

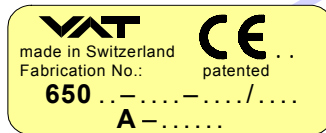
Pendulum control & isolation valve with RS232 interface, 2 sensor input for valve cluster operation

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

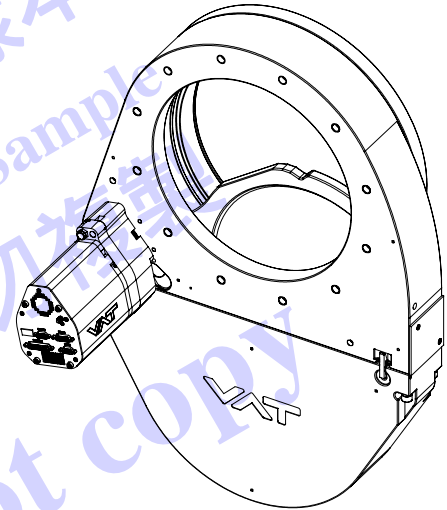
65050-JHGH-AQM1

configured with firmware **650C.1D.01**

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



← Fabrication number



Explanation of symbols:



Read declaration carefully before you start any other action!



Attention!



Product is in conformity with EC guidelines!



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



Keep body parts and objects away from the valve opening!



Hot surfaces; do not touch!



Loaded springs and/or air cushions are potential hazards!



Wear gloves!



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



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Elegant Translation Service Sample
Do not copy

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 ¹⁾ (α) [650 A / 650 G] [650 C / 650 H]	+ 24 VDC (±10%) [connector: POWER] 50 W max. (operation of valve with max. load) without PFO ⁴⁾ 60 W max. (operation of valve with max. load) with PFO ⁴⁾
Sensor power supply ²⁾ (β) [650 A / 650 C] Input Output	+ 24 VDC (±10%) / 36 W max. [connector: POWER] ± 15 VDC (±5%) / 1.0 A max. [connector: SENSOR]
Sensor power supply ²⁾ (β) [650 G / 650 H] Input Output	+ 24 VDC resp. ± 15 VDC [connector: POWER] same as input but: [connector: SENSOR] 2.0 A max. at ± 15 VDC 1.5 A max. at + 24 VDC

Calculation of complete power consumption:

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

whereas β depends on sensor supply concept and sensor power consumption.



Control and actuating unit (continuation)			
Sensor input Signal input voltage Input resistance ADC resolution Sampling time	0 – 10 VDC (linear to pressure) [connector: SENSOR] 100kΩ 0.23 mV 10 ms		
Digital inputs ³⁾	± 24 VDC max. [connector: INTERFACE]		
Digital outputs ³⁾ 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 ³⁾	0 - 10 VDC / 1mA max. [connector: INTERFACE]		
PFO ⁴⁾ battery pack [650 C / 650 H] Charging time Durability	2 minutes max. up to 10 years @ 25°C ambient; refer to «6.2.1 Durability of power fail battery» for details		
Compressed air supply	4 - 7 bar / 55 - 100 psi (above ATM)		
Ambient temperature	50 °C max. (<35°C recommended)		
Pressure control accuracy	0.1% of sensor full scale		
	DN 320 12" (65050 -)	DN 350 14" (65051 -)	DN 400 16" (65052 -)
Position resolution / position control capability	13'333 steps (full stroke)	13'422 steps (full stroke)	13'511 steps (full stroke)
Closing time throttling only	1.1 s (full stroke)	1.3 s (full stroke)	1.5 s (full stroke)
Opening time throttling only	1.1 s (full stroke)	1.3 s (full stroke)	1.5 s (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 «2.6.1 Sensor supply concepts» for details.
- 3) Refer to chapter «3.11.1 Schematics» for details.
- 4) PFO = Power Failure Option. Refer to «3.4 Behavior in case of power failure» for details.



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



The valve is 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



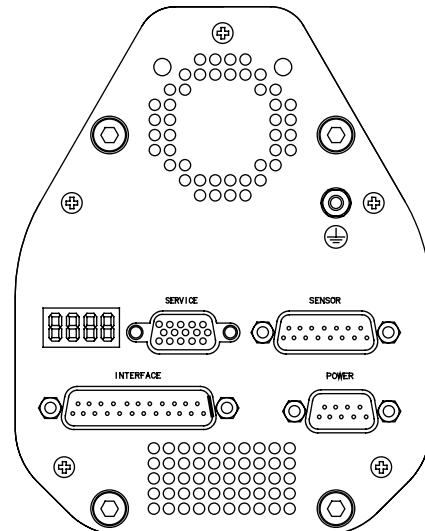
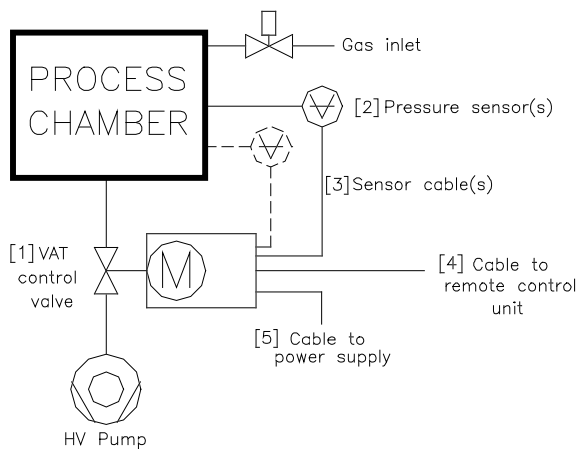
Fingers and objects must be kept out of the valve opening and away from moving parts. The valve plate may start to move just after power is supplied.



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



Do not disconnect air supply when device is under power.





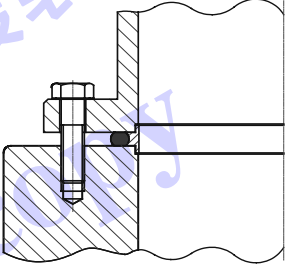
1. Install valve [1] into the vacuum system. Valve seat side should face process chamber. The valve seat side is indicated by the symbol "▽" on the valve flange.
Caution: Do not tighten the flange screws stronger than indicated under «2.3 Tightening torque».
Caution: Do not admit higher forces to the valve than indicated under «2.4 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.
Connect compressed air return line connection labeled '**OUT**' located at actuator.
Compressed air pressure (above ATM) must be in the range of: **4 - 7 bar / 55 - 100 psi**. Use only clean, dry or slightly oiled air. IN / OUT connections are 1/8" ISO/NPT internal threads.
3. Install sensor(s) [2] according to the recommendations of the sensor manufacturer and directives given under «2.5 Requirements to sensor connection».
4. Connect sensor cable [3] to sensor(s) and then to valve (connector: SENSOR). Refer to chapter «2.6 Electrical connection» for correct wiring.
Note: Input for second sensor is available on 650 **H** - and 650 **W** - versions only.
5. Connect valve to remote control unit [4] (connector: INTERFACE). Refer to «3.11.1 Schematics» for correct wiring.
6. Connect power supply [5] to valve (connector: POWER). Refer to chapter «2.6 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 «3.1.3 Safety mode».
7. This valve is equipped with a heating device. Connect VAT heating device according to manual of respective heating device.
8. Perform «3.6 Setup procedure» to prepare valve for operation.
Note: Without performing the setup procedure the valve will not be able to do pressure control.

2.3 Tightening torque

Tighten mounting screws of the flanges uniformly in crosswise order. Observe the maximum torque levels in the following table. Higher tightening torques deforms the valve body and may lead to malfunction of the valve.

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



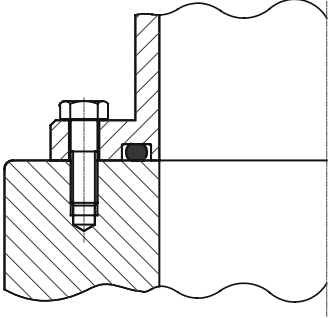
Caution: Make sure that screws are not too long otherwise the valve body may be damaged.

Note: Use slightly lubricated screws.

Refer to «8 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	1.0



Caution: Make sure that screws are not too long otherwise the valve body may be damaged.

Note: These torques are valid if depth of the mounting screws is min. 1 x thread diameter. Make sure that screws in use are capable to withstand applied torques. Lubricate screws slightly.

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 (65050 -)	Axial tensile or compressive force «F _A »		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_A 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

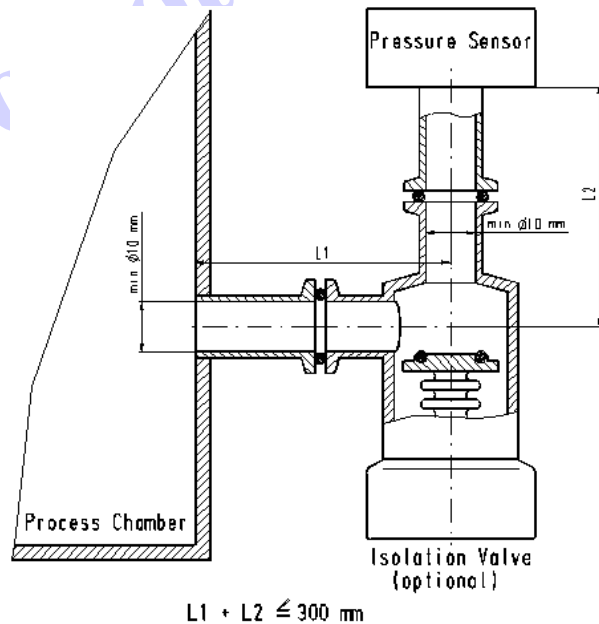
The sensor is normally connected to the chamber by a pipe. To maintain that the response time is not degraded by this connection it needs to meet the following requirements:

- Inner diameter of connection pipe: > = 10 mm
- Length of connection pipe: < = 300 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 ± 15 VDC from the 24 VDC.

Valve versions:

- 650 **G** and 650 **H** SPS module not included
- 650 **A** and 650 **C** SPS module included

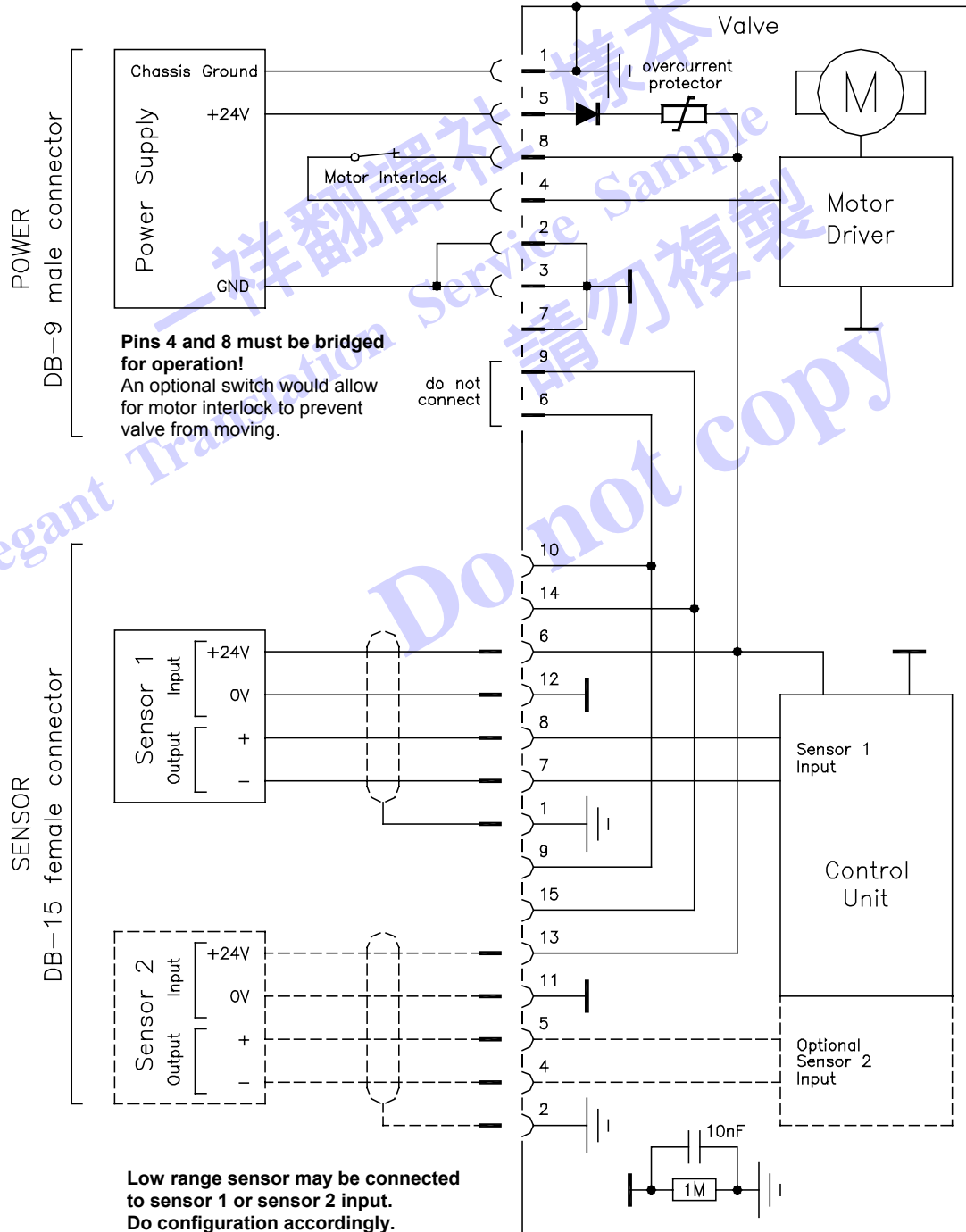
Note: The SPS module can be retrofitted. Refer to chapter «6.2.2 Retrofit / replacement procedure» for instruction.

Concepts:

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

2.6.2 Power and sensor connection (+24 VDC sensors)

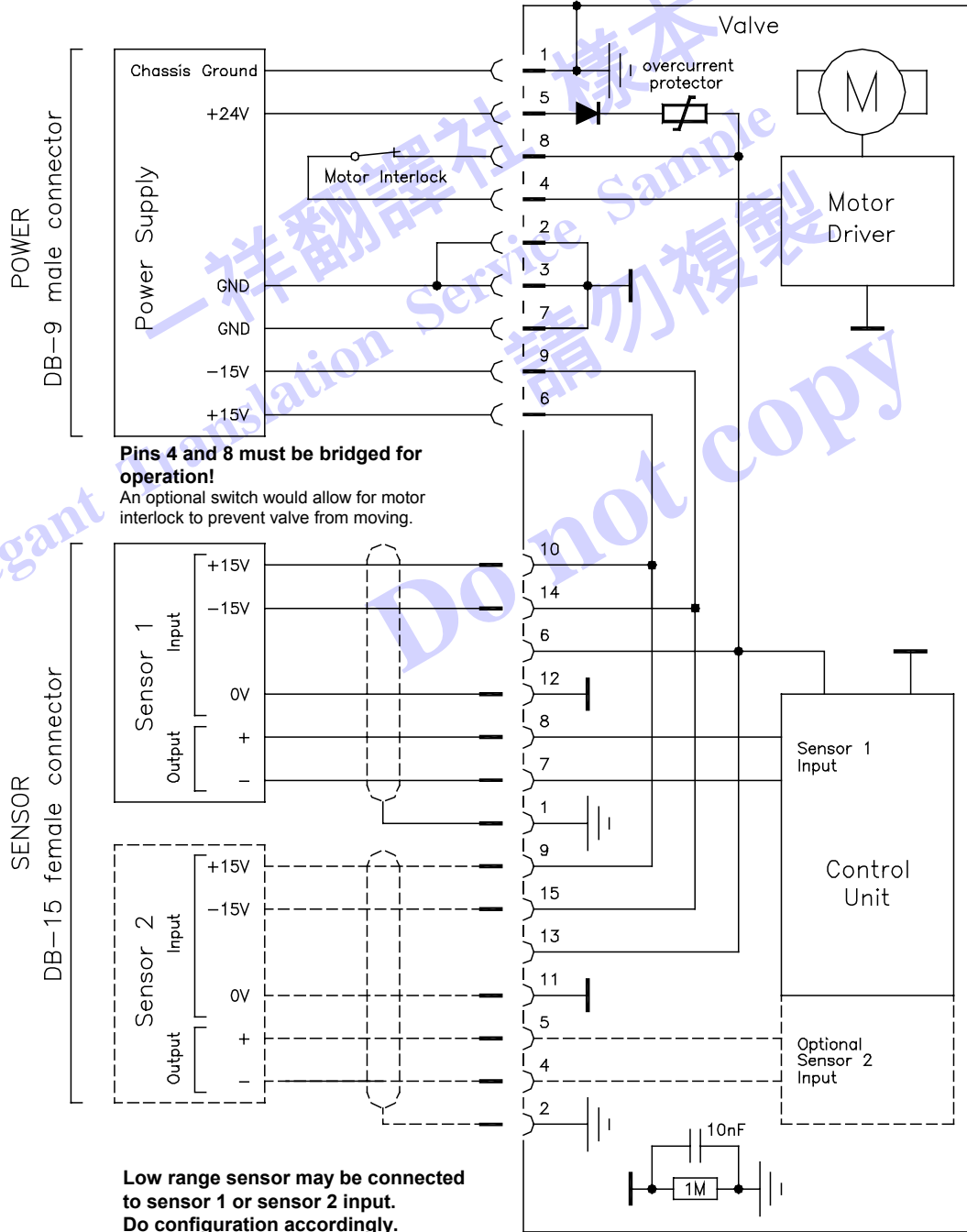
[650 G / 650 H versions recommended]



Note: Use shielded sensor cable(s). Keep cable as short as possible, but locate it away from noise sources.

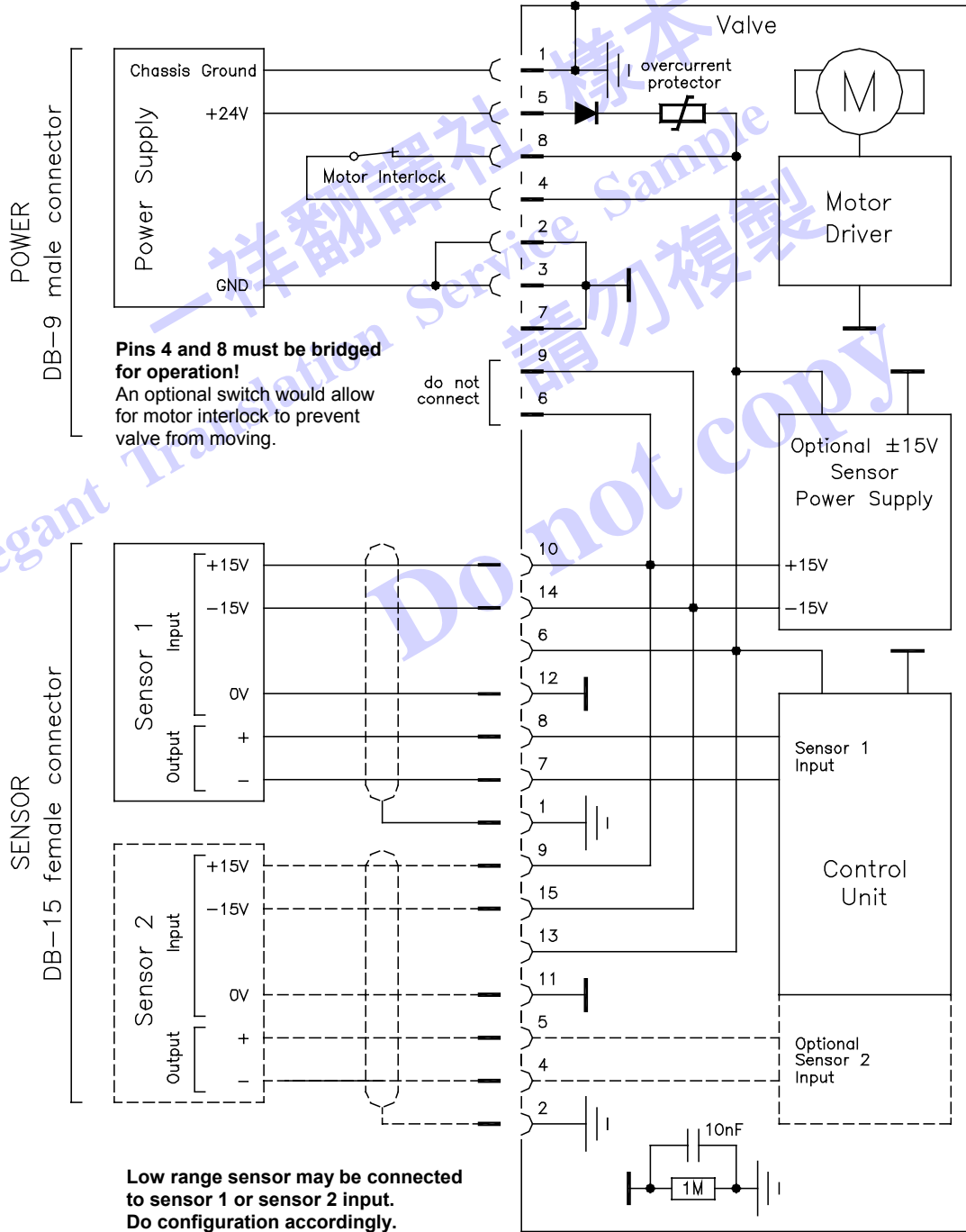
2.6.3 Power and sensor connection (± 15 VDC sensors) without optional SPS module

[650 G / 650 H versions only]



Note: Use shielded sensor cable(s). Keep cable as short as possible, but locate it away from noise sources.

2.6.4 Power and sensor connection (± 15 VDC sensors) with optional SPS module
 [650 A / 650 C versions only]



Note: Use shielded sensor cable(s). Keep cable as short as possible, but locate it away from noise sources.



2.6.5 RS232 interface connection

Refer to «3.11.1 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 a software from VAT. You can either use our freeware 'Control View' or purchase our 'Control Performance Analyzer'.

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 «3.1.1 Local operation» for details and to «8 Spare parts and accessories» for ordering numbers of service cable and software.

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3 Standard operation

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 by means of a computer. A service cable and a software from VAT is required. You can either download our freeware 'Control View' from www.vatvalve.com or purchase our 'Control Performance Analyzer'.

These softwares are beneficial especially for setup, testing and maintenance.

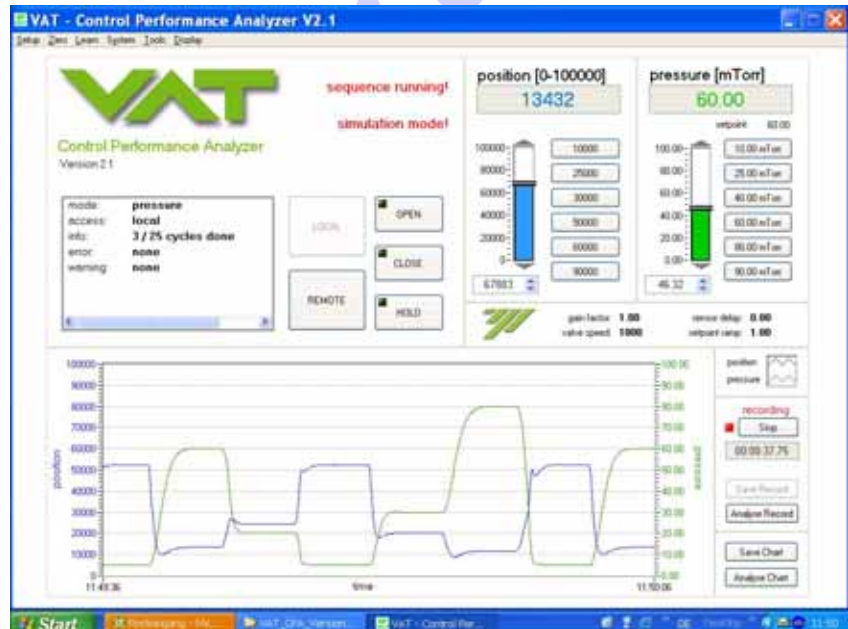
How to start: Connect service cable, start software and push button 'LOCAL' to enable for operation. Then enter menu Setup/Sensor and do sensor configuration according to your application to make sure that you get the correct pressure displayed.

'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



Note: 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.

Refer to «8 Spare parts and accessories» for ordering numbers of service cable and software.



3.1.2 Remote operation

This product is equipped with a RS232 interface to allow for remote operation. See section «3.11 RS232 interface» for details. 'Control View' or 'Control Performance Analyzer' software may be used for monitoring during remote control.

Note: In case 'Control View' or 'Control Performance Analyzer' is connected to valve make sure 'REMOTE' button is pushed to enable for remote operation.

3.1.3 Safety mode

By means of an external switch (see connection diagrams «2.6.1 to 2.6.4») 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 and control command is sent. If valve is in 9999 mode, valve open command has to be sent to start synchronization. Then the display shows 'INIT' for a moment followed by 'SYNC'.

When 'safety mode' is entered from 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.



3.2 Operation under increased temperature

This valve may be operated in the temperature range mentioned in chapter «1.1 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)	Display shows configuration of product and valve goes to 9999 mode. After receiving open command, valve runs to max. throttle position to detect limit stop for synchronization. Display shows 'SYNC' until synchronization is done. After synchronization the open command will be executed.	

Refer also to chapter «3.5 Display information».

3.4 Behavior in case of power failure

Valve position before power failure:	Reaction of valve:	
	Without Power Failure Option (PFO) 650 G 650 A	With Power Failure Option (PFO) 650 H 650 C
Closed (isolated)	Valve remains closed.	Valve remains closed. Display indicates F
Valve open or in any intermediate position	Sealing ring moves down and blocks the pendulum plate at the current position.	Valve will close or open depending on valve configuration *). Display indicates F

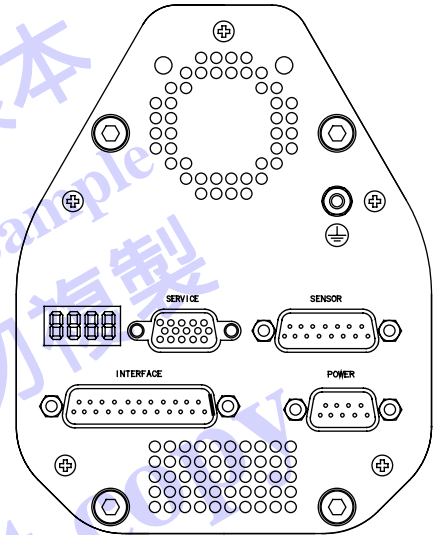
*) Provided that battery pack of the VAT controller is charged. Charging time after power up is 2 minutes .

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 see table on next page.

Display →



Power up:

Description	Digit 1	Digit 2	Digit 3	Digit 4
At first all dots are illuminated then configuration is displayed:	1	D	0	0
<ul style="list-style-type: none"> Firmware version [e.g. 1D00] (1st information for about 2s) Controller configuration (2nd information for about 2s) 			0 = basic	
SYNC indicates that power up synchronization is running.		2 = RS232 interface	1 = with SPS ¹⁾	1 = 1 sensor version
In case D C or D999 is displayed, motor interlock is active. Refer to «3.1.3 Safety mode» for details.		3 = RS232 interface with analog outputs	2 = with PFO ²⁾	2 = 2 sensor version
If valve is closed (isolated) display shows alternately C C and INIT . Synchronization will be done when first movement command is received.			3 = with SPS ¹⁾ and PFO ²⁾	

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

2) PFO = Power Failure Option

**Operation:**

Description / Mode	Digit 1	Digit 2	Digit 3	Digit 4
PRESSURE CONTROL mode	P	0 . . . 100 = valve position (% , 0 = closed / 100 = open)		
POSITION CONTROL mode	V			
Valve closed	C			
Valve open	O			
Closed / open interlock (Valve closed / open by digital input)	I			
HOLD (position frozen) activated	H			
ZERO running	Z			
LEARN running	L			
Safety mode established. Refer to «3.1.3 Safety mode» for details.	D			
Power failure	F			

Note: Rx/D / Tx/D activity of RS232 communication is displayed by 2 blinking dots in digit 2. The lower dot indicates Rx/D activity where the upper dot indicates Tx/D activity. The indication is not real time.

Errors:

Description	Digit 1	Digit 2	Digit 3	Digit 4
Compressed air failure (< 4 bar / 55 psi)	A	l	R	f
Compressed air on exhaust	A	l	R	x
Fatal error occurred	E	Error code. Refer to «5 Trouble shooting» for details		