

# Contents

1.Introduction	3
Safety instruction	3
2. Storage	4
General	4
Storage indoors	4
Storage outdoors or for a longer period	4
Storage in a warm place	4
3. Design	5
4. Variants	6
5. Function	7
6. Installation	8
Removal of covers	8
Tubing	8
Air supply requirements	8
Mounting	9
Connections	10
Single action positioner, Direct function	11
Double action positioner, Direct function	11
Electrical connections	12
Signs	14
D3 Digital Positioner model code	15
Certificates	16
Control Drawing 3-86	18
7. Control	19
Menus and pushbuttons	19
Other functions	19
Menu indicator	20
Menus	20
Changing parameter values	20
Menu system	21
First start	22
8. Maintenance/service	40
Disassembling PMV D3	40
Silencer	42
Spindle adapter	42
Potentiometer	43
Transmitter boards	43
Disassembling PMV D3 Ex	46
Filter change	47
Converting for remote control	48
9. Trouble shooting	49
10. Technical data	50
11. Spare parts	56

# **1. Introduction**

The PMV D3 is a digital positioner designed primarily for controlling adjustable valves.

The positioner can be used with single or double action actuators with either rotary or linear movement.

The PMV D3 can be equipped with modules for feedback, limit switches and a pressure gauge block. Pressure sensors can be installed in the pneumatic block to offer advanced diagnostics

The modules can be factory assembled before delivery or fitted later.

The modules for feedback and limit switches can contain the following:

Feedback 4-20 mA and one of the following functions:

- Two mechanical contacts
- Two reed switches
- Two inductive sensors, DIN 19234



Read the safety instructions in this manual carefully before using the product. The installation, operation, and maintenance of the product must be done by staff with the necessary training and experience. If any questions arise during installation, contact the supplier/sales office before continuing work.

## Warning

• The valve package moves when in operation and can cause personal injury or damage if handled incorrectly.

- If the input signal fails or is switched off, the valve moves quickly to its end position.
- If the compressed air supply fails or is turned off, fast movements can occur.
- The valve is not controlled by the input signals when in the Out of service mode. It will open/close in the event of a leak.
- If a high value is set for Cut off, fast movements can occur.
- When the valve is controlled in the Manual mode, the valve can move quickly.
- Incorrect settings can cause self-oscillation, which can lead to damage.

## Important

• Always turn off the compressed air supply before removing or disconnecting the air supply connection or the integral filter. Remove or disconnect with care because C- is still under pressure even after the air supply is turned off.

• Always work in an ESD protected area when servicing the PCB's. Make sure the input signal is switched off.

• The air supply must be free from moisture, water, oil and particles.

## **Special Conditions for Safe Use**

The enclosure of PMV D3I (Intrinsically safe) is made of aluminium and any impact or friction caused by external objects shall be avoided in the application.

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2. Storage

## General

The PMV D3 positioner is a precision instrument. Therefore it is essential that it is handled and stored in the right way. Always follow the instructions below!

**N.B.** As soon as the positioner is connected and started, internal air leakage will provide protection against corrosion and prevent the ingress of moisture. For this reason, the air supply pressure should always be kept on.

#### **Storage indoors**

Store the positioner in its original packaging. The storage environment must be clean, dry, and cool (15 to 26°C, 59 to 79°F.

# Storage outdoors or for a longer period

If the positioner must be stored outdoors, it is important that all the cover

screws are tightened and that all connections are properly sealed. The unit should be packed with a desiccant (silica gel) in a plastic bag or similar, covered with plastic, and not exposed to sunlight, rain, or snow.

This is also applicable for long-term storage (more than 1 month) and for long transport by sea.

#### Storage in a warm place

When the positioner is stored in a warm place with a high relative humidity and is subjected to daily temperature variations, the air inside the unit will expand and contract.

This means that air from outside the unit may be drawn into the positioner. Depending on the temperature variations, relative humidity, and other factors, condensation and corrosion can occur inside the unit, which in turn can give rise to functional disorders or a failure.

# 3. Design

The PMV D3 positioner contains:

- Electronic board with microprocessor, HART modem, Profibus, Foundation Fieldbus, display, etc.
- Valve block
- · Positional feedback with potentiometer
- Sealed compartment for electrical connections.

The push buttons and display are accessible underneath the aluminium cover, which is sealed with an O-ring.

A PC configurator is available free of charge on our webpage www.pmv.nu

The only requirements are: D3 positioner must have HART communication and a HART modem for connection between PC and positioner.

With the configurator, settings can be done and saved in the PC, then downloaded to the positioner.



The figure shows the PMV D3 with the cover removed.

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## PMV D3 General purpose

The PMV D3 digital positioner has an easy to use user interface with 5 pushbuttons and local graphic LCD display. Communication options include 4-20mA HART, Foundation Fieldbus and Profibus PA. All PMV D3 positioners are available with Feedback, Fail Freeze (Fail in last position and hold when power is lost), 270degree rotation (for extended travel) and Gauge block.

## **PMV D3 Explosion proof**

The PMV D3 digital positioner is available in explosion proof enclosure. The explosion proof PMV D3 features the same easy to use interface for local configuration as the **general purpose** version does. Communication with Hart, Foundation Fieldbus and Profibus is possible.

Further features are gauge ports and local graphic LCD display.

ATEX: EEx d IIB +  $H_2$  T6 (Ta +65°C), T5 (Ta +80°C)  $\langle \xi_x \rangle$  II 2GD

### **PMV D3 Intrinsically safe**

The PMV D3 digital positioner is available in intrinsically safe version for installation in hazardous areas. The intrinsically safe PMV D3 has all the same features and options as the general purpose version, gauge block, local graphic LCD display and feedback option etc. Communication with Hart and Profibus is possible.

ATEX: EEx ia IIC T4 Ta=-30...80°C  $\langle Ex \rangle$  II 1 GD CSA, FM Class I Div.1 Grps B, C, D, Class II Div.1 Grps E, F, G, T6, T5.





#### **Pressure sensors**

Pressure sensors can be installed in the pneumatic block in order to provide advanced diagnostics in combination with ValveSight software.

## **5.** Function Signal converter Control signal 4 - 20 mA and microprocessor Potentiometer Piezo-valve 2 Venting Piezo-valve 1 k Diaphragm 1.2 bar (17.4 psi) Venting Pressure regulator Replacable Filter C-Air supply 2 - 7 bar (30 - 105 psi) Actuator

The control signal function and the feedback from the potentiometer position are converted to digital signals that are processed with a PID algorithm in the microprocessor. This provides control signals to the two piezovalves.

Valves B and E deliver air to the actuator while valves C and F exhaust air from the actuator to atmosphere. Valves B and C are controlled by Piezo-valve 1 and valve A. Valves E and F are controlled by Piezo-Valve 2 and valve D.

Full supply pressure is directed to valves B and E. Air with filtered and reduced pressure is supplied to valves A, C, D and F.

For double acting actuators, connect C+ and C- to the actuator.

For single acting (spring return) actuators connect C+ to the actuator and plug port C-.

#### Assume equilibrium

Increasing input signal changes position in piezo-valve 1, causing valve A to close.

Supply pressure is then allowed to open valve B and flow to the actuator via the C+ port. When the actuator reaches its new steady state position piezo-valve 1 closes which causes valves B and C to close shutting off supply air to the actuator.

A decreasing input signal functions in the same manner, except uses piezo-valve 2 and valves D, E and F.

# 6. Installation

#### **Removal of cover** General purpose / Intrinsically safe

Remove cover by first loosening the screw 1 and then the two screws 2.

To install cover, first tighten the screw **1**, then the two screws **2**.

Tighten to 1,5 - 2 Nm.



#### **Explosion proof**

To remove covers, first unscrew securing screws, then unscrew covers.

To install, screw covers on as far as possible. Mount the securing screws. Back off slightly on the large cover to be able to screw down the securing screw completely.



## Tubing

Use tubes with a minimum inner diameter 6 mm (1/4").

## Air supply requirements

Max. air supply pressure, see the section Technical Data, Section 10.

The air supply must be free from moisture, water, oil, and particles. Standard: DIN/ISO 8573-1

The air must come from a refrigeration dried supply or be treated in such a way that its dew point is at least 10°C (18°F) below the lowest expected ambient temperature.

To ensure a stable and problem-free air supply, we recommend the installation of a filter/pressure regulator  $<40\mu$  as close to the positioner as possible.

Before the air supply is connected to the positioner, we recommend the hose is opened freely for 2 to 3 minutes to allow any contamination to be blown out. Direct the air jet into a large paper bag to trap any water, oil, or other foreign materials. If this indicates that the air system is contaminated, it should be properly cleaned.

> WARNING! Do not direct the open air jet towards people or objects because it may cause personal injury or damage.

Poor quality air supplies are the main source of problems in pneumatic systems.

## Mounting

**N.B.** If the positioner is installed in a hazardous environment, it must be of a type approved for this purpose.

The PMV D3 positioner, all versions, has an ISO F05 footprint, A. The holes are used to attach the PMV D3 to the mounting bracket B. Please contact PMV or your local distributor representative with actuator specifics for the proper mounting bracket and hardware.

The spindle adapter C can be changed to suit the actuator in question.

Remove the existing adapter using two screwdrivers. Check that the spring ring on the positioner spindle is undamaged and fit the new adapter. Alternative, press out pin and remove adapter.

## Spindles



It is important that the positioner's spindle and the arms, that transfer the actuator movements, are correctly mounted. Any tension between these parts can cause incorrect operation and abnormal wear.





## Connections

#### Air:

- Port S Supply air, 2-7 bar (30–105 psi)
- Port C+ Connection to actuator, opening
- Port C- Connection to actuator, closing (only for double action) Plug for single action.

#### **Electrical connection**

See page 12, 13.

#### Dimensions

Air connections: 1/4" NPT alt. G 1/4" Electrical connection: M20 x 1.5 alt. NPT 1/2"

Loctite 577 or equivalent is recommended as a sealant.

Must be plugged when converting to single action function.



For data for air and electrical connections, see section Technical Data on page 50.



## Single action positioner, Direct function

#### Actuator with closing spring

When the control signal increases, the pressure C+ to the actuator is **increased**. The valve stem moves upward and rotates the positioner spindle **counter-clockwise**. When the control signal drops to zero, C+ is vented and the valve closes.

## **Reverse function**

#### Actuator with opening spring

When the control signal increases the pressure C+ to the actuator is **increased**. The valve stem moves downward and the positioner spindle rotates **clockwise**. When the control signal drops to zero, C+ is vented and the valve opens.



#### **Double action actuator**

When the control signal increases, the pressure C+ to the actuator is increased. The valve stem is pressed upward and rotates the positioner spindle counter-clockwise. When the control signal is reduced, the pressure C-to the actuator increases and the valve spindle is pressed downward. If the control signal disappears, the pressure goes to C-, C+ vents, and the valve closes.

#### Fail in place (Fail Freeze)

Signal hold at previous position when input signal drops below 3,75 mA.

Drift rate in midrange <0,1% after 30 s and < 2% after 30 min.







## **Electrical connections**

Terminal block diagram for the PMV D3 and PMV D3 Ex.

### PMV D3

The terminal block (below) for the positioner is accessible when the aluminium cover and inner cover are removed, see Section 8.

#### Remote unit

The remote unit shall be connected between terminals 3, 4 and 5 in the PMV D3 and 3, 4 and 5 in the remote unit. Use a shielded cable and ground it in the PMV D3

#### See cdwg 3-86

Warning! In a hazardous environment where there is a risk of explosion, electrical connections must comply with the relevant regulations.

only. Max recommended distance between PMV D3 and remote unit: 5 m (16,4 ft).

**Note!** When converting the PMV D3 or PMV D3 Ex to a remote unit, modifications have to be done internally with a cable.



#### When installing PMV D3 Intrinsically safe unit, always consider cdwg 3-86.



#### PMV D3 Ex

The terminal (below) for the positioner is accessible when the terminal cover is removed, see Section 8.

#### See cdwg 3-86



**Warning!** In a hazardous environment where there is a risk of explosion, electrical connections must comply with the relevant regulations.



## Connecting a remote unit





#### Signs



D3E EXPLOSION PROOF DIGITAL VALVE POSITIONER	3E-30-HA
EEx d IIB+H₂ T6(Ta:+65°C)T80°C T5(Ta:+80°C)T95°C NEMKO 03ATEX 111 ⟨∑⟩II 2GD ℂ€ 0470 IP66	- NA
Electrical Rating: max 28V DC, max24mA, max0,67W Do not open while energized! Seal within 50 mm of the enclosu Max. working pressure: 700kPa/100 psi	re.
PALMSTIERNA INTERNATIONAL AB SOLNA SWEDEN www.pmv.nu	
S/N: 000000 H PB FF F EAN Bar Code Prod Year: 0000 SW rev: 0.0	

#### D3 Digital Positioner model code

A= Model no D 3 Х Digital positioner with display and indicator, General purpose D 3 T Digital positioner with display and indicator, Intrinsically safe ATEX D 3 E Digital positioner with display, no indicator, Explosion proof ATEX, CSA/FM B= Connections G 1/4" G air, M20 x 1,5 ectrical N 1/4" NPT air, 1/2" NPT electrical 1/4" NPT air, M20 x 1,5 electrical м C= Surface treatment Powder epoxy D= Function S Single acting Single acting, Fail Freeze L Р Single acting, Fail freeze remote mounted Μ Single acting, remote mounted D Double acting acting Κ Double acting Fail Freeze function 0 Double acting Fail freeze remote mounted Ř Double acting Remote mounted E= Spindle 3 Rotary VDI/VDE 3845 2 3 9 D type with thread/nut for Linear actuators 0 9 Double D type & adator spindle F= Cover and Indicator (No indicator on D3E, D3F) Black PMV, 90 deg, Arrow indicator Ρ V А Р V В Black, Extended travel, 270 deg Arrow indicator W C Worcester Controls, Arrow indicator Α G= Sensors/Temperature/seals Ζ No pressure sensors, NBR -30 to 80 deg C Y On Board pressure sensors, NBR -30 to 80 deg C H= Input signal/Protocoll 4-20 mA 4 5 HART, 4-20 mA Р Profibus PA F Foundation Fieldbus (Not for D3I) I= Feedback option (Limitations for D3E) No feedback option Х T\* Plug in 4-20 mA transmitter only + Alarm module S\* Limit switches MEC + 4-20 mA + Alarm N\* Limit sensors NAM + 4-20 mA + Alarm P\* Limit switches PXY + 4-20 mA + Alarm 4\* Slot type Namur sensor, P+F SJ2 S1N + Alarm Slot type Namur sensor, P+F SJ2 SN + Alarm 5\* 6\* Slot type Namur sensor, P+F SJ2N + Alarm J= Acessories No acessories Х Μ Gauge block For D3X, D3I only, For D3E (default) Gauge ports D3E, D3F (default)

A A A B C - D E E F F F - G H I J

\*Not for D3E, D3F

### Certificates

FLOWSERVE

Flow Control Division PMV, Palmstierna International AB

#### The Atex Directive 94/9/EC

#### THE DECLARATION OF CONFORMITY

Name & Address of MANUFACTURER	PMV Palmstierna International AB Korta Gatan 9
Within the European Community:	S-171 54 Solna
Description of Equipment:	D3E/Logix 800-15
Name & Address of the Notified Body which holds a copy of Technical file:	NEMKO AS P.O.BOX 73 Blindern NO-0314 Oslo
Equipment Marking:	EEx d IIB + H <sub>2</sub> T5/T6 $\langle Ex \rangle$ II 2 G
Reference of the: EC Type Examination Certificate EC Design Examination Certificate EC Certificate of Conformity	NEMKO 03ATEX111
Name & Address of the Notified Body monitoring the Manufacturer's Quality Assurance System: *	NEMKO AS P.O.BOX 73 Blindern NO-0314 Oslo
References of Harmonized Standards used:	EN 50014 EN 50018 EN ISO 9001:2000 EN 10204 EN 1127-1 EN 50081-1, EN 55011 Class B EN 50082-2 EN 61000-4-2,-3,-4,-5,-6 Lvl 3
References of European Standards and Directives used:	Pressure Equipment Directive 97/23/EC Machinery 98/37/EC CE Marking 93/68/EEC Electromagnetic Compatibility 89/336/EEC Low Voltage 72./23/EEC
Authorized Person for the MANUFACTURER Within the European Community:	Name: Roland Wedebrand Signature: Title: Director Operations
	Date: 2005-10-27
PMV Palmstierna International AB Korta S-171	Gatan 9 Phone +46 (0) 8 555 106 00

For full copy of certificates se www.pmv.nu

www.pmv.nu

Sweden

VAT Reg.No. SE556112603701





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# 7. Control

## Menus and pushbuttons

The positioner is controlled using the five pushbuttons and the display, which are accessible when the aluminium cover is removed.

For normal functioning, the display shows the current value. Press the ESC button for two seconds to display the main menu.

Use the pushbuttons to browse through the main menu and the sub-menus.

The main menu is divided up into a basic menu and a full menu, see page 21.

## **Other functions**

#### ESC

Exit the menu without making any changes (as long as any changes have not been confirmed with OK).

### FUNC

To select function and change parameters.

### OK

To confirm selection or change of parameters.

### MENU INDICATOR

Displays the position of the current menu row in the menu.



#### **IN SERVICE**

The positioner is following the input signal. This is the normal status when the positioner is working.

#### OUT OF SERVICE

The positioner is not following the input signal. Critical parameters can be changed.

#### MANUAL

The positioner can be adjusted manually using the pushbuttons. See section "Man/ Auto", page 29".

#### UNPROTECTED

Most of the parameters can be changed when the positioner is in the "Unprotected" position. However, critical parameters are locked when the positioner is in the "In service" position.

## Menu indicator



## Menus

To display the menus you can select:

- **Basic menu**, which means you can browse through four different steps

- **Full menu**, which comprises ten steps. Use the Shift Menu to browse through the steps

Full Menu can be locked out using a passcode.

The main menus are shown on the next page and the sub-menus on the subsequent pages.

## **Changing parameter values**

Change by pressing  $\langle \rangle$  until the desired figure is flashing.

Press to step to the desired figure. Confirm by pressing OK.

A change can be undone by pressing the **ESC** button, which returns you to the previous menu.



## Menu system



The menus are described on the following pages.



### BASIC MENU CALIBRATE

## **First start**

Calibrate in the basic menu is displayed automatically the first time the power is applied, and can be selected from the basic/ main menu at any later time.

A complete auto-calibration takes about 3 minutes and includes end limit calibration, auto-tuning, leak test, and a check on the speed of movement. Start the automatic calibration by selecting **Auto-Cal** and then answer the questions on the display by pressing **OK** or the respective arrow. The menu is described on the next page.

#### Calibration error messages

If a fault occurs during calibration, one of the following error messages can be displayed:

#### No movement/press ESC to abort

Typically the result of an air delivery issue to the actuator, or incorrect mounting and/or linkage arrangement. Check for proper supply air to the positioner, pinched tubing, proper actuator sizing, proper linkage and mounting arrangement.

#### Pot uncalibrated/press ESC to abort

The potentiometer has been set to an illegal value. The potentiomenter is aligned using the Calibrate - Expert cal - pot Menu. The calibration sequence must be restarted after the fault is corrected.

#### Air leak detected/ESC = abort OK = go on

An air leak has been detected. The calibration sequence should be restarted after the fault is corrected.

#### First start, Profibus

Connect the input signal at pos 1 and 2 on the terminal block. See Electrical connections in the manual.

In the SETUP/Devicedata/Profibus: change the address from 126 to any number between 1-125.

Never use the same number with more than one unit. Install values in failsafe mode, for communication when loss of signal.

Calibrate the unit.

GSD files are available at our web-page <u>www.pmv.nu</u>

# To install the D3\_PROFIBUS.DDL file to Siemens SIMATIC PDM.

1. Move the files to The directory with the DeviceInstall.exe. There should be one existing from Siemens that is included in PDM

2. Run the Program DeviceInstall.exe

Description BYTE **Parameter** SP Setpoint The SP has 5 bytes, 4 bytes for the float value and one status byte that has to be 128 or over (80 in hex) for the D3 to accept it. Use 128 means GOOD and everything should work fine. 4+1=5**READBACK** Position The READBACK has 5 bytes, 4 bytes for the float value and one status byte. 4+1=5POS D Digital position Gets a position in digital form 0 = Not initialized1 = Opened2 = Closed3 = Intermediate2 CHECKBACK Detailed information of the device, bit wise coded, more than one massage possible at ones. 3 RCAS\_IN Remote Cascade The RCAS\_IN has 5 bytes, 4 bytes for the float value and one status byte. 4+1=5RCAS OUT Remote Cascade The RCAS OUT has 5 bytes, 4 bytes for the float value and one status byte. 4+1=5

Status Byte

M	SB							LSB meaning	D3 use
0 0 0 0 1	0 0 0 0	0 0 0 0	0 0 1 1 0	1 1 0 1 0	0 1 0 1 0	X X X X X X	X X X X X	not connected device failure sensor failure out of service Good -	PROFIbus PA module failure No sensor value AI Function Block in O/S mode Non cascade measured value OK All Alarm values used
1	0	0	0	0	0	0	0	ok	
1	0	0	0	1	0	0	1	below low limit Lo	Advisory alarm
1	0	0	0	1	0	1	1	Above high limit Hi	Advisory alarm
1	0	0	0	1	1	0	1	Lo-Lo	Critical alarm
1	0	0	0	1	1	1	1	Hi-Hi	Critical alarm
Ex	amp	ple S	SP=	:43.	7%	and	50%		

Example SP = 43.7% and 50% Float Hex Status 43.7 42 2E CC CD 80 50.0 42 48 00 00 80 FLOWS

# (FF) Fieldbus Foundation function blocks

Function blocks are sets of data sorted by function and use. They can be connected to each other to solve a control process, or to a controlling DCS. To get a good introduction and understanding of FF look at <u>www.fieldbus.org</u> and download the "Technical Overview" from the About FF pages.

## (TB) Transducer Block

The TB contains unit specific data. Most of the parameters are the same as parameters found on the display. The data and the order of data varies between different products.

The AO-block setpoint (SP) and process value (PV) parameters are transceived to the TB through a channel.

The TB has to be in AUTO for the AOblock to be in AUTO.

The positioner has to be in menu-auto mode and in service to be controlled from the fieldbus.

If the positioner is placed in menu-manual mode then the transducer block will be forced to (LO) local override. In this way a person in the field will be able to control the positioner from the keypad, without collision with a control loop.

### (RB) Resource Block

The RB is a set of parameters that looks the same for all units and products. The values of the RB define unit information that concerns the Fieldbus Protocol such as

MANUFAC\_ID which informs the unique manufacturer id. For Flowserve it is 0x464C53.

The RB has to be in AUTO for the AOblock to be in AUTO.

#### (AO) Analogue Output Block

The AO follows Fieldbus Foundation's standard on content and action. It is used for transferring (SP) setpoints from the bus to the positioner.



CAS\_IN (cascade input) and RCAS\_IN (remote cascade input) are selected as inputs to the AO block depending on the MODE\_BLK parameter. The selected input will be relayed to the SP parameter of the AO block. BKCAL\_OUT (back calculated output) is a calculated output that can be sent back to a controlling object so that control bumps can be avoided. Usually the BKCAL\_OUT is set to be the (PV) process value of the AO-block, i.e. the actual measured position of the valve.

OUT is the primary calculated output of the AO block. During a limited action (ramping) of the AO block the RCAS\_OUT parameter will supply the final setpoint and the OUT parameter will be the limited output.

The transducer block is connected through a channel to the AO block. Through this channel the OUT value and SP are transceived.

In order to set the AO block to AUTO, the TB and the RB have to be in AUTO. Further the AO block has to be scheduled. Using National Instruments Configurator; scheduling can be done by adding the unit to a project and then click on the "upload to device"-icon.

To write a setpoint value by hand, add Man to MODE->Permitted parameter, and then choose MODE->Target to Man. Make sure that the unit is scheduled.

#### Example

A typical FF block loop control might look like the following:



Where the positioner is represented by the AO-block.

BASIC MENU CALIBRATE

The contents of the menu are shown on the next page. The various menu texts are described below.

Auto-Cal	Auto-tuning and calibration of end positions		
Start tune	Starts the tuning. Questions/commands are displayed durin		
	calibration. Select the type of movement, function, etc. with		
	and confirm with <b>OK</b> as shown in the chart on the next		
	page.		
Lose prev value? OK?	A warning that the value set previously will be lost (not during		
•	the first auto-tuning).		
Actuator? rotating	Select for rotating actuator.		
Actuator? linear	Select for linear actuator.		
Actuator single act	Select for single act.		
Actuator double act	Select for double act.		
<b>Direction? direct</b>	Select for direct function.		
<b>Direction? reverse</b>	Select for reverse function.		
In service? Press OK	Calibration finished Press OK to start positioner functioning		
In service. Tress OK	(If ESC is pressed, the positioner assumes the "Out of service"		
	nosition but the calibration is retained)		
	position but the canoration is retained).		
<u>TravelCal</u>	Calibration of end positions		
Start cal	Start end position calibration.		
Lose prev value? OK?	A warning that the previously set value will be lost.		
	Confirm with OK.		
	The calibration sequence starts.		
In service? Press OK	Calibration finished. Press OK to start positioner functioning.		
	(If ESC is pressed, the positioner assumes the "Out of service"		
	position but the calibration is retained).		
Perform	Setting gain		
Normal	100% gain		
Perform 50%, 25%,			
12%, L, M, S	Possibility to select a lower gain in steps.		
L, M, S	Preset values for L, M, S actuators		
Factory set	Resets all set values and enters Factory Mode. Should only		
Factory set	Resets all set values and enters Factory Mode. Should only be used by authorized staff.		

## **ExpertCal**

*Set point LO:* Use the calibrator set to 4 mA (or set another value on the display). Press OK.

*Set point HI:* Use a calibrator of 20 mA (or set another value on the display). Press OK.

*Transmitter:* Connect 10 - 28VDC. Connect an external mA meter to the loop. Read low value on mA meter and adjust with up/down key. Press OK to set low value. Repeat procedure to set High value. Also see video on www.pmv.nu

*Pot:* Potentiometer setting, see section 8. Also see video on www.pmv.nu

Full reset: Resets all set values.

**Pressure LO:** Use a supply of 2 bar (30 psi) (or set another value on the display). Press OK. Pressure read out only possible on PMV D3 with built in pressure sensor.

**Pressure H1:** Use a supply of 7 bar (105 psi) (or set another value on the display). Press OK. Pressure read out only possible on PMV D3 with built in pressure sensor.

Temp: Calibrate using a known temperature.

Aux input LO: Use the calibrator and a power supply of 4 mA (or set another value on the display). Press OK.

*Aux input HI:* Use a supply of 20 mA (or set another value on the display). Press OK.

**Pot:** Potentiometer setting, if its position relative to the gear segment has been changed. See Section 8.

Full reset: Resets all the set values.



The menu contents are shown in the figures on the right and the texts are described below:



Current values can be read using the Read Menu and some values can be reset.

Pos	Shows current position		
Set&pos	Set point and position	READ pos	
<u>Set&amp;dev</u>	Set point and deviation		Statistics
<u>Temp</u>	Shows current temperature	set&pos	n cycles
Aux	Shows auxinput signal valve. External pot or similar (Only Double board)	READ set&dev	Statistics acc travel
<u>Statistics</u> n cycles	Shows number of movements (turns)	READ temp	Statistics mean dev
Acc travel	Shows accumulated movement	READ	Statistics runtime
mean dev	Shows accumulated deviation in $\%$		Statistics
runtime	Shows accumulated runtime since last reset	READ Statistics	extr. temp
Extr temp	Shows extreme min and max temperature	READ Alarms	Statistics histogram
Histogram	Shows position and time for PV	4	
<u>Alarms</u>	Displays tripped alarms	Statistics Reset stat	Reset stat yes Reset stat

no



#### The Man/Auto menu is used to change between manual and automatic modes.

The menu contents are shown in the figures on the right and the various texts are described below:

#### AUT, OK = MAN

Positioner in automatic mode

#### MAN, OK = AUT

Positioner in manual mode

In the MAN mode, the value of POS can be changed using  $\checkmark$ . The pushbuttons increase/decrease the value in steps. The value can also be changed in the same way as for the other parameter values, as described on page 20.

#### **Other functions**

C+ can be fully opened by pressing  $\bigtriangleup$  and then immediately OK simultaneously.

C- can be fully opened by pressing vand OK simultaneously.

C+ and C- can be fully opened for blowing clean by pressing and OK simultaneously.

AUT, OK=MAN POS= 12,3% OK - MAN, OK=AUT POS= 12,3%

When changing between **MAN** and **AUT** mode, the **OK** button must be pressed for 3 seconds.



#### The Shift Menu is used to choose between the basic menu and the full menu.

The menu contents are shown in the figures on the right and the various texts are described below:

No Full menu selected.

Yes Basic menu selected.



Full Menu can be locked with a passcode, see Setup menu.



#### The Write Protect menu is used to protect all essential settings.

The menu contents are shown in the figures on the right and the various texts are described below:

- No Entered values are not write protected. "Unprotected" is displayed in the lower lefthand corner.
- Yes Entered values are write protected. Passcod needed for change to No (Applicable when a passcode has been set up in SETUP menu).

.



When changing between Yes and No mode, the OK button must be pressed for 3 seconds.

30



#### The Status Menu is used to select whether or not the positioner is in service.

The menu contents are shown in the figures on the right and the various texts are described below:

- o o service Not in service. Flashing indicator in upper lefthand corner of display.
- in service Positioner in service. Critical parameters cannot be changed.



When changing between **In service** and **Out of service**, the **OK** button must be pressed for 3 seconds.



#### The Setup Menu is used for various settings.

The menu contents are shown in the chart on the next page and the various texts are described below:

<u>Actuator</u>	Type of actuator	Size of actuator	<u>Time out</u>
Rotating	Rotating actuator.	Small	10 s
Linear	Linear actuator.	Medium	25 s
		Large	60 s
		Texas	180 s
Lever	Only for linear actuator.		
Lever stroke	Stroke length to achieve correc	t display.	
Level cal	Calibration of positions to achi	eve correct display.	
<b>Direction</b>			
Direct	Direct function (signal increase op	ens). Indicator/spindle ro	tates counter-clockwise.
Reverse	Reverse function.		
Character	Curves that show position as a	function of input signa	<u>al.</u>
Linear			
Equal %	— See diagram.	y y	
Quick open		<u>i</u> Qo	$\bigwedge$
Sqr root		Sqr	
Custom	Create own curve.	tin	
		ĕ <i>Eq</i> % ∕	X / /
<u>Cust chr</u>			× / /
# of point	Specify number of points (3.5		$\sim$ /

**# of point** Specify number of points (3, 5, 9, 17, or 33)

Cust curve Enter values on X and Y axes.

## Curr range

0%=4.0 mA

100%=20.0 mA

Possibility of selecting which input signal values will correspond to 0% and 100% movement respectively. Examples of settings: 4 mA = 0%, 12 mA = 100%, 12 mA = 0%, 20 mA = 100%.

х

Signal

<u>TRVL range</u> 0%=0.0%	<u>Setting end positions</u> Select Out of Service. Set percentage value	-	The display reverts to this value 10 minutes after any change is made.
	for desired end posi-	Start menu	Start in Basic menu or
0 100	tion (e.g. 3%).	<b>C</b> + +	Full menu.
Set 0%	Select In Service.	Contrast	Adjust display contrast
	Connect calibrator.		(Only Double board).
	and position (0%) and	Orient	Orientation of text on
	press OK	Dan mada	display.
100%=100.0%	Select Out of Service.	Par mode	motors such as P I D or
10070 1000070	Set percentage value for		K Ti Td
	desired end position (e.g.		11, 11, 10.
	97%).	Devicedata	
Set 100%	Select In Service.	HW rew	1
	Connect calibrator. Move	SW rew	General parameters.
	forward to desired end	Capability	
	position (100%) and		
	press OK.	HART	Menu with HART para-
Toyl otal	Dehaviour at set and		meters. Only amendable
<u>IIVICUI</u>	position		with HART communi-
Set low	Choose between Free (90		cator. It is possible to read
Section	to mechanical stop)	Drofibus	from display.
	Limit (stop at set end	Status	Indicates present status
	position), and Cut off (go	Device ID	Serial number
	directly to mechanical	Address	1-126
	stop at set end position).	Tag	Allotted ID
Set high	Similar to Set low.	Descriptor	ID description
Values	Select position for Cut off	Date	N/A
	and Limit at the	Failsafe	Value = preset pos
	respective end positions.		Time = Set time + $10$ sec=
Doccoodoc	Satting passoodes for		time before movement
1 assecues	various functions		Valve act = failsafe
Full menu	Passcode for access to		(preset pos) or lastvalue
I un monu	full menu.		Alarm out- On/Off
Write prot	Passcode for removing		Alam out- Olyon
	write protect.	Foundation Fieldb	us
Expert	Passcode for access to	Device ID	Serial number
	Expert menu (TUNING).	Nod address	Address on the bus
Fact set	Passcode to return to		provided by the DCS
	default values applicable		system
	when positioner was	TAG-PD_TAG	Name provided by the
	delivered.	<b>D</b>	DCS system
Numbers between ()	as besued as 0000 bars	Descriptor	PMV D3 positioner
nancodes $0 = n_0 n_1$	asscode required	Date Sim immer	N/A (not applicable)
pusseoues. 0 – 110 pe	isseede required.	Sim jumper	Simulate Jumper, FF Si-
Appearance	On display		activated - ON
Language	Select menu language.		activated - OIN
Units	Select units.		
Def. Display	Select value(s) to be		

<u>On display</u>
Select menu language.
Select units.
Select value(s) to be
displayed during service.

## FULL MENU TUNING

The menu contents are shown in the chart on the next page and the various texts are described below:

Close time	Minimum time (Min 0.005) from fully open to closed.
<u>Open time</u>	Minimum time (Min 0.05) from closed to fully open.
<u>Deadband</u>	Setting deadband. Min. 0.2%.
<u>Expert</u>	Advanced settings.
Control	See explanations below.
Togglesten	Test tool for checking functions. Overlays a square wave on the
Togglestep	set value.
Self test	Internal test of processor, potentiometer, etc.
Leakage	Air leakage in actuator/tubing can be compensated by settings.
Undo	You can read last 20 changes.

#### P,I,D and K,Ti,Td parameters

If one of the gains is changed, the corresponding value in the other gain set is changed accordingly.

#### Min Pulse

The minimum pulse lengths (the "minpulses") are displayed in the menu, and can be changed.

Normal values are:

DN1, DN2:	2750 to 4300
UP1, UP2:	3750 to 5220

#### Spring adjust

The spring adjust function compensates the airflow linearly with the actuator C+ chamber volume (for a constant position error), so that low volumes get less flow. This is needed for linear single-acting actuators, where a low C+ volume means that the actuator spring is extended, its force is reduced, and less flow is needed for stable position changes.



The menu contents are shown in the chart on the next page and the various texts are described below:

Alarm generated when deviation occurs
Alarm on/off.
Allowed distance before alarm is generated.
Total deviation time before alarm is generated.
Select ON/OFF offers output on terminals.
Behaviour of valve when alarm is generated.
Alarm above/below a certain level.
Alarm on/off.
Setting of desired min. position.
Setting of desired max. position. — See diagram below!
Desired hysteresis.
Select ON/OFF offers output on terminals.
Behaviour of valve when alarm is generated.

Limit 2

See Limit 1.



	Pos=aux	External potentiometer		
	On/Off	Function on/off.		
	Max diff	Max. allowed deviation between internal and external potentiometer.		
	Alarm out	Select ON/OFF offers output on terminals 13 and 14.		
	Valve act	Behaviour of valve when alarm is generated.		
	Aux input	External input signal 4-20 mA.		
+0	On/Off	Alarm on/off.		
<del>.</del>	   Minipos	Setting of desired min. position. Function similar to Limit 1 and 2	2.	
	Maxpos	Setting of desired max. position.		
	Hysteresis	Desired hysteresis.		
	Valve act	Behaviour of valve when alarm is generated.		
<u>Temp</u> On/Off		<u>Alarm based on temperature</u> Temperature alarm on/off.		
Low temp		Temperature setting.		
High temp		Temperature setting.		
Hysteresis		Allowed hysteresis.		
Alarm out		Select ON/OFF offers output on terminals.		
Valve act		Behaviour of valve when alarm is generated.		



Valve act		
No action	Alarm generated only. Operations not affected.	
Goto open	C+ gives full pressure and valve moves to fully open position. Positioner changes to position Manual.	
Goto close	C- gives full pressure and valve moves to fully closed position. Positioner changes to position Manual.	
Manual	Valve stays in unchanged position. Positioner moves to position Manual.	



The menu contents are shown in the chart below.

The default values that were set on delivery can be reset using the Fact Set menu. Values from calibration and from other settings will then be lost.





FACT SET no yes

(\*) appear if L

Single Board



FACT SET no yes

39

# 8. Maintenance/service

When carrying out service, replacing a circuit board, etc., it may be necessary to remove and refit various parts of the positioner. This is described on the following pages.

Read the Safety Instructions on page 3 before starting work on the positioner.

Cleanliness is essential when working with the positioner. Contamination in the air ducts will infallible lead to operational disturbances. Do not disassemble the unit more than that described here.

Do not take the valve block apart because its function will be impaired.

When working with the PMV D3 positioner, the work place must be equipped with ESD protection before the work is started.



Always turn off the air and electrical supplies before starting any work.

When upgrading electronically parts inside a PMV positioner approved for installation in Hazardous locations special procedures apply, permission from PMV/Flowserve is required prior to the start of work.

Please contact a Flowserve office for information regarding proper procedures. www.pmv.nu or infopmv@flowserve.com

## **Disassembling PMV D3**

### Removing cover and inner cover

• Unscrew the screws A and remove the cover. When mounting cover – see page 8.

• Pull off the arrow pointer, B, using a small screw driver.

• Unscrew the screws C, pull the inner cover slightly in the direction of the arrow, and remove the cover. Do not remove the filter plug.





**Circuit boards (pcb)** 



Disconnect or switch off the electric power supply before starting any work.

• Lift off the display pcb.





• Release the cable connections E, F and G,

• Unscrew the spacers H and lift up the terminal board I



### Valve block



Turn off the air and electric power supply before starting any work.

• Remove the four screws I and lift out the valve block

### N.B. Do not disassemble the valve block



• When installing the valve block — torque the four screws to 1,4 Nm and seal with Locktite 222.

## Silencer

A silencer, L (option) can be mounted under the plate M on the PMV D3. Contact PMV.



## Spindle adapter

The spindle adapter can be changed to suit the actuator in question, see page 9 or video at www.pmv.nu

## Potentiometer

 $90^{\circ}$  and  $270^{\circ}$  spring loaded potentiometer The spring-loaded potentiometer K can be removed from the gearwheel for calibration or replacement.

If the potentiometer is replaced or the setting is changed, it must be calibrated.

• Select the menu Calibrate - Expert - Cal pot. The display shows Set gear (1).

• Turn the spindle shaft (2) cw to end position and press OK. Turn ccw to the end and press OK.

• Unmesh the potentiometer (3) and turn it according to display until OK is shown. Press OK.



## **Transmitter boards**

The equipment for transmitter feedback consists of a circuit board A, cam assembly B and screws.

The circuit board exists in four:

- with mecanical switches, SPDT
- with namur sensors, DIN 19234
- with proximity switches
- with feedback transmitter only



### Transmitter board installation



Caution! Turn off the power and air supply before starting the installation.

Important for PMV D3 units with hazardous approvals: Maintenance and repairs only to be made by authorized staff.

• Remove the cover, indicator and inner cover according to the description on page 40.

• Check that both spacers C are installed.



• Secure the circuit board with the enclosed screws E.

• Install the cam asssembly **B** on the shaft and push it down to its position. If the board has microswitches, be careful not to damage the levers.











- Install the inner cover with the two screws, G.
- Connect the wiring for the transmitter feedback on the terminal block, according to the drawing on next page.







- $\bullet$  Tighten the cam assembly screws  ${\bf F}$  when the cams are correctly adjusted.
- Install the indicator and cover. To calibrate the feedback transmitter, see drawing on next page.



## **Disassembling PMV D3 Ex**

• Loosen the screws A and B and remove the caps C och D.

• Remove the inner display cover **E** by loosening the four screws **F**.

 $\bullet$  Carefully remove the display board and loosen the connection  ${\bf H}$  and  ${\bf I}.$ 

• Release the wide cable from the connector **J** on the terminal board.

• Loosen the three screws **K**.

• Remove the circuit board package L, consisting of terminal and processor board.

 $\bullet$  Remove he four screws M and lift the block N.

• Pressure sensor board O, (option) can only be moved after the block N is removed.



# Filter change, PMV D3 and PMV D3 Ex



Turn off the compressed air supply before starting any work. Otherwise the filter can be uncontrollably blown out of the positioner by the air pressure, which can be dangerous.

• Remove the filter cap using a coin of suitable size.

**Note!** Do not use a screwdriver. The filter cap might crack and cause air leakage.

• When installing the filter/filter plug, start by installing the O-ring in the bottom of the cavity in the pneumatic block. Do *not* try to install it on the threaded filter plug.

Insert filter in the filter plug, then thread the filter plug into pneumatic block.



## **Converting for remote control**



Disconnect or switch off the electric power supply before starting any work.

• Remove cover and inner cover, see page 40.

- Lift off the display pcb, **D**.
- Disconnect and secure the pot cable.
- Install transmitter board D3-AS38T, F.
- Install the enclosured wire between G and O on the transmiter board.

• Connect the wiring between terminals 3, 4, 5 in the PMV D3 unit and 3, 4, 5 in the remote unit.

Use a shielded wire and ground it in the PMV D3 unit only.

Avoid longer distance than 5 m between PMV D3 unit and remote unit.







# 9. Trouble shooting

Fault symptom	Action
Change in input signal to positioner does not affect actuator position.	• Check air supply pressure, air cleanliness, and connection between positioner and actuator.
	• Out of service, in manual mode.
	• Check input signal to positioner.
	• Check mounting and connections of po- sitioner and actuator.
Change in input signal to positioner ma-	Check input signal.
kes actuator move to its end position.	• Check mounting and connections of po- sitioner and actuator.
Inaccurate regulation.	<ul> <li>Implement auto-tuning. Check for any leaks.</li> <li>Uneven air supply pressure.</li> <li>Uneven input signal.</li> <li>Wrong size of actuator being used.</li> <li>High friction in actuator/valve package.</li> <li>Excess play in actuator/valve package.</li> <li>Excess play in mounting of positioner on actuator.</li> <li>Dirty/humid supply air.</li> </ul>
Slow movements, unstable regulation.	<ul><li>Implement auto-tuning.</li><li>Increase the deadband (Tuning menu).</li><li>Adjust Performance (Calibrate menu).</li></ul>

# **10.** Technical data

Rotation angle Stroke Input signal Air supply

Air delivery Air consumption Air connections Cable entry Electrical connections Linearity Repeatability Hysteresis Dead band Display UЛ Processor **CE** directives EMC Voltage drop, Double board Voltage drop, Single board without HART Voltage drop, Single board with HART Vibrations Enclosure Material Surface treatment Temperatur range Weight

Alarm output Alarm Supply Voltage Mounting position min. 30° max 100°, option 270° 5—130 mm (0.2" to 5.1") 4—20 mA 2-7 bar (30-105 psi) DIN/ISO 8573-1 Free from oil, water and moisture. Filtered to min. 40 micron 350 nl/min (13.8 scfm) <0.3 nl/min (0.01 scfm) 1/4" G or NPT 3 x M20 or 1/2" NPT Screw terminals 2.5 mm<sup>2</sup> /AWG14 <1% < 0.5% < 0.4% 0.2-10% adjustable Graphic, view area  $15 \times 41 \text{mm} (0.6 \times 1.6^{\circ})$ 5 push buttons 16 bit, M 16C 93/68EEC, 89/336/EEC, 92 /31/EEC EN 50 081-2, EN 50 082-2  $<10.1 \text{ V} => \text{resistance } 505 \Omega$  $< 8.0 \text{ V} \Rightarrow$  resistance 400  $\Omega$  $< 9.4 \text{ V} \Rightarrow \text{resistance } 470 \Omega$ <1% up to 10 g at frequency 10 — 500 Hz IP66/NEMA 4X Die-cast aluminium, A2/A4 fasteners Powder epoxy  $-30 \text{ to } +80^{\circ}\text{C} (-22 \text{ to } 176^{\circ} \text{ F})$ PMV D3X, 1.4 kg (3 lbs). PMV D3E, 3 kg (6.6 lbs) Transistor Ri 1 K $\Omega$ 8-28 V DC Anv

#### **Mechanical switches**

Type Size Rating

#### Namur sensors

(N32-V3-N) Type Load current Voltage range Hysteresis Temp

#### **Proximity switches**

Type Rating Operating time Breakdown voltage Contact resistance Mechanical/electrical life

#### **Slot Namur switches**

(**S32-S1N, S32-SN, S32-N**) Type Load current Voltage Hysteresis Temp

#### 4 - 20 mA transmitter

Supply Output Resolution Linearity full span Output current limit Load impedance SPDT Sub Sub miniature 3 A/125 V AC 2 A/30 V DC

Proximity DIN 19234 NAMUR 1 mA ≤ I ≤ 3 mA 5 - 25 V DC 0.2 % -20°C to 85°C (-4°F to 185°F)

SPDT 5 W/250 mA/30 V DC/125 V AC 0.7 ms 200 V DC 0.1 Ω >50 x 10<sup>6</sup> operations

Proximity DIN EN 60947-5-6 1 mA ≤ I ≤ 3 mA 8 V DC 0.2 % -25°C to 85°C (-13°F to 185°F)

9 - 28 V DC 4 - 20 mA 0.1 % +/-0.5 % 30 mA DC 800 Ω @ 24 V DC

# With optional gauge block installed







# **Explosion proof version**





FLOWSERVE

# **11.** Spare parts





No	Part no	Description
1	D3-SP6	Black cover incl. Screws
1	D3-SP6W	White cover incl. Screws
1	D3-SP6WC	Worcester cover incl. Screws
2	D3-SP11	Internal cover incl. screws
3	P3-SP13	Cover plate incl. screw
4	3-SXX	Spindle adaptor $(XX = 01, 06, 26, 30, 36)$
5	3-AS23	S23 Shaft compl. Incl. gearwheel, friction clutch, spring
5	3-AS39	S39 Shaft compl. Incl. gearwheel, friction clutch, spring
5	3-AS09	S09 Shaft compl. Incl. gearwheel, friction clutch, spring
6	D3-SP1	Block complete, incl cable, rubber seal, filter plug
6	D3-SP1-IS	Block complete, incl cable, rubber seal, filter plug IS
6	D3-SP1-PS	Block complete, Pressure sensors, incl cable, seal, filter plug
6	D3-SP1-PI	Block complete, Pressure sensors, incl cable, seal, filter plug, IS
6	D3-SP1-FF	Block complete, incl cable, rubber seal, filter plug, Fail Freeze
6	D3-SP1-PFF	Block complete, Pressure sensors, incl cable, rubber seal,
		filter plug, Fail Freeze
7	D3-SP9	Filterplug, incl. O-ring, filter
8	3-SP8	Potentiometer compl. incl. spring, holder, cable
9	3-SP37HR	PCB LCD Display assy Hi Res type
10	D3-SP35P	PCBs (Terminal and processor) Profibus
10	3-SP80X	PCB Motherboard
10	3-SP80H	PCB Motherboard HART
10	3-SP80I	PCB Intrinsically safe
10	3-SP80IH	PCB Intrinsically safe, HART
11	3-SP84	Pressure sensor PCB assy complete.
12	3-SP48A	Indicator arrow assy
13	D3-SP/SCREW	Kit, bag with screws
14	D3-SP/SEAL	Kit, bag with O-rings, seals
15	D3-SP42	Cables & PC boards to pneumatic block
16	D3-SP34G	Gauge block G, complete
16	D3-SP34N	Gauge block NPT, complete
17	3-AS81T	PCB Transmitter 4-20mA assy
17	3-AS81M	PCB Transmitter and Mechanical switches, assy
17	3-AS81N	PCB Transmitter and Namur sensors, assy
17	3-AS81P	PCB Transmitter and Proximity switches, assy
17	3-AS81N4	PCB Transmitter, slot type Namur sensors(P+F SJ2 S1N), assy
17	3-AS81N5	PCB Transmitter, slot type Namur sensors(P+F SJ2 SN), assy
17	3-AS81N6	PCB Transmitter, slot type Namur sensors(P+F SJ2N), assy
18	D3-67	Silencer, Sintered brass





No	Part no	Description
1	D3E-SP2	Front cover assy incl. Screw, O-ring, black
1	D3E-SP2W	Front cover assy incl. Screw, O-ring, white
1	D3E-SP2WC	Front cover assy incl. Screw, O-ring, Worcester
2	D3E-SP3	Terminal cover complete, incl. Screw, black
3	D3E-SP4	Internal cover incl. screws
4	3-SXX	Spindle adaptor (XX = 01, 06, 26, 30, 36)
5	D3-SP1	Block complete, incl cable, rubber seal, filter plug
5	D3-SP1-PS	Block complete, Pressure sensors, incl cable, seal, filter plug
6	D3-SP9	Filterplug, incl. O-ring, filter
7	3E-SP8	Potentiometer compl. incl. spring, holder, cable
8	3-AS23	S23 Shaft compl. Incl. gearwheel, friction clutch, spring
8	3-AS39	S39 Shaft compl. Incl. gearwheel, friction clutch, spring
8	3-AS09	S09 Shaft compl. Incl. gearwheel, friction clutch, spring
9	3E-SP80X	PCB Mother board
9	3E-SP80XT	PCB Mother board, 4-20mA transmitter
9	3E-SP80H	PCB Mother board HART
9	3E-SP80HT	PCB Mother board, HART 4-20mA transmitter
10	3-SP84	Pressure sensor PCB assy complete.
11	3-SP37HR	PCB LCD Display assy Hi Res type
12	3E-SP83	PCB Terminals
13	D3E-SP/SCREW	Kit, bag with screws
14	D3E-SP/SEAL	Kit, bag with O-rings, seals
15	D3E-SP42	Cables & PC boards to pneumatic block



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