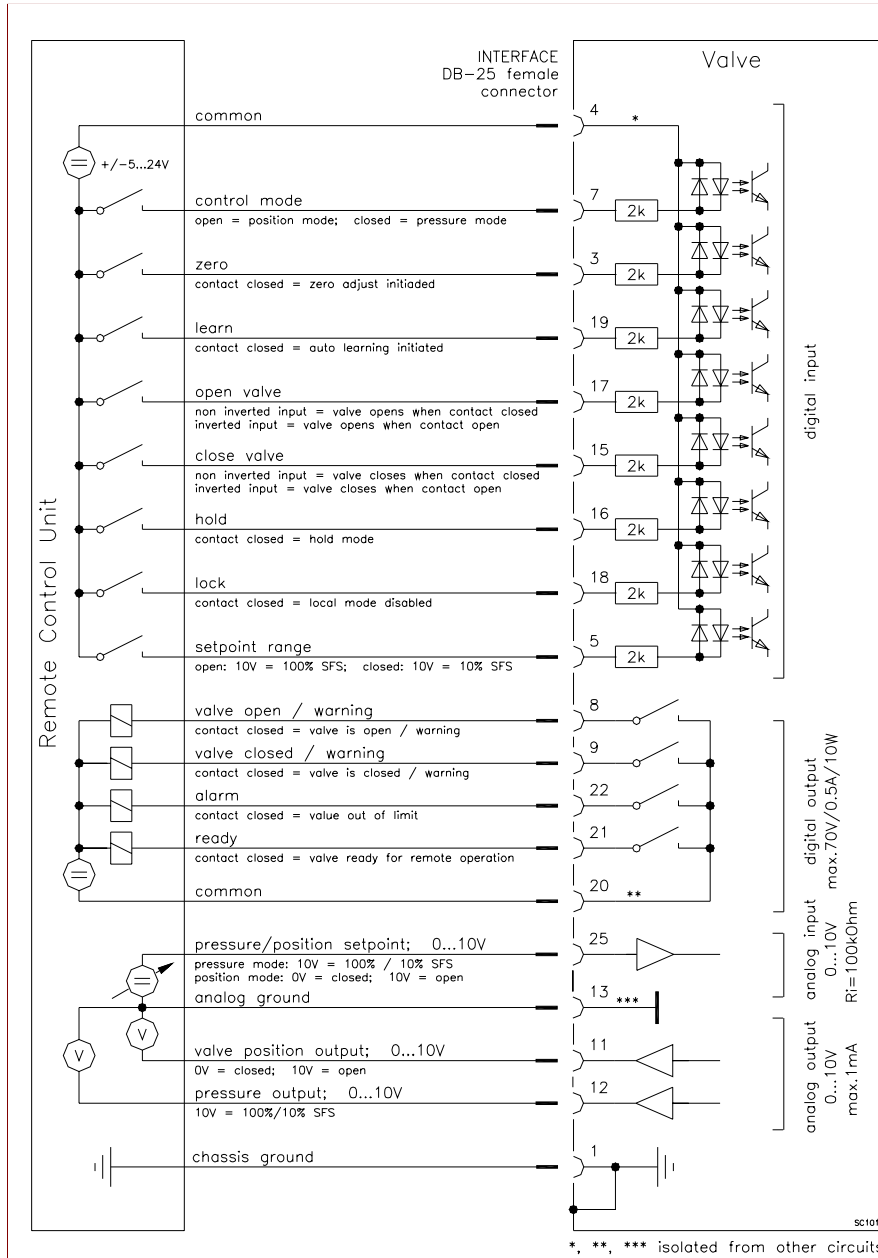


**Note:** Use a shielded cable for analog inputs. Do not connect other pins than indicated above!

**Connector:** Use only screws with 4-40UNC thread for fastening the DB-25 connector!



**b) Configuration with voltage source for digital inputs:**



**Note:** Use a shielded cable for analog inputs. Do not connect other pins than indicated above!  
**Connector:** Use only screws with 4-40UNC thread for fastening the DB-25 connector!



3.11.2 Digital inputs

Pin	Function	Signal type	Description	Priority
7	<b>CONTROL MODE</b>	Digital input <sup>1)</sup>	<p>This pin selects the control mode. This valve may either be operated as pressure controller or as position controller.</p> <p><u>PRESSURE CONTROL</u> is activated as long as optocoupler is 'on'. The PID controller controls the chamber pressure according to the pressure SETPOINT by means of the valve position.</p> <p><u>POSITION CONTROL</u> is activated when optocoupler is 'off'. The valve position is directly controlled according to the position SETPOINT.</p>	6 <sup>2)</sup>
5	<b>SETPOINT RANGE</b>	Digital input <sup>1)</sup>	<p>This pin selects the SETPOINT RANGE. Low range extension is activated as long as optocoupler is 'on'. It's effective in pressure control mode only.</p> <p>This function extends the lower 10% range of sensor full scale (SFS) to the full 0-10V for SETPOINT input. Herewith you can achieve better resolution, especially in case of a 2 sensor system.</p> <p>Example with SFS = 100mTorr:            Not active (10V=100%) &gt;&gt; 10V setpoint = 100mTorr            Active (10V=10%): &gt;&gt; 10V setpoint = 10mTorr</p>	N/A
16	<b>HOLD</b>	Digital input <sup>1)</sup>	<p>This function stops the valve at the current position. After release of the signal the valve will return to the selected CONTROL MODE.</p> <p>This function is activated as long as optocoupler is 'on'.</p>	5 <sup>2)</sup>
17	<b>OPEN VALVE</b>	Digital input <sup>1)</sup>	<p>This function will open the valve.</p> <p>This function is activated as long as optocoupler is 'on' in <b>non inverted</b> configuration.            This function is activated as long as optocoupler is 'off' in <b>inverted</b> configuration.</p> <p>Configuration can be done in local operation via service port.            Default settings is not inverted</p>	3 <sup>2)</sup>
15	<b>CLOSE VALVE</b>	Digital input <sup>1)</sup>	<p>This function will close the valve.</p> <p>This function is activated as long as optocoupler is 'on' in <b>non inverted</b> configuration.            This function is activated as long as optocoupler is 'off' in <b>inverted</b> configuration.</p> <p>Configuration can be done in local operation via service port.            Default settings is not inverted</p>	2 <sup>2)</sup>

- 1) All digital inputs are digitally filtered. Filter delay is 50ms. This means that digital signals must be applied for at least 50ms to be effective. Refer to «Function and wiring» for details about input circuit.
- 2) Highest priority is 1. Functions with lower priorities will not be effective as long as higher priority functions are active.



Pin	Function	Signal type	Description	Priority
3	ZERO	Digital Input <sup>1)</sup>	<p>This function compensates the pressure gauge offset voltage and sets the pressure value to zero. In case of a 2 sensor system both sensor inputs will be adjusted.</p> <p>This function is initiated by the 'off' to 'on' transition of the optocoupler.</p> <p>If 'on' remains established this will not re-initiate the function and does also not block functions with lower priorities.</p> <p><b>Note:</b> Do not perform ZERO as long as pressure gauge voltage is shifting.</p> <p><b>Note:</b> Do not perform ZERO, if the base pressure of your vacuum system is higher than 1‰ of sensor full scale. We recommend disabling ZERO function in this case. You can disable the function in local operation via service port.</p>	1 <sup>2)</sup>
19	LEARN	Digital Input <sup>1)</sup>	<p>The LEARN routine determines the control characteristic of the vacuum system.</p> <p>This function is initiated by the 'off' to 'on' transition of the optocoupler. A transition from 'on' to 'off' while the routine is running would stop it.</p> <p>While running, the routine may not be interrupted by another function with higher priority. If 'on' remains established after completion this will not re-initiate the function and does also not block functions with lower priorities.</p> <p><b>Note:</b> Without a LEARN data set the PID controller is not able to perform pressure control.</p>	4 <sup>2)</sup>
18	LOCK	Digital input <sup>1)</sup>	<p>This function locks the valve in remote operation. In case the valve is in local operation it will turn to remote operation. Local operation via service port is not possible when LOCK is activated.</p> <p>When the signal is released the valve remains in remote operation but local operation may be activated via service port.</p>	N/A
6	DIGITAL GROUND	Digital ground	<p>Ground for all digital inputs. Ground is used when digital inputs are operated by switches. Connect switches to ground.</p> <p>Refer also to «Function and wiring» configuration a).</p>	
4	DIGITAL COMMON	Digital common	<p>Common for all digital inputs. Common is used when digital inputs are driven by voltage sources. Connect + or – terminal of source with common (input optocouplers are capable of bidirectional operation).</p> <p>Refer also to «Function and wiring» configuration b).</p>	

- 1) All digital inputs are digitally filtered. Filter delay is 50ms. This means that digital signals must be applied for at least 50ms to be effective. Refer to «Function and wiring» for details about input circuit.
- 2) Highest priority is 1. Functions with lower priorities will not be effective as long as higher priority functions are active.



## 3.11.3 Digital outputs

Pin	Function	Signal type	Description
8	<b>VALVE OPEN SERVICE REQUEST</b>	Digital output <sup>1)</sup>	<p>This output is active in all operation modes and indicates either that the valve is open or that a service is requested.</p> <p>A service request is indicated when the valve requires cleaning due to contamination.</p> <p>Configuration of the functionality of this output can be done in local operation via service port.</p> <p>By default the output indicates open</p>
9	<b>VALVE CLOSED SERVICE REQUEST</b>	Digital output <sup>1)</sup>	<p>This output is active in all operation modes and indicates either that the valve is close or that a service is requested.</p> <p>A service request is indicated when the valve requires cleaning due to contamination.</p> <p>Configuration of the functionality of this output can be done in local operation via service port.</p> <p>By default the output indicates close</p>
22	<b>ALARM</b>	Digital output <sup>1)</sup>	<p>The meaning of the alarm output depends on the operation mode.</p> <p><u>LEARN:</u> LEARN is not completed yet.</p> <p><u>PRESSURE CONTROL:</u> Actual pressure is out of <math>\pm 2\%</math> range of SETPOINT</p> <p><u>POSTION CONTROL:</u> Actual position is out of <math>\pm 0.1\%</math> range of SETPOINT</p>
21	<b>READY</b>	Digital output <sup>1)</sup>	<p>This signal indicates that the valve is ready for remote operation.</p> <p>If this signal is not active the valve is in one of the following modes:</p> <ul style="list-style-type: none"><li>• Synchronization during power up</li><li>• Local operation via service port</li><li>• Safety mode. Refer to «Safety mode» for details.</li></ul>
20	<b>COMMON</b>	Digital common	Common for all digital outputs.

1) Refer to «Function and wiring» for details about output circuit.



## 3.11.4 Analog inputs and outputs

Pin	Function	Signal type	Description
25	<b>SETPOINT</b>	Analog input <sup>1)</sup>	<p>The meaning of the setpoint input depends on the operation mode.</p> <p><u>LEARN:</u> A voltage of 0-10V shall be applied to this input as pressure limit for learn. The limit pressure is in linear relation to the applied voltage. 10V relates to sensor full scale. In case of 2 sensor operation 10V relates to sensor 1 full scale (high range).</p> <p><b>Note:</b> To activate pressure limit function for remote operation it must be configured accordingly. Refer to «Interface configuration»</p> <p><u>PRESSURE CONTROL:</u> A voltage of 0-10V shall be applied to this input as pressure setpoint. The pressure setpoint is in linear relation to the applied voltage. Depending on selected SETPOINT RANGE 10V means either sensor full scale or 10% of sensor full scale. In case of 2 sensor operation 10V relates to sensor 1 full scale (high range).</p> <p><u>POSITION CONTROL:</u> A voltage of 0-10V shall be applied to this input as position setpoint. The position setpoint is in linear relation to the applied voltage. 0V is closed but not isolation function and 10V is open position. (Use digital input for isolation function)</p>
12	<b>PRESSURE</b>	Analog output <sup>1)</sup>	<p>This output indicates the current pressure as 0-10V. The output voltage is in linear relation to the pressure. Depending on the selected SETPOINT RANGE 10V means either sensor full scale or 10% of sensor full scale. In case of 2 sensor operation sensor full scale relates to sensor 1 (high range).</p>
11	<b>POSITION</b>	Analog output <sup>1)</sup>	<p>This output indicates the current valve position as 0-10V voltage range. The voltage is in linear relation to the valve position. 0V is closed but not isolation function and 10V is open position. (Use digital output for isolation function)</p>
13	<b>ANALOG GROUND</b>	Analog ground	Ground for analog input and analog outputs.
1	<b>CHASSIS GROUND</b>	Chassis ground	Chassis ground connected to case. Shall be used to connect cable shield.

1) Refer to «Function and wiring» for details about input / output circuit.



## 4 Trouble shooting

Failure	Check	Action
No dots lighted on display	- 24 V power supply ok?	- Connect valve to power supply according to «Electrical connection» and make sure that power supply is working.
Remote operation does not work	- Local operation via service port active - Safety mode active, check for D on display?	- Switch to remote operation.  - Provide power to motor to allow for operation. - Refer to «Electrical connection» for details.
Display shows «E 20» (fatal error - limit stop of valve unit not detected)		- Reset control unit. Cycle power (OFF→ON) or - Send reset command: - local via service port with CV/CPA/Service Box2 - If reset unsuccessful, replace actuator according to «Maintenance procedures».
Display shows «E 22» (fatal error - rotation angle of valve plate limited during operation)	- Valve plate mechanically obstructed?	- Resolve obstruction. - Reset control unit. Cycle power (OFF→ON) or - Send reset command: - local via service port with CV/CPA/Service Box2
Display shows «E 40» (fatal error - motor driver failure detected)		- Replace control unit according to «Maintenance procedures».
Display shows «D C» or «D999» Motor Interlock is open	- Motor power supplied?	- Provide power to motor to allow for operation. - Refer to «Electrical connection» for details.
Display shows «SR» (Service Request)	- Valve unit heavy contaminated or gate seal heavily sticking?	- Clean valve and/or replace gate seal according to «Maintenance procedures».
CLOSE VALVE does not work	- Safety mode active, check for D on display? - Maintenance mode active	- Provide power to motor to allow for operation. - Refer to «Electrical connection» for details. - Refer to "Display shows «M C»" in this table
OPEN VALVE does not work	- Safety mode active, check for D on display? - Maintenance mode active	- Provide power to motor to allow for operation. - Refer to «Electrical connection» for details. - Refer to "Display shows «M100»" in this table
Display shows «M C» Maintenance mode active		- Pin 14 of service connector is connected to ground. Plate will close. Further movement of plate is blocked. <sup>1)</sup>
Display shows «M100» Maintenance mode active		- Pin 13 of service connector is connected to ground. Plate will open. Further movement of plate is blocked. <sup>1)</sup>
POSITION CONTROL does not work	- Safety mode active, check for D on display?	- Provide power to motor to allow for operation. - Refer to «Electrical connection» for details.
	- POSITION CONTROL selected, check for V on display?	- Select POSITION CONTROL mode. Refer to «Position control» for details.
COMPRESSED AIR FAILURE «AIRf»	- No or too less air pressure on air input of valve	- Connect air or increase air pressure. Make sure that the air pressure is more than 4 bar (55 psi).
COMPRESSED AIR FAILURE at Exhaust «AIRx»	- Wrong connection of compressed air input and output - No compressed air at output exhaust	- Connect compressed air in accordance chapter installation.  - Contact your local VAT service centre for support.

1) Priority of pin 14 is higher than pin 13. If pin 14 is connected to ground after pin 13 the valve will close.  
Ground of service connector is at pin 4 and 8.



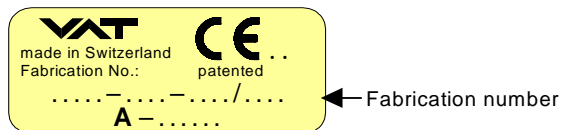
Failure	Check	Action
Pressure reading is wrong or pressure reading is negative	<ul style="list-style-type: none"> <li>- Sensor(s) connected?</li> <li>- 2 sensor version present at valve controller?</li> <li>- ZERO done?</li> <li>- Does sensor power supply provide enough power for sensor(s)?</li> </ul>	<ul style="list-style-type: none"> <li>- Refer to «Electrical connection».</li> <li>- Check valve version on page 1. Verify configuration. Refer to «Setup procedure».</li> <li>- Perform ZERO when base pressure is reached. Refer to «ZERO» for details.</li> <li>- Verify sensor supply voltage.</li> </ul>
ZERO does not work	<ul style="list-style-type: none"> <li>- Valve in open position, check for O on display?</li> <li>- ZERO disabled?</li> </ul>	<ul style="list-style-type: none"> <li>- OPEN VALVE and bring chamber to base pressure before performing ZERO.</li> <li>- Enable ZERO. Refer to «Valve and sensor configuration» for details.</li> </ul>
Pressure is not '0' after ZERO  PRESSURE CONTROL does not work	<ul style="list-style-type: none"> <li>- Sensor voltage shifting?</li> <li>- System pumped to base pressure?</li> <li>- Sensor offset voltage exceeds <math>\pm 1.4V</math></li> <li>- Safety mode active, check for D on display?</li> <li>- PRESSURE CONTROL selected, check for P on display?</li> <li>- LEARN done?</li> </ul>	<ul style="list-style-type: none"> <li>- Wait until sensor does not shift any more before performing ZERO.</li> <li>- OPEN VALVE and bring chamber to base pressure before performing ZERO.</li> <li>- Replace pressure gauge.</li> <li>- Provide power to motor to allow for operation. Refer to «Electrical connection» for details.</li> <li>- Select PRESSURE CONTROL mode. Refer to «Pressure control» for details.</li> <li>- Perform LEARN. Refer to «Setup procedure» for details.</li> </ul>
PRESSURE CONTROL not optimal	<ul style="list-style-type: none"> <li>- Setup done completely?</li> <li>- LEARN done?</li> <li>- ZERO performed before LEARN?</li> <li>- LEARN interrupted?</li> <li>- Was gas flow stable during LEARN?</li> <li>- Tuning done?</li> <li>- Is sensor range suited for application?</li> <li>- Noise on sensor signal?</li> </ul>	<ul style="list-style-type: none"> <li>- Perform «Setup procedure» completely.</li> <li>- Perform LEARN. Refer to «LEARN» for details.</li> <li>- Perform ZERO then repeat LEARN. Refer to «Setup procedure» for details.</li> <li>- Repeat LEARN. Refer to «LEARN» for details.</li> <li>- Repeat LEARN with stable gas flow. Refer to «LEARN» for details.</li> <li>- Tune valve for application. Refer to «Tuning of control performance» for details.</li> <li>- Use a sensor with suitable range (controlled pressure should be &gt;3% and &lt; 98% of sensor full scale).</li> <li>- Make sure a shielded sensor cable is used.</li> </ul>

If you need any further information, please contact one of our service centers. You can find the addresses on our website: <http://www.vat.ch>

## 5 Maintenance & repairs

Under clean operating conditions, the valve does not require any maintenance during the specified cycle life. Contamination from the process may influence the function and requires more frequent maintenance.

Before carrying out any maintenance or repairs, please contact VAT. It has to be individually decided whether the maintenance/repair can be performed by the customer or has to be carried out by VAT. The fabrication number on the valve



has always to be specified.

All supplies (e. g. compressed air, electrical power) must be disconnected for removal/installation of the valve from/into the system.



Even with disconnected supply, loaded springs and/or air cushions in cylinders can be potential hazards.



Keep fingers and objects away from the valve opening!

Products returned to VAT must be free of harmful substances such as e.g. toxic, caustic or micro-biological ones. If products are radioactively contaminated, fill in the VAT form «Contamination and Radiation Report» and send it with the product. The form is available at VAT. The maximum values indicated in the form must not be exceeded.



## 5.1 Maintenance procedures



Keep fingers out of the valve during maintenance work.



Use cleanroom gloves during maintenance work.

Two preventive maintenance procedures are defined for this valve. These are:

- **Replacement of isolation seals** (gate and body seal of sealing ring) **and valve cleaning**
- **Replacement of actuator and actuator shaft seals**

Required frequency of cleaning and replacement of seals is depending on process conditions.



A critical factor influencing the maintenance period is the lifetime of the vacuum grease, being limited under increased temperature. In this case grease will separate to PTFE and oil. The oil may flow and contaminate the valve parts.

VAT can give the following **recommendations for preventive maintenance**:

	unheated *)	heated $\leq 80^{\circ}\text{C}$ *)	heated $> 80^{\circ}\text{C}$ *)
<b>isolation seals</b> (gate and body seal of sealing ring)	200'000 cycles	6 months but max. 200'000 cycles	3 months but max. 200'000 cycles
<b>actuator shaft seals</b>	1'000'000 cycles	6 months	3 months

\*) This figures are reference values for clean conditions under various temperatures. These values do not include any impact of the process. Therefore preventive maintenance schedule has finally to be checked for the actual process conditions.



Prevent gap between body and sealing ring from air gun cleaning. Otherwise vacuum grease may be distributed and contaminate the valve.



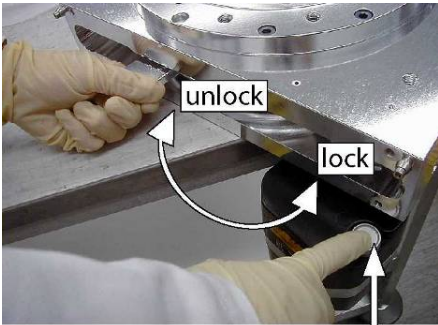
valve body →  
 gap →  
 sealing ring →  
 pendulum plate →


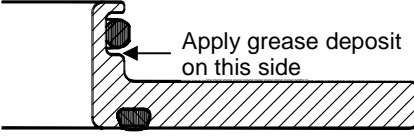


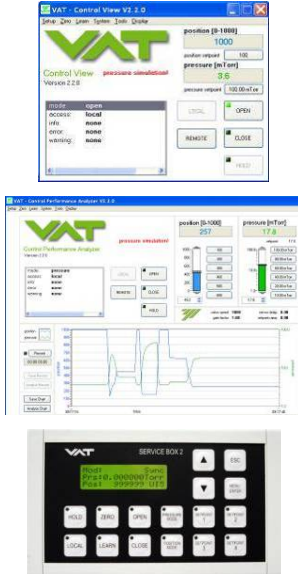
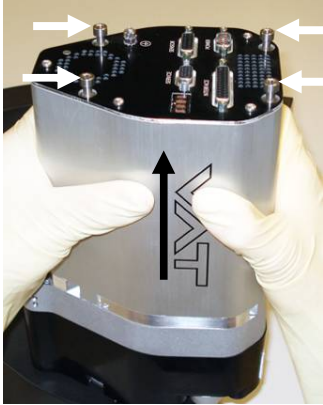
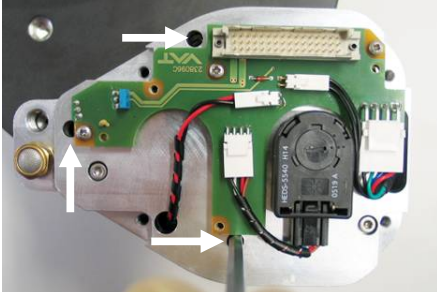
**Replacement of isolation seals** (gate and body seal of sealing ring) **and valve cleaning**

**Replacement of actuator and actuator shaft seals**

**Note:** Electrical power and compressed air is required to perform steps 2 to 9 during disassembly respectively 9 to 2 during assembly.

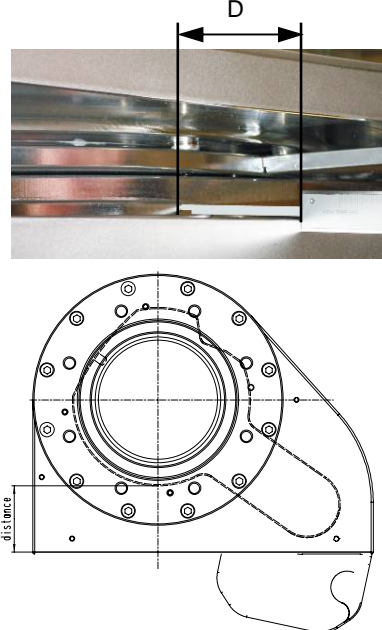
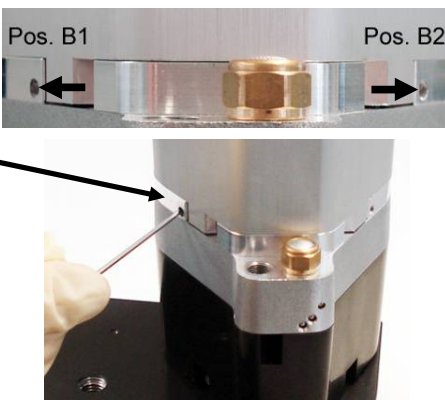
Description		Required tool						
<ol style="list-style-type: none"> <li>Vent both valve chambers.</li> <li>Open bonnet screws. Press snap in fixation on one side and pull bonnet a little bit on that side. Than press snap in fixation on other side and remove valve bonnet.</li> </ol> <p><b>Caution:</b> Weight of valve bonnet is approx.</p> <table border="1"> <tr> <td>DN320 / 12" (65050 - . . . . .)</td> <td>13.0 kg</td> </tr> <tr> <td>DN350 / 14" (65051 - . . . . .)</td> <td>15.0 kg</td> </tr> <tr> <td>DN400 / 16" (65052 - . . . . .)</td> <td>18.0 kg</td> </tr> </table>	DN320 / 12" (65050 - . . . . .)	13.0 kg	DN350 / 14" (65051 - . . . . .)	15.0 kg	DN400 / 16" (65052 - . . . . .)	18.0 kg		<p>Allen wrench 8mm</p>
DN320 / 12" (65050 - . . . . .)	13.0 kg							
DN350 / 14" (65051 - . . . . .)	15.0 kg							
DN400 / 16" (65052 - . . . . .)	18.0 kg							
<ol style="list-style-type: none"> <li>Open valve <b>Caution:</b> Stand away from valve – pendulum plate moves out of the valve body.</li> <li>Unfasten mounting screw for pendulum plate.</li> <li>Remove pendulum plate.</li> </ol>		<p>open end wrench 13mm</p>						
<ol style="list-style-type: none"> <li>With one hand press the MAINTENANCE BUTTON to lower the sealing ring, with your second hand unlock the sealing ring by pressing the handle.</li> <li>Release MAINTENANCE BUTTON.</li> <li>Remove sealing ring.</li> <li>To prevent the shaft and retaining pins from moving during work, switch the valve to safety mode. Refer to «Safety mode» for details.</li> </ol> <p><b>Note:</b> Retaining pins will move up.</p>								

Description	Required tool											
<p>10. Remove gate and body o-ring from sealing ring carefully with a soft tool.</p> <p>11. Remove grease residues at sealing ring with alcohol. Clean sealing ring and pendulum plate with alcohol or in an ultrasonic bath.</p> <p>12. Clean out valve body with alcohol. Use an appropriate non metal tool with a cloth to enter valve body. Do not enter valve body with hands!  Then blow out valve body with clean air.  Do not directly expose seals (actuator and retaining pin feedthroughs) to air stream!</p> <p>13. Clean or replace gate seal if necessary. Install gate o-ring to sealing ring without grease.</p>												
<p>14. Clean or replace body seal if necessary. Lubricate body o-ring with the quantity of vacuum grease listed in the table to the right.</p>	<table border="1"> <thead> <tr> <th>Valve size</th> <th>Quantity of grease [ml]</th> </tr> </thead> <tbody> <tr> <td>DN320 / 12" (65050 - . . . . - . . . .)</td> <td>0.3</td> </tr> <tr> <td>DN350 / 14" (65051 - . . . . - . . . .)</td> <td>0.4</td> </tr> <tr> <td>DN400 / 16" (65052 - . . . . - . . . .)</td> <td>0.4</td> </tr> </tbody> </table>	Valve size	Quantity of grease [ml]	DN320 / 12" (65050 - . . . . - . . . .)	0.3	DN350 / 14" (65051 - . . . . - . . . .)	0.4	DN400 / 16" (65052 - . . . . - . . . .)	0.4			
Valve size	Quantity of grease [ml]											
DN320 / 12" (65050 - . . . . - . . . .)	0.3											
DN350 / 14" (65051 - . . . . - . . . .)	0.4											
DN400 / 16" (65052 - . . . . - . . . .)	0.4											
<p>15. Install body o-ring into sealing ring.</p>												
<p>16. Deposit vacuum grease on the bottom side of the body seal according to drawing below. Pay attention that the quantity of vacuum grease listed in the table to the right is distributed constantly over the whole circumference.</p>	<table border="1"> <thead> <tr> <th>Valve size</th> <th>Quantity of grease [ml]</th> </tr> </thead> <tbody> <tr> <td>DN320 / 12" (65050 - . . . . - . . . .)</td> <td>0.5</td> </tr> <tr> <td>DN350 / 14" (65051 - . . . . - . . . .)</td> <td>0.7</td> </tr> <tr> <td>DN400 / 16" (65052 - . . . . - . . . .)</td> <td>1.1</td> </tr> </tbody> </table>	Valve size	Quantity of grease [ml]	DN320 / 12" (65050 - . . . . - . . . .)	0.5	DN350 / 14" (65051 - . . . . - . . . .)	0.7	DN400 / 16" (65052 - . . . . - . . . .)	1.1			
Valve size	Quantity of grease [ml]											
DN320 / 12" (65050 - . . . . - . . . .)	0.5											
DN350 / 14" (65051 - . . . . - . . . .)	0.7											
DN400 / 16" (65052 - . . . . - . . . .)	1.1											
												
<p><b>Note:</b> For Replacement of actuator or actuator shaft seals, proceed with step 19 otherwise go to step 17.</p> <p>17. Reassembly the valve in reverse order, step 9...3.</p> <p>18. Close the valve bonnet, see step 40.</p>												

Description	Required tool		
<p>19. Release the valve from safety mode. Refer to «Safety mode» for details</p> <p>20. Move the valve to position 50% (half opened) This is necessary, in order to dismount the actuator. See steps 24.</p> <p>21. Disable PFO option feature via 'Power Fail Status' in menu 'System' of CV or CPA software, and turn off the power</p>		<ul style="list-style-type: none"> <li>• CV software</li> <li>• CPA software</li> </ul> <p>or</p> <ul style="list-style-type: none"> <li>• Service Box 2</li> </ul>	
<p>22. Disconnect 24VDC power. Wait for 60s, then disconnect cable and compressed air from valve actuator.</p> <p>23. Unfasten all 4 controller screws and lift controller carefully from actuator.</p>		<p>Allen Wrench 4 mm</p>	
<p>24. Unfasten all 3 actuator screws and remove actuator.</p>		<p>Allen Wrench 5 mm</p>	

Description	Required tool		
<p>25. Remove actuator shaft seals carefully with a soft tool.</p> <p>26. Clean actuator feedthrough with alcohol.</p> <p>27. Lubricate each o-ring groove with 0.1 ml vacuum grease. Pay attention that grease is distributed constantly over the whole circumference.</p>		<ul style="list-style-type: none"> <li>• Soft tool (o-ring remover)</li> <li>• Vacuum grease</li> </ul>	
<p>28. Clean or replace seals if necessary. Lubricate each o-ring with 0.05 ml vacuum grease.</p> <p>29. Install o-rings.</p> <p>30. Deposit 0.1 ml vacuum grease on each o-ring. Pay attention that grease is distributed constantly over the whole circumference.</p>			
<p>31. Remove fixation kit and mounting screw for pendulum plate.</p> <p>32. Clean screw and slightly lubricate thread. Then reinstall fixation kit.</p> <p>33. Clean actuator shaft and lubricate it with 0.1 ml vacuum grease.</p>			
<p>34. Install actuator</p> <ul style="list-style-type: none"> <li>• Tighten actuator screws with 6 Nm.</li> <li>• Remove vacuum grease from actuator shaft face after installation.</li> </ul>		<p>Allen Wrench 5mm</p>	
<p>35. Install controller</p> <ul style="list-style-type: none"> <li>• Tighten the controller screws with 1 Nm.</li> <li>• Connect cables at controller</li> <li>• Connect compressed air at actuator</li> </ul>		<p>Allen Wrench 4mm</p>	



Description	Required tool										
36. Turn on power of controller. <b>Note:</b> valve moves to close position.  37. Open valve and install sealing ring and pendulum plate in reverse order as they had been disassembled (steps 9 to 3).		open end wrench 13mm									
<p><b>If actuator was replaced</b>, proceed with point 38, otherwise go to point 40.</p> 38. Close valve and check if pendulum plate is in center of flange. Check can be done either visual or by measurement. When the valve is mounted to a tool, the bonnet has to be removed and the center position can be measured by a depth gauge (see picture). If the centering (or distance) is not correct, proceed with point 39.		<table border="1"> <tr> <td data-bbox="1145 631 1189 772">DN</td> <td data-bbox="1189 631 1353 772">Distance D [mm] between bonnet flange surface and pendulum plate.</td> </tr> <tr> <td data-bbox="1145 772 1189 907">320</td> <td data-bbox="1189 772 1353 907">60.5 ±0.5</td> </tr> <tr> <td data-bbox="1145 907 1189 1041">350</td> <td data-bbox="1189 907 1353 1041">59.0 ±0.5</td> </tr> <tr> <td data-bbox="1145 1041 1189 1276">400</td> <td data-bbox="1189 1041 1353 1276">62.0 ±0.5</td> </tr> </table>	DN	Distance D [mm] between bonnet flange surface and pendulum plate.	320	60.5 ±0.5	350	59.0 ±0.5	400	62.0 ±0.5	
DN	Distance D [mm] between bonnet flange surface and pendulum plate.										
320	60.5 ±0.5										
350	59.0 ±0.5										
400	62.0 ±0.5										
39. If necessary adjust pendulum plate: a. Move pendulum plate a little towards open (e.g. position 1% of full stroke) b. Use adjustment screw at flange side of actuator (1 turn clockwise adjusts pendulum plate by about 3mm towards open). c. Restart valve in menu 'System/Recovery' d. Check pendulum plate position according point 38 and redo adjustment procedure if necessary.	<p>Adjusting screw mounted either in actuator position «B1 standard» or «B2 option»</p> 	Allen wrench 2mm									
40. Clean valve bonnet sealing surface and o-ring <ul style="list-style-type: none"> <li>• Mount valve bonnet, see step 2.</li> <li>• Tightening torques for bonnet screws, see in table to the right.</li> </ul>	<b>Max. torque 16 Nm</b>	Allen wrench 8mm									

## 5.2 Option board

The option board may or may not be equipped in your valve depending on the order. Refer to page 1 of this manual to check valve version. This board includes the optional modules for the valve which are:

- $\pm 15\text{VDC}$  sensor power supply (SPS)
- Power failure option (PFO)

It is available in 3 versions. These are:

- SPS module only
- PFO module only
- SPS and PFO module

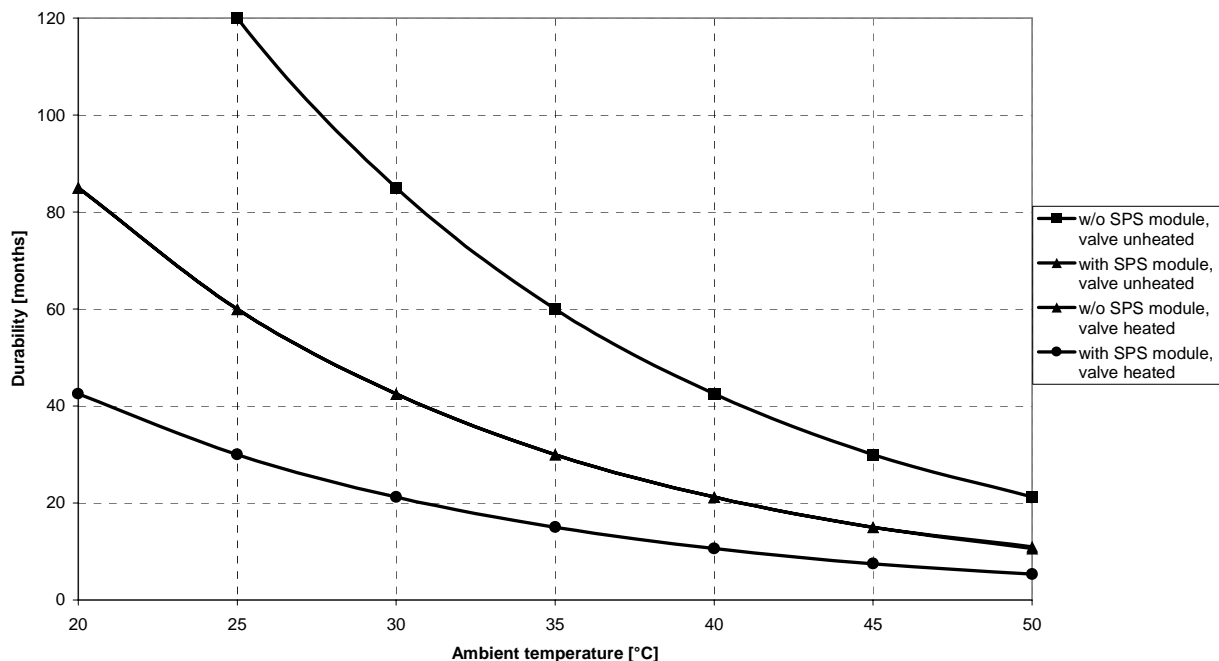
The modules may be retrofitted or replaced easily. The battery lifetime of the PFO module depends on the ambient temperature (see below). To assure PFO function the option board must be replaced after battery life has expired. For ordering number of the modules refer to «Spare parts and accessories».

### 5.2.1 Durability of power fail battery

The curves in the graph show the estimated life of UltraCap PFO in the worst condition (max. sensor load = 1 A, valve heating temperature = 150 degree C).

If the SPS is not fully loaded (< 1 A) or heating temperature of valve body is lower than 150 degree C, the corresponding life time curve will be somewhere in between the upper and the lower curve.

Therefore please determine the equivalent maintenance period for replacing the UltraCap battery (Option board).



**Note:** This graph shows estimated life of UltraCap PFO for reference and not as guaranteed value.

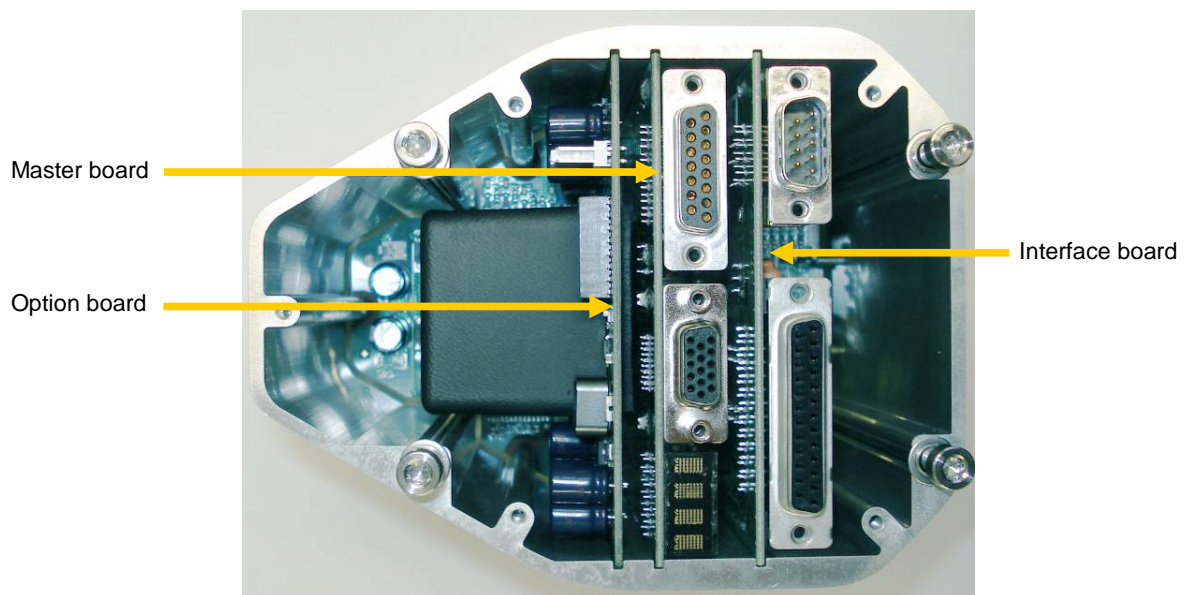
### 5.2.2 Retrofit / replacement procedure



#### ESD Precaution!

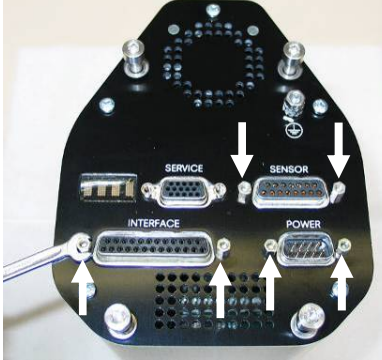

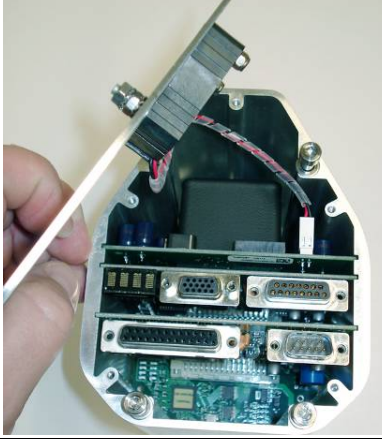
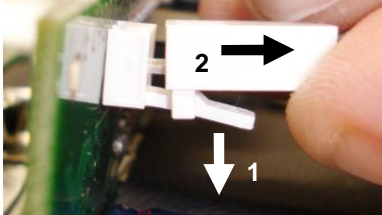
All work on the control and actuating unit has to be done under ESD protected environment to prevent electronic components from damage!

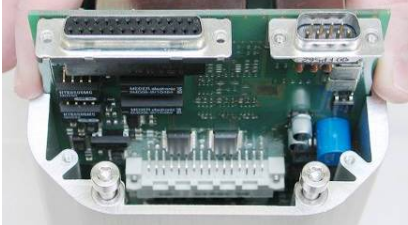
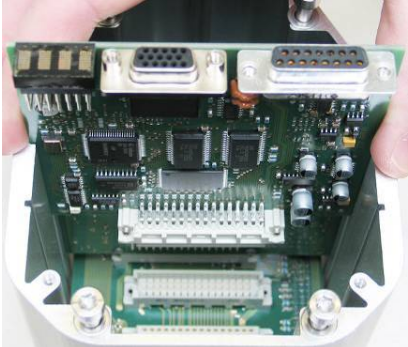
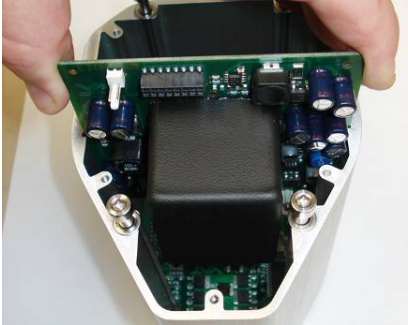
Top view on control and actuating unit with panel removed:



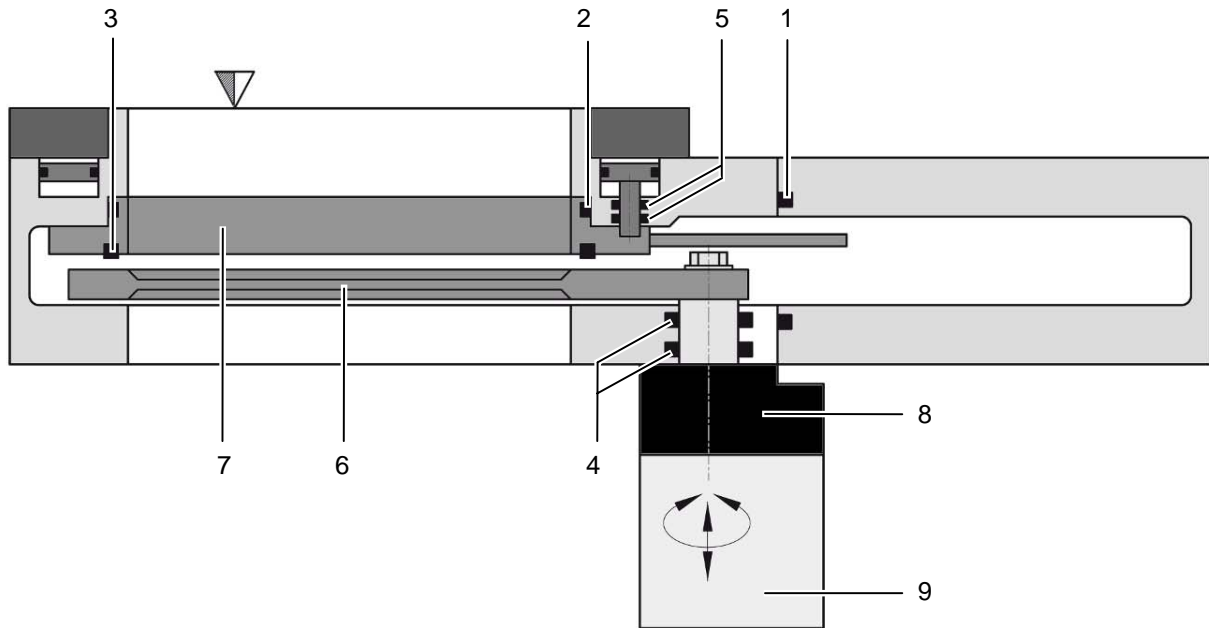
**Note:** All boards have a fixed position into control and actuating unit. It is not possible to fit a board in other position as shown in picture above. Do not try out other positions, that may be destroy the socket of boards!



Description		Required tool
<p>1. Remove female screw locks from POWER, SENSOR and INTERFACE connectors.</p>		<p>Open end wrench 4.5 mm</p>
<p>2. Remove the panel screws.</p>		<p>Pozidriv screw driver size 1</p>
<p>3. Lift the panel carefully.</p>		
<p>4. Pull out the option board a little.            5. Push the connector release (1) a little down and disconnect fan cable (2) from option board.</p>		

Description		Required tool
6. Remove or replace interface board.		
7. Remove or replace master board.		
8. Remove or replace option board.		
9. Insert master board and interface board in reverse order as disassembled at correct positions (see steps 7 to 6).		
10. Reconnect fan cable to option board (see steps 5 to 4).		
11. Place the panel and tighten panel screws with 1.1 Nm (see steps 3 to 2).		Pozidriv screw driver size 1
12. Tighten female screw locks from POWER, SENSOR and INTERFACE connectors with 1.1 Nm (see step 1).		Open end wrench 4.5 mm

## 6 Drawing



- 1 Bonnet seal
- 2 Body seal
- 3 Plate seal
- 4 Rotary feedthrough seals
- 5 Shaft feedthrough seals
- 6 Pendulum plate
- 7 Sealing ring
- 8 Actuator

Control unit

## 7 Spare parts



Please specify the **fabrication number of the valve** (see yellow label on valve) when ordering spare parts. This is to ensure that the appropriate spare parts are supplied.

### 7.1 Control unit

Item	Description	
	Valve size Product ordering number	All sizes 650 . . . . .
9	Control unit	Too many to list. Depends on configuration, please contact VAT.
	Option board with SPS module (±15VDC sensor power supply)	371399
	Option board with PFO module (power failure option)	371397
	Option board with SPS and PFO module	326113
	Controller separation kit including 4.5m cable	264881



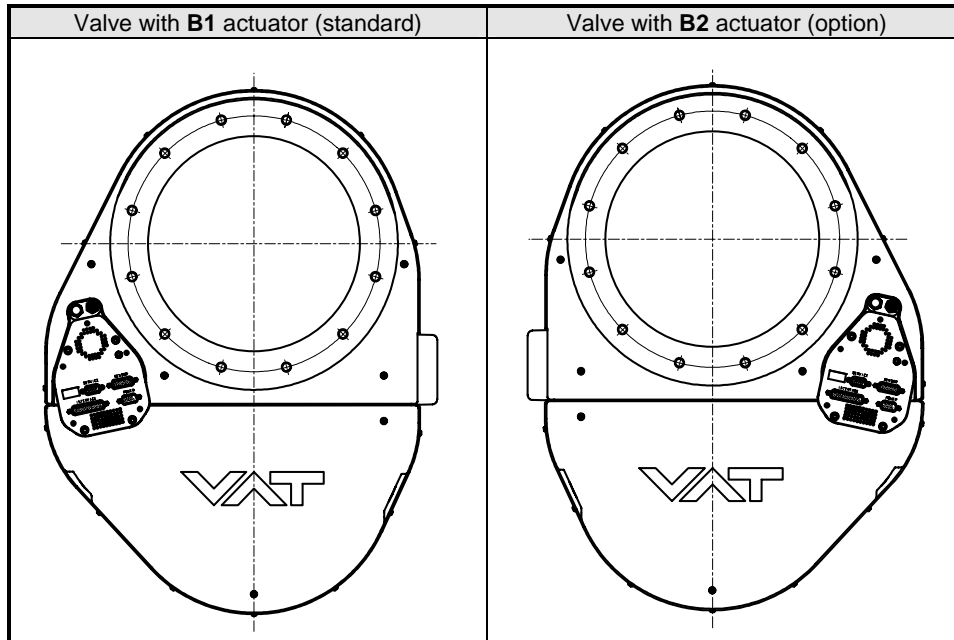
## 7.2 Valve unit

Item	Description	DN 320 / 12" 65050 - . . . .	DN 350 / 14" 65051 - . . . .	DN 400 / 16" 65052 - . . . .
1	Bonnet seal Viton other materials	N-5100-280 on request	N-5100-281 on request	N-5100-282 on request
2	Body seal (Viton) This includes a 2ml syringe of vacuum grease	206529	230885	244435
3	Gate seal Viton other materials	N-5100-279 on request	N-5100-280 on request	N-5100-282 on request
	Seal kit vacuum (Viton). This consists of item 2 and 3.	206528	230884	244437
	Syringe of vacuum grease 2ml 5ml		206792 206793	
4	Actuator shaft seals (Viton)		N-5111-329 (2 pcs required per valve)	
5	Sealing ring shaft seals (Viton)		N-7121-112 (24 pcs required per valve)	
6	Pendulum plate: - Blank B1 *) - Blank B2 *) - Hardanodized B1 *) - Hardanodized B2 *) - Nickel coated B1 *) - Nickel coated B2 *)	211275 211276 96603-01 98378-01 on request on request	217681 on request 222787 on request on request on request	239455 on request 235219 on request on request on request
7	Sealing ring - Blank - Hardanodized - Nickel coated	230236 229310 on request	237812 233301 on request	239438 235224 on request
8	Actuator B1 *) B1 *) B2 *)	308134 (version with stainless steel silencer on compressed air exhaust)	242217 245382	

**Note:** Use only spare parts manufactured by VAT to assure safe and reliable operation!

\*) Refer to figures on next page to check for actuator position options.

Actuator position options:



### 7.3 Accessories

Item	Description	Part number
	24 VDC power supply unit (input: 100 – 240 VAC)	249775
	'Control Performance Analyzer' package for Windows® consisting of software and cable	600SP-99NN-AAA
	'Control View' software for Windows®	248126 free download from <a href="http://www.vatvalve.com">www.vatvalve.com</a> or available on order against charge
	Service cable (PC to valve connection)	230327 free wiring information available for download from <a href="http://www.vatvalve.com">www.vatvalve.com</a>
	Connector kit consisting of: •DB-9 female POWER plug •DB-15 male SENSOR plug •DB-25 male INTERFACE plug	242411
	Service Box 2	601BS-29NN-000
	Control panel (rack-mount version of Service Box 2)	602BS-29NN-000



## 7.3.1 Centering ring with Viton o-ring

Description					
Valve size		DN 100 / 4"	DN 160 / 6"	DN 200 / 8"	DN 250 / 10"
Product ordering number		65040 - . . . .	65044 - . . . .	65046 - . . . .	65048 - . . . .
Centering ring with Viton o-ring (for ISO-F installation only)	Aluminum	32040-QAZV	32044-QAZV	32046-QAZV	32048-QAZV
	Stainless steel	32040-QEZV	32044-QEZV	32046-QEZV	32048-QEZV

Description						
Valve size			DN 320 / 12"	DN 350 / 14"	DN 400 / 16"	
Product ordering number			65050 - . . . .	65051 - . . . .	65052 - . . . .	
Centering ring with Viton o-ring (for ISO-F installation only)	Aluminum		32050-QAZV	-	32052-QAZV	



## 8 Warranty

Each product sold by VAT Vakuumventile AG (VAT) is warranted to be free from the manufacturing defects that adversely affect the normal functioning thereof during the warranty period stated in VAT's «Terms of Sale» immediately following delivery thereof by VAT, provided that the same is properly operated under conditions of normal use and that regular, periodic maintenance and service is performed or replacements made, in accordance with the instructions provided by VAT. The foregoing warranty shall not apply to any product or component that has been repaired or altered by anyone other than an authorized VAT representative or that has been subject to improper installation or abuse, misuse, negligence or accident. VAT shall not be liable for any damage, loss, or expense, whether consequential, special, incidental, direct or otherwise, caused by, arising out of or connected with the manufacture, delivery (including any delay in or failure to deliver), packaging, storage or use of any product sold or delivered by VAT shall fail to conform to the foregoing warranty or to the description thereof contained herein, the purchaser thereof, as its exclusive remedy, shall upon prompt notice to VAT of any such defect or failure and upon the return of the product, part or component in question to VAT at its factory, with transportation charges prepaid, and upon VAT's inspection confirming the existence of any defect inconsistent with said warranty or any such failure, be entitled to have such defect or failure cured at VAT's factory and at no charge therefor, by replacement or repair of said product, as VAT may elect. VAT MAKES NO WARRANTY OR REPRESENTATION OF ANY KIND, EXPRESS OR IMPLIED, (INCLUDING NO WARRANTY OR MERCHANTABILITY), EXCEPT FOR THE FOREGOING WARRANTY AND THE WARRANTY THAT EACH PRODUCT SHALL CONFORM TO THE DESCRIPTION THEREOF CONTAINED HEREIN, and no warranty shall be implied by law.

Furthermore, the «Terms of sale» at the back of the price list are applicable.