

Adaptive Pressure Controller

PM-6 for Control Pendulum Valve & Butterfly Control Valve (with motor driver option) SMD-version

This manual is valid for product with the
 product identification number

FABR. NO. 650PM-24C . -

650PM-24J . -

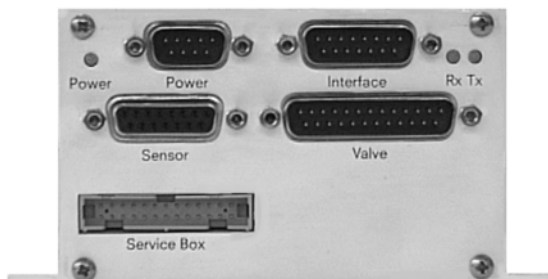
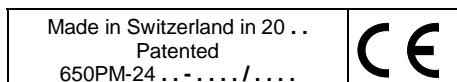
650PM-24F . -

650PM-24K . -

configured with Software Version

**65PM.7G.00 / 65PM.7G.04 / 65PM.7G.07 / 65PM.7G.08 / 65PM.7G.17 / 65PM.7G.29 / 65PM.7G.33 /
 65PM.7G.57 / 65PM.7G.58**

The product identification is specified on the rear panel of each PM controller:



STOP

Read these «**Installation, Operating and Maintenance Instructions**» (IOMI) and the enclosed
 «**General Safety Instructions**» carefully before you start any other action.



Table of content

1	Intended use of product	2
1.1	Technical data	3
2	Installation	4
2.1	Content of VAT PM controller delivery	4
2.2	Hardware installation	4
2.2	PM Configuration (Setup Sequence)	6
3	Operation	7
3.1	Local mode	7
3.2	Remote mode	7
3.3	Power failure / power-fail option (Series 65 only)	7
3.4	Compressed air failure (Series 65 only)	7
4	Preventive Maintenance	8
4.1	SRAM battery exchange	9
4.2	Power-fail battery exchange	12
5	Spare parts / retrofit options	17
6	Trouble shooting	18
7	Repairs	19
8	Warranty	19
9	Engineering information	20
9.1	Wiring of connectors	20
9.2	RS232C interface: configuration	23
9.3	RS232C communication	23
9.4	User information and recommendations	27

1 Intended use of product

This product is an adaptive pressure controller for VAT series 65 and series 61 (with motor driver option) control valves. The product may only be operated within the ranges specified in chapter 1.1 and with VAT series 65 or series 61 (with motor driver option) control valve. Additional technical information see chapter 9 'Engineering information'.



1.1 Technical data

Supply voltage: 24 VDC ($\pm 10\%$)

Power consumption: with 1 valve connected: 84 W max. (3.4A)
with 2 valves connected: 122 W max. (5.1A)

Environmental temperature: without Power Failure Option: 0 – 50 °C
with Power Failure Option: see diagram in chapter 4

Sensor power supply: +15 VDC ($\pm 5\%$), 1000 mA max. total current (for sensor 1 and 2)
-15 VDC ($\pm 5\%$), 1000 mA max. total current (for sensor 1 and 2)

RS232C default setting:	65PM.7G.00 (standard)	65PM.7G.04	65PM.7G.07	65PM.7G.08
Baud rate	4800	9600	9600	9600
Data length	7 bit	7 bit	7 bit	7 bit
Parity bit	EVEN	EVEN	EVEN	EVEN
2 nd answer	DISABLED	ENABLED	DISABLED	ENABLED
Logic input	not inverted (contact closed = valve closes)	inverted (contact open = valve closes)	not inverted (contact closed = valve closes)	inverted (contact open = valve closes)

RS232C default setting:	65PM.7G.17	650PM.7G.29	65PM.7G.33	650PM.7G.57
Baud rate	19200	4800	9600	9600
Data length	8 bit	8 bit	7 bit	7 bit
Parity bit	ODD	EVEN	0	0
2 nd answer	ENABLED	ENABLED	DISABLED	ENABLED
Logic input	not inverted (contact closed = valve closes)	not inverted (contact closed = valve closes)	not inverted (contact closed = valve closes)	not inverted (contact closed = valve closes)

RS232C default setting:	650PM.7G.58
Baud rate	9600
Data length	7 bit
Parity bit	EVEN
2 nd answer	ENABLED
Logic input	not inverted (contact closed = valve closes)

2 Installation

2.1 Content of VAT PM controller delivery

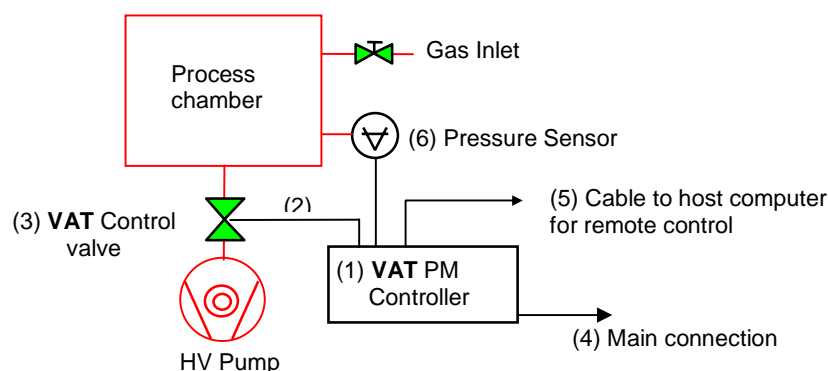
Adaptive Pressure Controller PM-6

Plug for mains connection of PM-6

Plug for interface cable

Plug for cable of sensor 1 (standard) and 2 (option)

2.2 Hardware installation



Picture 1: **Hardware for Pressure Control**

Confirm that hardware is complete (picture 1)

- (1) Adaptive Pressure Controller, hereafter referred to as PM controller; confirm that battery life has not expired (Check label at rear panel of PM controller), if expired see chapter 4 'Preventive maintenance'
- (2) Connection cable: valve - PM controller; VAT part number 650CV-99L
- (3) VAT Series 65 / 61 control valve
- (4) Mains connection cable, wiring information see chapter 9.1.2 'Connector of mains'
- (5) Interface cable, wiring information see chapter 9.1.3 'Connector of interface'
- (6) Sensor 1 (standard) and 2 (option)
- (7) Cable for sensor 1 and 2, wiring information see chapter 9.1.1 'Connector for sensors'
- (8) Service box for manual operation (not part of controller delivery)



Install hardware

- Install VAT control valve (3) according to the Installation, Operation and Maintenance Instruction Manual of the VAT Series 65 / 61 control valve. Make sure compressed air is hooked up to control valve, check pressure: 4 - 7 bar / 55 - 100 psi (only Series 65)
- Install sensor(s) (6) according to the recommendations of the sensor manufacturer
- Install PM controller (1) into control rack.
- Connect valve cable (2) to control valve and then to PM controller (connector: valve)
- Connect sensor cable (7) to sensor(s) and then to PM controller
- Connect interface cable (5) to PM controller (connector: interface)
- Connect mains cable (4) to PM controller
- Connect service box (option)



2.2 PM Configuration (Setup Sequence)

STEP		LOCAL MODE (if service box is available)	REMOTE MODE
1	POWER ON	1. PM controller: Turn on power switch at the rear panel of the PM controller. Note: Valve will close, if not in closed position 2. Service-box: Start-up display (Software version, type of interface, etc.) appears, until valve is in closed position 3. Service-box: CLOSED appears on display, otherwise please refer to chapter 6 'Trouble shooting'.	
2	SELECT MODE	Select LOCAL operation by pressing «LOCAL» key for 2 seconds.	Select REMOTE operation by pressing «REMOTE» key on service box for 2 seconds or select remote operation through RS232 interface (see chapter 9.3.1 for 'RS232C commands')
3	SENSOR SETUP ¹⁾	Press simultaneously «LEARN» and «ZERO» key for 2 seconds (notation used hereafter: «&», e.g. «LEARN» & «ZERO»). Then, use «↑» and «↓» key to change parameters (VOLTAGE RANGE; DISPLAY RANGE; DISPLAY UNIT; GAIN FACTOR; SENSOR TYPE; ZERO ADJUST) for each sensor. Toggle with «F1» key to the next setup parameter. Press «F2», when finished.	See chapter 9.3.3 for RS232 commands. Example: Sensor 1, Voltage Range: 0-10V; Display Range: 0-10; Display Unit: Torr; Gain Factor: 1; Sensor Type: Torr; Zero Adjust: enabled; s:1332010<CR><LF>
4	ZERO ADJUST (Offset compensation of sensor output)	Evacuate process chamber to high vacuum. When the base pressure is reached, press «ZERO» key for 2 seconds to reset the offset of the pressure sensor. Disable ZERO function in SENSOR SETUP, if the base pressure of your system is higher than 1‰ of sensor full scale.	Evacuate process chamber to high vacuum. When the base pressure is reached send RS232 command: Z:<CR><LF> (see chapter 9.3.1) Disable ZERO function in SENSOR SETUP, if the base pressure of your system is higher than 1‰ of sensor full scale.
5	LEARN ²⁾ (Determination of control characteristics of your process chamber)	Process chamber at high vacuum, control gate valve is open: Open gas inlet and set gas flow (see recommendation below). Press «LEARN» key for 3 seconds to perform the autolearning routine of the PM controller. The autolearning routine may take several minutes and can be aborted by pressing the «F1» key. Note: It is not necessary to repeat LEARN , if the sensor setup is changed, or if the second sensor is selected for pressure control. The controller covers 5% to 5000% of the gasflow which was used at LEARN .	Process chamber at high vacuum, control valve is open: Open gas inlet and set gas flow (see recommendation below). Then send LEARN command: L:000800<CR><LF> (see chapter 9.3.1) The autolearning routine may take several minutes. Note: It is not necessary to repeat LEARN , if the sensor setup is changed, or if the second sensor is selected for pressure control. The controller covers 5% to 5000% of the gasflow which was used at LEARN .

legend:

1)

The default **GAIN FACTOR** is 1.00. See chapter 9.3.3 'Sensor setup command' if resetting is necessary. When going to higher or lower values, change gain factor by one step only.

- gain factor > 1 means: faster control but higher overshoot of pressure
- gain factor < 1 means: slower control but lower overshoot of pressure

Just 98% of pressure sensor range can be used during control.

If no sensor is used, select as display parameter 'POS'.

2)

Ideal gasflow for autolearning

$$Q = 40 \cdot p_{SFS} \cdot L_{min}$$

Q.....gasflow for autolearning [sccm]

p_{SFS}.....sensor full scale pressure [torr]

L_{min}min. controllable conductance [l/s]



3 Operation

3.1 Local mode

Only available for 650PM-24... with a service box. Please refer to service box IOMI.

3.2 Remote mode

Remote operation:

Press «REMOTE» key for 2 seconds on service box or select remote operation through RS 232C interface. For details about interface wiring please refer to chapter 9.1.3.2 «RS232C interface». For details about control command please refer to chapter 9.3.1 «Control commands».

3.3 Power failure / power-fail option (Series 65 only)

All parameters will remain stored during a power failure.

If a power-fail battery is installed, the PM controller has to be hooked up to power

- for at least 10h if a Ni-Cd PFO is installed (650PM-24B. / 650PM-24E.)
- for at least 10 min if an Ultra Cap Board is installed (650PM-24C. / 650PM-24J. / 650PM-24F. / 650PM-24K.)

to assure repeated valve closures in case of a power failure.

Note: With service box: By pressing the «F2» key for 2 seconds, the **power fail option** will be **disabled** for 1 minute. A 'D' will be displayed on the control panel.

3.4 Compressed air failure (Series 65 only)

The Series 65 valve has a compressed air sensor. The **valve can only be operated** if the **compressed air pressure is above 4 bar (55 psi)**.

4 Preventive Maintenance


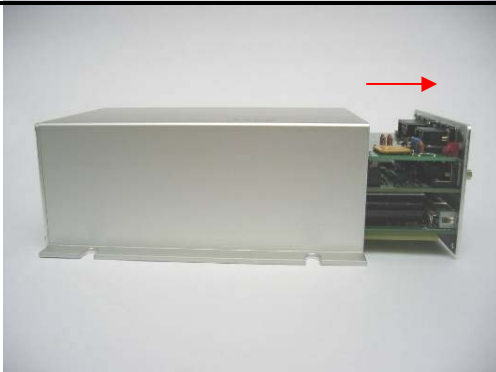


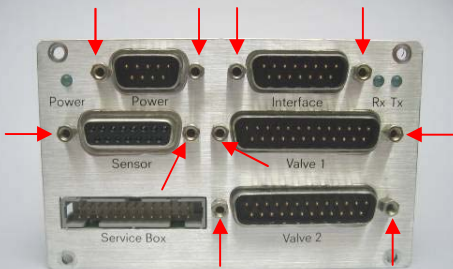
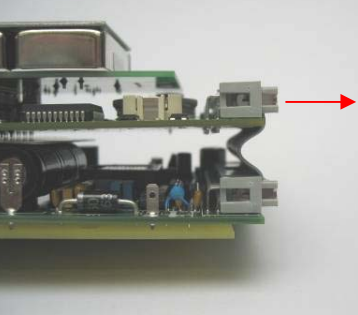
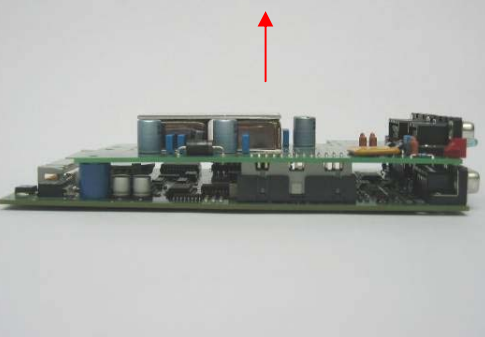
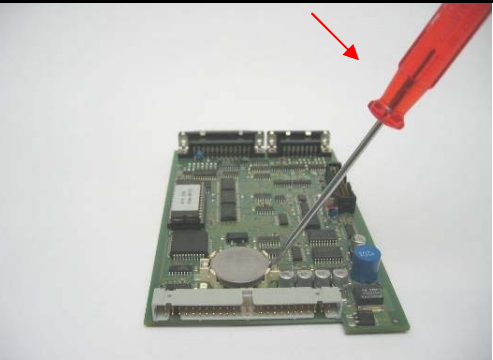
ESD Precaution!

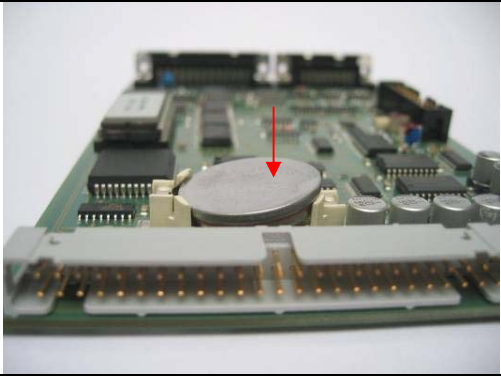
All work on the controller has to be done under ESD protected environment to prevent electronic components from damage!

Preventive maintenance is required only for the power fail option (PFO) and the SRAM battery. Typical lifetime for the SRAM battery is 5 years, for PFO see following graph. Please check delivery date on the top of the PM-Controller. When lifetime expires, the PFO battery and/or the SRAM battery need to be exchanged.

4.1 SRAM battery exchange

Description		Required tool
<ol style="list-style-type: none"> 1. Turn off power to PM controller, disconnect power cable and wait for 60 seconds 2. Disconnect sensor cable, valve cable and interface cable 		
<ol style="list-style-type: none"> 3. Remove 4 Phillips head screws on each corner of the PM-6 		Phillips head screw driver
<ol style="list-style-type: none"> 4. Pull out the boards 		

<p>5. Remove all bolts and front panel with the wrench</p>		<p>Wrench 4.5mm</p>
<p>6. Remove the flat cable carefully from the upper board (master board)</p>		
<p>7. Pull connector board from the master board</p>		
<p>8. Remove the battery carefully from the master board</p>		<p>small screw driver</p>

<p>9. Push the new battery carefully into the battery socket</p>		
<p>10. Follow steps 7 to 3 to reassemble the controller</p>		

4.2 Power-fail battery exchange

Preventive maintenance on PFO is required only for the following controller part numbers:

650PM-... **C** ... (with Ultracap battery pack, 1 valve up to DN250/10")

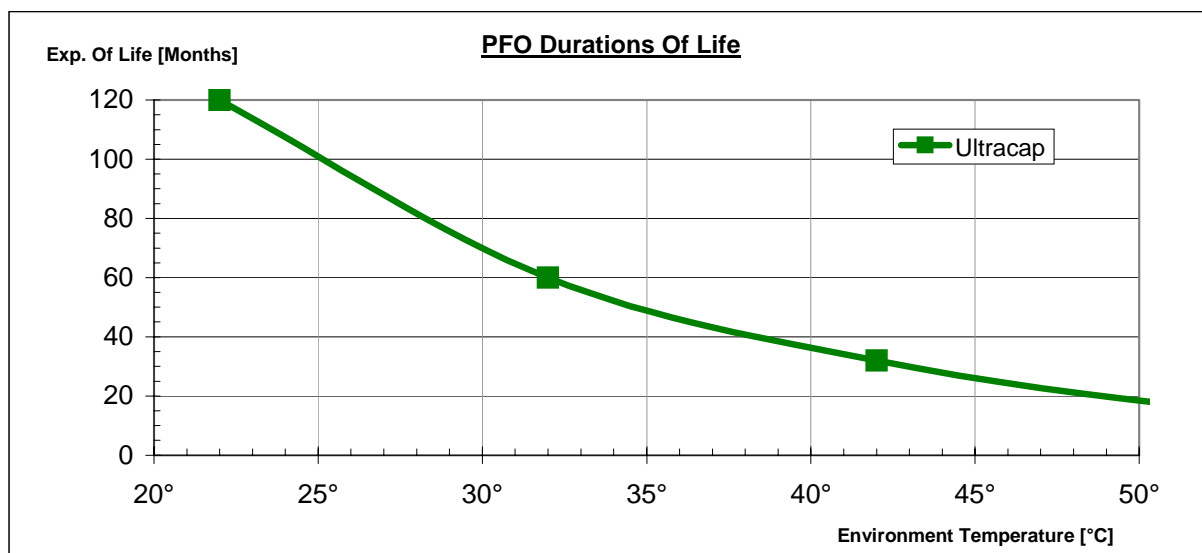
650PM-... **J** ... (with Ultracap battery pack, 1 valve from DN320/12")



650PM-... **F** ... (with Ultracap battery pack, 2 valve up to DN250/10")

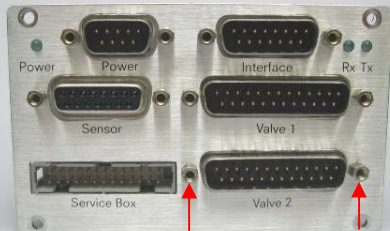
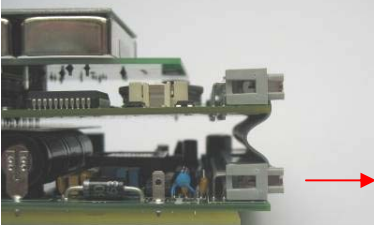
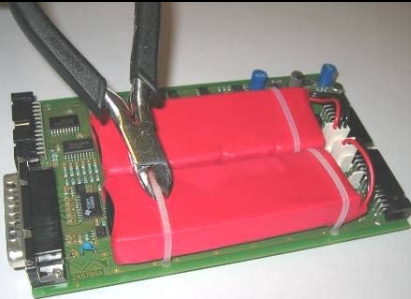
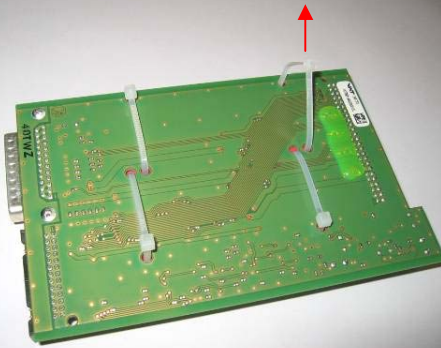
650PM-... **K** ... (with Ultracap battery pack, 2 valve from DN320/12")

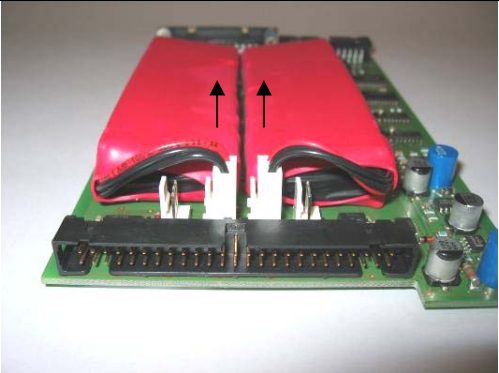
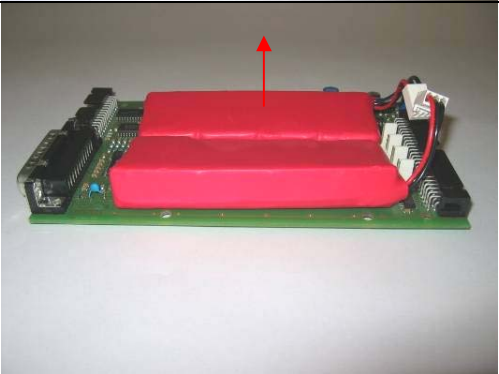
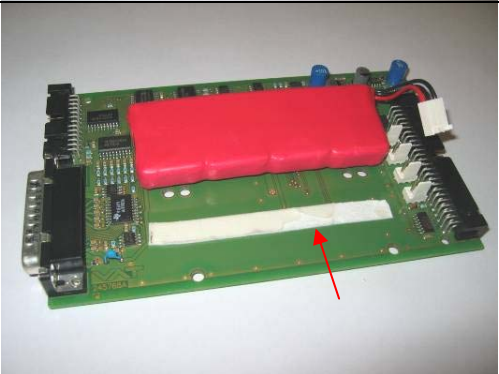
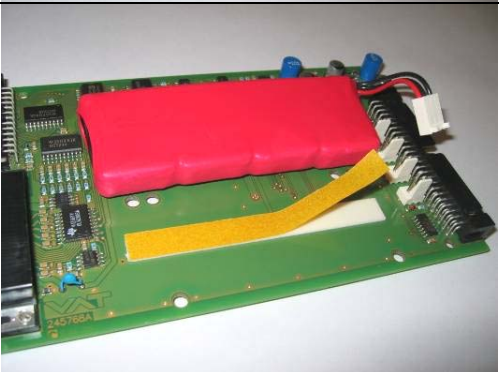
When the battery life expires the power-fail battery pack needs to be exchanged (typical lifetime is shown in below graph, check production date specified on label on the top of PM controller).




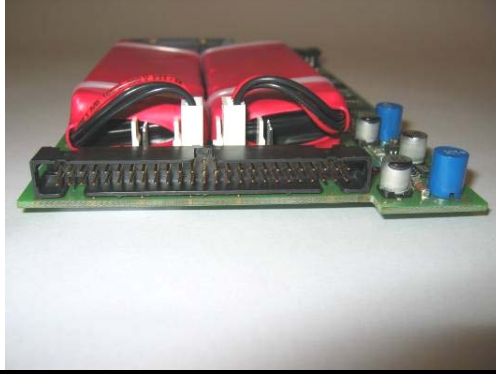
The life time of an Ultra-Cap-battery is specified with 50'000 hours surrounding temperature is not higher than 30°C . A significant decrease is directly linked with higher temperatures. The following diagram shows the influence on life time at various ambient temperatures.



Description		Required tool
<ol style="list-style-type: none"> 1. Turn off power to PM controller, disconnect power cable and wait for 60 seconds 2. Disconnect sensor cable, valve cable and interface cable 		
<ol style="list-style-type: none"> 3. Remove 4 Phillips head screws on the corner of the PM-6 		<p>Phillips head screw driver</p>
<ol style="list-style-type: none"> 4. Pull out the boards 		

<p>5. Remove two bolts</p>		<p>Wrench 4.5mm</p>
<p>6. Remove the flat cable carefully from the lower board (option board)</p>		
<p>7. Cut the cable ties</p>		<p>wire cutting pliers</p>
<p>8. Remove the cable ties on the back side</p>		

<p>9. Disconnect the connectors of Ultracap module from the board</p>		
<p>10. Remove the Ultracap module carefully from the board</p>		
<p>11. Remove the old double sided tape</p>		
<p>12. Attach the new double sided tape and remove the cover</p>		

<p>13. Place the new Ultracap module on the board</p>		
<p>14. Attache the cable ties</p>		
<p>15. Fasten the cable ties with an appropriate pliers</p> <p>16. Perform step 15 on all four positions</p>		<p>Pliers for cable ties</p>
<p>17. Connect the connectors of Ultracap modules with the board</p>		



18. Follow steps 6 to 3 to reassemble the controller 19. Attach label with new production date on top of PM controller		
---------------------------------------------------------------------------------------------------------------------------	--	--

5 Spare parts / retrofit options

Description	Ordering No.
PFO kit with UltraCap for 1 valve (\leq DN250), consisting of: UC module, labels	262175
PFO kit with UltraCap for 1 valve (\geq DN320), consisting of: UC module, labels	262176
PFO kit with UltraCap for 2 valves (\leq DN250), consisting of: UC modules, labels	262176
PFO kit with UltraCap for 2 valves (\geq DN320), consisting of: UC modules, labels	262177
Spare kit with UltraCap PFO for 1 valve(\leq DN250), consisting of: SRAM battery, UC modules, labels	308030
Spare kit with UltraCap PFO for 1 valve(\geq DN320), consisting of: SRAM battery, UC modules, labels	308031
Spare kit with UltraCap PFO for 2 valves (\leq DN250), consisting of: SRAM battery, UC modules, labels	308031
Option board kit with UltraCap for 1 valve (\leq DN250), consisting of: Option board, labels	263774
Option board kit with UltraCap for 1 valve (\geq DN320), consisting of: Option board, labels	263776
Option board kit with UltraCap for 2 valves (\leq DN250), consisting of: Option board, labels	263775
Option board kit with UltraCap for 2 valves (\geq DN320), consisting of: Option board, labels	263777
SRAM battery spare kit, consisting of: SRAM battery, label	263790
LOGIC interface	94383-R1
Connector board with RS232C interface	102603-R1
Connector board with RS485C interface	206798
Service box for manual operation of PM control	650BS-29NN

6 Trouble shooting

Problem	Recommendation
LED Power is off	Check power supply and connection cable
LED TX does not flash when command is sent to PM6	Check RS232 connection cable and configuration of host interface
LED RX does not flash when command is sent to PM6	Check RS232 connection cable and configuration of host interface
On service box: LEDs and LCD display inactive	Check, if 24 VDC supply is on
On service box: Control does not respond to keyboard commands	Control in REMOTE, switch PM controller to LOCAL
On service box: No or weak text on LCD display	Adjust brightness; «F1» & «F2» & «↑» key
'PAR:ER' or flashing 'P' displayed	<ul style="list-style-type: none"> - New learn should be performed - If error occurs after new auto learning <u>and</u> power disruption, replace battery for SRAM memory
On service box: 'ROM:ER' displayed	EPROM defective, replace EPROM
On service box: LED on «CLOSE» key is flashing, valve is closed and does not respond to RS 232 or keyboard commands	<ul style="list-style-type: none"> - Logic CLOSE input on RS 232 interface is active <ul style="list-style-type: none"> a) RS 232 interface connected, but interlock feedback is missing Check why input is missing. b) RS232C interface connector is not connected - Logic inputs on RS 232 interface are enabled, but connector inputs are not wired.
On service box display: VALVE NOT CONNECTED	Valve not connected to PM controller, attach connection cable
On service box display: VALVE PLATE BLOCKED	<ul style="list-style-type: none"> - Pendulum plate does not reach the position sensor. Make sure, pendulum plate is not blocked, no differential pressure is on pendulum plate, check again.
On service box display: COMPRESSED AIR FAILURE	<ul style="list-style-type: none"> - No compressed air hooked up to valve, connect air, make sure air pressure is > 4 bar (55 psi)
On service box display: COMPR. AIR ON EXHAUST	<ul style="list-style-type: none"> - Compressed air hooked up to exhaust output. Make sure, there is no pressure on compressed air exhaust connection ('OUT'). - Note: Valve cannot close, if there is compressed air pressure on exhaust connection
Pressure reading is wrong Negative pressure reading	<ul style="list-style-type: none"> - Confirm that sensor setup is correct, press «LEARN» & «ZERO» - When base vacuum is reached and pressure reading is off, perform ZERO command
ZERO command does not work	<ul style="list-style-type: none"> - Valve is not in open position, OPEN valve and bring chamber to high vacuum - ZERO command is disabled, check sensor setup («LEARN» & «ZERO»)
Display not '0' after ZERO command	<ul style="list-style-type: none"> - Sensor offset voltage is larger than ±1.4V - System not pumped to base pressure
Pressure control not optimal after LEARN command	<ul style="list-style-type: none"> - The PM controller reoptimizes the parameters for each set point, repeat pressure control command after adaption is completed - ZERO command was not performed before LEARN command - LEARN command was performed with different gas flow, repeat LEARN sequence - Make sure sensor range is suited for application (>3% of f.s.) - Noise on sensor signal, check sensor voltage, make sure a shielded sensor cable is used



Installation, Operating, and Maintenance Instructions Series 65.0 / 61.0 (with motor driver option)

Problem	Recommendation
On service box: '*' stays on LCD display	- Pressure is outside control range
On service box: Valve open or in control mode 'E' displayed on front panel	- Pendulum plate does not reach end position because of mechanical obstruction. - Check valve installation (torque on valve flange mounting screws too high, see Installation and Operating Instruction for valve!). Check and clean valve
Controller does not respond to RS 232 commands	- Verify that RS232 configuration is correct Section 1.1 - Confirm that PM controller is in REMOTE - Logic inputs on RS232C interface override RS232 commands
Controller responds with error message	- Wrong command or transmission error, see chapter 9.3 'RS232C communication'

7 Repairs

Contact VAT for repair. Please check first the fabrication No. 650PM- -) marked on the rear panel of the PM controller. Your VAT representative will discuss with you how the repair can be carried out best.

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 one-year period 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.

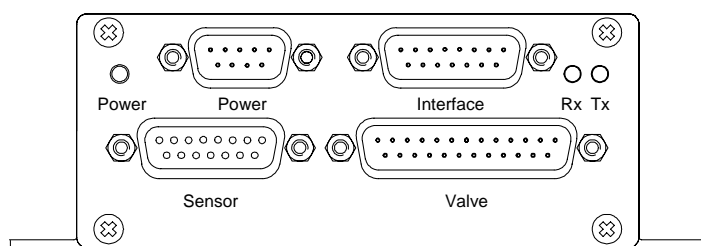
Furthermore, the «Terms of sale» at the back of the price list are applicable.

9 Engineering information

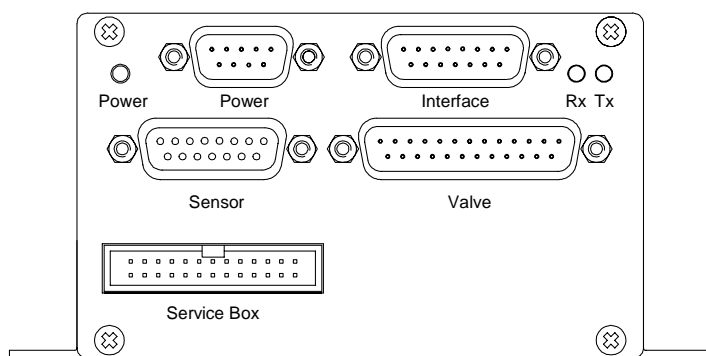
9.1 Wiring of connectors

9.1.1 PM 6 connectors

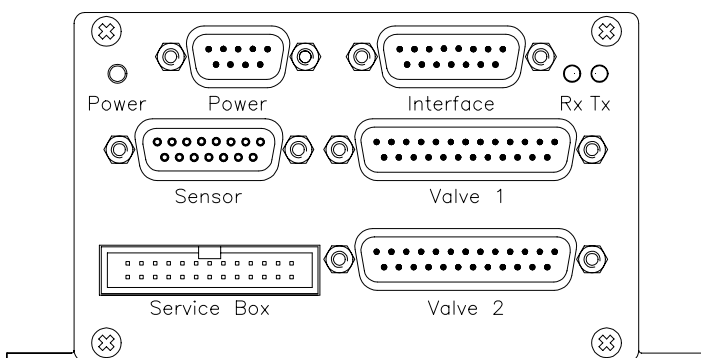
Without power-fail option: VAT Part no.: 650PM-64**A** .-. . . .



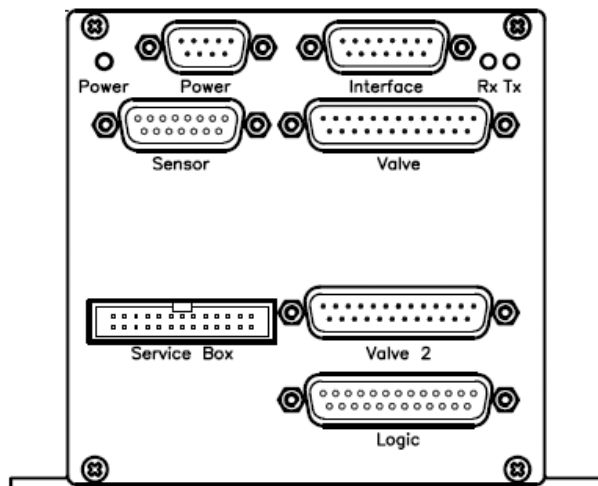
With power-fail option: VAT Part no.: 650PM-24**B** .-. . . . or 650PM-24**C** .-. . . . or 650PM-24**J** .-. . . .



2 valve version with power-fail option: VAT Part no.: 650PM-24**E** .-. . . . or 650PM-24**F** .-. . . .



2 valve version (\geq DN320) with power-fail option: VAT Part no.: 650PM-24K



9.1.2 Sensor connector of PM control

PIN	Description
1,2	Connect shield of sensor cable
4	(-) Sensor 2 signal (optional)
5	(+) Sensor 2 signal (optional)
7	(-) Sensor 1 signal
8	(+) Sensor 1 signal
9,10	+ 15 VDC, max., $\pm 5\%$, 1000 mA max. *
11,12	0 VDC
14,15	- 15 VDC, max., $\pm 5\%$, 1000 mA max. *


* total current for both sensors is 1000 mA

Mind: Do not connect other PINs than indicated in the table above!

Recommendations:


- Use shielded sensor cable
- Keep cable as short as possible, but locate it away from noise sources
- Use power supply of the PM control for the sensor
- Mount the sensor, especially capacitance diaphragm gauges, at place free of mechanical shock and vibration.
- Observe recommendations of sensor manufacturer

9.1.3 Power supply connector

PIN	Description
1	Ground 
2,3	0 VDC
4,5	24 VDC, 3.5A max.



9.1.4 Connector for interface

PIN	Function	Description
	RS 232C	
2	TxD	Transmitted data from the PM control
3	RxD	Received data by the PM control
7	GND	Signal Ground
1	Ground 	Chassis Ground
	Digital Inputs / Outputs	
12	Input: CLOSE VALVE	65PM.7G.00, 7G.07, 7G.17, 7G.29, 7G.33, 7G.57, 7G.58: Valve closes when contact between PIN 12 and 13 is closed 65PM.7G.04, 7G.08: Valve closes when contact between PIN 12 and 13 is opened
13	Common for input	
14	Output: VALVE CLOSED	Opto coupler output (max. 30 V / 0.1 A, min. 5 V / 1 mA) (PINS 14 and 15 are bridged when valve is in closed position)
15	Common for output	

Mind: Do not connect other PINs than indicated in the table above!

9.2 RS232C interface: configuration

VAT can supply a customized EPROM with any of the configurations specified below. Please contact your VAT representative for a customized RS232 configuration.

BAUD RATE	PARITY BIT	DATA LENGTH	2. ANSWER	LOGIC INPUT
110	EVEN	7 BITS	DISABLED	not inverted
300	ODD	8 BITS	ENABLED	inverted
600	1			
1200	0			
2400				
4800				
9600				
19200				

Note: The 'CLOSE VALVE' input overrides RS232 commands and disables the service box. When the input is reset, the controller will execute the previous command.

9.3 RS232C communication

9.3.1 Control commands

<CR>...Carriage Return (0D hexadecimal); <LF>...Linefeed (0A hexadecimal)

Description	Commands	Acknowledgements 2nd acknowledgement in parenthesis	Examples / Explanation
<u>Remote</u> Operation	U:01<CR><LF>	U:<CR><LF>	= switch to Remote
<u>Local</u> Operation	U:02<CR><LF>	U:<CR><LF>	= switch to Local
<u>Close</u> valve	C:<CR><LF>	C:<CR><LF> (C:<CR><LF>)	= close
<u>Open</u> valve	O:<CR><LF>	O:<CR><LF> (O:<CR><LF>)	= open
<u>Select valve position</u> in 1/1000 of stroke (0000 = closed, 1000 = open)	R:xxxxxx<CR><LF>	R:<CR><LF> (R:<CR><LF>)	R:000428<CR><LF> = 428 * 1/1000 of stroke
<u>Zero</u> Sensor offset adjustment	Z:<CR><LF>	Z:<CR><LF>	automatic zero adjustment
<u>Learn</u> up to maximum pressure to be learned in 1/1000 of sensor full scale	L:00xxxx<CR><LF>	L:<CR><LF>	L:001000<CR><LF> = up to sensor full scale L:000100<CR><LF> = up to 100 * 1/1000 = 10%

Pressure command: 'S.' Standard command xxxx = 0000 to 1000 Pressure in 1/1000 of full scale	S:00xxxx<CR><LF>	S:<CR><LF> (S:<CR><LF>)	S:000119<CR><LF> = 119 * 1/1000 of sensor full scale
Select Sensor 1	U:12<CR><LF>	U:<CR><LF>	Default, after power on
Select Sensor 2	U:13<CR><LF>	U:<CR><LF>	
Hold mode Freeze valve position	H:<CR><LF> K:<CR><LF>	H:<CR><LF> K:<CR><LF>	= start hold = change to pressure mode Note: Command can be used in pressure and position mode.
Reduced positioning speed in 1/1000 of maximum speed (remains stored until next speed is given and is set to 1000 after mains is switched off) Function is active for R:	V:xxxxxx<CR><LF>	V:<CR><LF>	V:000200<CR><LF> R:000428<CR><LF> = Actuator speed is 200 * 1/1000 = 20% of maximum speed, while gate is moved to position 428 * 1/1000 = 428
Disable Powerfail Option	U:14<CR><LF>	U:<CR><LF>	After power-up, PFO is always enabled.
Enable Powerfail Option	U:15<CR><LF>	U:<CR><LF>	
Interlock front panel keys	U:03<CR><LF> U:04<CR><LF>	U:<CR><LF> U:<CR><LF>	= interlock Local/Remote buttons = release Local/Remote buttons
Disable LOGIC INPUT	U:16<CR><LF>	U:<CR><LF>	= Disable LOGIC INPUT
Enable LOGIC INPUT	U:17<CR><LF>	U:<CR><LF>	= Enable LOGIC INPUT
valve 2 inactive	U:07<CR><LF>	U:<CR><LF>	= set valve 2 inactive
valve 1 inactive	U:08<CR><LF>	U:<CR><LF>	= set valve 1 inactive
valve 1 and 2 active	U:09<CR><LF>	U:<CR><LF>	= set valve 1 and 2 active

Note:

Control commands are accepted only, when the PM controller is in REMOTE mode, except of the command 'U:01<CR><LF>'

Control commands are acknowledged by one or two acknowledgements:

- 1st acknowledgement: Confirmation that command has been received, within 40 ms
- 2nd acknowledgement: If enabled, confirmation that command has been executed

Please refer to chapter 9.2 'RS232C interface: configuration', to select 1 or 2 command acknowledgements.

Commands U:07, U:08 and U:09 are only valid if both valves are connected and in closed position. If not, error message **E:000010** will be returned.

9.3.2 Inquiry commands

(<CR>...Carriage Return (0D hexadecimal); <LF>...Linefeed (0A hexadecimal))

Description	Commands	Acknowledgements	Examples / Explanation
Actual valve position in 1/1000 of stroke (0 = closed, 1000 = open)	A:<CR><LF>	A:xxxxxx<CR><LF>	A:000428<CR><LF> = 428 * 1/1000 of stroke
Actual pressure in 1/1000 of sensor full scale	P:<CR><LF>	P:xxxxxx<CR><LF>	P:000119<CR><LF> = 119 * 1/1000 of sensor full scale P: -00004<CR><LF> = -4 * 1/1000 of sensor full scale (-0.4% (sensor offset))
Pressure setpoint value in 1/1000 of sensor full scale	W:<CR><LF>	W:xxxxxx<CR><LF>	W:000119<CR><LF> = 119 * 1/1000 of sensor full scale
Control mode	M:<CR><LF>	M: POS<CR><LF> M: PRESS<CR><LF>	= POSITION MODE = PRESSURE MODE



Installation, Operating, and Maintenance Instructions

Series 65.0 / 61.0 (with motor driver option)

<u>Self test</u>	T:<CR><LF>	T:___OK<CR><LF> T:PAR-ER<CR><LF> T:ROM-ER<CR><LF>	= memory o.k. = parameter error = EPROM error (see section «Trouble shooting» if «PAR-ER» or «ROM-ER» appears)
<u>Sensor zero offset</u> in 1/1000 of sensor full scale	z:<CR><LF>	z:xxxxxx<CR><LF>	z:000015<CR><LF> = 15 * 1/1000 of sensor full scale
<u>Valve cycle counter</u>	c:<CR><LF>	c:xxxxxxxxxx<CR><LF>	c:0000125013<CR><LF> = 125'013 cycles
	n:<CR><LF>	n:<CR><LF>	= set counter to zero
<u>Software version</u>	i:01<CR><LF>	i:01xxxxxxxx<CR><LF>	i:0165PM3BOO<CR><LF> = software version 65PM.3B.00
<u>Read current sensor setup</u>	i:02<CR><LF>	i:02sabcdef<CR><LF>	Current sensor 1 setup; for abcdef refer to setup command s:
<u>Read current sensor setup</u>	i:03<CR><LF>	i:03sabcdef<CR><LF>	Current sensor 2 setup; for abcdef refer to setup command s:
<u>Position error</u>	p:<CR><LF>	p:___OK<CR><LF> p:POS-ER <CR><LF> p:AIR-ER <CR><LF>	= position o.k. = plate position error = compressed air failure
	f:<CR><LF>	f:<CR><LF>	= reset error flag
<u>valve status</u>	i:04<CR><LF>	i:04V1:aV2:b<CR><LF>	a = 1 (valve 1 activ) a = 0 (valve 1 inactive) b = 1 (valve 2 activ) b = 0 (valve 2 inactive) b = - (not connected)
<u>valve position</u>	i:05<CR><LF>	i:05V1:aV2:b<CR><LF>	a = 0 (valve 1 open) a = C (valve 1 closed) a = N (valve 1 in intermediate pos.) b = 0 (valve 2 open) b = C (valve 2 closed) b = N (valve 2 in intermediate pos.) b = - (not connected)
<u>upload of learned data</u>	u:mmm<CR><LF>	u:mmmddddddddddd<CR><LF>	mmm = index 000-082 to up-/download complete data
<u>download of learned data</u>	d:mmmddddddddddd<CR><LF>	d:mmm<CR><LF>	all indices have to be used ddd.. = data in hexadecimal format (0...9, A...F)

Note:

After receipt of an inquiry command, the PM controller sends back the corresponding acknowledgement within a maximum of 40 ms.

9.3.3 Sensor setup command

(<CR>...Carriage Return (0D hexadecimal); <LF>...Linefeed (0A hexadecimal))

Description	Commands		Acknowledgements	Examples / Explanation
<u>Sensor Setup</u>	s:xabcde<CR><LF>		s:<CR><LF>	s:2332010<CR><LF>
x = Sensor nr.	1 = sensor 1	2 = sensor 2		2 = sensor 2
a = Voltage Range	0 = 0 - 1 V 1 = 0 - 2 V	2 = 0 - 5 V (0 - 4 V for 65PM.7G.04) 3 = 0 - 10 V		3 = 0 - 10 V input signal
b = Display Range	0 = 0 - 1.000 1 = 0 - 2.000 2 = 0 - 5.000 3 = 0 - 10.00 4 = 0 - 20.00 5 = 0 - 50.00 6 = 0 - 100.0 7 = 0 - 200.0	8 = 0 - 500.0 9 = 0 - 1000 A = 0 - 2000 B = 0 - 5000 C = 0 - 2.500 D = 0 - 25.00 E = 0 - 250.0 F = 0 - 2500		3 = 0 - 10.00 full scale
c = Display Unit	0 = mbar 2 = Torr 4 = Pa 6 = V 8 = 0001-1000 A = Position Mode only	1 = µbar 3 = mTorr 5 = kPa 7 = % 9 = none		2 = pressure display in Torr
d = Gain Factor	0 = 1.00 1 = 1.33 2 = 1.78 3 = 2.37 4 = 3.16 5 = 4.22 6 = 5.62 7 = 7.50	8 = 0.1 9 = 0.13 A = 0.18 B = 0.23 C = 0.32 D = 0.42 E = 0.56 F = 0.75		0 = Gain factor 1.00
e = Sensor Type	0 = mbar / Pa	1 = Torr		1 = Torr sensor
f = Zero Adjust	0 = enable	1 = disable		0 = Zero adjust enable

9.3.4 Error messages

Error messages	Description
E:000001<CR><LF>	Parity error
E:000002<CR><LF>	<CR> or <LF> is missing
E:000003<CR><LF>	«:» is missing
E:000004<CR><LF>	Wrong letter code
E:000005<CR><LF>	Numerical value not given in 6 digits
E:000006<CR><LF>	Numerical value larger 1000
E:000007<CR><LF>	PRESSURE MODE, ZERO or LEARN selected with no sensor connected (display format set for no sensor)
E:000008<CR><LF>	Command given in operating mode LOCAL
E:000009<CR><LF>	RS232 commands Z: and L:XXXXXX given while a logic input is activated
E:000010<CR><LF>	Commands U:07, U:08 or U:09 given while valve2 is not connected or both valves are not in closed position.
E:000200<CR><LF>	Error with ZERO - PM controller is switched in control mode PRESSURE MODE - function ZERO locked (= DISABLED)

9.4 User information and recommendations

9.4.1 Operation sequence of PM controller

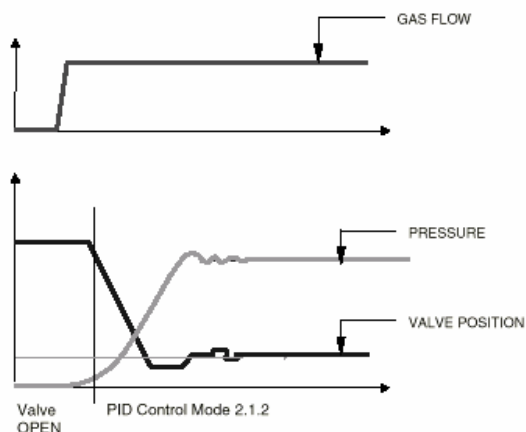


Diagram 1

Initialization

Prior to pressure control the SENSOR SETUP routine, the ZERO and LEARN routine need to be performed. LEARN determines the non-linear characteristics of the valve, the time constant of the system and calculates optimized control parameter across the entire control range.

Pressure Control Sequence in LOCAL mode or with 'S' Command

Pressure control starts after «PRESSURE MODE» and a «SET POINT» is selected or after a pressure control command is sent to the PM controller.

9.4.2 How to optimize sensor signal resolution

Full scale signal of the sensor is converted by a 12bit AD converter. The resolution depends therefore on the Voltage Range.

Example:

Sensor: 1 Torr full scale, 0 to 10 VDC output;
 Required pressure range: 0 to 120 mT

Standard sensor setup on PM: Voltage Range: 0-10V, Display Range: 1, Display Unit: Torr
 → Resolution of PM controller: $1\text{Torr} * 0.03\% = 0.3\text{mT}$

Recommended for sensor setup: Voltage Range: 0-2V, Display Range: 0-200, Display Unit: mTorr
 → Resolution of PM controller: $200\text{mTorr} * 0.03\% = 0.06\text{mT}$