

# P4 • P5/EP5



**PMV**  
Valve Control System



## IOM Instructions





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Manufacturers declaration • Hersteller-Erklärung • Déclaration de fabricant

**G B**

### **Manufacturers declaration**

in compliance with EC directive 89/ 392/ EEC, annex I I B and 89/ 336/ EEC.

We hereby confirm that the appliances described in this sheet has been manufactured in compliance with the applicable standards and is intended for installation in a machine/ application, and that commissioning is strictly prohibited until evidence has been provided that the machine/ application in question is also in compliance with EC directive 89/ 392/ EEC and 89/ 336/ EEC.

This manufacturers declaration is applicable to the following PMV-Positioner series:  
P4, P5, EP5, F5.

**D**

### **Herstel ler-Erkärung**

im sinne der EG-richtlinie 89/ 392/ EWG, A nhang I I B und 89/ 336/ EWG.

H iermit erklären wir, daß die in diesem Blatt beschriebenen Geräte entsprechend den gültigen Normen gebaut und zum Einbau in eine Maschine oder Applikation bestimmt sind, sowie daß deren Inbetriebnahme so lange untersagt ist, bis festgestellt wurde, daß diese Maschine/Applikation ebenfalls der EG-Richtlinie 89/ 392/ EWG und 89/ 336/ EWG entspricht. Diese H erstellererklärung hat für folgende PMV-Stellungsregler-Serien

Gültigkeit:

P4, P5, EP5, F5.

**F**

### **Déclaration de fabricant**

au sens dela directive de la CE 89/ 392/ CEE, annexe I I B et CE/ 89/ 336/ CEE.

N ous déclarons par la présente que les appareils décrits sur cette page sont construits en conformité avec les normes en vigueur et qu'ils sont destinés à être montés dans une machine ou une application, nous déclarons également que leur mise en service est interdite tant qu'il n'a pas été constaté que cette machine/application satisfait également à la directive CE 89/ 392 CEE et CE/ 89/ 336/ CEE.

Cette déclaration de fournisseur est valable pour les types d'appareils PMV suivants:  
P4, P5, EP5, F5.

Mr. Roland Wedebrand  
President, Palmstiernas Instrument AB

### Special Conditions for Safe Use

The enclosure is made of aluminium and any impact or friction caused by external objects shall be avoided in the application.


Rubbing of the window with dry fabrics shall be avoided when the positioner is used in an hazardous atmosphere in order to avoid potentially incandive static discharges.

Always check [www.pmv.nu](http://www.pmv.nu) for latest edition of manual.

# 1. Introduction

## P4

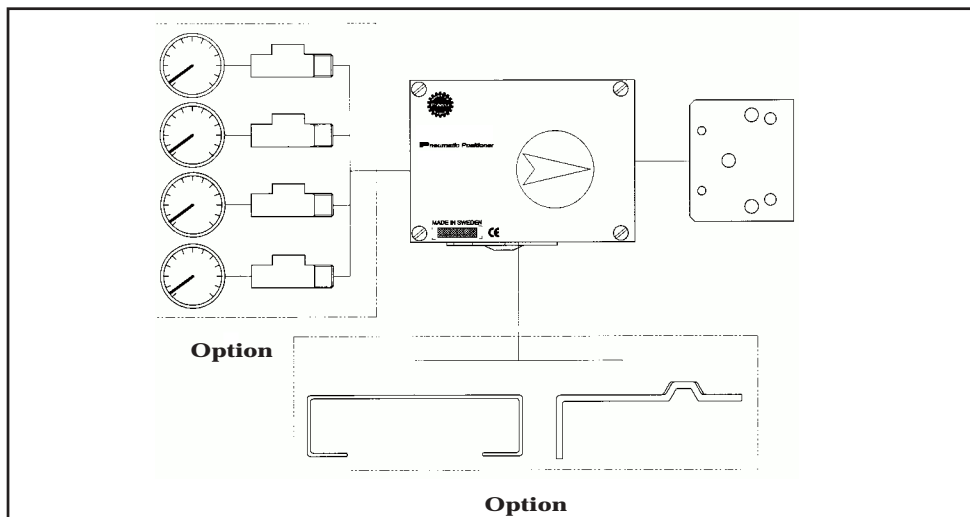
The P4 is a pneumatic valve positioner for double acting actuators, rotary or linear. It can also be used for single acting applications by simply plugging one of the outlet ports, C1 or C2.

ATEX:  II 2 G

It features a standardized foot print, external zero adjustment, gold plated spool valve, positive internal pressure and a bright visible position indicator. The simple, sturdy design with few moving parts together with the well proven spool valve design provides long and trouble free operation. Together with the unit, a wide range of mounting kits are offered for quarter turn and linear applications.

Calibration and set up is quick and simple, all done by thumb wheels. The unit requires a minimum of maintenance and the only tool needed is a flat screw driver.

For installation of gauges T-connectors are required.



## P5

The base unit of the system is the pneumatic positioner, used in either single or double acting applications. P5 comes standard with built in dampers, a high gain spool valve assembly, gauge ports and an O-ring sealed housing. The housing utilizes a unique O-ring seal that can be adjusted to a sealed or drained position.

The modular design concept allows for easy addition of accessories such as I/P converter and/or a feedback package, both which are isolated from the basic pneumatic unit. These accessories can be factory or field mounted.

Ease of calibration and maintenance are built into to the design with easily accessible span and zero adjustment, and very simple parts replacement.

ATEX:  II 2 GD

## EP5

The EP5 has same features and benefits as the P5 positioner. It's modular to suit several applications,

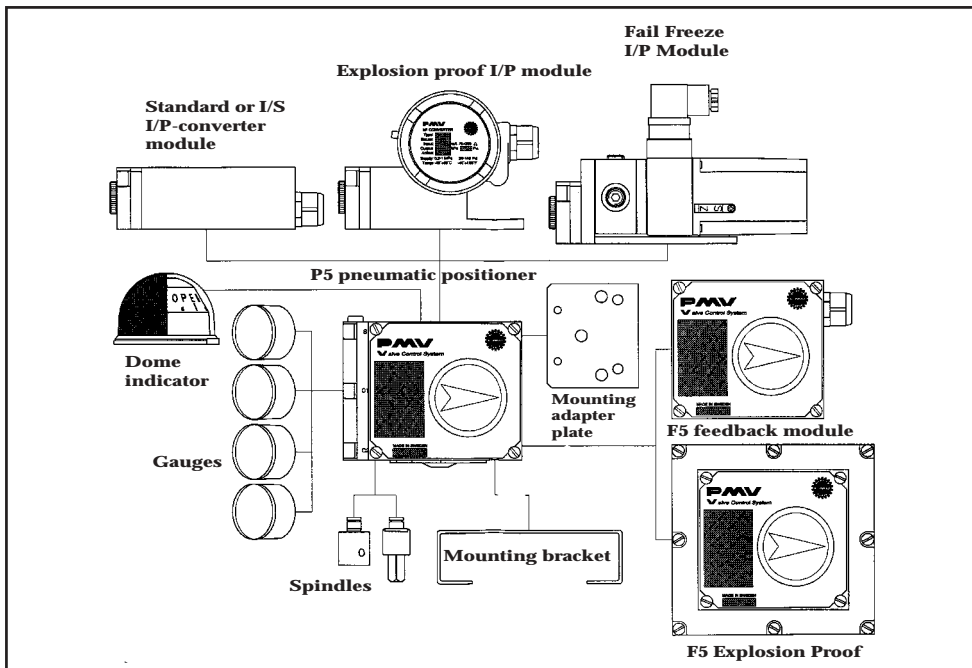
General applications, intrinsically safe, explosion proof and fail freeze versions are offered.

Intrinsically Safe: ATEX: EEX ia IIC T4  II 1 GD

CSA, FM Class I, Div, Group ABCD

Explosion proof: ATEX: EEX d IIB+H<sub>2</sub>, T4-T6  II 2 GD

CSA, FM Div I, Class 1,2 & 3 Group BCDEFG





## 2. Storage instructions

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### **PMV Positioner and feedback module storage and handling procedures**

PMV Positioners and feedback modules are precision instruments which should be stored and handled accordingly to avoid problems or damage.

Electropneumatic positioners/feedback modules contain electronic components which can be damaged by exposure to water. Appropriate precautions should be taken to protect units while in storage.

### **Warehouse storage**

Stored in original PMV shipping containers, units should be stored in an environmentally controlled area, i.e. clean, cool (15-26°C, 60-80°F) and dry, out of direct sunlight or weather exposure.

### **Field storage**

**Note:** Once the air supply to the positioner is connected and turned on, internal air bleed will prevent the ingress of moisture and protect the unit from corrosion. It is recommended that the air supply be left on at all times.

- If units are installed immediately, turn, and leave on, the air supply.
- If positioners must be stored outdoors, tighten all covers which may have loosened in shipment, make sure all open enclosure entry points are sealed.

Feedback modules should have cover tightened and conduits entries sealed. Positioners/ Feedback modules should be wrapped and sealed air and watertight with desiccant inside the plastic, units should be securely covered with an opaque cover and not exposed to direct sunlight, rain or snow.

### **Pneumatic positioners**

Units should have all ports sealed and be protected from direct exposure to weather. For long term storage (>1 month) or overseas shipment units should be protected with plastic and desiccant.

### **Potential damage mechanism**

When units are stored in hot, humid climates, the daily heating/cooling cycle will cause air to expand/contract and be drawn in and out of the positioner/feedback housing.

Dependent on the local temperature variations, humidity and dew points and time in storage condensation could occur and accumulate inside on the I/P Converter causing erratic operation or failure due to water and corrosion. The potential for condensation damage is especially high in southern climates and aggravated if units are exposed to direct sunlight.

**For further assistance, please contact you nearest PMV office.**

## Storage Seal (P5/EP5)

P5/EP5 is supplied with all enclosure entry points sealed. The seal is only a storage seal, not to be used as seal when P5/EP5 is in operation. If Storage Seal is removed or damaged, make sure all open enclosure entry points are proper resealed before further shipping or storage.

Use circular stickers marked **I**, **S** and **OUT**, supplied on Storage Seal or vapour proof tape.

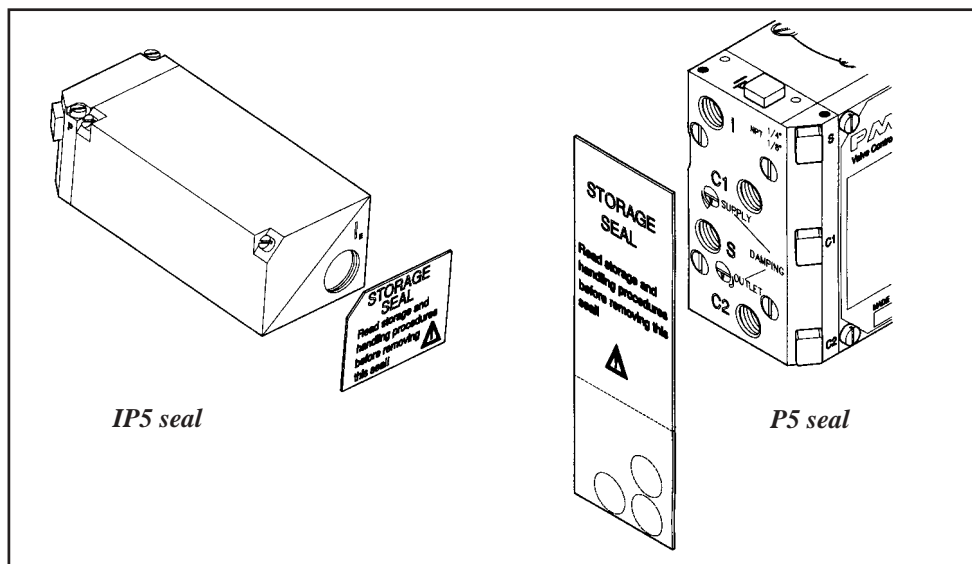
### P5

Remove Storage Seal from connection block, mount positioner on actuator/valve, make connections according to section 5, (Page 10). Calibrate span and Zero according to section 7, (Page 13).

Clean any oil/debris off the connecting block, then reseal open enclosure entry ports, use circular stickers marked **I**, **S** and **OUT**, supplied on Storage Seal or vapour proof tape.

### EP5

Follow P5 instructions as above. Remove Storage Seal for conduit entry **IE**, connect input signal cable and install proper cable gland to secure the units sealing.



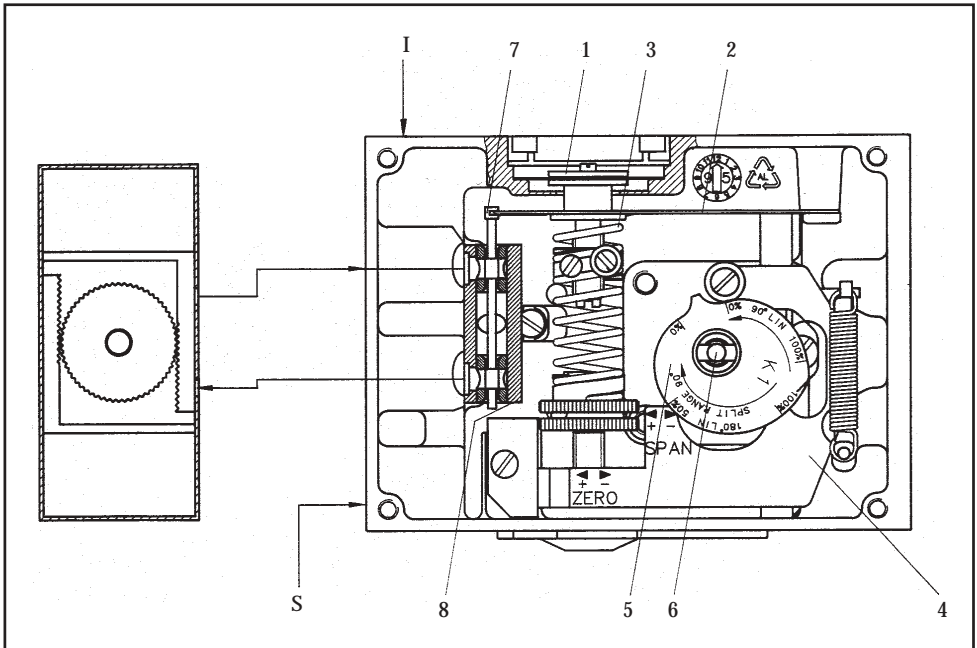
# 3. Function

The P4 and P5/EP5 operates on a force balance principal. Force is originated by the signal pressure transmitted through a diaphragm on to the balance arm. The opposing force is achieved through the feedback spring and is proportional to the position of the lower arm.

The lower arm position is determined by the position of the cam which is secured to the spindle and connected to the actuator shaft thus providing the feedback from the actuator/valve. When these two forces are equal, the balance arm and the spool in the pilot valve are in a neutral position — the complete unit is in a balanced position. Air is supplied to the pilot valve through port S, and controls the air flow through ports C1 and C2

## Assume an equilibrium position.

An increased control pressure will deflect the diaphragm **1** down, compressing the feedback spring **3**. The balance arm **2** moves the spool **7** in the pilot valve **8** furnishing supply air to the actuator, while at the same time air is exhausted from actuator and is vented to atmosphere through the pilot valve and the OUT port . With the increased supply air, the actuator rotates (or moves linearly) moving the positioner spindle **6**. The spindle and cam **5** rotate, forcing the lower arm **4** upwards compressing the feedback spring **3**. This motion will continue until the two forces are equal and the unit is in an equilibrium position.





## 4. Installation

### Air requirements

Maximum supply pressure is 1 MPa (150 psi). Supply air shall be clean, dry and free from oil, water, moisture, foreign parts and debris.

The air shall be freeze-dried or similar to a dew point of at least 10°C (18°F) below lowest expected ambient temperature.

A <40µ filter/regulator is recommended to be installed as close to P4/P5/EP5 as possible to ensure proper supply air quality.

Before making pneumatic connections to the positioner, it is recommended that the supply air lines are opened up and allowed to vent for 2-3 minutes to clear any debris from the line. It is further recommended that a large paper bag is used to collect any oil or humidity that may be present in the line during this purging, direct the air flow into the bag. Should excessive amounts of oil and/or humidity be present at this stage, a review of the pneumatic system should be carried out and the problem corrected.

**Poor air quality is one of the major causes of premature failure of pneumatic equipment.**

### Installation

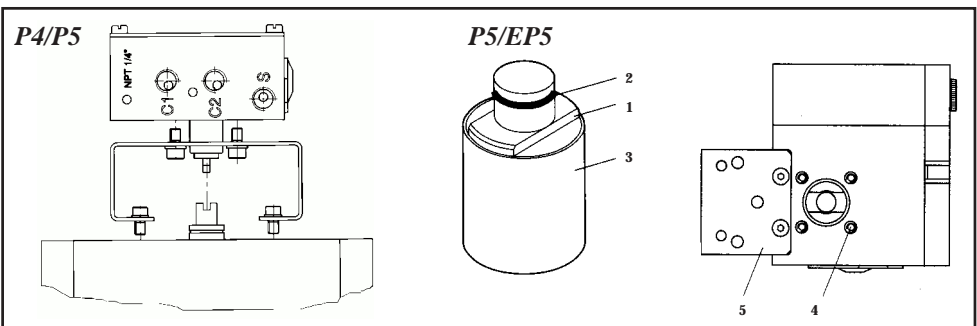
P4 and P5/EP5 mounts on to the actuator using either the ISO F05 holes **4** and a PMV ISO mounting kit or by using the optional mounting adaptor and screws **5** to mount P5 on to existing PMV mounting kits.

Proper alignment of the positioner spindle to the actuator shaft is very important since improper alignment can cause excessive wear and friction to the positioner.

### P5/EP5 only

The spindle/positioner shaft assembly allows for quick and simple spindle changes. To ensure the proper connection, the spindle **3** has a spring clip **2** that must be properly installed. A solid "click" should be felt when assembling the two pieces insuring that the two flats **1** are engaged into the positioner shaft groove.

The spindle can be removed, by inserting two screwdrivers under the two tapered surfaces of the spindle and bending carefully. When the spring clip releases the spindle will eject.





# 5. Connections

Air connections are tapped for 1/4" G or NPT male connectors and are clearly marked.

Gauge ports are for 1/8" G or NPT.

We recommend use of Loctite® 577 or similar user preferred for sealing.

Electrical connection on I/P unit accepts 1/2" NPT or PG 13,5 (M20) cable gland.

**Port I** Input instrument pneumatic signal 20-100kPa (3-15 psi)

**Port S** Supply air, maximum 1 MPa (150 psi) Minimum 0,15 MPa (21 psi) for EP5

**Port C1, C2** Actuator connections (0,2-1 MPa). C2 opening port.

For single acting operation plug port **C1** for increasing signal to open valve. Plug **C2** for decreasing (reverse) signal to open valve.

**OUT** Exhaust air port. **Do not block!** Exhaust filter optional.

**Port Ip** Gauge port for pneumatic input signal.

**Port I<sub>E</sub>** Input electric signal (4-20 mA) (On the I/P unit.)

**Port P** Gauge port for I/P unit output pressure ( On the I/P unit)

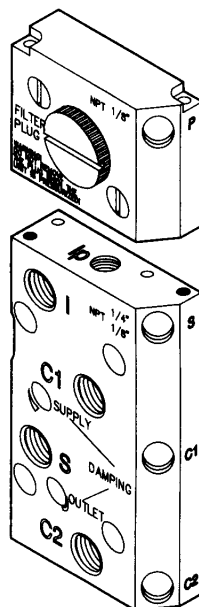
*P5/EP5 only*

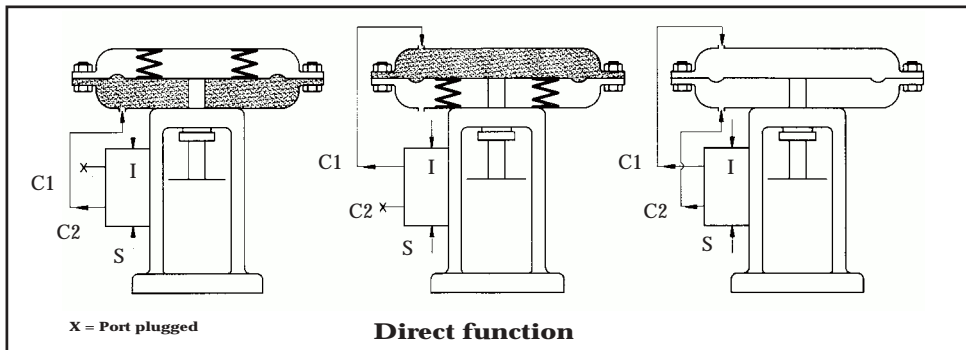
Ports **Ip, P, S, C1 and C2** are sealed with plugs. To install gauges, unscrew plugs and replace with gauges.

Port **OUT** is for venting the unit. All air from the positioner, actuator and I/P unit is vented to atmosphere through this port. **Do not block this port.** A high flow silencer or an exhaust pipe can be connected to this port to prevent foreign objects from entering and blocking the units exhaust. Connector in exhaust port must not have less than 9 mm (3/8") orifice.

When using gases other than air for supply — Please contact PMV.

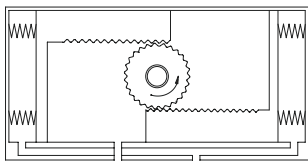
On EP5 (P5 with I/P unit installed) I/P unit is supplied with air from port **S**. Port **I** is automatically sealed off and protected. No connection shall be made to this port. See pages 13 and 14 for more information.



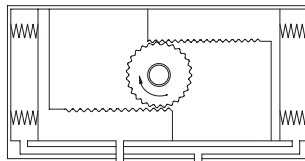


Direct function  
Air to open

Reverse function  
Air to close

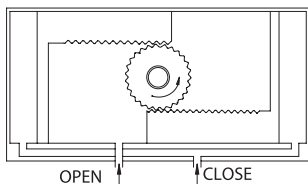


PLUG C1



PLUG C2

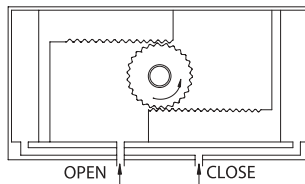
Spring  
Return



OPEN

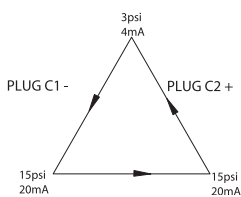
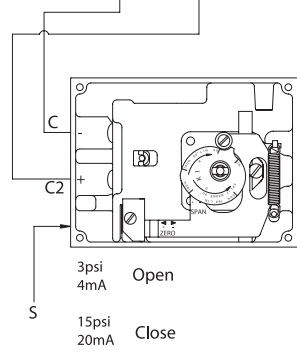
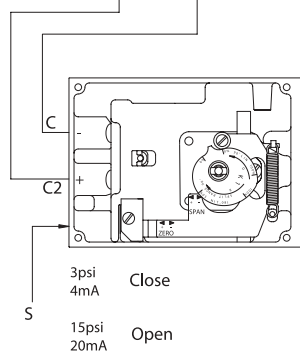
CLOSE

Double  
acting



OPEN

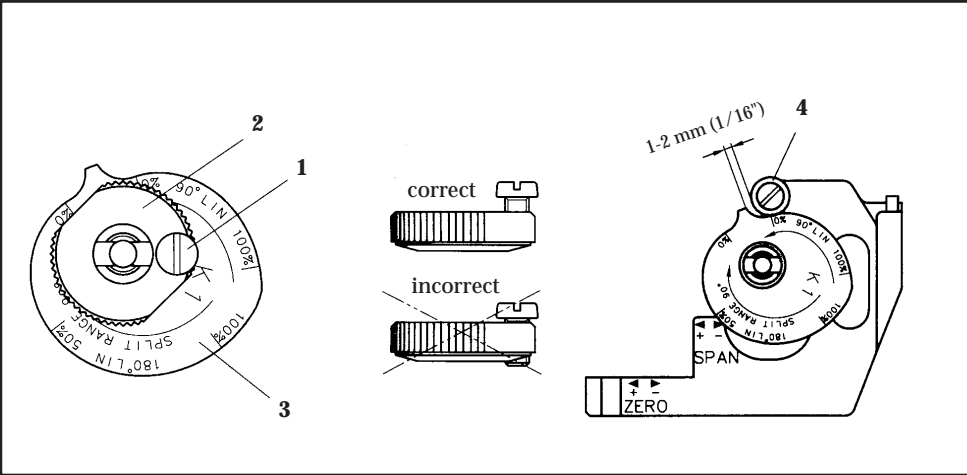
CLOSE



Signal/connection  
Spring return actuator

# 6. Cam adjustment

With the cover and indicator removed, loosen the screw **1** and turn the cam locking nut **2** counterclockwise until the cam loosens. Adjust the cam **3** as desired making sure that the ball bearing **4** always is riding on an active lobe on the cam. To secure the cam, make sure that screw **1** is backed out from the locking nut **2** then finger tighten the locking nut and tighten screw **1**. Install and adjust the indicator and reinstall cover.



# 7. Calibration

P4/P5/EP5 is when shipped from PMV pre-calibrated for  $90 \pm 0,5$  deg rotation, (can also be 30, 45 or 60 deg, see installed cam). For most applications the valve closed position is more critical than valve open position, most attention should be paid at valve closed position. Always start calibration procedure by applying 0 % input signal, then adjusting zero. P4/P5/EP5 is calibrated by turning thumb wheels **1** & **4**.

Arrows on arm **5** indicate turning direction of thumb wheels.

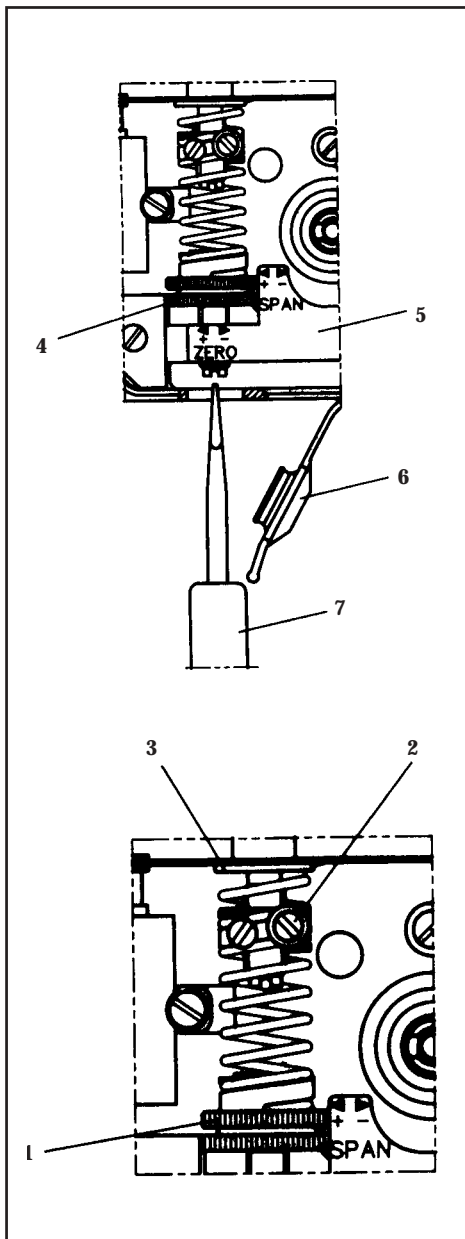
< “+“ = Increase zero/span

> “-“ = Decrease zero/span

## Calibration procedure

Check cam seating, section 6 before starting calibration procedure.

1. Apply 0 % input signal (0% = 20 kPa/3 psi or 4 mA)
2. Wait for steady state.
3. Adjust zero by turning the silver (lower) thumb wheel **4** with finger or with screwdriver **7** from the outside.
4. Apply 100% input signal (100% = 100 kPa/ 15 psi or 20 mA)
5. Wait for steady state then memorize result.
6. Apply 0% input signal.
7. Adjust span if necessary. This is done by first loosening screw **2**, then turning the yellow (upper) thumb wheel **1** “+“ or “-“ and finally tightening screw **2**. Spring top must not be in contact with spring guide **3**.
8. Check zero and adjust if needed.
9. Repeat steps 2 to 8 until desired calibration is achieved.



## 8. Indicator adjustment

**P5/EP5:** To adjust the indicator, take off front cover and pull the indicator upwards until it comes off the Allen screw.

Before installing the indicator make sure that the Allen screw is tightened. Press the indicator on the screw and adjust it by rotating clockwise to desired position.

**P4:** Loose screw, adjust indicator, tighten screw.

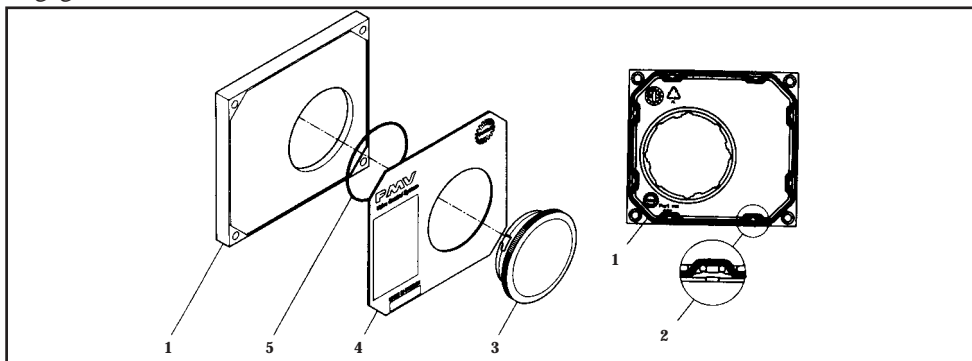
## 9. Front cover and indicator cover

The front cover of P5 is secured to the pneumatic unit with four captured screws and sealed with an O-ring **1**. The O-ring can be looped over notches **2** in the front cover to allow for drainage. There are eight locations on the front cover where the O-ring can be looped. This O-ring system is common to the Pneumatic unit, I/P unit and Feedback unit in the PMV Valve Control System P5. This unique sealing system allows for complete sealing or draining of the units by changing the position of the O-ring.

The indicator cover **3** is O-ring sealed and secured by a bayonet coupling. The indicator cover is also used to secure the identification cover **4**.

To remove the indicator cover turn it slightly counterclockwise until it loosens. Identification cover and O-ring **5** are now removable.

When installing indicator cover and identification cover make sure that the O-ring is properly engaged.



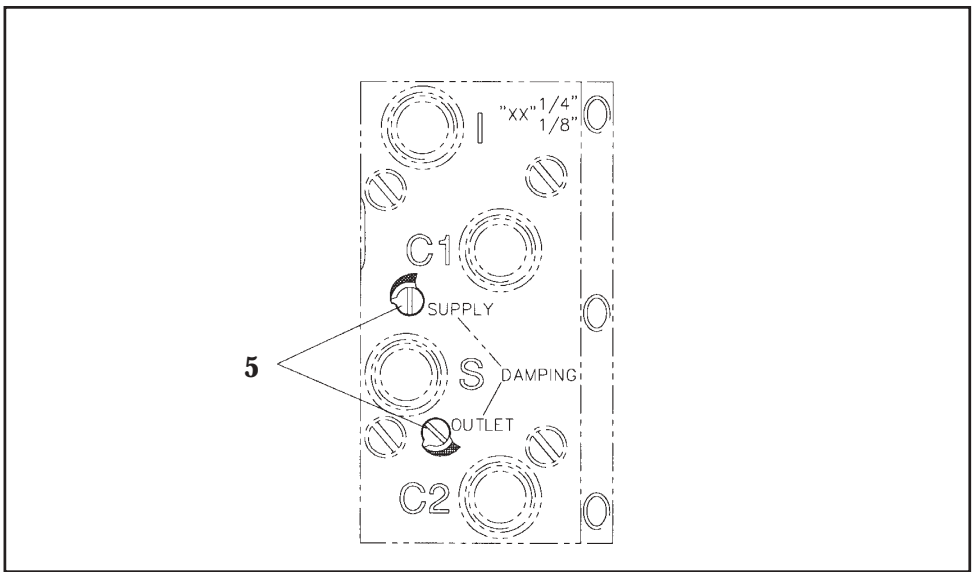
# 10. Dampers (P5/EP5)

The standard built in dampers **5** located on the connecting block provide a simple means of adjusting the actuator travel speed.

For maximum actuator travel speed dampers shall be adjusted to minimum damping position. (Fig).

**Double acting actuators** – adjust only OUTLET damper, set SUPPLY damper in minimum damping position.

**Single acting actuators** – adjust both dampers for desired operation.



# 11. I/P Unit (P5/EP5)

**WARNING! Units installed in hazardous areas must have proper approvals.**

The I/P unit is mounted directly on top of the positioner unit. No external air supply is needed since the I/P unit is supplied with air from the positioner unit.

Port I on the positioner unit will be plugged when the I/P unit and the appropriate gauge block gasket installed. The I/P unit accepts a 4-20 mA input signal.

The I/P unit is equipped with a built in 30 micron filter (Fig 4).

**Caution:** Do not operate the unit without filter and filterplug installed. Ensure that wiring between I/P and terminals are properly seated in rubber clamp.

Do not unscrew filterplug when the positioner is pressurized.

Span and Zero for the I/P converter is factory set and can not be adjusted

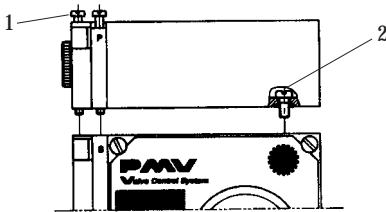


Fig 1



Fig 2

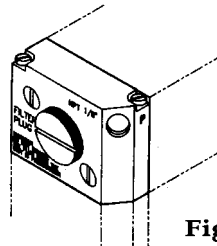


Fig 4

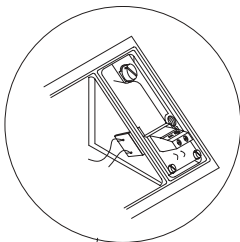


Fig 3

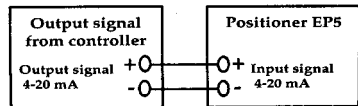
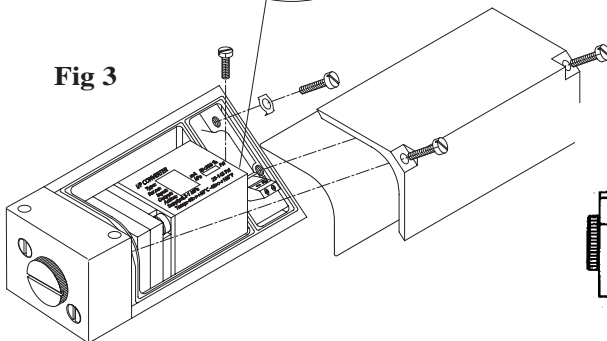


Fig 5

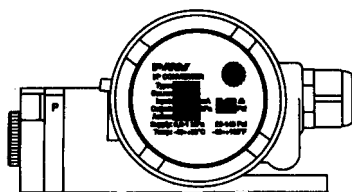


Fig 6



## 12. How to mount the I/P Unit to the positioner unit (P5/EP5)

Switch off supply air and disconnect input signal – port **I**.

Loosen screws **3** and remove connection block **1**, the gauge or plug from port **I<sub>p</sub>**, the fitting from port **I** and existing gasket **4**. Carefully install gasket **6** supplied together with I/P unit. When correct installed port **I** will be blocked by the gasket.

Make sure that relief valve spring **5** is installed properly. Install the connection block **1** to the positioner unit **2**.

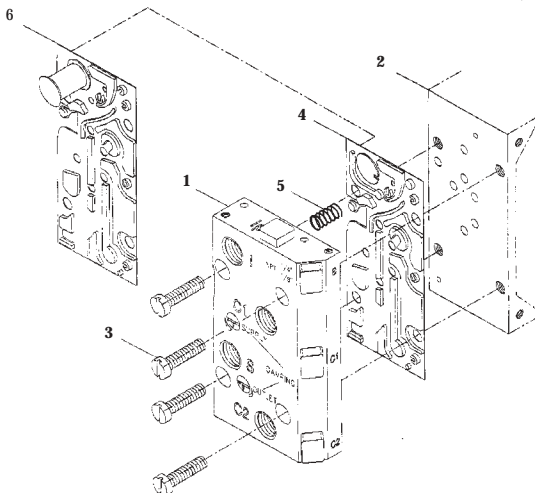
Remove cover on I/P unit.

Install the I/P unit to the top of the Positioner unit, making sure that the four O-rings are present and properly seated. Tighten the unit with the three screws. (See fig. 1 and 2 page 16) Screw **1** first, screw **2** last.

**WARNING!** Units installed in hazardous areas must have proper approvals.

Connect input signal cable to port **I<sub>e</sub>** and tighten the cable gland (see fig 5 on page 16). Adjust the O-ring on the I/P Unit housing to desired position - sealed or drained. (See fig 3 on page 16 or section 9 on page 14).

A gauge indicating output signal from the I/P converter can be installed in port **P**. Make sure that the filter plug is tightened before supply air is switched on (Fig 4 on page 16).



# 13. Maintenance



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

Please contact your local PMV Sales office for information regarding proper procedures.

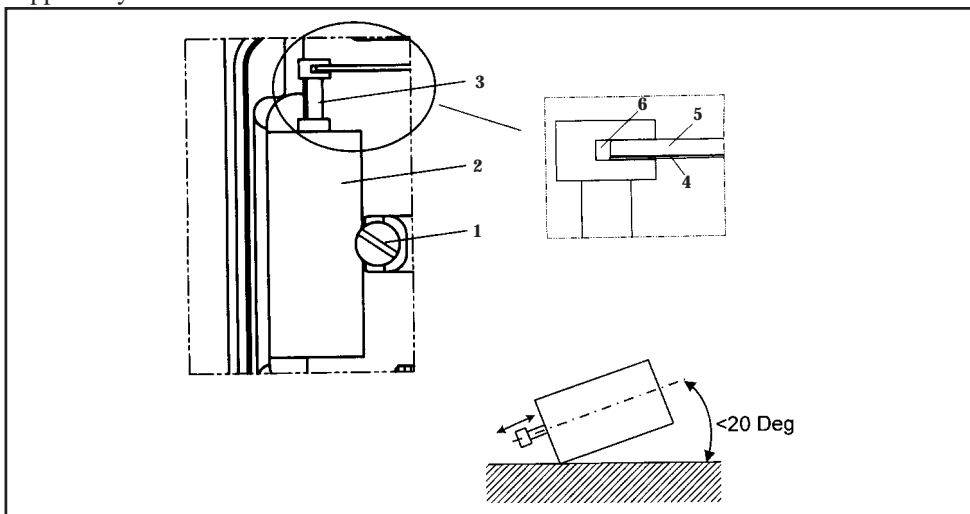
[www.pmv.nu](http://www.pmv.nu) or [info@pmv.nu](mailto:info@pmv.nu)

## Pilot valve

To remove the pilot valve for cleaning or inspection, remove the screw **1** and carefully lift out the complete assembly **2**. Gently remove the spool **3** from the block and clean the parts, using methylate cleaner or similar. Blow the parts dry with compressed air. Install the spool into the pilot valve housing, place it on a flat surface, then lift it carefully in one end. Before reaching 20 deg angle the spool should slide by itself.

Should the parts show signs of wear, a new assembly is recommended. Mixing spool valves and valve bodies may result in very high bleed rates and poor performance. Check the O-rings, then secure and install the pilot valve assembly into positioner unit, press it towards the positioner housing wall and secure it with screw **1**. Make sure that the leaf spring **4** on the balance arm **5** is properly fitted in the groove on the spool **6**. Check again to insure smooth operation of the assembly.

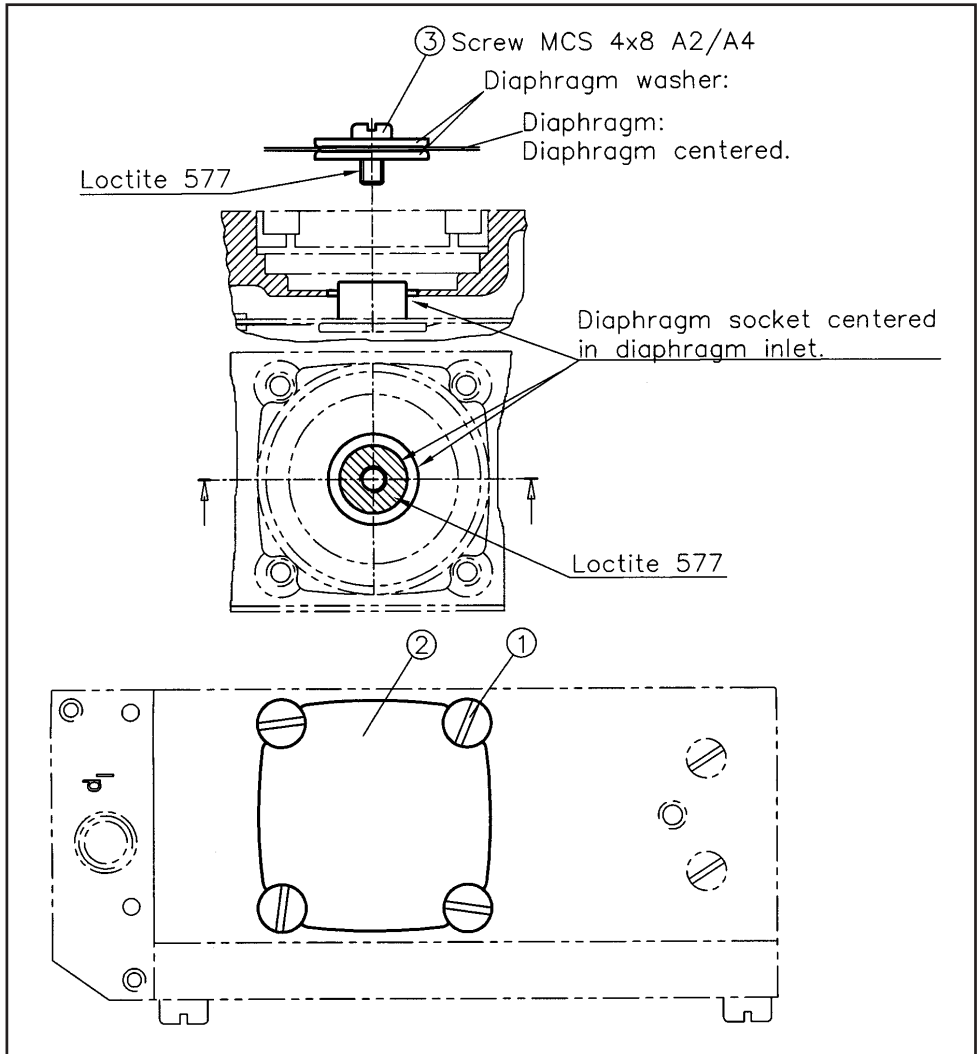
To maintain original factory performance specifications, use only spool valve assemblies supplied by PMV.



## Diaphragm

If P5 is equipped with I/P unit (EP5), the I/P unit must be removed to access the diaphragm. When installing the diaphragm make sure to place one washer on each side of the diaphragm. Put some Loctite 577 on the thread, install the screw **3** and tighten.

Make sure the diaphragm is centered.



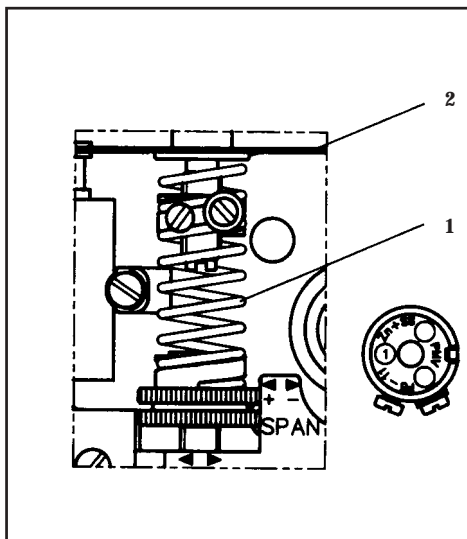
Check the O-ring for the diaphragm cover **2**, install the O-ring into the positioner housing, then install cover **2**. Secure crosswise with screws **1**, first turn loosely. Torque shall be 4,5 Nm (40 in-lbs).

## Feedback spring

Once the front cover and indicator are removed, the feedback spring can be easily accessed.

Hold the spring **1** from the top, pull down and out.

When installing, hold the assembly at the top, guide the lower part to position on the zero screw, then press down until it fits easily under the balance arm **2**. Make sure that the assembly is aligned properly against the lower arm and the notch is engaged in the tab on the balance arm **2**.

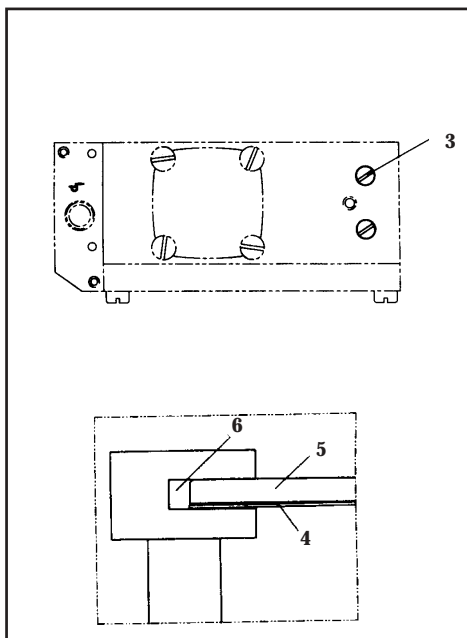


## Balance arm

The balance arm **3** can only be removed after I/P unit, diaphragm and feedback spring have been removed. (See sections above and on page 16, 18 and 19).

Loosen the screws **3** and the balance arm can be removed.

installing the balance arm make sure that the leafspring **4** on the underside of the balance arm **5** is properly engaged into the groove **6** of the spool in the pilot valve. Tighten the two screws **3** holding the balance arm to the positioner.



## Lower arm

Once the front cover is removed, the lower arm can be easily accessed.

Remove the indicator, feedback spring and the cam.

Loosen screw **2** and remove twist stop **1**.

Remove screw **3**, lower arm **4**, rod **5** and spring **6**.

Check rod and lower arm for wear, replace if necessary. Clean the rod and install it in the lower arm. The lower arm should move easily and smoothly.

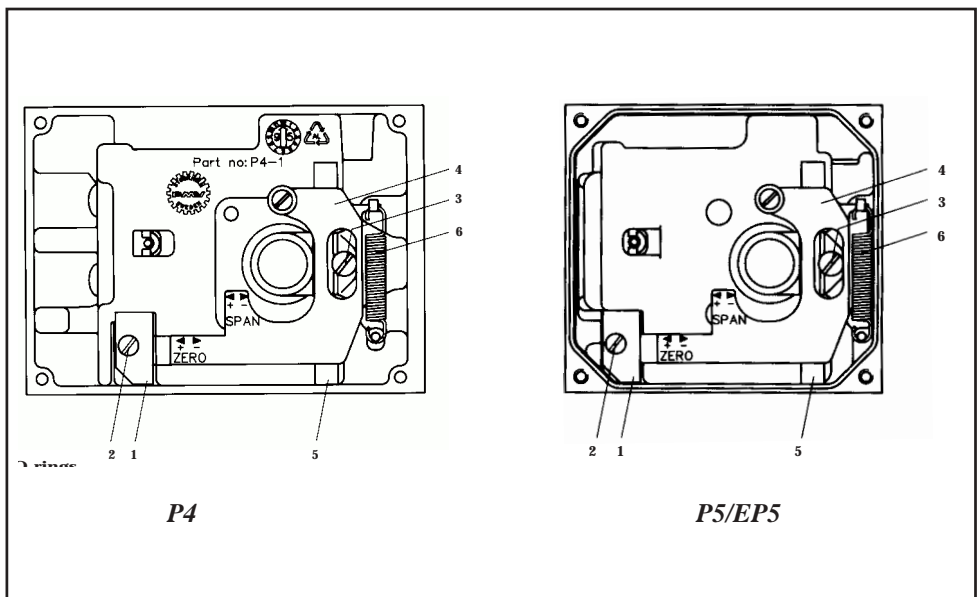
Install the lower arm and rod assembly into the positioner housing, making sure that the spring **6** is attached properly to the lower arm and positioner housing.

Secure the lower arm and rod assembly with the screw **3**.

Check again that the lower arm moves smoothly.

Apply a small amount of grease on the small tongue on the lower arm, then install and secure the twist stop.

Install cam, feedback spring, indicator and front cover.





## O-rings

With time and use, O-rings can become brittle. This can cause poor operation and even failure of the positioner.

Always check O-rings when performing any work on the positioner and replace bad O-rings.

A thin layer of silicon grease applied on the NBR (Black) O-rings prolongs their life. On Q (red) O-rings, use a non silicon based grease.

## Filter plug (EP5)

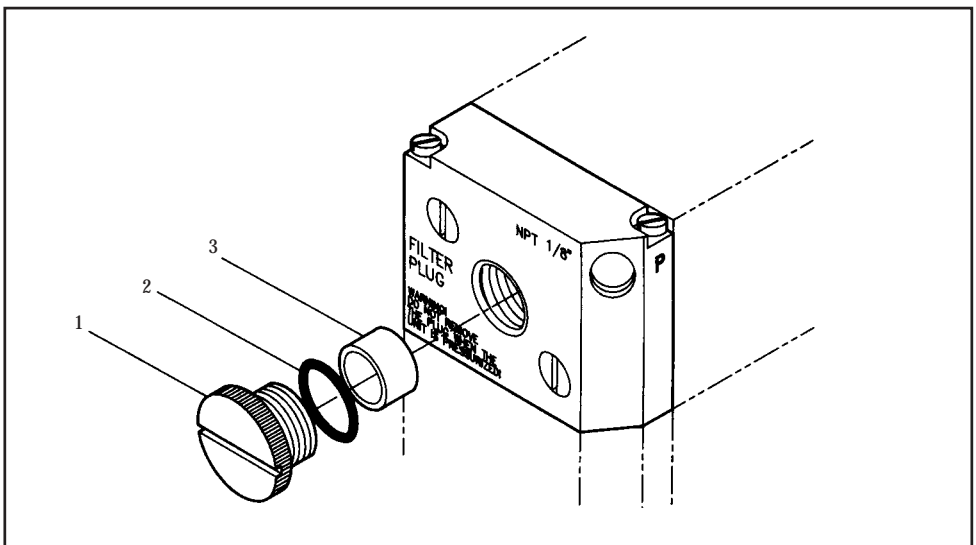
**Caution! Do not operate the unit without filter and filter plug installed. Do not attempt to unscrew filter plug while positioner is pressurized.**

EP5 is equipped with a built in secondary filter located on the side of the I/P unit.

For replacement or inspection, make sure that positioner unit is not pressurized, then unscrew filter plug **1**. Remove filter **3** and install a new into the filter plug . Check condition of O-ring **2** and filter compartment. If moisture is found, check upstream filters/oil-water separators.

Moisture can cause I/P failure.

Reinstall filter plug.



## 14. Feedback unit (P5 or EP5)

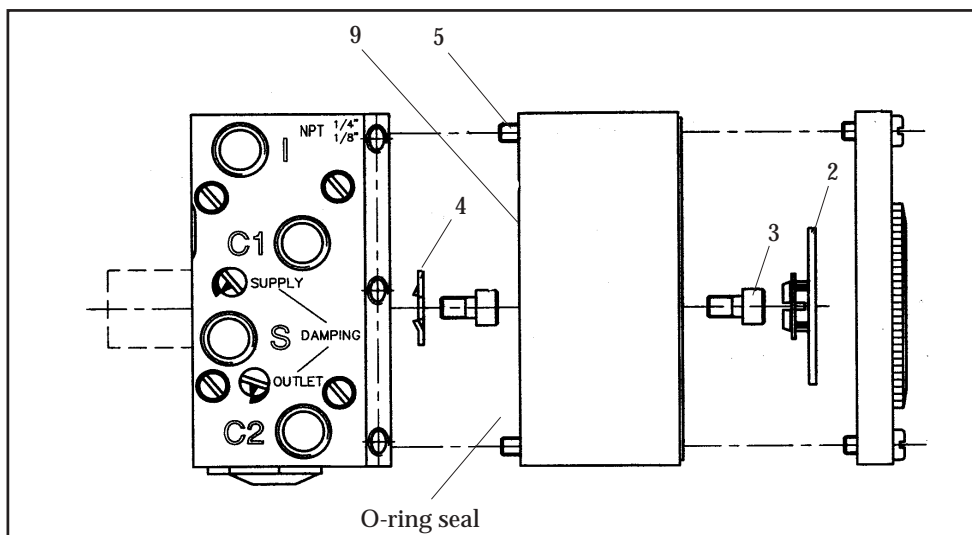
See feedback module instructions for connections and calibration.

The P5 or EP5, Valve Control System, can easily be equipped with a Feedback unit, model F5. This unit will mount directly on top of the Pneumatic positioner replacing the positioner front cover. The O-ring located on the bottom of the Feedback unit, F5, will provide the same sealing or draining capabilities as the front cover. The indicator and front cover from the positioner unit can then be installed on to the Feedback unit.

**WARNING! Units installed in hazardous locations must have proper approvals.**

Installing the feedback unit.

- Remove the front cover, indicator, and Allen head screw from the top of the positioner spindle.
- Install the drive coupling **4** and adjust the O-ring seal on the bottom in either sealed or draining position. (See section 6, page 10).
- Install the Feedback unit **9** on top of the Positioner unit, making sure the coupling is properly engaged before tightening the four screws **5**.
- Make electrical connections and tighten cable glands. (See F5 manual for details).
- Adjust cams and/or potentiometer to desired position.
- Install the indicator and front cover.



## 15. Trouble shooting

---

Note: All PMV-positioners are serialized. Please note down, and provide the serial number when contacting the factory for trouble shooting or service.

Signal change has no effect on the actuator position.

- Check indicator and screw.
- Check air supply to positioner and tubing to the actuator.
- Check input signal to positioner.
- Check diaphragm for damage or leakage.
- Check pilot valve function.
- Check cam for correct setting.
- Check I/P output

Signal change results in actuator running to end positions.

- Check coupling between positioner and actuator.
  - Check cam position and locking screw.
  - Check input signal.
- Inaccurate positioning.
- Dirty or worn pilot valve.
  - Defective or leaking diaphragm.
  - Input signal fluctuates.
  - Incorrect sizing of actuator.
  - Valve/actuator "stiction".
  - High valve/actuator breakaway torque.
  - Loose cam.



# 16. Technical data

## P4

---

Input Signal	20-100 kPa/3-15 Psi (6-30 Psi optional)
Linearity (%)*	0,7
Hysteresis+deadband (%)*	0,8
Repeatability (%)*	0,5
Pressure gain at load 20% (%/%)	20 %/% ISA 75.13 1989 (kPa/kPa) 300

Air consumption at supply pressure:

0,6 MPa/87 Psi 8 nl/min (0.31 SCFM)

Air delivery at supply pressure:

0,2 MPa/29 Psi 140 nl/min (5.46 SCFM)  
0,4 MPa/58 Psi 245 nl/min (9.55 SCFM)  
0,6 MPa/87 Psi 350 nl/min (13.65) SCFM

Supply Pressure Max 1 MPa/150 Psi  
Temperature range -20°C to +85°C (-4°F to 185°F)  
Connector threads 1/4" NPT  
Weight std. 0,9 kg/2 lbs

\* % of full scale.



## P5

## EP5

Input Signal	20-100 kPa/3-15 Psi (6-30 optional)	4-20 mA
Linearity	≤ 0,5%*	≤ 0,5%*
Hysteresis	≤ 0,75%*	≤ 0,5%*
Repeatability	≤ 0,5%*	≤ 0,5%*
Gain	(pressure 600 kPa/87 Psi) 1 000 (kPa/kPa) Min 66%/ % ISA S75.13	

Air consumption at Supply pressure:

0,2 MPa/29 Psi	5,4 nl/min 0.19 SCFM	6,1 nl/min 0.22 SCFM
0,4 MPa/58 Psi	12,3 nl/min 0.43 SCFM	13,6 nl/min 0.48 SCFM
0,6 MPa/87 Psi	20 nl/min 0.71 SCFM	22 nl/min 0.78 SCFM
0,8 MPa/116 Psi	27,8 nl/min 0.98 SCFM	30,5 nl/min 1.08 SCFM
1 MPa/145 Psi	35,7 nl/min 1.26 SCFM	39 nl/min 1.38 SCFM

Air delivery at Supply Pressure:

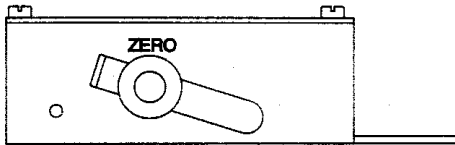
0,2 MPa/29 Psi	200 nl/min 6.9 SCFM	
0,4 MPa/58 Psi	370 nl/min 12.8 SCFM	
0,6 MPa/87 Psi	540 nl/min 18.8 SCFM	
0,8 MPa/116 Psi	710 nl/min 24.7 SCFM	
1 MPa/145 Psi	880 nl/min 30.6 SCFM	
Supply Pressure Max 1 MPa/150 Psi		0,15-1 MPa/21,8-150 Psi

Temperature range	-20°C to +85°C (-4°F to 185°F)	
Connector threads	1/4" NPT or G	
Gauge threads	1/8" NPT or G	
Weight std.	1,1 kg/2.4 lbs	1,5 kg/3.4 lbs
Weight with gauges	1,3 kg/2.9 lbs	1,8 kg/3.9 lbs
Ingress protection		IP 66/NEMA 4

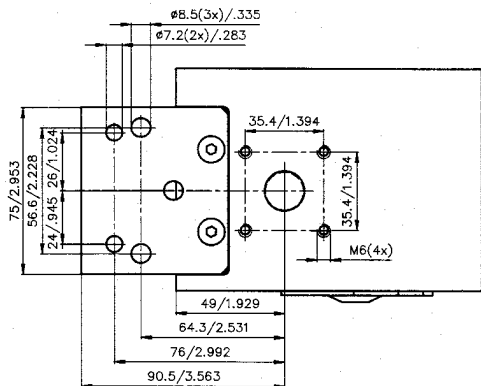
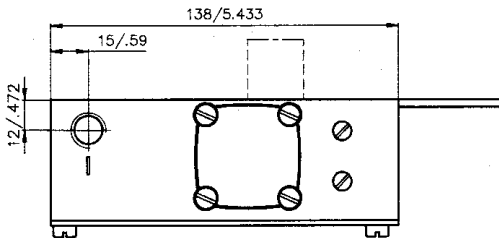
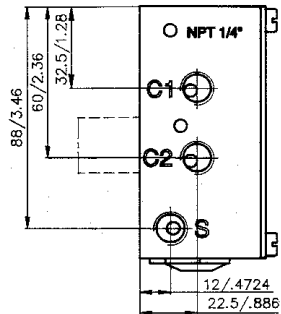
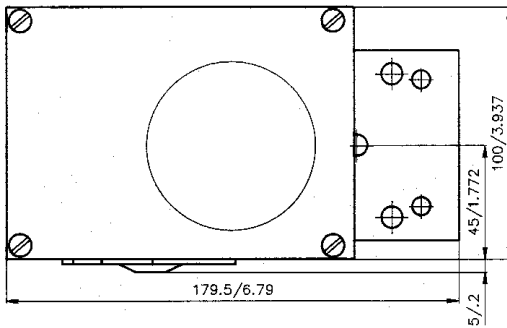
\* Per cent of full scale.

(The information in this manual is subject to change without notice.)

# Dimensional drawing (P4)

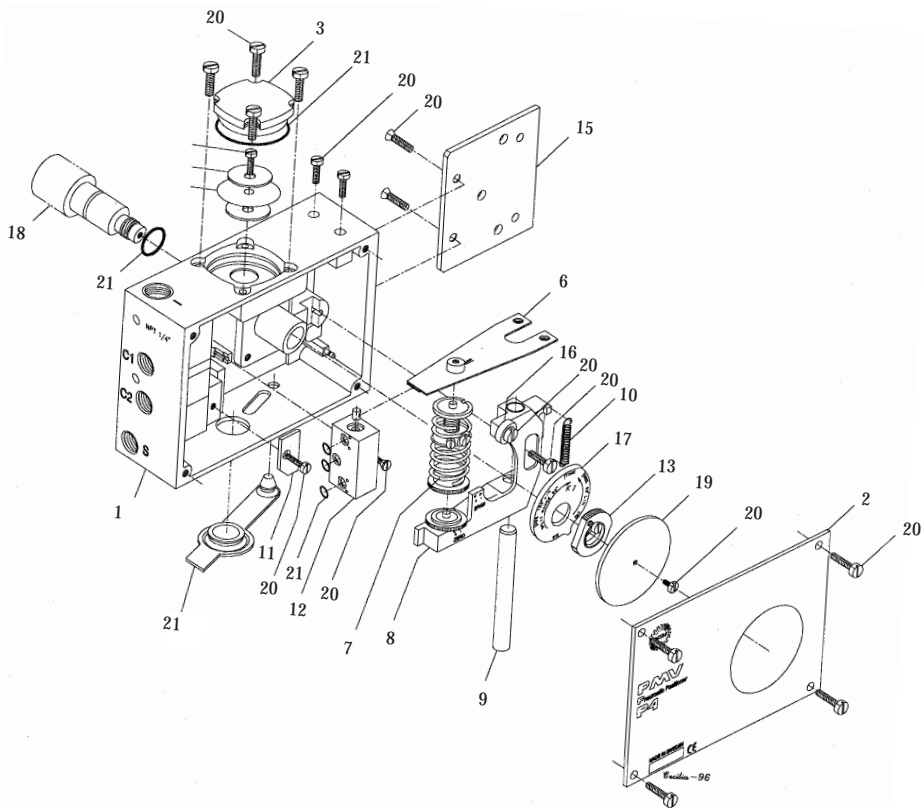


For selection of the feedback-spindle pls see "Drive shaft dimension drawing"



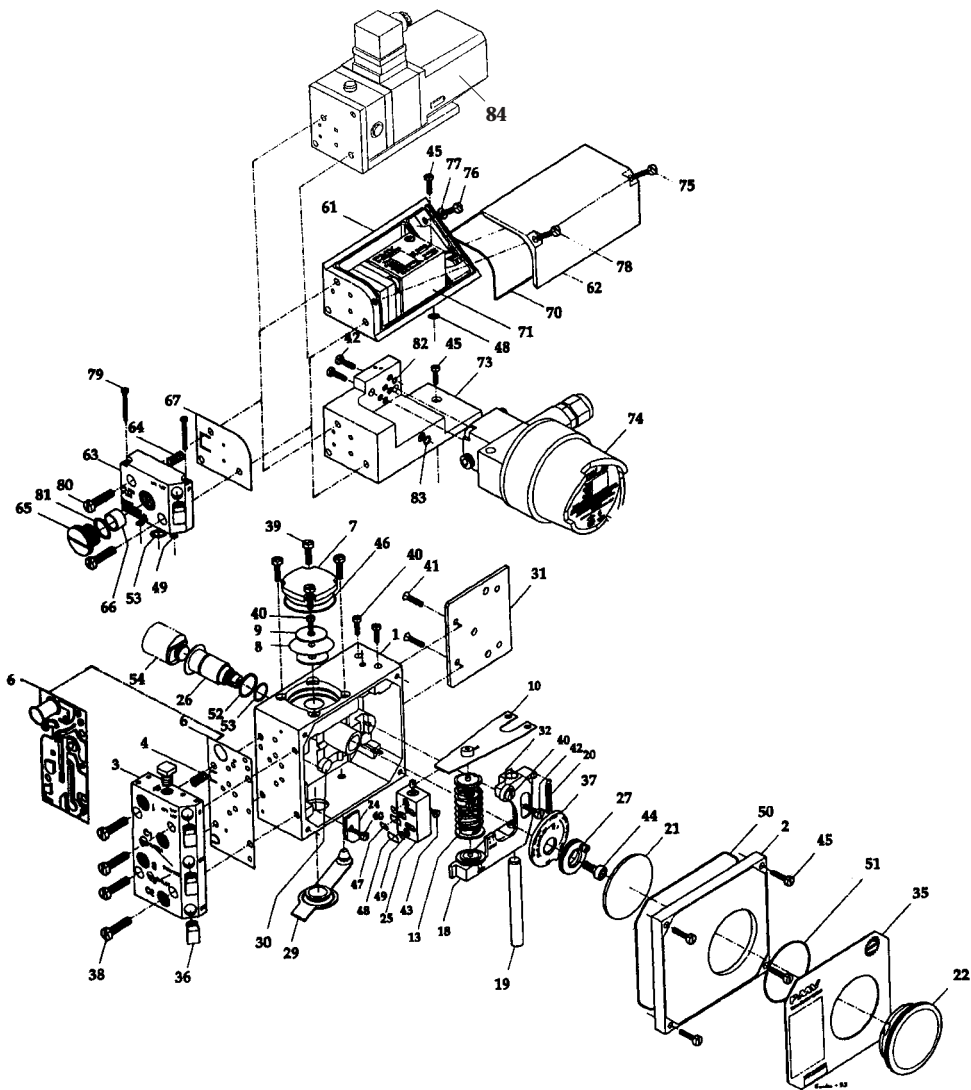
# 17. Spare parts

P4



No	Part no	Qty	Description	Remarks
1.		1	Housing 1 N/A	
2.	P4-xx	1	Front cover	
3.	P4-7	1	Diaphragm cover incl. O-ring	
4.	P5-8	1	Diaphragm	
5.	P5-9	2	Diaphragm washer	
6.	P5-10	1	Balance arm	
7.	P5-AS13/315	1	Feedback spring 3-15 Psi assembly	
7.	P5-AS13/630	1	Feedback spring 6-30 Psi assembly	(Green)
8.	P4-AS18	1	Lower arm assembly	
9.	P5-19	1	Rod	
10.	P5-20	1	Spring	
11.	P5-24	1	Twist stop	
12.	P4-AS25	1	Pilot valve incl. O-rings	
13.	P5-27	1	Cam locking nut incl. screw	
15.	P5-31	1	Mounting adapter incl. screws	
16.	P5-32	1	Ball bearing	
17.	P5-K1	1	Cam K1 90°/180° Linear 0-100%, split range 0-50-100% 1	
17.	P5-Kxx	1	Cam special, K2-K10 (ConsultPMV)	
18.	P4-	1	Cxx Spindle (Consult PMV)	
19.	12013	1	Indicator Arrow type 1	
20.	P4-SCREW		Screw set Set	
21.	P4-SEAL NBR		Seal and O-ring set NBR, Nitrile rubber. Set (4, 21)	

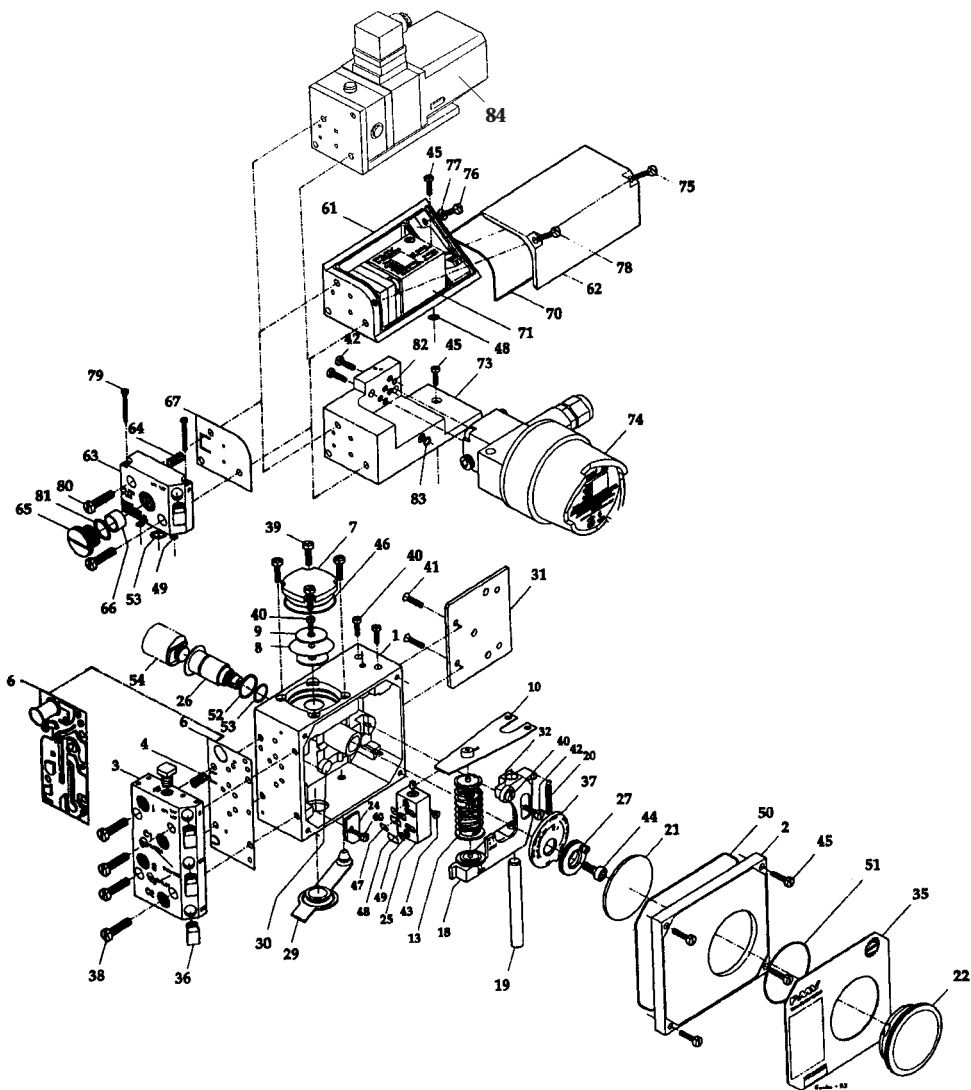
# Spare parts, P5/EP5



Pos	Part no	Qty	Description
1		1	Housing
2	P5-2	1	Front Cover incl. O-ring
3	P5-AS3N	1	Connecting block NPT 1/4" assembly
3	P5-AS3G	1	Connecting block G 1/4" assembly
4	P5-4	1	Relief valve spring
6	P5-6P	1	Gasket for P5
6	P5-6EP	1	Gasket for EP5
7	P5-7	1	Diaphragm cover incl. O-ring
8	P5-8	1	Diaphragm
9	P5-9	2	Diaphragm washer
10	P5-10	1	Balance arm
13	P5-AS13/315	1	Feedback spring 3-15 psi assembly
13	P5-AS13/630	1	Feedback spring 6-30 psi assembly
18	P5-18	1	Lower arm assembly
19	P5-19	1	Rod
20	P5-20	1	Spring
21	P5-21A	1	Indicator Arrow
21	P5-21F	1	Indicator Flag
21	P5-21P	1	Indicator Pointer
22	P5-22T	1	Indicator cover Transparent incl. O-ring
22	P5-22F	1	Indicator cover Flag incl. O-ring
22	P5-22B	1	Indicator cover Blind incl. O-ring
24	P5-24	1	Twist stop
25	P5-25	1	Pilot valve incl. O-rings
26	P5-26	1	Shaft incl. O-rings, screw
27	P5-27	1	Cam locking nut incl. screw
29	P5-29	1	Zero cover
30	P5-30	1	Cover
31	P5-31	1	Mounting adapter, incl screws
32	P5-32	1	Ball bearing
35	P5-xx/xx	1	Identification cover
36	12047N	4	Plug NPT 1/8"
36	12047G	4	Plug 1/8" G
37	P5-Kxx	1	Cam
38-45, 75-80	P5-Screws	1	Screw set P5/EP5
46-53	P5-Seal NBR 1		O-ring set P5/EP5
81-83, 6 , 67, 70			Nitrile, NBR
46-53	P5-Seal Q	1	O-ring set P5/EP5
81-83, 6 , 67, 70			Silicone, Q
54	P5-Sxx	1	Spindle adaptor



# Spare parts, P5/EP5







Pos	Part no	Qty	Description
61		1	I/P box
62	E5-2	1	I/P cover incl. screws
63	E5-AS3N	1	I/P nose NPT 1/4" assembly
63	E5-AS3G	1	I/P nose G 1/4" assembly
64	P5-4	1	Relief valve spring
65	E5-5	1	Filter plug incl. Filter 66, O-ring, 81
66	E5-6	1	Filters (5 per package)
67	E5-7	1	Gasket I/P
71	E5-STD	1	I/P converter
73	E5 N-AS 11 E5 G-AS 11	1	Mounting bracket Round I/P incl. screws, O-rings, I/P Nose
74	FU-STD	1	Enclosure incl. I/P converter Std.
74	E5-EX/EU	1	Enclosure incl. I/P converter, flameproof Cenelec
74	E5-EX/US	1	Enclosure incl. I/P converter, Explosionproof FM, CSA
84	E5-FS	1	I/P converter fail in last position incl. bracket



# 18. Certificates

19/07/2002 09:30 05719301488 ABB AUTOMATION S. 03

Translation

## EC-Type Examination Certificate

- Directive 94/9/EC -  
Equipment and protective systems intended for use  
in potentially explosive atmospheres

**DMT 02 ATEX E 121 X**

(1) **Equipment:** IP-converter type Doc. 900771

(2) **Manufacturer:** ABB Automation Products GmbH

(3) **Address:** D 32425 Mirdan

(4) **The design and construction of this equipment and any acceptable variations therein are specified in the relevant EC-type examination certificate.**

(5) **The certificate body of Technische Montan Technologie GmbH notified body 20.0138 in accordance with the provisions of the ATEX Directive has examined the design and construction of this equipment and found that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres.**

(6) **The examination and test results are recorded in the test and assessment report BVS PP 02.2007 EG.**

(7) **The Essential Health and Safety Requirements are covered by compliance with:**  
EN 50014:1997+A1+A2 General requirements  
EN 50018:2000 Flameproof enclosure

(8) **If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the standards in this certificate.**

(9) **This EC-Type Examination Certificate relates only to the design, examination and tests of the specified equipment. Further requirements of the Directive apply to the manufacturing process and supply of this equipment. These are not covered by this certificate.**

(10) **The marking of the equipment shall include the following:**


Signed: Jockers  
DMT-Certification body

Signed: Eickhoff  
Head of Special Services unit

**II 2G EEx d IIC T4/T5/T6**  
Deutsche Montan Technologie GmbH  
Eisen, dated 28. June 2002

Page 1 of 2: DMT 02 ATEX E 121 X  
EN 50014:1997+A1+A2, EN 50018:2000  
As valid equipment: 1.00771.doc, Version 02/19/04, Date: 02/02/02, 1716

19/07/2002 09:109 05719301488 ABB AUTOMATION S. 04



Appendix to

## EC-Type Examination Certificate

**DMT 02 ATEX E 121 X**

(13) **13.1 Subject and type**  
IP-converter type Doc. 900771

(14) **13.2 Description**  
The converter serves for the transformation of an in-phase DC current into a proportional pressure. As pressure media other flammable gases than Oxygen or Oxygen enriched gas mixtures are used.  
Optionally, a current unit, type of protection, intrinsic safety (Ex) in IIC T4/T5/T6; TDV 99 ATEX 1487 X), and 900771.doc.

(15) **13.3 Parameters**

15.3.1 Electrical data (non inductively safe supply)	
Nominal current	≤ 50 mA
15.3.2 Electrical data (inductively safe supply)	
As per TDV 99 ATEX 1487 X	
15.3.3 Parametric data	
Supply voltage (unprotected side)	≤ 10 bar
Output signal	≤ 1 bar
15.3.4 Thermal data (non inductively safe supply)	
Maximum input current	50 50 50 mA
Ambient temperature range	-40 °C up to 55 70 85 °C
Temperature class	T4 T5 T6
15.3.5 Thermal data (inductively safe)	
Maximum input current	50 60 60 100 100 120 120 150 mA
Ambient temperature range -40 °C up to	55 70 75 75 75 75 75 75 °C
Temperature class	T4 T5 T6 T6 T6 T6 T6 T6

(16) **Test and assessment report**  
BVS PP 02.2007 EG as of 28.06.02

(17) **Special conditions for safe use**

17.1 The IP Converter is designed for use at an ambient temperature range of -40 °C up to 85 °C in II C at II 2G.

17.2 If the IP Converter is used at an ambient temperature above 60 °C, or below -20 °C, cable type and cable length approved for a service temperature corresponding to the maximum ambient temperature decreased by 10 K, respectively corresponding to the minimum ambient temperature increased by 10 K, respectively.

Page 1 of 2: DMT 02 ATEX E 121 X  
EN 50014:1997+A1+A2, EN 50018:2000  
As valid equipment: 1.00771.doc, Version 02/19/04, Date: 02/02/02, 1716

# Cenelec A tex, black label

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ABE AUTOMATON

S: DF



17.3.1. Variants with inherently safe control units shall not be used (intrinsically safe ones may have been used in type of protection) (unapproved variants must be immediately made ready).

We confirm the correctness of the translation from the German original.  
In the case of exhibition only the German wording shall be valid and binding.

4/3/07 Essen 28 June 2002  
BVS-WZ/AN A 2001/0773

Deutsche Montan Technologie GmbH

DMT Certification body

Head of service user

DMT e.V. DMT CERTIFIKATION  
Dortmunder Straße 100, 44149 Dortmund, Germany  
Phone: +49 (0)201 725 111, Fax: +49 (0)201 725 114





Date: 2003-04-30 Page: 2 of 2



Nemko 03ATEX112X

**[1] EC-TYPE EXAMINATION CERTIFICATE**

(2) Equipment or Protected System Intended for use in Potentially explosive atmospheres Directive 94/9/EC

[3] EC-Type Examination Certificate Number: Nemko 03ATEX112X

[4] Equipment or Protective System: Pneumatic Valve Positioner

[5] Applicant/Manufacturer: PAV Palmsiderms Instrument AB

[6] Address: Korta gatan 9  
SE-141 84, Solna  
Sweden

[7] This equipment or protective system and any equivalent variation thereto is specified in the schedule to this certificate and the documents therein referred to.

[8] Nordic AS, notified body number 0090, is, in accordance with Article 9 of Council Directive 94/9/EC of 23 March 1994, certifies that the equipment or protective system has been found to comply with the Essential Health and Safety requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in confidential report no. 200309116

[9] Compliance with the Essential Health and Safety Requirements has been assessed by compliance with:

EN 50014:1997 + A1:1999 + A2:1999

EN 15403-1:2002

[10] If the sign "X" is placed after the certificate number, it indicates that the equipment or protective system is subject to special conditions for safe use specified in the schedule to this certificate.

[11] This EC-TYPE EXAMINATION CERTIFICATE relates only to the design, examination and test of the specified equipment or protective system in accordance to the directive 94/9/EC. The manufacturing process and supply of this equipment or protective system. These are not covered by this certificate.

[12] The marking of the equipment or protective system shall include the following:



II 1 GD

Oulu, 2003-04-30

R. Riihelä  
Rolf Heel  
Certification Department

*This certificate may only be reproduced in its entirety and without any change, schedule included.*

Postal Address: P.O. Box 73, Biskopsgården 30, FI-00101, Helsinki, Finland  
Telephone: +358 9 4722 96 81 30  
Fax: +358 9 4722 96 85 50



Page: 1 of 2

Nemko 03ATEX112X  
**[13] Schedule**  
**[14] EC-TYPE EXAMINATION CERTIFICATE No Nemko 03ATEX112X**

[15] Description of Equipment or Protective System  
The PAV positioner is a valve actuator used in either single or double acting applications. The enclosure is made of aluminium and it has a extruded flange or dome shaped plastic window for position indicator on the front cover.

**Type Designation**

P5

**Data**

Max. Supply Pressure: 1MPa (150PSI)

**Ingress Protection Code**

IP 66 according to IEC 60529

Type-EX according to NEMA 250

[16] Report No. 200309116 and the list of Schedule Documents P5 Technical File Contents Rev. D, Dated 2003-04-30.

**[17] Special Conditions for Safe Use**

1. The enclosure is made of aluminium and impact or friction caused by external objects shall be avoided in the application.
2. Rubbing of the windows with dry fabrics shall be avoided when the positioner is used in an IIC atmosphere in order to avoid potentially incendive static discharges.
3. The ambient temperature range for the positioner is: -20°C <T<+35°C

**[18] Essential Health and Safety Requirements**

See item 9

*This certificate may only be reproduced in its entirety and without any change, schedule included.*

Postal Address: P.O. Box 73, Biskopsgården 30, NO-0403, Oslo, Norway  
Telephone: +47 22 36 83 30  
Fax: +47 22 36 85 50

# Cenelec Atex, white label

Cenelec, Charleroi, Street, Leuze, LS8-20T, LUX  
 Tel: +44 (0)113 246 2349 Fax: +44 (0)113 246  
 Website: <http://www.cenelec.eu>  
 Email: [info@cenelec.eu](mailto:info@cenelec.eu)  
 Video Conferencing: +44 (0)113 234 8888

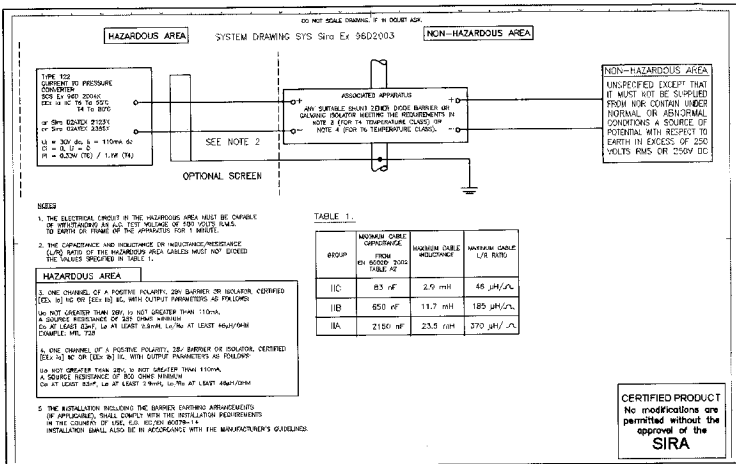
## WatsonSmith

Instructions specific to hazardous area installations  
 (reference Instructions ATEX Directive 94/9/EC, Annex II, 1.0.6.)  
 The following instructions apply to this installation. See also the IPE Converter covered by  
 certificate number Sira 0401262122X.

### 1 Certification Marking Label



- It is recommended that the installer refers to Watson Smith drawing number 99-133; system drawings for further details.
- The equipment should not be used outside the stated ambient temperature range.
- Where the equipment is marked as being type certified, then it is recommended that, after installation, it is checked or near the equipment whether the installation is to EEC or EEx d.
- The certificate number has an 'X' suffix, which indicates that the certificate contains special conditions for safe use. Those installing or inspecting the equipment should have access to this subject Annex II, clause 1.5.
- The equipment has not been assessed as a safety-related device (as referred to by Directive 2002/95/EC Annex II, clause 1.5) and, therefore, this equipment shall be carried out by suitably-trained personnel in accordance with the applicable codes of practice.
- Repair of this equipment shall be carried out by the manufacturer or in accordance with the applicable code of practice.
- Anyone coming into contact with aggressive substances, then it is the responsibility of the user to take suitable precautions that prevent it from being adversely affected, thus ensuring that the type of protection is not compromised.
- Flammable liquids or gases that may affect polymeric materials that may affect polymeric materials.
- Suitable precautions: e.g. regular checks as part of routine inspections or establishing from the material's data sheet that it is resistant to specific/chemicals/steam/liquid.



### CSA APPROVED VERSION

Intrinsically Safe Approval for  
Class I, Groups A, B, C and D with a temperature classification of.

T4A at 85°C  
T6 at 55°C

The unit must be installed according to drawing 96-111.

Division 2 Approval for  
Class I, Division 2, Groups A, B, C and D

These devices are certified as components for use in a suitable enclosure subject to the acceptance of CSA or the Inspection authority having jurisdiction.

### CENELEC APPROVED VERSION

Intrinsically Safe Approval as  
E Ex ia IIC T4 at 80°C  
T6 at 55°C

Certificate number Ex96D2004X  
Ambient -40°C to 80°C (except for T6)

The following table applies for Is input currents and ambient temperatures

Current Is mA	Maximum Ambient Temperature		
	°C		
	T4	T5	T6
50	80	80	53
60	80	80	47
100	80	80	
120	80	75	
150	80	57	

The unit must be installed alone in a metallic enclosure with  
i) a magnesium content of less than 6% by weight.  
and ii) a minimum IP rating of IP20

The distance from the terminals to any earthed metal must be greater than 3mm and the circuit must be capable of withstanding a voltage of 500 Vrms to case or earth for one minute.

The unit must be installed according to drawing 96-108.

### **WARNING!**

These instruments must be installed in accordance with local and national codes of practice, especially for hazardous area installations. The instruments are fully isolated from ground and therefore grounding is unnecessary for functional purposes. However, grounding may be necessary to conform to installation codes.

### HAZARDOUS AREA VERSIONS

The instrument is available in versions suitable for use in hazardous areas. The hazardous area versions carry information on their certification on a special label. This gives an indication to the correct areas of use.

### **WARNING!**

Installation of any hazardous area equipment should be made in accordance with hazardous area installation codes and also of course to the installation to the installation and operating instructions provided. The manufacturer cannot be held responsible for incorrect installation or any customer modifications to, or repair of, a certified instrument as this may invalidate the certified design. If a certified instrument should fail, no attempt should be made by the user to effect repair. The unit should be returned to the factory.

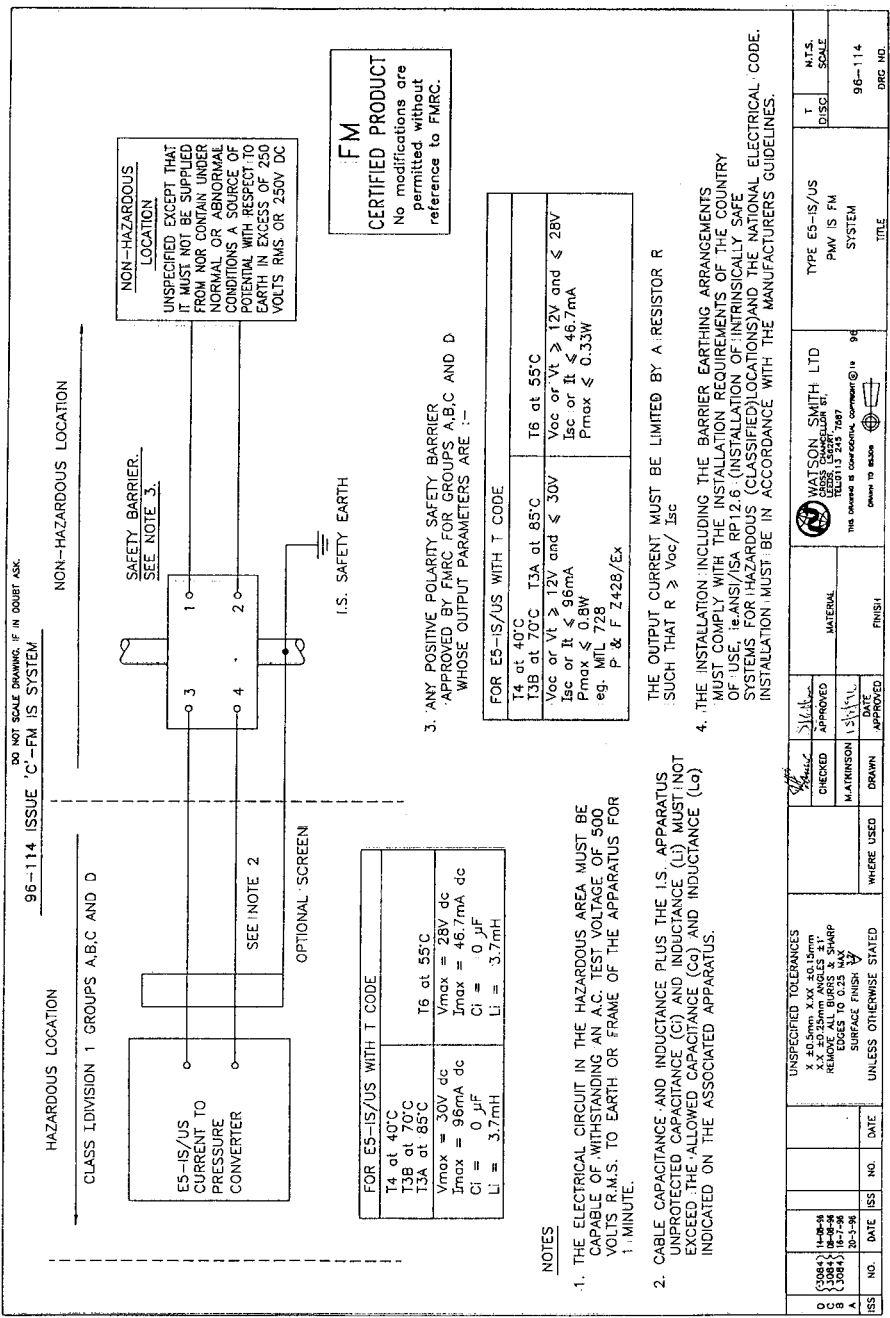
### FM APPROVED VERSION

Intrinsically Safe Approval for  
Class I, Division 1, Groups A B C D hazardous locations with a temperature classification of.

T4 ambient 40°C  
T3B ambient 70°C  
T3A ambient 85°C  
T6 ambient 55°C

These units must be installed in accordance with:

- The National Electrical Code (ANSI/NFPA 70) and ANSI/ISA RP 12.6, "Installation of Intrinsically Safe Instrument Systems in Class 1 Hazardous (Classified) Locations".
- The installation drawing 96-114.
- The Installation and Operating Instructions provided with each unit.
- The I/P shall be installed in a properly grounded metal enclosure.



DO NOT SCALE DRAWING, IF IN DOUBT ASK.

HAZARDOUS LOCATION

NON-HAZARDOUS LOCATION

CLASS DIVISION 1 GROUPS A,B,C AND D

SAFETY BARRIER. SEE NOTE 3.

I.S. SAFETY EARTH

UNSPECIFIED EXCEPT THAT IT MUST NOT BE SUPPLIED FROM NOR CONTAIN UNDER NORMAL OR ABNORMAL CONDITIONS A SOURCE OF POTENTIAL WITH RESPECT TO EARTH IN EXCESS OF 250 VOLTS RMS OR 250V DC

FM CERTIFIED PRODUCT

No modifications are permitted without reference to FMRC.

FOR E5-IS/US WITH T CODE	
T4 at 40°C	T6 at 55°C
T3B at 70°C	Vmax = 28V dc
T3A at 85°C	Imax = 46.7mA dc
Vmax = 30V dc	Ci = 0.1µF
Imax = 96mA dc	Li = 3.7mH
Ci = 0.1µF	
Li = 3.7mH	

3. ANY POSITIVE POLARITY SAFETY BARRIER APPROVED BY FMRC FOR GROUPS A,B,C AND D WHOSE OUTPUT PARAMETERS ARE :-

FOR E5-IS/US WITH T CODE	
T4 at 40°C	T6 at 55°C
T3B at 70°C	Voc or Vt ≥ 12V and ≤ 28V
Voc or Vt ≥ 12V and ≤ 30V	Isc or It ≤ 46.7mA
Isc or It ≤ 96mA	Pmax ≤ 0.8W
Pmax ≤ 0.8W	eg. MIL 728
eg. MIL 728	P & F 7428/Ex

**NOTES**

- THE ELECTRICAL CIRCUIT IN THE HAZARDOUS AREA MUST BE CAPABLE OF WITHSTANDING AN A.C. TEST VOLTAGE OF 500 VOLTS R.M.S. TO EARTH OR FRAME OF THE APPARATUS FOR 1 MINUTE.
- CABLE CAPACITANCE AND INDUCTANCE PLUS THE I.S. APPARATUS UNPROTECTED CAPACITANCE (C<sub>U</sub>) AND INDUCTANCE (L<sub>U</sub>) MUST NOT EXCEED THE ALLOWED CAPACITANCE (C<sub>g</sub>) AND INDUCTANCE (L<sub>g</sub>) INDICATED ON THE ASSOCIATED APPARATUS.

THE OUTPUT CURRENT MUST BE LIMITED BY A RESISTOR R SUCH THAT  $R \geq V_{oc} / I_{sc}$

- THE INSTALLATION INCLUDING THE BARRIER EARTHING ARRANGEMENTS MUST COMPLY WITH THE INSTALLATION REQUIREMENTS OF THE COUNTRY OF USE (ie ANSI/ISA SP12.0 (INSTALLATION OF INSTRUMENTALLY SAFE SYSTEMS FOR HAZARDOUS (CLASSIFIED) LOCATIONS) AND THE NATIONAL ELECTRICAL CODE. INSTALLATION MUST BE IN ACCORDANCE WITH THE MANUFACTURERS GUIDELINES.

ISS	NO.	DATE	ISS	NO.	DATE	WHERE USED	UNLESS OTHERWISE STATED
0	0084	18-7-98					
8	0084	18-7-98					
A	0084	18-7-98					

APPROVED	CHECKED	DRAWN	FINISH
<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>

MATERIAL	FINISH

**WATSON SMITH LTD**  
 2305 CANNON ROAD ST.  
 CHASSY CHESHIRE  
 TEL: 01273 235 7587  
 FAX: 01273 235 7587

This drawing is controlled. Comment @ 10

TYPE	T	N.T.S.
E5-IS/US	DISC	SOLE
PKM/IS FM SYSTEM		
		96-114
		DRG NO.

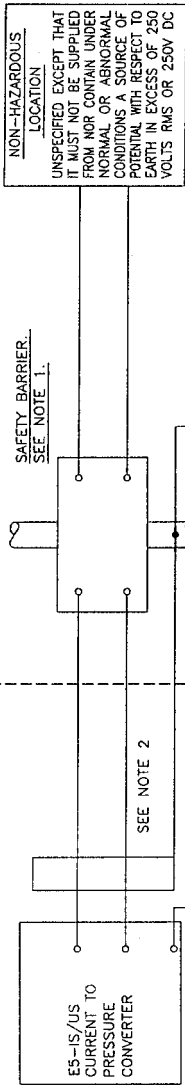
DO NOT SCALE DRAWING. IF IN DOUBT ASK.

96-111 ISSUE'E'—CSA IS SYSTEM

HAZARDOUS LOCATION

CLASS I DIVISION 1 GROUPS A, B, C AND D

NON-HAZARDOUS LOCATION



I.S. SAFETY EARTH

TEMPERATURE CODE	(MAX) AMBIENT
T4A	85°C
T6	55°C

**C.S.A.**  
**CERTIFIED PRODUCT**  
 No modifications are permitted without reference to C.S.A.

**NOTES**

- ANY POSITIVE POLARITY SAFETY BARRIER APPROVED BY C.S.A. FOR GROUPS A, B, C AND D WHOSE OUTPUT PARAMETERS ARE :—  
 28V (max)  
 300 Ohms (min)  
 eg. P & F Z42B/Ex
- THE INSTALLATION INCLUDING THE BARRIER EARTHING ARRANGEMENTS MUST COMPLY WITH THE CANADIAN ELECTRICAL CODE PART I.
- THE DEVICE IS ALSO SUITABLE FOR CLASS II GROUPS E, F, G, & CLASS III HAZARDOUS LOCATIONS WHEN INSTALLED IN A SUITABLE DUST EXCLUDING ENCLOSURE.
- SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY & DIV 2 SUITABILITY.  
 LA SUBSTITUTION DE COMPOSANTS PEUT COMPROMETTRE LA SECURITE INTRINSEQUE ET DIV 2.
- THE TYPE ES-IS/US TERMINALS WHEN SUPPLIED AS FLYING LEADS MUST BE SUITABLY SECURED TO AN ENCLOSURE WITH AN APPROPRIATE FASTENER.

ISS	NO.	DATE	ISS	NO.	DATE	UNSPECIFIED TOLERANCES	WHERE USED	DRAWN	APPROVED	MATERIAL	FINISH	TYPE ES-IS/US PAV IS C.S.A. SYSTEM	T DISC	NTS. SCALE	
E	308-2	14-3-88				UNSPECIFIED TOLERANCES X ±0.5mm MAX ±0.15mm DIMENSIONS UNLESS SHOWN OTHERWISE REMOVE 0.25mm BARRS SHARP EDGES TO 0.25 MAX SURFACE FINISH $\sqrt{V}$		CHECKED: <i>[Signature]</i> DRAWN: MATRINSON	APPROVED: <i>[Signature]</i> APPROVED:			TYPE ES-IS/US PAV IS C.S.A. SYSTEM	T DISC	NTS. SCALE	
D	308-1	11-9-88											TYPE ES-IS/US PAV IS C.S.A. SYSTEM		
C	308-0	11-9-88											TYPE ES-IS/US PAV IS C.S.A. SYSTEM		
A	308-0	11-9-88											TYPE ES-IS/US PAV IS C.S.A. SYSTEM		
		25-5-88										TYPE ES-IS/US PAV IS C.S.A. SYSTEM			
												TYPE ES-IS/US PAV IS C.S.A. SYSTEM			

**WATSON SMITH LTD**  
 1000 SHEPPARD AVENUE E.  
 UNIT 113 SCARBOROUGH, ONT.  
 M1B 3Y7  
 TEL: (416) 291-7987  
 FAX: (416) 291-7987  
 THE ABOVE IS A COMPUTER GENERATED DRAWING  
 DRAWN TO SCALE

96-111  
 DRG. NO.







**Palmstiernas Instrument AB**  
Korta Gatan 9 • 171 54 Solna  
Tel: +46 (0)8-555106 00 • Fax: +46 (0)8-555106 01  
E-mail: [info@pmv.nu](mailto:info@pmv.nu) • [www.pmv.nu](http://www.pmv.nu)