D3
Digital Positioner

Manual
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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 D3 can be equipped with modules for feedback, limit switches, and a pressure gauge block.

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

Safety instruction

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.
2. Storage

General
The PMV 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.
The D3 positioner contains:
- Electronic board with microprocessor, HART modem, 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.

The figure shows the D3 with the cover removed.
4. Variants

D3 270° deg.
D3 up to 270° deg for extended travel range is available. It features all benefits and options similar to the standard D3. Communication with HART or Profibus is possible.

D3 Explosion proof
The digital positioner D3 is available in explosion proof enclosure. It features the same easy to use user interface for local configuration as D3. Communication with Hart or Profibus is possible.
Further features are gauge ports and local graphic LCD display.

D3 Intrinsically safe
The digital positioner D3 is available in intrinsically safe version for installation in hazardous areas. It features the same easy to use user interface for local configuration as D3. Communication with HART or Profibus is possible. It features all benefits and options similar to the Standard D3 positioner, gauge block, local graphic LCD display and feedback option etc.

D3 remote mounted
The D3 with remote mount is now available on the market for order. This version is suitable for installations in severe applications e.g. vibrations, high or low temperature corrosive environment, high mountings or difficult of access, etc. A flat or dome style indicator can be fitted on the feedback box installed on the actuator. Max recommended distance between D3 and remote unit is 5 m.
5. Function

Double action function

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

The two piezo-valves are closed in the schematic diagram above and have no effect on the valves A and D. Air from the pressure regulator is lead through the open valve A to the valve B, which opens. The supply pressure can now pass through valve B to the actuator via H. The actuator then moves in the direction of the arrow. At the same time, air from valve A keeps valve C open and allows venting of the actuator.

When both the piezo-valves open, valve A closes but valve D opens and controls valves E and F to that the actuator moves in a direction opposite to the arrow. When only piezo-valve 1 is open, the actuator is stationary.

Single action function

Valve B is used for the supply air and valve F for venting.
6. Installation

**Tubing**

Use tubes with an inner diameter of minimum 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.

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 <40µ 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 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 D3 positioner has an ISO F05 footprint, A. The holes are used to attach it to the mounting bracket B, which is suitable for most types of linear actuator.

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.

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.

**Assembly examples**

![Assembly diagram showing Rotary movement and Linear movement]
The D3 Ex positioner has an ISO F05 footprint, A. The holes are used to attach it to the mounting bracket B, which is suitable for most types of linear actuators.

The spindle adapter C can be changed to suit the actuator in question, see previous page.

**Connections**

**Air:**
- Port S: Supply air, 2-7 bar
- Port C+: Connection to actuator
- Port C-: Connection to actuator (only for double 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 48.*
**Single action positioner**  
(Direct function)

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

**Actuator with opening spring**  
When the control signal increases, the pressure C+ to the actuator is reduced. The springs press the valve spindle upward and the positioner spindle rotates counter-clockwise. When the control signal drops to zero, C+ is vented and the valve opens.

**Double action positioner**  
(Direct function)

**Double action actuator**  
When the control signal increases, the pressure C+ to the actuator is increased. The valve spindle 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.
**Electrical connections**

The diagrams show the terminal blocks in D3 and D3 Ex.

**Remote unit**

The remote unit shall be connected between terminals 3, 4 and 5 in the D3 and 3, 4 and 5 in the remote unit. Use a shielded cable and ground it in the D3 only. Max recommended distance between D3 and remote unit: 5 m.

Note! When converting D3/D3 Ex for use with remote unit, some changes have to be done inside the positioner, see Section 8.

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

**D3**

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

When installing D3 Intrinsically safe unit, always consider cdwg D3-70.
D3 Ex

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

![Diagram](image)

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

1. 4-20 mA + input signal
2. 4-20 mA – input signal
3. (Remote unit)
4. (Remote unit)
5. (Remote unit)
9. AUX input 4-20 mA +
10. AUX input 4-20 mA –
11. 4-20 mA + Feedback, 10-28 V DC
12. 4-20 mA – Feedback, 10-28 V DC
13. Alarm output +, 8-28 V DC
14. Alarm output –, 8-28 V DC
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 16.

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 21”.

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

There are indicators at both sides of the display window and they indicate as follows:

- Flashing in position **Out of service**
- Flashing in position **Manual**
- Displayed in position **Unprotected**

The indicators on the right-hand side show the position in the current menu.

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 \[ \text{keydown} \] until the desired figure is flashing.

Press \[ \text{keydown} \] 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.
First start
Calibrate in the basic menu is displayed automatically the first time the positioner is connected up, and can be selected from the basic/main menu at any later time.

A complete 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:

Invalid movement/press ESC to abort
No movement because the air is incorrectly connected, for example. After the fault is corrected, the calibration sequence must be restarted.

Pot unaligned/press ESC to abort
The potentiometer has been set to an illegal value. The potentiometer 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.

Increase C- damper/ESC = abort
OK to retry
Increase C+ damper/ESC = abort
OK to retry
Speed of movement is too fast. Adjust with the damper screws (see page 5). Press OK. Repeat the adjustment and press OK until the speed is correct. If there is an abort, the calibration sequence must be restarted.

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.
Do never use the same number to more than one unit. Install values in failsafe mode, for communication when loss of signal.
Calibrate the unit.
GSD files are available at our homepage www.pmv.nu

Clockwise = Increased damping/Less flow
CCW = Decreased damping/More flow
3 revsCCW = Max flow

Note! Too much increased damping (low flow) might cause irregular actuator function.
The contents of the menu are shown on the next page. The various menu texts are described below.

<table>
<thead>
<tr>
<th><strong>Auto-Cal</strong></th>
<th>Auto-tuning and calibration of end positions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Start tune</strong></td>
<td>Starts the tuning. Questions/commands are displayed during calibration. Select the type of movement, function, etc. with ▼ and confirm with <strong>OK</strong> as shown in the chart on the next page.</td>
</tr>
<tr>
<td><strong>Lose prev value? OK?</strong></td>
<td>A warning that the value set previously will be lost (not during the first auto-tuning).</td>
</tr>
<tr>
<td><strong>Actuator? rotating</strong></td>
<td>Select for rotating actuator.</td>
</tr>
<tr>
<td><strong>Actuator? linear</strong></td>
<td>Select for linear actuator.</td>
</tr>
<tr>
<td><strong>Actuator single act</strong></td>
<td>Select for single act.</td>
</tr>
<tr>
<td><strong>Actuator double act</strong></td>
<td>Select for double act.</td>
</tr>
<tr>
<td><strong>Direction? direct</strong></td>
<td>Select for direct function.</td>
</tr>
<tr>
<td><strong>Direction? reverse</strong></td>
<td>Select for reverse function.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>TravelCal</strong></th>
<th>Calibration of end positions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Start cal</strong></td>
<td>Start end position calibration.</td>
</tr>
<tr>
<td><strong>Lose prev value? OK?</strong></td>
<td>A warning that the previously set value will be lost. Confirm with OK. The calibration sequence starts.</td>
</tr>
<tr>
<td><strong>In service? Press OK</strong></td>
<td>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).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Perform</strong></th>
<th>Setting gain</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Normal</strong></td>
<td>100% gain</td>
</tr>
<tr>
<td><strong>Perform 50%, 25%, 12%, L, M, S</strong></td>
<td>Possibility to select a lower gain in steps.</td>
</tr>
<tr>
<td><strong>L, M, S</strong></td>
<td>Preset values for L, M, S actuators</td>
</tr>
<tr>
<td><strong>Factory set</strong></td>
<td>Resets all set values and enters Factory Mode. <strong>Should only be used by authorized staff.</strong></td>
</tr>
</tbody>
</table>

**Note.** Original P. I. D. will always be shown in display.
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.
Pressure LO: Use a supply of 2 bar (30 psi) (or set another value on the display). Press OK.
Pressure HI: Use a supply of 7 bar (105 psi) (or set another value on the display). Press OK.
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.
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
- **Set&dev** Set point and deviation
- **Temp** Shows current temperature
- **Aux** Shows auxinput signal valve. External pot or similar
- **Statistics**
  - **n cycles** Shows number of movements (turns)
  - **Acc travel** Shows accumulated movement
  - **mean dev** Shows accumulated deviation in %
  - **runtime** Shows accumulated runtime since last reset
  - **Extr temp** Shows extreme min and max temperature
  - **Histogram** Shows position and time for PV
- **Alarms** Displays tripped alarms
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 ▲▼. The push-buttons 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 15.

**Other functions**
C+ can be fully opened by pressing ▲ and then immediately OK simultaneously.

C- can be fully opened by pressing ▼ and OK simultaneously.

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

When changing between **MAN** and **AUT** mode, the **OK** button must be depressed for 3 seconds.
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 left-hand corner.
- **Yes**: Entered values are write protected. Passcode 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 depressed for 3 seconds.
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 left-hand 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 depressed 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:

<table>
<thead>
<tr>
<th>Actuator</th>
<th>Type of actuator</th>
<th>Size of actuator</th>
<th>Time out</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotating</td>
<td>Rotating actuator.</td>
<td>Small</td>
<td>10 s</td>
</tr>
<tr>
<td>Linear</td>
<td>Linear actuator.</td>
<td>Medium</td>
<td>25 s</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Large</td>
<td>60 s</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Texas</td>
<td>180 s</td>
</tr>
</tbody>
</table>

**Lever** Only for linear actuator.

**Lever stroke** Stroke length to achieve correct display.

**Level cal** Calibration of positions to achieve correct display.

**Direction**
- **Direct** Direct function (signal increase opens). Indicator/spindle rotates counter-clockwise.
- **Reverse** Reverse function.

**Character** Curves that show position as a function of input signal.
- **Linear**
- **Equal %** See diagram.
- **Quick open**
- **Sqr root**
- **Custom** Create own curve.

**Cust chr**
- **# 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%.
Setting end positions

**TRVL range**

0% = 0.0%

Select Out of Service.
Set percentage value for desired end position (e.g. 3%).

**Set 0%**

Select In Service.
Connect calibrator.
Move forward to desired end position (0%) and press OK.

100% = 100.0%

Select Out of Service.
Set percentage value for desired end position (e.g. 97%).

**Set 100%**

Select In Service.
Connect calibrator. Move forward to desired end position (100%) and press OK.

Behaviour at set end position

**Trvl ctrl**

Choose between Free (go to mechanical stop), Limit (stop at set end position), and Cut off (go directly to mechanical stop at set end position).

**Set low**

Similar to Set low.

**Set high**

Values
Select position for Cut off and Limit at the respective end positions.

Setting passcodes for various functions

**Passcodes**

Passcode for access to full menu.

**Full menu**

Passcode for removing write protect.

**Write prot**

Passcode for access to Expert menu (TUNING).

**Expert**

Passcode to return to default values applicable when positioner was delivered.

**Fact set**

Numbers between 0000 and 9999 can be used as passcodes. 0 = no passcode required.

**Appearance**

On display

**Language**

Select menu language.

**Units**

Select units.

**Def. Display**

Select value(s) to be displayed during service.
The display reverts to this value 10 minutes after any change is made.

**Start menu**

Start in Basic menu or Full menu.

**Contrast**

Adjust display contrast.

**Orient**

Orientation of text on display.

**Par mode**

Display of control parameters such as P, I, D or K, Ti, Td.

**Devicedata**

General parameters.

**HW rew**

**SW rew**

**Capability**

Menu with HART parameters. Only amendable with HART communicator. It is possible to read from display.

**HART**

**Profibus**

Indicates present status

**Status**

**Device ID**

Serial number

**Address**

1-126

**Tag**

Allotted ID

**Descriptor**

ID description

**Date**

N/A

**Failsafe**

Value = preset pos

Time = Set time + 10 sec = time before movement

Valve act = failsafe (preset pos) or last value (present pos)

Alarm out = On/Off
The menu contents are shown in the chart on the next page and the various texts are described below:

<table>
<thead>
<tr>
<th>Close time</th>
<th>Minimum time from fully open to closed.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open time</td>
<td>Minimum time from closed to fully open.</td>
</tr>
<tr>
<td>Deadband</td>
<td>Setting deadband. Min. 0.2%.</td>
</tr>
<tr>
<td>Expert</td>
<td>Advanced settings.</td>
</tr>
<tr>
<td>Togglstep</td>
<td>Test tool for checking functions.</td>
</tr>
<tr>
<td></td>
<td>Overlays a square wave on the set value.</td>
</tr>
<tr>
<td>K, Ti, Td</td>
<td>Setting K, Ti, and Td parameters.</td>
</tr>
<tr>
<td>Self test</td>
<td>Test of processor, potentiometer, etc.</td>
</tr>
<tr>
<td>Leakage</td>
<td>Air leakage detected can be either</td>
</tr>
<tr>
<td></td>
<td>connections, positioner tubing or</td>
</tr>
<tr>
<td></td>
<td>actuator.</td>
</tr>
<tr>
<td>Undo</td>
<td>You can read last 20 changes.</td>
</tr>
</tbody>
</table>
TUNING Close time
  - Close time
    - Min = 0.05

TUNING Open time
  - Open time
    - Min = 0.05

TUNING Deadband
  - Deadband
    - D = 0.2%

TUNING Expert
  - Expert Togglestep
    - K, Ti, Td
    - Self test
    - Leakage
    - Undo
  - Togglestep Runtime
    - Togglestep Cycletime
    - Togglestep size
    - Togglestep start
    - Togglestep Abort step
The menu contents are shown in the chart on the next page and the various texts are described below:

**Deviation**  
Alarm generated when deviation occurs

**On/Off**  
Alarm on/off.

**Distance**  
Allowed distance before alarm is generated.

**Time**  
Total deviation time before alarm is generated.

**Alarm out**  
Select ON/OFF offers output on terminals 13 and 14.

**Valve act**  
Behaviour of valve when alarm is generated.

**Limit 1**  
Alarm above/below a certain level.

**On/Off**  
Alarm on/off.

**Minipos**  
Setting of desired min. position.

**Maxpos**  
Setting of desired max. position.  
See diagram below!

**Hysteresis**  
Desired hysteresis.

**Alarm on**  
Select ON/OFF offers output on terminals 13 and 14.

**Valve act**  
Behaviour of valve when alarm is generated.

**Limit 2**  
See Limit 1.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pos=aux</strong></td>
<td>External potentiometer</td>
</tr>
<tr>
<td><strong>On/Off</strong></td>
<td>Function on/off.</td>
</tr>
<tr>
<td><strong>Max diff</strong></td>
<td>Max. allowed deviation between internal and external potentiometer.</td>
</tr>
<tr>
<td><strong>Alarm out</strong></td>
<td>Select ON/OFF offers output on terminals 13 and 14.</td>
</tr>
<tr>
<td><strong>Valve act</strong></td>
<td>Behaviour of valve when alarm is generated.</td>
</tr>
<tr>
<td><strong>Aux input</strong></td>
<td>External input signal 4-20 mA.</td>
</tr>
<tr>
<td><strong>On/Off</strong></td>
<td>Alarm on/off.</td>
</tr>
<tr>
<td><strong>Minipos</strong></td>
<td>Setting of desired min. position.</td>
</tr>
<tr>
<td><strong>Maxpos</strong></td>
<td>Setting of desired max. position.</td>
</tr>
<tr>
<td><strong>Hysteresis</strong></td>
<td>Desired hysteresis.</td>
</tr>
<tr>
<td><strong>Valve act</strong></td>
<td>Behaviour of valve when alarm is generated.</td>
</tr>
</tbody>
</table>
**Temp**

**Alarm based on temperature**

- **On/Off**: Temperature alarm on/off.
- **Low temp**: Temperature setting.
- **High temp**: Temperature setting.
- **Hysteresis**: Allowed hysteresis.
- **Alarm out**: Select ON/OFF offers output on terminals 13 and 14.
- **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.

The menu contents are shown in the chart on the next page and the various texts are described 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.
<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAN/AUTO</td>
<td>AUTO_OK=MAN MAN_OK=AUT</td>
</tr>
<tr>
<td>CALIBRATE</td>
<td>AutoCal TravelCal Perform ExpertCal</td>
</tr>
<tr>
<td></td>
<td>Set point** Pressure Temp Aux input</td>
</tr>
<tr>
<td></td>
<td>Transm. Rop Full reset</td>
</tr>
<tr>
<td>SETUP</td>
<td>Actuator type size</td>
</tr>
<tr>
<td></td>
<td>Lever (*) Stroke Lever cal direct</td>
</tr>
<tr>
<td></td>
<td>Direction Character Cust chr</td>
</tr>
<tr>
<td></td>
<td>Cust curve # of points Xo= Yo=</td>
</tr>
<tr>
<td></td>
<td>0%-4mA 100%-20mA</td>
</tr>
<tr>
<td></td>
<td>Troll range Set low Set high Values</td>
</tr>
<tr>
<td></td>
<td>Troll ctrl free cutoff Cutoff Low 0.1</td>
</tr>
<tr>
<td></td>
<td>Cutoff High 99.9 Limit Low Limit Hi</td>
</tr>
<tr>
<td>PROTECTION</td>
<td>yes no Enter code</td>
</tr>
<tr>
<td>STATUS</td>
<td>o o service In service</td>
</tr>
<tr>
<td></td>
<td>Rotating single act small medium</td>
</tr>
<tr>
<td></td>
<td>large Texas-size</td>
</tr>
<tr>
<td></td>
<td>Direction Character Cust chr</td>
</tr>
<tr>
<td></td>
<td>Cust curve # of points Xo= Yo=</td>
</tr>
<tr>
<td></td>
<td>0%-4mA 100%-20mA</td>
</tr>
<tr>
<td></td>
<td>Troll range Set low Set high Values</td>
</tr>
<tr>
<td></td>
<td>Troll ctrl free cutoff Cutoff Low 0.1</td>
</tr>
<tr>
<td></td>
<td>Cutoff High 99.9 Limit Low Limit Hi</td>
</tr>
<tr>
<td>PASSCODES</td>
<td>Language English percent percent</td>
</tr>
<tr>
<td></td>
<td>Svenska Deutsch Francais mm percent</td>
</tr>
<tr>
<td></td>
<td>mm percent mm</td>
</tr>
<tr>
<td></td>
<td>Units Setpoint degrees degrees inch</td>
</tr>
<tr>
<td></td>
<td>Position degrees inches</td>
</tr>
<tr>
<td></td>
<td>Pressure degrees degrees bar psi</td>
</tr>
<tr>
<td></td>
<td>Temp degrees C degrees F Kelvin</td>
</tr>
<tr>
<td></td>
<td>Def. Displ Start menu Contrast</td>
</tr>
<tr>
<td></td>
<td>normal last value normal basic</td>
</tr>
<tr>
<td></td>
<td>Orient Par mode Right P.I.D K.T. Td</td>
</tr>
<tr>
<td>DEVICES</td>
<td>Close time 0 Open time 0 Deadband 0.5</td>
</tr>
<tr>
<td></td>
<td>Expert Tog Time cycle time</td>
</tr>
<tr>
<td></td>
<td>HW rev SW rev Hart** PROFI*** Status</td>
</tr>
<tr>
<td></td>
<td>Device ID Address Tag Date</td>
</tr>
<tr>
<td></td>
<td>Value Time Date Alarm out</td>
</tr>
</tbody>
</table>
|                | Devicemodel only readable with Hart device(*) appear if linear set ** Not available with Profinus *** Only Profinus
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 infallibly 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 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.

Disassembling PMVD3

Removing cover and inner cover
• Unscrew the screws A and remove the cover.

• Pull off the arrow pointer, B.

• Unscrew the screws C, pull the inner cover slightly in the direction of the arrow, and remove the cover.
Circuit boards (pcb)

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

- Lift off the display pcb.

- Unscrew the spacers E, release the cable connections F and G, and lift up the processor pcb.

- Remove the terminal board by unscrewing the spacers H.
Valve block

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

• Release the connector F from the processor pcb.

¥ Remove the four screws I.

¥ Lift out the valve block

N.B. Do not disassemble the valve block

¥ When installing the valve block Ñ 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 D3. Contact PMV.

Spindle adapter
The spindle adapter can be changed to suit the actuator in question, see page 9.
Potentiometer

**90° and 270° 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 mechanical 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 starting the installation.

Important for D3 Intrinsically safe units:
Transmitter boards NOT for on site mounting by customer. FM, CSA and ATEX certificate only valid when transmitter board is mounted by manufacturer.

- Remove the cover, indicator and inner cover according to the description on page 37.

- Check that both spacers C are installed.

- Carefully mount the circuit board in its position. The pins D should fit in the connector and the positioners motherboard. Make sure that the feedback PC board is properly connected.

- Secure the circuit board with the enclosed screws E.

- Install the cam assembly B on the shaft and push it down to its position. If the board has microswitches, be careful not to damage the levers.
• Tighten the screws \textbf{F}, on the cam assembly. Do not tighten the screws to hard. The cams should be able to move in relation to each other.

• Install the inner cover with the two screws, \textbf{G}.

• Connect the wiring for the transmitter feedback on the terminal block, according to the drawing on next page.

• Adjust the position where the switches/sensors should be affected, by turning the cams with a screwdriver.

• Tighten the cam assembly screws \textbf{F} when the cams are correctly adjusted.

• Install the indicator and cover. To calibrate the feedback transmitter, see drawing on next page.
For more information see manual chapter 6, Transmitter boards.
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.

• Carefully remove the display board and loosen the connections H and 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.

• Remove the four screws M and lift the block N.
Filter change, D3 and 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.
Converting for remote control

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

- Remove cover and inner cover, see page 37.
- Lift off the display pcb, D.
- Disconnect and secure the pot cable.
- Install transmitter board D3-AS38T, F.
- Install the enclosed wire between G and O on the transmitter board.
- Connect the wiring between terminals 3, 4, 5 in the D3 unit and 3, 4, 5 in the remote unit.

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

Avoid longer distance than 5 m between D3 unit and remote unit.
# 9. Trouble shooting

<table>
<thead>
<tr>
<th>Fault symptom</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in input signal to positioner does not affect actuator position.</td>
<td>• Check air supply pressure, air cleanliness, and connection between positioner and actuator.</td>
</tr>
<tr>
<td></td>
<td>• Check input signal to positioner.</td>
</tr>
<tr>
<td></td>
<td>• Check mounting and connections of positioner and actuator.</td>
</tr>
<tr>
<td>Change in input signal to positioner makes actuator move to its end position.</td>
<td>• Check input signal.</td>
</tr>
<tr>
<td></td>
<td>• Check mounting and connections of positioner and actuator.</td>
</tr>
<tr>
<td>Inaccurate regulation.</td>
<td>• Implement auto-tuning. Check for any leaks.</td>
</tr>
<tr>
<td></td>
<td>• Uneven air supply pressure.</td>
</tr>
<tr>
<td></td>
<td>• Uneven input signal.</td>
</tr>
<tr>
<td></td>
<td>• Wrong size of actuator being used.</td>
</tr>
<tr>
<td></td>
<td>• High friction in actuator/valve package.</td>
</tr>
<tr>
<td></td>
<td>• Excess play in actuator/valve package.</td>
</tr>
<tr>
<td></td>
<td>• Excess play in mounting of positioner on actuator.</td>
</tr>
<tr>
<td></td>
<td>• Dirty/humid supply air.</td>
</tr>
<tr>
<td>Slow movements, unstable regulation.</td>
<td>• Implement auto-tuning.</td>
</tr>
<tr>
<td></td>
<td>• Adjust the pressure adjusting screws.</td>
</tr>
<tr>
<td></td>
<td>• Increase the deadband (Tuning menu).</td>
</tr>
<tr>
<td></td>
<td>• Adjust Performance (Calibrate menu).</td>
</tr>
</tbody>
</table>
10. Technical data

Rotation angle
min. 30° max 100°

Stroke
5 - 130 mm (0.2” to 5.1”)

Input signal
4 - 20 mA

Air supply
2 - 7 bar (30 - 87 psi) Free from oil, water and moisture. Filtered to min. 30 micron

Air delivery
400 nl/min (13.8 scfm)

Air consumption
<0.3 nl/min (0.01 scfm)

Air connections
1/4” G or NPT

Cable entry
3 x M20 or 1/ 2” NPT

Electrical connections
Screw terminals 2.5 mm² /AWG14

Linearity
<1%

Repeatability
<0.5%

Hysteresis
<0.4%

Dead band
0.2-10% adjustable

Display
Graphic, view area 15 x 41mm (0.6 x 1.6”)

UI
5 push buttons

Processor
16 bit, M 16C

CE directives
93/68EEC, 89/336/EEC, 92 /31/EEC

EMC
EN 50 081-2, EN 50 082-2

Voltage drop
<10.1V

Vibrations
<1% up to 10 g at frequency 10 - 500 Hz

Enclosure
IP66/NEMA 4X

Material
Die-cast aluminium, A2/A4 fasteners

Surface treatment
Powder epoxy

Temperatur range
–30 to +80°C (–22 to 176° F)

Weight
D3X, 1.4 kg (3 lbs). D3E, 3 kg (6.6 lbs)

Alarm output
Transistor Ri 1KΩ

Alarm Supply Voltage
8 - 28 V
**Mechanical switches**

**Type**
SPDT

**Size**
Sub Sub miniature

**Rating**
3 A/125 V AC
2 A/30 V DC

**Namur sensors**

**Type**
Proximity DIN 19234 NAMUR

**Load current**
\[ \leq 1 \text{ mA} \leq 3 \text{ mA} \]

**Voltage range**
5 - 25 VDC

**Hysteresis**
0.2 %

**Temp**

\[-20°C \text{ to } 85°C \text{ (−4°F to 185°F)}\]

**Proximity switches**

**Type**
SPDT

**Rating**
5 W/250 mA/30 V DC/125 V AC

**Operating time**
0.7 ms

**Breakdown voltage**
200 VDC

**Contact resistance**
0.1 \(\Omega\)

**Mechanical/electrical life**

\[ >50 \times 10^6 \text{ operations} \]

**4 - 20 mA transmitter**

**Supply**
9 - 28 VDC

**Output**
4 - 20 mA

**Resolution**
0.1 %

**Linearity full span**
\[ +/−0.5 \% \]

**Output current limit**
30 mA DC

**Load impedance**
800 \(\Omega\) @ 24 VDC
Certificate of Compliance

Certificate: 1278854
Project: 1278854
Issued to: Palmsiernas Instrument AB
Korta Gatan 9
Solna, 171 54 SWEDEN
Attention: Mr. Mats Ragnarsson

The products listed below are eligible to bear the CSA Mark shown

Issued by: R. Wiltsh
Authorized by: Marc Mlano
Operation Manager

PRODUCTS

Class 2238 02 - Process Control Equipment - For Hazardous Locations
Class I, Div. I, Groups C and D; Class II, Div. 1, Groups E, F and G; Class III, Div. 1: Excl. Type 4X:

Model D3E xUX+3VP32X Electronic-Pneumatic Valve Positioner: input rated 2S Vdc, 24 mA max. Temp.
Code 16 @ Max Ambient 65 Deg C; Temp. Code T5 @ Max Ambient 51 Deg C.
Note: the x's in the D3E model code denote minor mechanical and electrical variations.
1. **CERTIFICATE OF CONFORMITY**

2. Nemko Certificate reference: **Nemko Nr. Ex 01E385**

3. This Certificate is issued for the following electrical equipment, intended for use in potentially explosive atmospheres:

   Apparatus or system: Valve Positioner
   Certified type: D3E

4. Manufactured by:
   Palmeissna Instrument AB
   Kortes gatan 9
   5-17154 Solna
   Sweden
   The Manufacturer

5. The electrical apparatus or system and any acceptable variations thereof are specified in the Annex and possible supplement(s) to this Certificate and in the descriptive documents therein referred to.

6. Nemko, being an Approved Certification Body in accordance with Article 14 of the Council Directive of the European Communities of 18 December, 1975 (75/441/EEC), confirms that the apparatus has been found to comply with the following harmonized European Standards:
   - CENELEC EN 50014: 1997
   - A1: 1999
   - CENELEC EN 50018: 2000
   and has successfully met the type verification and test requirements of those standards.

   A confidential test report has been compiled on these verifications and tests.

   Test Report: 300039119

7. The code for the electrical apparatus is: EEx d IIB + H, T6/5 Ta: 65°C/80°C

8. By marking the supplied electrical apparatus, the manufacturer attests on his own responsibility that the apparatus complies with the descriptive documents referred to in the Annex to this Certificate and has satisfied all design and testing requirements of the harmonized European Standards referred to in point 6 above.

9. This electrical apparatus may be marked with the distinctive community mark as printed on this certificate, and specified in Annex II of the Council's Directive of 18 January 1984 (84/447/EEC).

   Total number of pages in the Annex to this Certificate: 2

   This Certificate may only be reproduced in its entirety and without change.

   Oslo, 2001-09-26

   [Signature]
   Head of Section for Ex-equipment

   [Signature]
   Certification Engineer
<table>
<thead>
<tr>
<th>Pos</th>
<th>Part no.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>D3-SP6</td>
<td>Cover incl. screws</td>
</tr>
<tr>
<td>2</td>
<td>D3-SP11</td>
<td>Internal cover incl. screws</td>
</tr>
<tr>
<td>3</td>
<td>P3-SP13</td>
<td>Cover plate incl. screws</td>
</tr>
<tr>
<td>4</td>
<td>P5-Sxx</td>
<td>Spindle adapter</td>
</tr>
<tr>
<td>5</td>
<td>D3-SP1</td>
<td>Block compl incl. cable, rubber seal, filter-plug</td>
</tr>
<tr>
<td>6</td>
<td>D3-SP9</td>
<td>Filter-plug incl. O-ring, filter</td>
</tr>
<tr>
<td>7</td>
<td>D3-SP8</td>
<td>Potentiometer compl incl. spring, holder, cable</td>
</tr>
<tr>
<td>8</td>
<td>D3-SP8-270</td>
<td>Potentiometer compl incl. spring, holder, cable, 270deg</td>
</tr>
<tr>
<td>9</td>
<td>D3-SP20</td>
<td>Shaft compl incl. gearwheel, friction clutch</td>
</tr>
<tr>
<td>10</td>
<td>D3-SP20-270</td>
<td>Shaft compl.incl. gearwheel, friction clutch, 270deg</td>
</tr>
<tr>
<td>11</td>
<td>D3-SP37</td>
<td>Pcb display assy</td>
</tr>
<tr>
<td>12</td>
<td>D3-SP35X</td>
<td>PCBs (terminal and processor)</td>
</tr>
<tr>
<td>13</td>
<td>D3-SP35H</td>
<td>PCBs (terminal and processor) HART</td>
</tr>
<tr>
<td>14</td>
<td>D3-SP35I</td>
<td>PCBs (terminal and processor) intrinsically safe</td>
</tr>
<tr>
<td>15</td>
<td>D3-SP35IH</td>
<td>PCBs (terminal and processor) intrinsically safe, HART</td>
</tr>
<tr>
<td>16</td>
<td>D3-SP35P</td>
<td>PCBs (terminal and processor) Profibus</td>
</tr>
<tr>
<td>17</td>
<td>P48A</td>
<td>Arrow pointer</td>
</tr>
<tr>
<td>18</td>
<td>D3-SP/SCREW</td>
<td>Kit, bag with screws</td>
</tr>
<tr>
<td>19</td>
<td>D3-SP/SEAL</td>
<td>Kit, bag with O-rings, seals</td>
</tr>
<tr>
<td>20</td>
<td>D3-SP42</td>
<td>Cables and PC boards to pneumatic block</td>
</tr>
<tr>
<td>21</td>
<td>D3-SP34G</td>
<td>Gaugeblock G, complete</td>
</tr>
<tr>
<td>22</td>
<td>D3-SP34N</td>
<td>Gaugeblock N, complete</td>
</tr>
<tr>
<td>23</td>
<td>D3-AS38M</td>
<td>Transmitter board, Mechanical switches, assy</td>
</tr>
<tr>
<td>24</td>
<td>D3-AS38N</td>
<td>Transmitter board, Namur sensors, assy</td>
</tr>
<tr>
<td>25</td>
<td>D3-AS38P</td>
<td>Transmitter board, Proximity switches, assy</td>
</tr>
<tr>
<td>26</td>
<td>D3-AS38T</td>
<td>Transmitter board 4-20, assy</td>
</tr>
<tr>
<td>27</td>
<td>D3-SP46G</td>
<td>Dumpvalve valve assy ÓGÓ for single acting</td>
</tr>
<tr>
<td>28</td>
<td>D3-SP46N</td>
<td>Dumpvalve valve assy ÓNÓ for single acting</td>
</tr>
<tr>
<td>30</td>
<td>D3-SP6WC</td>
<td>Cover incl. screws, Worcester</td>
</tr>
<tr>
<td>31</td>
<td>D3-67</td>
<td>Silencer</td>
</tr>
<tr>
<td>Pos</td>
<td>Part no.</td>
<td>Description</td>
</tr>
<tr>
<td>-----</td>
<td>----------</td>
<td>-------------</td>
</tr>
<tr>
<td>1</td>
<td>D3E-SP2</td>
<td>Front cover incl. screw</td>
</tr>
<tr>
<td>2</td>
<td>D3E-SP3</td>
<td>Terminal cover incl. screw</td>
</tr>
<tr>
<td>3</td>
<td>D3E-SP4</td>
<td>Internal cover incl. screws</td>
</tr>
<tr>
<td>4</td>
<td>P5-Sxx</td>
<td>Spindle adapter</td>
</tr>
<tr>
<td>5</td>
<td>D3-SP1</td>
<td>Block compl. incl. cable, rubber seal, filter-plug</td>
</tr>
<tr>
<td>6</td>
<td>D3-SP9</td>
<td>Filter plug incl. O-ring, filter</td>
</tr>
<tr>
<td>7</td>
<td>D3E-SP8</td>
<td>Potentiometer compl. incl. spring, holder, cable</td>
</tr>
<tr>
<td>8</td>
<td>D3E-SP8-270</td>
<td>Potentiometer compl. incl. spring, holder, cable</td>
</tr>
<tr>
<td>9</td>
<td>D3E-SP20</td>
<td>Shaft compl. incl. gearwheel, friction clutch</td>
</tr>
<tr>
<td>10</td>
<td>D3E-SP20-270</td>
<td>Shaft compl. incl. gearwheel, friction clutch</td>
</tr>
<tr>
<td>11</td>
<td>D3-SP37</td>
<td>Display pcb</td>
</tr>
<tr>
<td>12</td>
<td>D3E-SP35X</td>
<td>All PCB’s, (processor, mother, terminal)</td>
</tr>
<tr>
<td>13</td>
<td>D3E-SP35H</td>
<td>All PCB’s, HART, (processor, mother, terminal)</td>
</tr>
<tr>
<td>14</td>
<td>D3E-SP40</td>
<td>Terminal PCB</td>
</tr>
<tr>
<td>15</td>
<td>D3E-SP/Screw</td>
<td>Kit with screws D3E</td>
</tr>
<tr>
<td>16</td>
<td>D3E-SP/Seal</td>
<td>Kit with O-rings</td>
</tr>
<tr>
<td>17</td>
<td>D3E-SP42</td>
<td>Cable for pneumatic block, incl. 2 x PCB</td>
</tr>
<tr>
<td>18</td>
<td>D3E-SP46G</td>
<td>Dump valve G assy for D3E</td>
</tr>
<tr>
<td>19</td>
<td>D3E-SP46N</td>
<td>Dump valve NPT assy for D3E</td>
</tr>
<tr>
<td>20</td>
<td>D3E-SP18</td>
<td>Adapter complete for dump valv assy</td>
</tr>
</tbody>
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