



*PMV D20*  
*Digital Positioner*

*Installation*  
*Operation*  
*Maintenance*

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# 1. General information

## 1.1 Using

The following instructions are designed to assist in unpacking, installing and performing maintenance as required on FLOWSERVE products. Product users and maintenance personnel should thoroughly review this bulletin prior to installing, operating or performing any maintenance.

In most cases FLOWSERVE valves, actuators and accessories are designed for specific applications (e.g. with regard to medium, pressure, temperature). For this reason they should not be used in other applications without first contacting the manufacturer.

## 1.2 Terms concerning safety

The safety terms DANGER, WARNING, CAUTION and NOTE are used in these instructions to highlight particular dangers and/or to provide additional information on aspects that may not be readily apparent.



**DANGER:** indicates that death, severe personal injury and/or substantial property damage will occur if proper precautions are not taken.



**WARNING:** *indicates that death, severe personal injury and/or substantial property damage can occur if proper precautions are not taken.*



**CAUTION:** *indicates that minor personal injury and/or property damage can occur if proper precautions are not taken.*



**NOTE:** *indicates and provides additional technical information, which may not be very obvious even to qualified personnel.*

Compliance with other, not particularly emphasised notes, with regard to transport, assembly, operation and maintenance and with regard to technical documentation (e.g. in the operating instruction, product documentation or on the product itself) is essential, in order to avoid faults, which in themselves might directly or indirectly cause severe personal injury or property damage.

### 1.3 Protective clothing

FLOWSERVE products are often used in problematic applications (e.g. extremely high pressures, dangerous, toxic or corrosive mediums). In particular valves with bellows seals point to such applications. When performing service, inspection or repair operations always ensure, that the valve and actuator are depressurised and that the valve has been cleaned and is free from harmful substances. In such cases pay particular attention to personal protection (protective clothing, gloves, glasses etc.).

### 1.4 Qualified personnel

Qualified personnel are people who, on account of their training, experience and instruction and their knowledge of relevant standards, specifications, accident prevention regulations and operating conditions, have been authorised by those responsible for the safety of the plant to perform the necessary work and who can recognise and avoid possible dangers.

### 1.5 Installation



**DANGER:** Before installation check the order-no, serial-no. and/ or the tag-no. to ensure that the valve/actuator is correct for the intended application.

Do not insulate extensions that are provided for hot or cold services.

Pipelines must be correctly aligned to ensure that the valve is not fitted under tension.

Fire protection must be provided by the user.

### 1.6 Spare parts

Use only FLOWSERVE original spare parts. FLOWSERVE cannot accept responsibility for any damages that occur from using spare parts or fastening materials from other manufactures. If FLOWSERVE products (especially sealing materials) have been on store for longer periods check these for corrosion or deterioration before using these products. Fire protection for FLOWSERVE products must be provided by the end user.

### 1.7 Service / repair

To avoid possible injury to personnel or damage to products, safety terms must be strictly adhered to. Modifying this product, substituting nonfactory parts, or using maintenance procedures other than outlined in this instruction could drastically affect performance and be hazardous to personnel and equipment, and may void existing warranties. Between actuator and valve there are moving parts. To avoid injury FLOWSERVE provides pinch-point-protection in the form of cover plates, especially where side-mounted positioners are fitted. If these plates are removed for inspection, service or repair special attention is required. After completing work the cover plates must be refitted.

Apart from the operating instructions and the obligatory accident prevention directives valid in the country of use, all recognised regulations for safety and good engineering practices must be followed.

**WARNING:**

Before products are returned to FLOWSERVE for repair or service FLOWSERVE must be provided with a certificate which confirms that the product has been decontaminated and is clean. FLOWSERVE will not accept deliveries if a certificate has not been provided (a form can be obtained from FLOWSERVE).



flange faces to prevent the ingress of foreign materials. These caps should not be removed until the valve is actually mounted into the system.

## 1.8 Storage

In most cases FLOWSERVE products are manufactured from stainless steel. Products not manufactured from stainless steel are provided with an epoxy resin coating. This means that FLOWSERVE products are well protected from corrosion. Nevertheless FLOWSERVE products must be stored adequately in a clean, dry environment. Plastic caps are fitted to protect the

## 1.9 Valve and actuator variations

These instructions cannot claim to cover all details of all possible product variations, nor in particular can they provide information for every possible example of installation, operation or maintenance. This means that the instructions normally include only the directions to be followed by qualified personnel where the product is being used for its defined purpose. If there are any uncertainties in this respect particularly in the event of missing product-related information, clarification must be obtained via the appropriate FLOWSERVE sales office.

## 2. Unpacking

Each delivery includes a packing slip. When unpacking, check all delivered valves and accessories using this packing slip.

Report transport damage to the carrier immediately.

In case of discrepancies, contact your nearest FLOWSERVE location.

### 3. PMV D20 overview

The **PMV D20** is a two-wire loop powered, 4-20 mA input digital valve positioner.

The **PMV D20** positioner controls actuators with linear and rotary mountings.

The **PMV D20** is completely powered by the 4-20 mA input signal. The minimum input signal required to function is 3,6 mA. As an option the D20 can be equipped with HART protocol to allow bidirectional communication.

Since the positioner is insensitive to supply pressure changes and can handle supply pressures from 1,5 to 6 barg (22 to 105 psig), a supply regulator is usually not required; however, in applications where the supply pressure

is higher than the maximum actuator pressure rating a supply regulator is required to lower the pressure to the actuator's maximum rating (not to be confused with operating range). A coalescing air filter is recommended for all applications due to the close tolerances in the positioner.

**PMV D20** positioner accessories: Optional analog feedback system as well as limit switch unit and a directly attachable double acting module.

**NOTE:** *The air supply must conform to ISA 7.0.01 or IEC 770 (a dew point at least 10°C/18°F below ambient temperature, particle size below five microns – one micron recommended – and oil content not to exceed one part per million).*

## 4. Specifications

### 4.1 Technical data

Input signal	4-20 mA
Current supply min.	3,6 mA
Current supply Max.	150 mA
Load Standard	400 ohm at 20mA
Load HART	470 ohm at 20mA
Voltage dropStandard	8 VDC at 20mA
Voltage dropHART	9.4 VDC at 20mA
Angle of rotation min	0-40°
Angle of rotation Max	0-90°
Air supply range	1.5 – 6 bar
Out put	0-100% of air supply pressure
Air supply quality	Free from oil, dust and moisture IEC 770, ISA 7.0.01
Air supply effect	<0.1%FS for10% pressure change at 6 Bar
Ingress protection	IP66 / Nema 4X
Operating humidity	0-100% rh non-condensing
Air connections	1/4" NPT
Cable entry	2 x 1/2" or 2 x M20x 1,5
Terminals	Screw terminals 2,5 mm <sup>2</sup> (AWG 14)
Operating Temperature	-20 to +85°C-40 to +85°C (optional)
Storage temperature	-40 to +85°C
Air delivery capacity	7 Nm <sup>3</sup> /h @ 6 bar (3 bar diff pressure)
Air delivery capacity Double acting	7 Nm <sup>3</sup> /h @ 6 bar (3 bar diff pressure)
Air consumption Single acting	0,120 Nm <sup>3</sup> /h @ 6 bar
Air consumption Double acting	0,120 Nm <sup>3</sup> /h @ 6 bar
Cv air delivery Single acting	0,12
Cv air delivery Double acting	0,12
Cut off function	Close 0.5% Open 99.5%
Linearity	<1%
Sensitivity	<0.05%
Resolution	<0,1%
Repeatability	<0.2%
Hysteresis + dead band	<0.5%
Temp effect	<0.1%/10K
Mounting position effect	<0,2%
CE	93/68/EEC, 2004/108/EEC, 2006/95/EEC
Approvals	Ex II G Ex ia IIC T4 Ta: 85°C
Certificate nr	Nemko 08ATEX1362X
Housing material	Die cast Aluminium
Surface treatment	Powder coating
Soft goods	Nitrile
Weight	1,5 kg

## 4.2 Mechanical switches

Type	SPDT
Size	Sub Sub miniature
Rating	3A, 125 VAC / 2A, 30VDC
Mechanical life	>1 x 10 <sup>6</sup> operations

### Namur sensors

Type	P+F NJ2 V3 N Inductive DIN 19234
Load current	<1mA>3mA
Voltage range	5-25 VDC
Hysteresis	3-15% (5% typical)
Temp range	-25° to +100° C (-248° to 373° F)

### Namur sensors

Type	P+F SJ2-N
Normal Voltage	8 VDC
Load current	1mA<I<3mA
Voltage range	(5-25 VDC)
Hysteresis (max)	0.2%
Temp range	-25° to +100° C (-248° to 373° F)

### Namur sensors

Type	P+F SJ2-SN
Normal Voltage	8 VDC
Load current	1mA<I<3mA
Voltage range	5-25 VDC
Hysteresis (max)	(0.2%)
Temp range	-40° to +100° C (-233° to 373° F)

### Namur sensors

Type	P+F SJ2-S1N
Normal Voltage	8 VDC
Load current	1mA<I<3mA
Voltage range	5-25 VDC
Hysteresis (max)	0.2%
Temp range	-25° to +100° C (-248° to 373° F)

### Proximity switches

Type	SPDT
Rating	10W
Voltage max	200VDC
Current max	500mA
Contact resistance max	0.2 ohm

Operating time 1.0 ms

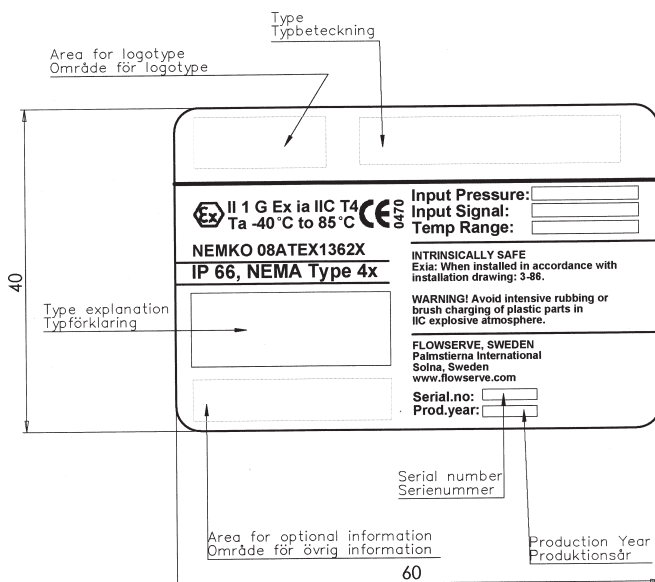
### Transmitter

Power supply 12-28 VDC  
 Output 1-22 mA  
 Resolution 0.1%  
 Linearity  $\pm 0.5\%$   
 Load impedance 600 ohm at (12 VDC and 20mA)

### Alarm Output

Supply 3-28 VDC  
 Output 20mA @ 24 VDC

## 4.3 Type sign



## 4.4 D20 Model Code

<b>A =</b>	<b>Model no</b> D20 Digital compact positioner, General purpose, LED status
<b>B =</b>	<b>Approval, Certificate</b> D General purpose version I Intrinsically safe version ATEX
<b>C =</b>	<b>Connections Air, Electrical</b> M 1/4" NPT air, M20 x 1,5 electrical x 2 N 1/4" NPT air, 1/2" NPT electrical x 2
<b>D =</b>	<b>Housing/Surface treatment</b> U Aluminium/Powder epoxy, black
<b>E =</b>	<b>Function</b> S Single acting D Double acting, incl gauges (2) Stainless/Brass
<b>F =</b>	<b>Mounting options / Spindle</b> 09 Double D type, adaptor spindle 12 Flowtop, D-style+ nut, direct mounting, Kit 30144 include 23 VDI/VDE 3845 rotary, Mounting kit not included 39 IEC 534-6, Flat D type, nut incl. Mounting kit not included 40 VDI/VDE 3847 Linear, Flat D, Mounting kit 30145 included
<b>G =</b>	<b>Cover and Indicator</b> PVA PMV, Black cover, Arrow indicator PVB PMV, Black cover, No indicator PVD PMV, Black cover, Dome indicator
<b>H =</b>	<b>Temperature/seals</b> Z Standard -20°C to 85°C (-4°F to 185°F) Q Low temp -40°C to 85°C (-38°F to 185°F)
<b>I =</b>	<b>Input signal/Protocol</b> 4 4-20 mA / none 5 4-20 mA, / HART
<b>J =</b>	<b>Feedback option, 4-20 mA transmitter, switches</b> X No feedback option T 4-20 mA transmitter only S Limit switches Mechanical SPDT + 4-20mA N Namur V3 type sensor, P+F NJ2-V3-N + 4-20mA P Limit switches Proximity SPDT + 4-20mA 4 Slot type Namur sensor, P+F SJ2-S1N + 4-20mA 5 Slot type Namur sensor, P+F SJ2-SN + 4-20mA 6 Slot type Namur sensor, P+F SJ2-N + 4-20mA
<b>K =</b>	<b>Options, Add in electronics</b> 0 Standard diagnostics
<b>L =</b>	<b>Accessories</b> X No accessories M Gauge block 1/8" G (2 x gauges included) N Gauge block 1/8" NPT (2 x gauges included)

Example: **A A A B C D - E F F G G G - H I J K L**

## 4.5 Control Drawing

[illegible]

## 4.6 Certificates



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### [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 08ATEX1362X
- [4] Equipment or Protective System: Valve Positioner
- [5] Applicant/ Manufacturer: Palmstierna International AB
- [6] Address: Korta gatan 9  
S-17154 Solna  
Sweden
- [7] This equipment or protective system and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.
- [8] Nemko AS, notified body number 0470 in accordance with Article 9 of Council Directive 94/9/EC of 23 March 1994, certifies that this 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. 118427

- [9] Compliance with the Essential Health and Safety Requirements has been assured by compliance with:  
CENELEC EN 60079-0: 2006, CENELEC EN 60079-11: 2007, CENELEC EN 60079-26: 2004
- [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 tests of the specified equipment or protective system in accordance to the directive 94/9/EC.  
Further requirements of the Directive apply to 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 1G

Ex ia IIC T4 Ta:85°C

Oslo, 2008-12-12



Rolf Hoel  
Certification Manager, Ex-products

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

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Telephone:  
+47 22 96 03 30  
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Enterprise number:  
NO 974404532



Nemko 08ATEX1362X

Date: 2008-12-12



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## [13] Schedule

### [14] EC-TYPE EXAMINATION CERTIFICATE No Nemko 08ATEX1362X

#### [15] Description of Equipment or Protective System

The **D20-series** digital positioners designed primarily to control modulating valves. The positioner can be used with single action actuators with either rotary or linear movement.

The positioner comprises:

- electronic board with microprocessor, display etc,
- pneumatic valve block,
- positional feedback with potentiometer
- the positioner can also 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 4-20mA and one of the following functions:
- Two mechanical switches: Two reed switches: Two inductive sensors.
- option with remote unite with potentiometer

#### Model code overview

D20 series digital positioners.

The series comprises the three main models D20, D21, D22 with options as specified in the model code.

D20 Digital compact positioner, General purpose, LED status

D21 Digital positioner, LCD display, LED status

D22 Digital positioner, full LCD menu, LED status

#### D 2x ABCD-EFFGGG-HIJKL

A: A character or digit indication of the configuration of the digital positioner.

B: I : Intrinsically Safe

C: A letter indicating the size threaded entries for electrical and air connections.

D: Housing / Surface treatment.

E: Function.

F: Mounting options / Spindle.

G: Cover and indicator options.

H: Temperature / seals.

I: Input signal / Protocol: 4-20mA/ Hart, Profibus / Fieldbus.

4: 4-20mA / none

5: 4-20mA / Hart

P: Profibus

F: Foundation Fieldbus

J: Feedback options.

T 4-20 mA transmitter only

S Limit switches Mechanical SPDT + 4-20mA

N Namur V3 type sensor, P+F NJ2-V3-N + 4-20mA

P Limit switches Proximity SPDT + 4-20mA

4 Slot type Namur sensor, P+F SJ2-S1N + 4-20mA

5 Slot type Namur sensor, P+F SJ2-SN + 4-20mA

6 Slot type Namur sensor, P+F SJ2-N + 4-20mA

K: options, add in electronics

L: Accessories

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Enterprise number:

NO 974404532



Nemko 08ATEX1362X

Date: 2008-12-12



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**D20 Safety Data for External Connections****4-20mA input signal & Hart . Terminals no. 1, 2**

Maximum input voltage.	$U_i$ :	28V
Maximum input current.	$I_i$ :	93mA
Maximum input power.	$P_i$ :	653mW
Maximum internal capacitance.	$C_i$ :	11,28nF
Maximum internal inductance.	$L_i$ :	11,28μH

**Switches, Mechanical or Proximity. Terminals 3-5, 6-8 or 4-5, 7-8**

Maximum input voltage.	$U_i$ :	28V
Maximum input current.	$I_i$ :	45mA
Maximum input power.	$P_i$ :	315mW
Maximum internal capacitance.	$C_i$ :	1nF
Maximum internal inductance.	$L_i$ :	1μH

**Switches, Mechanical or Proximity with isolator barriers. Terminals 3-5, 6-8**

Maximum input voltage.	$U_i$ :	10,6V
Maximum input current.	$I_i$ :	29,7mA
Maximum input power.	$P_i$ :	79mW
Maximum internal capacitance.	$C_i$ :	1nF
Maximum internal inductance.	$L_i$ :	1μH

**Namur switch and isolator barrier. Terminals 3-4, 6-7**

Maximum input voltage.	$U_i$ :	10,6V
Maximum input current.	$I_i$ :	29,7mA
Maximum input power.	$P_i$ :	79mW
Maximum internal capacitance.	$C_i$ :	40nF
Maximum internal inductance.	$L_i$ :	100μH

**4-20mA Output - Terminals 9-10**

Maximum input voltage.	$U_i$ :	28V
Maximum input current.	$I_i$ :	93mA
Maximum input power.	$P_i$ :	653mW
Maximum internal capacitance.	$C_i$ :	16,4nF
Maximum internal inductance.	$L_i$ :	11,3μH

**Alarm. Terminals 11-12**

Maximum input voltage.	$U_i$ :	28V
Maximum input current.	$I_i$ :	45mA
Maximum input power.	$P_i$ :	315mW
Maximum internal capacitance.	$C_i$ :	5,7nF
Maximum internal inductance.	$L_i$ :	11,3μH

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Date: 2008-12-12



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## Remote Unit

Remote unit is connected to terminals 3-4-5.  
 The remote unit comprises a potentiometer mounted in an aluminium enclosure.  
 The remote unit may be connected to D20 with a cable up to 10m length. The maximum output power at terminals 3-4-5 is Po: 0,38W.

## Ingress Protection Code

IP 66/67 according to EN 60529  
 Type 4X according to NEMA 250

## Ambient temperature

Temperature range:  $-40^{\circ}\text{C} \leq T_a \leq 85^{\circ}\text{C}$

## [16] Report No. 118427

**Descriptive Documents technical file content** "Technical File contents intrinsically safe (ia) certification of D20 Rev. A Dated 2008-12-08.

## [17] Special Conditions for Safe Use

### 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. The above data for the diode safety barriers assumes linear resistive output characteristics.
3. The installation and connection information according to the Control drawing 3-86 has to be taken into account.

## [18] Essential Health and Safety Requirements

See item 9

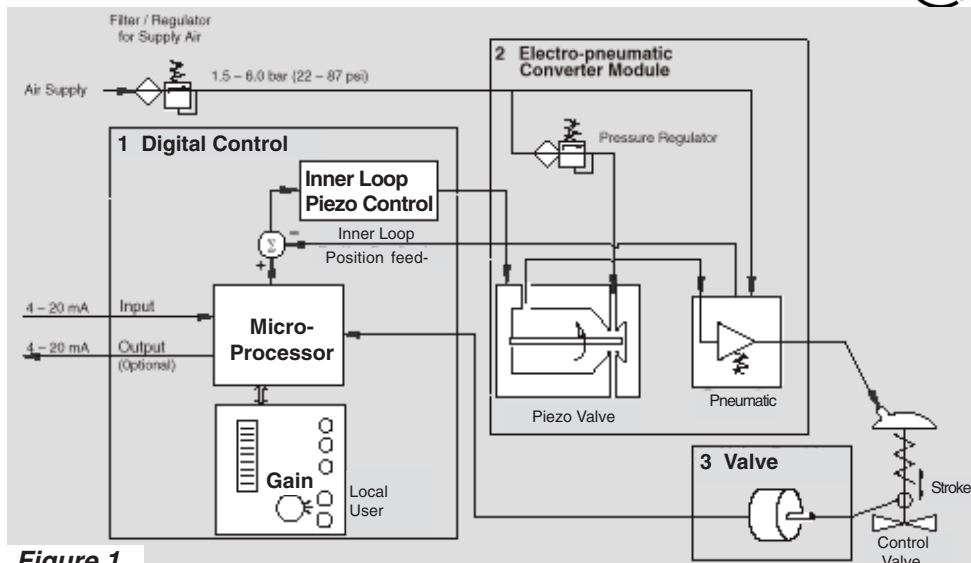
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Enterprise number:  
 NO 974404532



**Figure 1.**

## 5. Principle of operation

The **PMV D20** positioner is a digital positioner with various options. The positioner consists of three main modules:

1. The microprocessor-based electronic control module includes direct local user interface switches
2. The piezo valve-based electro-pneumatic converter module
3. The infinite resolution valve position sensor.

The basic positioner operation is best understood by referring to figure 1. The complete control circuit is powered by the two-wire, 4-20 mA command signal. The analog 4-20 mA command is passed to the microprocessor, where it is compared to the measured valve stem position. The control algorithm in the processor performs control calculations and produces an output command to the piezo valve, which drives the pneumatic

amplifier. The position of the pilot valve in the pneumatic amplifier is measured and relayed to the inner loop control circuit. This two-stage control provides for more responsive and tighter control than is possible with a single stage control algorithm. The pneumatic amplifier controls the airflow to the actuator. The change of pressure and volume of the air in the actuator causes the valve to stroke. As the valve approaches the desired position, the difference between the commanded position and the measured position becomes smaller and the output to the piezo is decreased. This, in turn, causes the pilot valve to close and the resulting flow to decrease, which slows the actuator movement as it approaches, the new commanded position. When the valve actuator is at the desired position, the pneumatic amplifier output is held at zero, which holds the valve in a constant position.

## 6. Mounting and installation

## 6.1 General

Before starting installation, inspect the digital positioner for any transit damages. The **PMV D20** positioner is installed with a mounting kit (according to NAMUR specification) to the left-hand actuator support rod.

Generally, the unit can be installed in any mounting position. The stroke feed-back is realized by a follower arm and stem clamps.

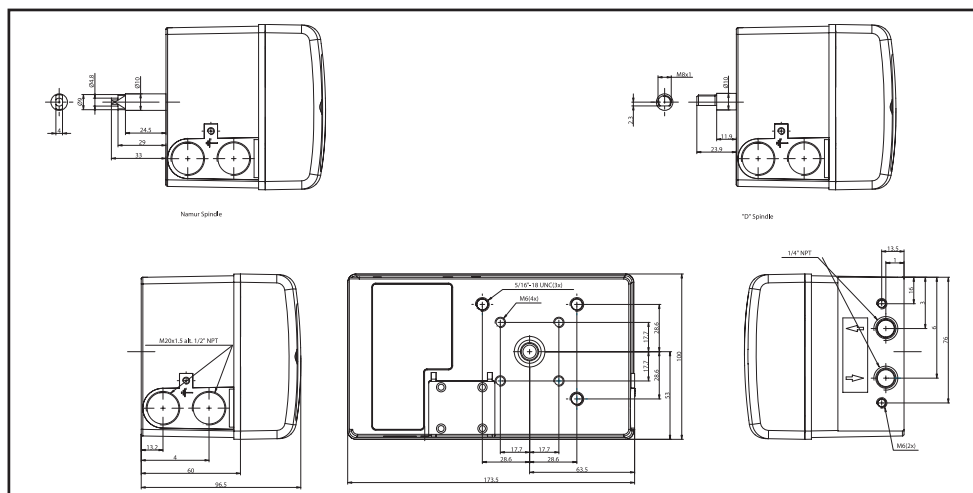
The mounting of rod actuators (according

to NAMUR) is described in Figure 3.

For the two mounting possibilities of cast yoke actuators (according to NAMUR, IEC 534 part 6) refer to Figure 5.

After installation, ensure all screw connections are tightened correctly and all moving parts are free from excessive friction.

Tighten front cover screws to 0.65 Nm to ensure IP rating.



**Figure 2. Dimensional drawing**

## 6.2 Mounting of the PMV D20 positioner on a linear pneumatic actuator (NAMUR / IEC 534 part 6)

(See Figure 3)

**Valve:** Standard globe valve or equivalent

**Actuator:** Single-acting pneumatic actuator

**Positioner:** PMV D20 with NAMUR mounting kit.

The mounting of a rod actuator kit (according to IEC 534 part 6) is described in an example by using the following equipment:

Pre-assembly: Valve with actuator (valve stroke is matched with the actuator stroke).

For mounting, proceed as follows:

### Mounting the Follower Arm (Figures 3 and 6)

1. Unscrew the lock nut for the follower arm attachment.
2. Place the follower arm on the shaft at the back of the positioner and fasten it with the lock nut. The follower pin should point back from the positioner.



**CAUTION:** Maximum torque  
0,25 Nm (0,18 ft-lbs).

### Mounting the stem clamp bracket and take-off arm (Figure 3)

1. Attach the stem clamp bracket to the stem clamp and fasten it with two hexagon socket screws and lock washers.
2. Attach the take off arm to the stem clamp bracket and fasten it with a hexagon socket capscrew and a washer. Ensure the take-off arm slot is centered.

### Mounting the positioner (Figure 3)

1. Adjust the actuator to mid-stroke.
2. Pre-assemble the mounting bracket on the left actuator leg hand-tight with two U-bolts, nuts and lockwashers.
3. Attach the positioner to the pre-assembled mounting bracket and fasten it with two hexagon head screws and two lock washers. Check that the follower pin is inserted in the slot of the take-off arm and the follower arm is positioned at a right angle to the outer edge of the positioner.

4. Tighten all screws and nuts.

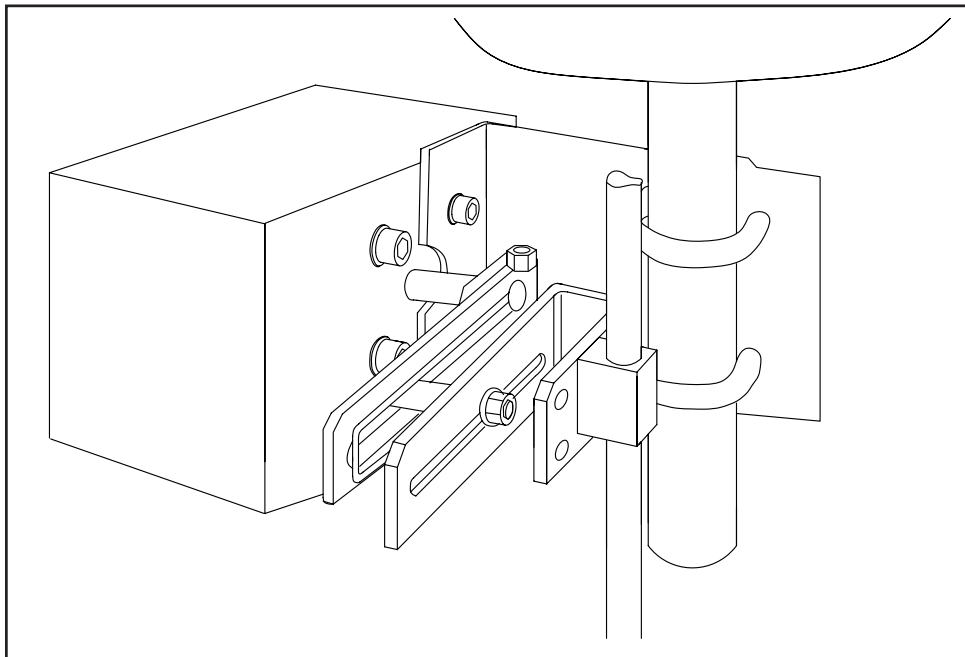


**NOTE:** A slight unsymmetrical mounting increases the linearity deviation but does not affect the performance of the device. Depending on the actuator size and stroke it may be necessary to flip the take-off arm (Figure 3) by 180° and attach it to the opposite side of the stem clamp bracket.

### Follower pin adjustment (Figure 4)

The positioner follower pin must be adjusted to match the valve stroke in the following manner:

1. Adjust the follower pin (STROKE + 10 mm) as indicated on the follower arm's embossed scale (Figure 6).
2. Exhaust the actuator.
3. Loosen the follower pin and shift it along the follower arm until the control marking on the feedback gear (Figure 4) is horizontal (points to the center of the feedback potentiometer). Fasten the follower pin in this position.
4. Adjust the actuator to full stroke and check the follower pin adjustment the same way as described in step 3. As the actuator strokes, the rotation of the feedback gear should be between the inner control markings. If the length of rotation is outside the control markings, adjust the



**Figure 3. Mounting on a Rod Actuator (IEC 534 part 6)**

follower pin farther out on the feedback lever to reduce the angle of rotation.

**NOTE:** Stroke the actuator carefully and ensure the follower arm does not interfere with valve parts, actuator or positioner. Do not adjust the follower pin too near to the slot end of the take-off arm.

The minimum lateral distance should be approximately 5 mm (0,2 inches) to pre-

vent bending of the feed-back mechanism.

## 6.3 Rotary actuators

### Mounting the PMV D20 positioner on a quarter-turn actuator (closed or open by spring)

The mounting of a pneumatic double-piston part-turn valve actuator (in accordance with VDI/VDE 3845) is described as an example by using the following equipment:

**Quarter-turn valve actuator:** Rack & pinion or scotch yoke, closed or open by spring.

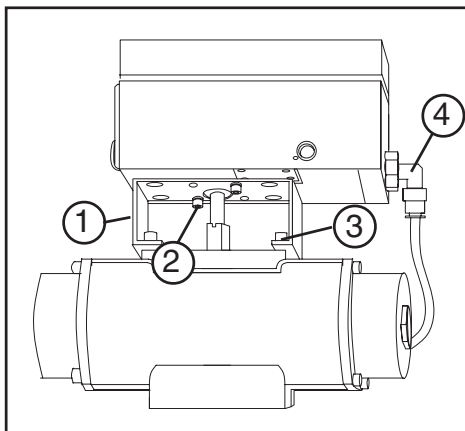
## Rotary actuators VDI/VDE 3485 (Namur)

Mount bracket **1** to positioner. Secure with 4 x M6 screws **2**.

Fit positioner on actuator and secure with 4 x screws **3**.

Install tubing **4** between actuator and positioner.

See section 7.



## Linear actuator “Flow act” (Direct mounting, integrated tubing).

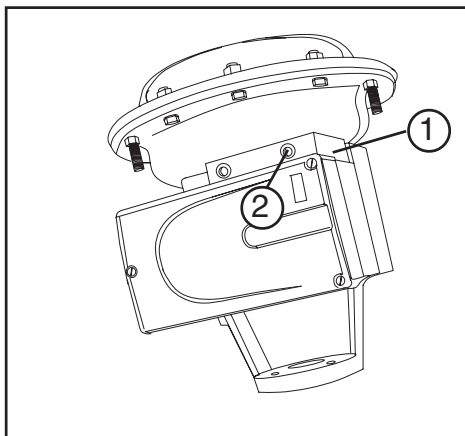
Check O-rings, Install bracket **1** to positioner and secure with screws.

Fit pin on valve stem.

Fit lever arm to positioner shaft.

Fit and check O-rings and positioner to actuator and secure with 2 x screws **2**.

No tubing needed, it's integrated with actuator, fit plug in positioner out port.



## Linear actuator VDI/VDE 3847 (Direct mounting, integrated tubing).

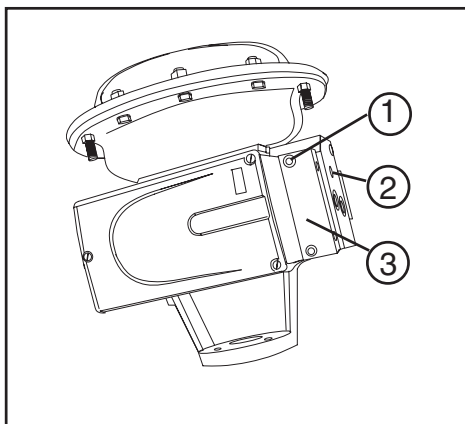
Check O-rings, Install bracket **1** to positioner and secure with 2 x screws **2**.

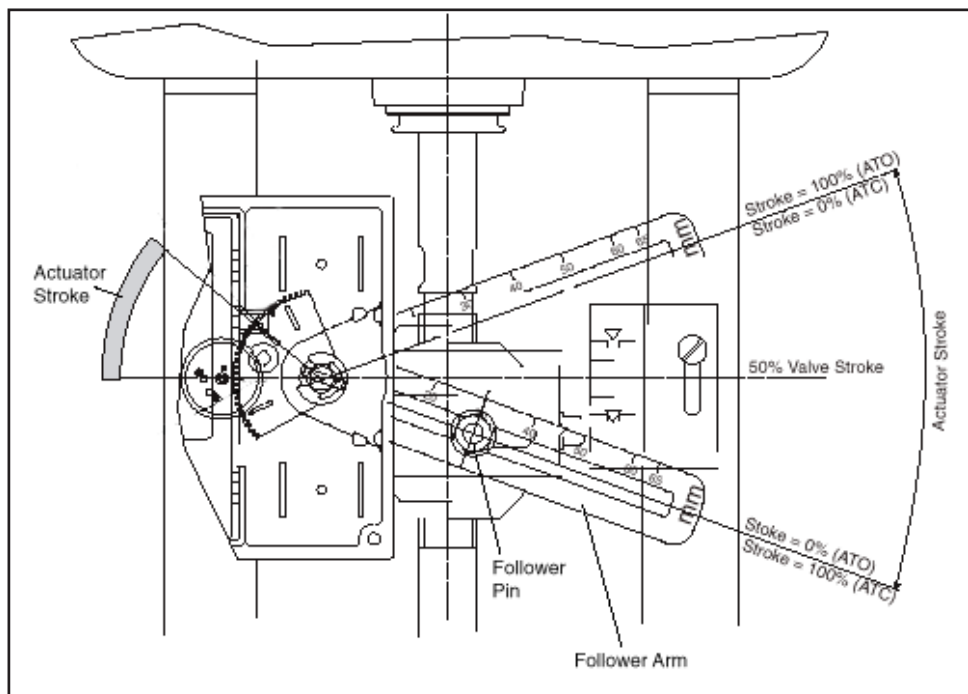
Fit pin on valve stem.

Fit lever arm to positioner shaft.

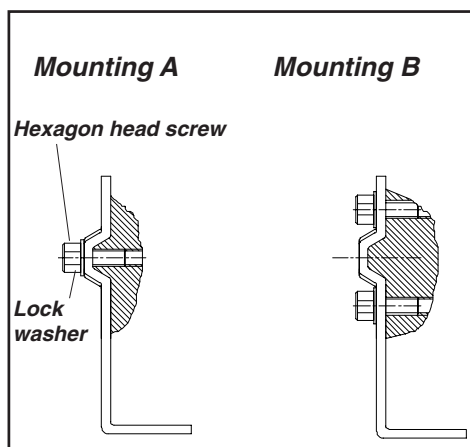
Fit and check O-rings and positioner to actuator and secure with 2 x screws **3**.

No tubing needed, it's integrated with actuator.

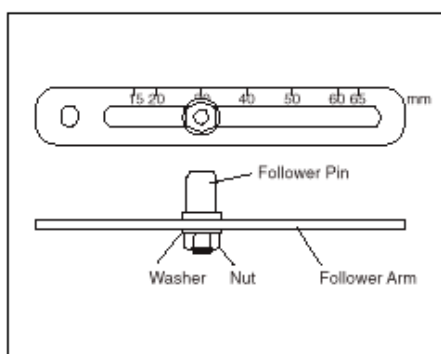




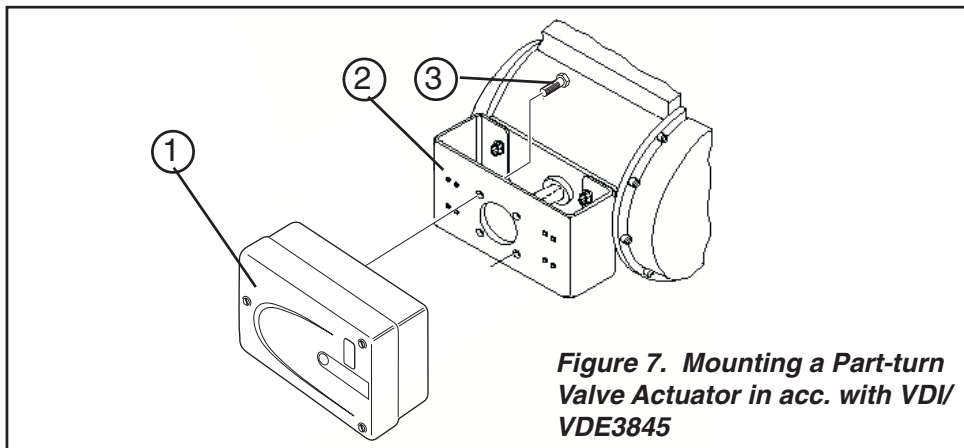
**Figure 4. Basic Adjustment for a Linear Pneumatic Actuator**



**Figure 5. Yoke Actuator Mounting (according to IEC 534 part 6)**



**Figure 6. Follower Arm (standard)**



**Figure 7. Mounting a Part-turn Valve Actuator in acc. with VDI/VDE3845**

### Mounting the positioner (Figure 7)

Place the positioner (1) onto the mounting block (2) of the actuator using four screws (3). Ensure the coupler fits

on to the shaft of the quarter-turn connection on the part-turn valve actuator.

## 7. Tubing positioner to actuator

After mounting has been completed, tube the positioner to the actuator using the appropriate compression fitting connectors:

**Air connections:** 1/4" NPT (standard air connection).

**Auxiliary power:** Pressurized air or permissible gases, free of moisture and dust in according with IEC 770 or ISA 7.0.01.

**Pressure range:** 1,5 – 6 bar (30 – 90 psi).

For connecting the air piping, the following notes should be observed:

1. The positioner passageways are equipped with filters, which remove medium and coarse size dirt from the pressurized air. If necessary, they are easily accessible for cleaning.

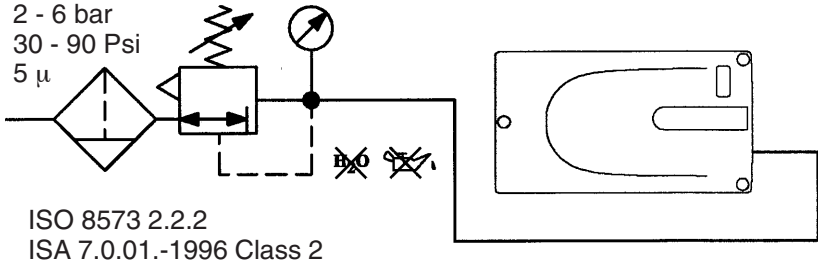
2. Supply air should meet IEC 770 or ISA 7.0.01 requirements. A coalescing filter should be installed in front of the supply air connection (Figure 8). Now connect the air supply to the filter, which is connected to the **PMV D20** positioner.

3. With a maximum supply pressure of 6 bar (102 psi) a regulator is not required.

4. With an operating pressure of more than 6 bar (90 psi), a reducing regulator is required.

The flow capacity of the regulator must be larger than the air consumption of the positioner (7 Nm<sup>3</sup>/h @ 6 bar / 4,12 scfm @ 90 psi).

5. Connect the outlet connector (Figure 8) of the positioner with tubing, independent of the action (direct or reverse).



## 8. Wiring and grounding guidelines

**Electrical connections:** signal cable with cable passage (1/2" NPT, or M20 x 1,5) to terminals 2 x 2,5 mm.

**Input signal:** 4 – 20 mA

**NOTE:** Observe the minimum requirements of voltage and equivalent electrical load:

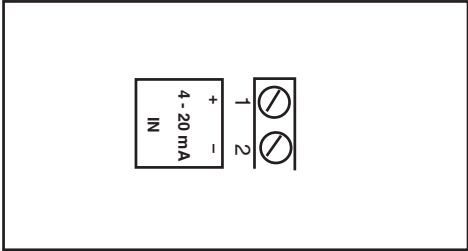
8 VDC at 20 mA

The performance is ensured only for a minimum input current of 3,6 mA.

For wiring, the following notes should be observed:

**NOTE:** The input loop current signal to the **PMVD20** should be in shielded cable. Shields must be tied to a ground at only one end of the cable to provide a place for environmental electrical noise to be removed from the cable. In general, shield wire should be connected at the source. (Figure 8).

Connect the 4-20 mA current source to terminals +1 and -2, see connection table.



**Figure 8. Connections**

Connection	Description
+1	Input +4-20 mA
-2	Input -4-20 mA
↑ ○	Pneumatic output signal (outlet)
↓ ○	Air supply

### 8.1 Grounding screw

The grounding screw, located inside the positioner cover, should be used to provide the unit with an adequate and reliable earth ground reference. This ground should be tied to the same ground as the electrical conduit. Additionally, the electrical conduit should be earth grounded at both ends of its run. The grounded screw must not be used to terminate signal shield wires.

8.2 Electromagnetic compatibility

The **PMV D20** digital positioner has been designed to operate correctly in electromagnetic (EM) fields found in typical industrial environments. Care should be taken to prevent the positioner from being used in environments with excessively high EM field strengths (greater than 10 V/m). Portable EM devices such as hand-held two-way radios should not be used within 30 cm of the device.

Ensure proper wiring and shielding

techniques of the control lines, and route control lines away from electro-magnetic sources that may cause unwanted noise.

An electromagnetic line filter can be used to further eliminate noise.

In the event of a severe electrostatic discharge near the positioner, the device should be inspected to ensure correct operability. It may be necessary to recalibrate the **PMV D20** positioner to restore operation.

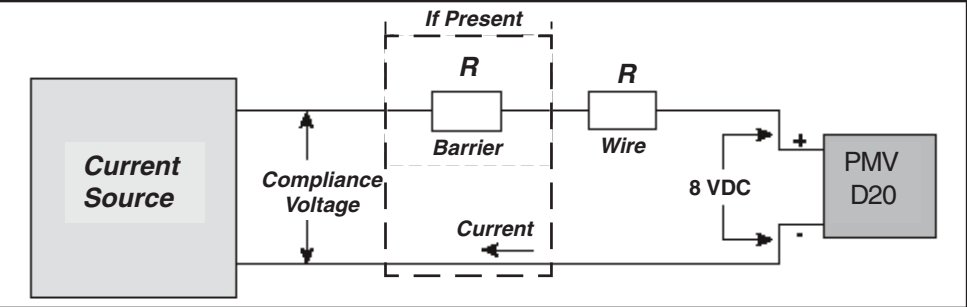


Figure 9. Compliance voltage

8.3 Compliance voltage

Output compliance voltage refers to the voltage limit the current source can provide. A current loop system consists of the current source, wiring resistance, barrier resistance (if present), and the **PMV D20** impedance.

The **PMV D20** requires that the current loop system allow for a 8.0 - 9.4 VDC drop across the positioner at maximum loop current.

**CAUTION:** Never connect a voltage source directly across the positioner terminals. This could cause permanent circuit board damage.

In order to determine if the loop will support the **PMV D20**, perform the following calculation:

Voltage = Compliance Voltage(@Current<sub>MAX</sub>)  
- Current<sub>MAX</sub>(R<sub>barrier</sub> + R<sub>wire</sub>)

To support the **PMV D20** the calculated voltage must be greater than 9.4 VDC for D20 HART and 8 VDC for non-HART.

Example: DCS Compliance Voltage = 19 V

$$R_{\text{barrier}} = 300\Omega$$

$$R_{\text{wire}} = 25\Omega$$

$$\text{CURRENT}_{\text{MAX}} = 20 \text{ mA}$$



$$\text{Voltage} = 19 \text{ V} - 0.020 \text{ A}(300\Omega + 25\Omega) = \underline{12.5 \text{ V}}$$

This system will support the **PMV D20**, as the voltage 12.5 V is greater than the required 8 VDC for non-HART and 9.4 VDC for HART.

## 9. Operation

### 9.1 General

The D20 is operated by the yellow button. Depending on desired action, press the button:

- during a number of seconds (Ex:  5 sec.) or
- a number of times. (Ex:  x3 )

All operation steps are indicated by lit or flashing LED(s).

### 9.2 Startup

Connect Air supply and a mA-simulator to the positioner.



**Warning:** During calibration, the actuator may stroke unexpectedly.

### 9.3 Calibration

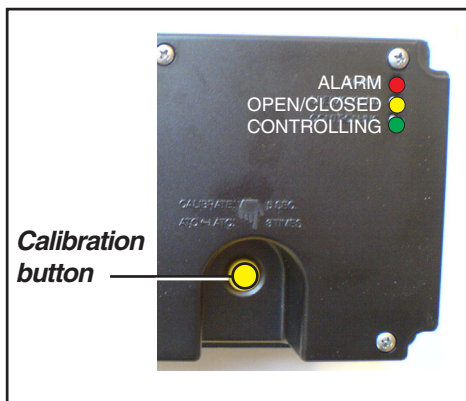
Apply 4 mA current as input signal.



**5 sec.**

Press the button for 5 sec. (Release the button when the three LED:s start to flash alternately). The calibration starts, the actuator goes go to max. and min. position and calculates the control parameters.

The Calibration procedure will take between 30 seconds and some minutes depending on actuator size.



The three LED:s will flash alternately during calibration.

After calibration all the three LED:s are lit for a moment.

A successfull calibration is indicated by yellow or green LED:



Green LED flashes = In service



Yellow LED flashes = In service.  
The unit vents in max or min position.

An unsuccessfull calibration is indicated by error codes:



D20 does not reach the setpoint.

For other indications, see **Error codes**, page 30.

9.4 Set of Direct or Reverse  
action

**Note! For safety reason, this operation has to be done max 5 minutes after calibration. If time has run out, or if power is disconnected during the five minutes, perform a new calibration, before changing the direction.**

Run 4 mA. If valve is in right position, then check the position over the whole range (8, 12, 16 and 20 mA).



If the direction need to be changed: press the button 3 times and the direction will change.

Check operation at 4 – 8 – 12 – 16 and 20 mA

9.5 Show gain setting

If the actuator position is unstable or selfoscillating after calibration, the gain can be adjusted.

Gain can be set from **A** (lowest) to **G** (highest). Default is **D**.



To **show** the current gain setting, press the button four times.

To indicate the current setting, the LEDs flashes according to the following:

LEDs show:	<b>Y R R</b> 	<b>G (Highest)</b>
LEDs show:	<b>Y R Y</b> 	<b>F</b>
LEDs show:	<b>Y R G</b> 	<b>E</b>
LEDs show:	<b>Y G</b> 	<b>D Default</b>
LEDs show:	<b>Y G G</b> 	<b>C</b>
LEDs show:	<b>Y G Y</b> 	<b>B</b>
LEDs show:	<b>Y G R</b> 	<b>A (Lowest)</b>

The gain code sequence is repeated 5 times.

### Button functions:

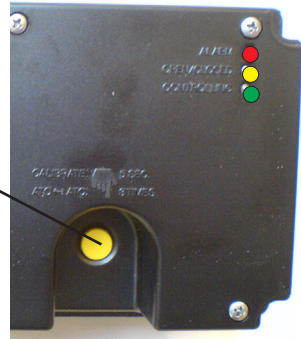
**Press 5 sec = Calibration**

**Press x3 = Direct/reverse action**

**Press x4 = Show gain setting**

**Press x5 - x11 = Change gain setting**

**To indicate that a command is accepted, the three LED:s light up.**



## 9.6 Change of gain setting

To lower the gain, press the button: 7, 6 or 5 times (5= lowest).








To increase the gain (if actuator is moving to slow).

Press the button: 9, 10 or 11 times (11= highest) to increase the gain.

The LED:s flashes alternately when the button is pressed. After gain change the LED:s show the gain code (see 9.3) five times.

The default value after first calibration is **D**.

After this, the gain settings are finished.

-  **x11** G (Highest)
-  **x10** F
-  **x9** E
-  **x8** **D Default**
-  **x7** C
-  **x6** B
-  **x5** A (Lowest)

↑↑ Higher  
|  
↓↓ Lower

## 10. Limit switches & 4 - 20 mA transmitter (Optional)

### Caution!

The installation of electrical equipment in hazardous areas must comply with the procedures contained in the certificates of conformity. Country specific regulations may apply.

Electrical safety is determined only by the power supply device.

### 10.1 General

D20 can be equipped with optional plug in modules for limit switches and/or 4-20 mA feedback transmitter

### 10.2 Model selection

See D20 model code

### 10.3 Principle of operation

The stroke of the actuator/valve is picked up by the potentiometer inside the D20. Movement is transferred from actuator via lever or shaft coupling. Cams/vanes mounted on the positioner shaft actuate limit switches 1 and 2. The switching point can be adjusted on each cam/vane.

The position transmitter converts actual position into a 4-20mA output signal. This loop requires an external 12-25 VDC power supply.

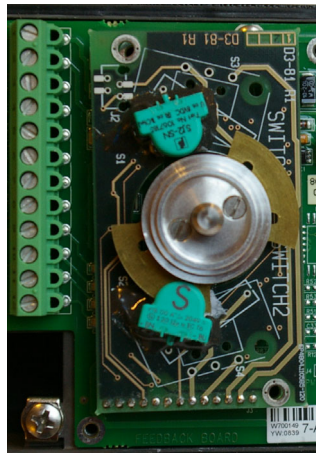
### 10.4 Installation



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

### Important!

For D20 installed in hazardous areas, maintenance and repair must only be made by authorized and trained staff.



- Remove cover, indicator if present and inner plastic cover.

- Check that spacers are installed on the printed circuit board.

- Carefully install feedback board into its position on the pins.

- Secure it with two (2) screws.

- Install cam assembly on the shaft, if feedback card has mechanical micro switches, be careful to not damage switch arms.

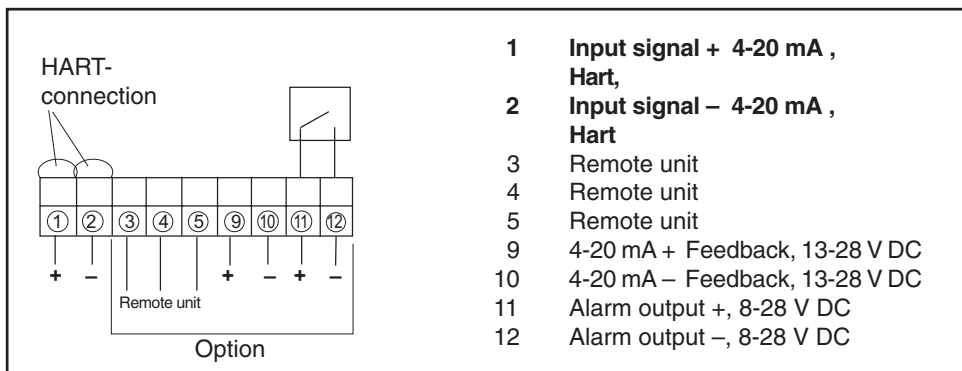
- Install plastic inner cover.

- Adjust cams/vanes to ensure proper switching.

- Secure cam/van position by locking them with two (2) screws.

- Calibrate 4-20 mA transmitter, (see next page).

- Install cover.



## 10.5 D20 Calibration of 4-20 mA input signal and/or 4-20mA feedback transmitter

• Press and hold button while switching on power to the D20, keep the button pressed for 6 sec. The eeprom will now be erased, and then all three LEDs are lighted. The LEDs will start to flash yellow-red. This starts FACTORY MODE!

### To calibrate 4-20 mA input signal

• Apply 4.0 mA input signal and then push the button three (3) times until all LEDs are lighted. The LEDs will now start flash yellow-red again.

Apply 20.0 mA input signal and then push the button three (3) times until all LEDs are lighted.

### To calibrate 4-20 mA transmitter output signal

**Note!** If no transmitter board is installed the LEDs will start flash yellow-yellow and the unit is ready for continued calibration. If there is a transmitter board installed the LEDs will start flash yellow-green.

The feedback transmitter output signal on pin 9 and 10 will now follow the input

signal instead of the position. Apply 4.0 mA input signal. Measure the output signal and adjust the input signal up/down until the output signal is 4.0 mA. Push the button three times until all LEDs are lighted. The unit will now start to flash yellow-green again.

The output signal on pin 9 and 10 will continue to follow the input signal instead of the position. Apply 20.0 mA input signal. Measure the output signal and adjust the input signal up/down until the output signal is 20.0 mA. Push the button three times until all LEDs are lighted.

The LEDs will start flash yellow-yellow and the unit is ready for continued calibration.

Press the button for 5 sec until the LEDs start alternating, D20 starts to calibrate stroke.

After calibration the unit will start running in normal operation.

# 11. Trouble shooting

## 11.1 PMV D20 Normal operation

<div>G</div> <div><div></div></div>	Normal operation.	
<div>Y</div> <div><div></div></div>	Valve fully closed or open "Cut off" enabled.	

## 11.2 PMV D20 error codes

An unsuccessful calibration is indicated by the LED:s. The type of error is shown by the flash sequence.

Error code	Probable Cause	Action
<div>R</div> <div><div></div></div> <div>(Alarm)</div>	Deviation between set value and valve position.	

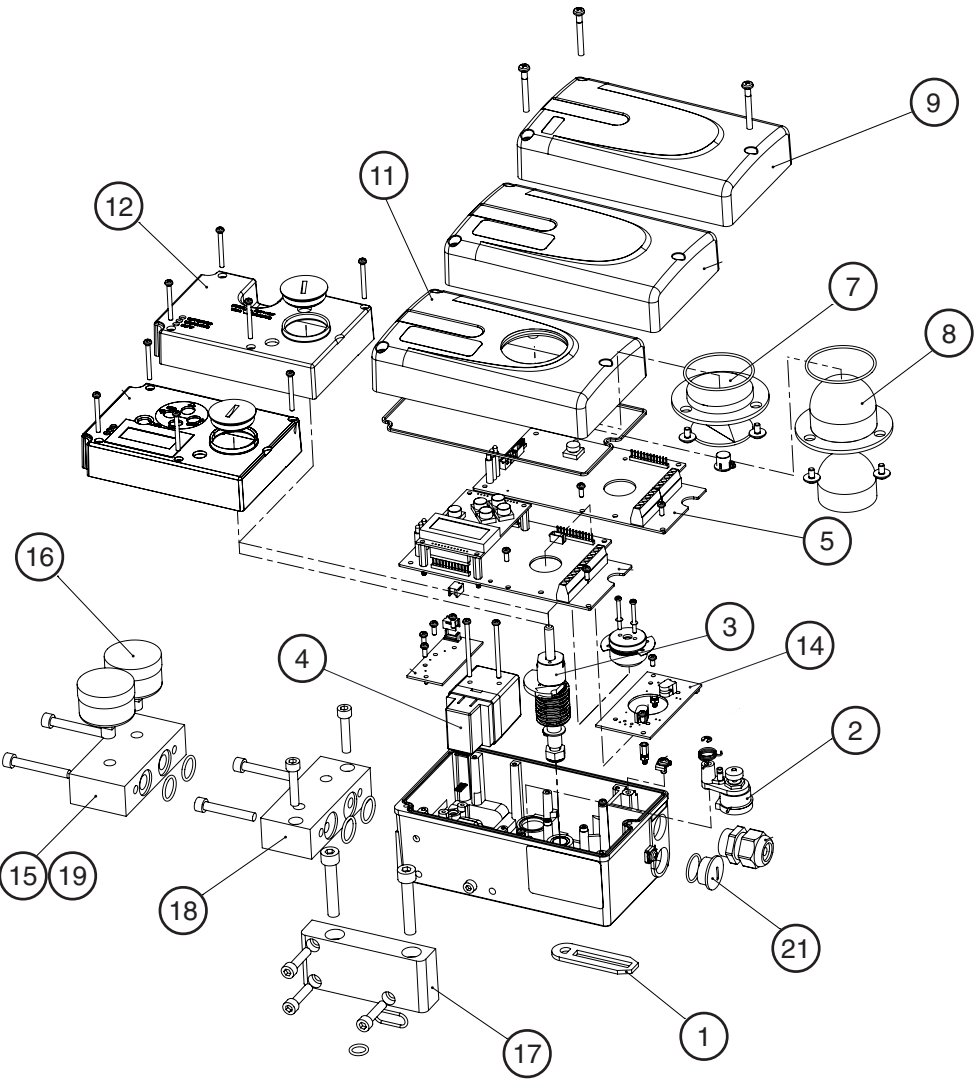
### Calibration

<div>R G</div> <div><div></div><div></div></div> <div>(No movement)</div>	No air supply or shaft do not move.	Check air supply Check shaft movement.
<div>R Y G</div> <div><div></div><div></div><div></div></div>	Pot not calibrated.	Calibrate the pot.
<div>R G R</div> <div><div></div><div></div><div></div></div>	Hallsensor value too low.	
<div>R R G</div> <div><div></div><div></div><div></div></div>	Hallsensor span too low.	Check hallsensor connection.
<div>R Y R</div> <div><div></div><div></div><div></div></div>	Hallsensor value too high.	
<div>Y R</div> <div><div></div><div></div></div>	Unit in Factory Mode.	Calibrate 4 - 20 mA input signal.
<div>Y G</div> <div><div></div><div></div></div>	4 - 20 mA feedback installed.	Calibrate output.

## 11.3 PMV D20 symptoms and solutions

Failure	Probable Cause	Corrective action
No LED is flashing.	Current source below 3,6 mA . Incorrect wiring polarity.	Verify current source supplies at least 3,6 mA. Check wiring for correct polarity.
Valve position reading is not what is expected.	Stem position sensor mounting is off 180 degrees.  D20 not calibrated.  Tight shutoff MPC (Minimum position cutoff) is active.	Reposition sensor.  Calibrate D20.  No action.
D20 goes in wrong direction.		Change direction (Section 9.4).
D20 is oscillating.		Decrease gain (Section 9.6).
D20 is responding slow.		Increase gain (Section 9.6).

# 12. Spare parts



POS	PMV P/N	Description	Remarks
		Housing	N/A
1	31947	Lever arm set	
2	30116	Potentionmeter assy. Compl	
3	D2-AS5D	Shaft D-type Linear, incl nut	
3	D2-AS5N	Shaft VDI/VDE 3845 Rotary	
4	D2-SP50 STD	Air relay assy. Ind. O-rings, screws, standard temp.	
4	D2-SP50 LT	Air relay assy. Ind. O-rings, screws, low temp.	
5	7-SP80 1X	Electronics	
5	7-SP80-I 1X	Electronics, Intrinsically Safe	EEx ia
5	7-SP80-H 1H	Electronics, HART	HART
5	7-SP80-I-H 1H	Electronics, HART Intrinsically Safe	EEx ia, Hart
7	30125	Indicator, flat assy. Complete	
8	D2-SP17	Indicator, dome style assy. Complete	
9	7-SP25B	Front cover, no indicator, black, ind. screws	
11	7-SP25BI	Front cover, for indicator/dome, black, ind. screws	
12	7-SP25	Inner cover assy.	
14	3-As81T	4-20 mA transmitter only	
14	3-As81M	Mechanical switches assy. comp (incl. cams, screws)	
14	3-As81P	Proximity switches assy. compl.	
14	3-As81N	P+F NJ2-V3-N sensors assy. compl.	
14	3-As81D4	P+F SJ2 S1N sensors assy. compl.	
14	3-As81D5	P+F SJ2 SN sensors assy. compl.	
14	3-As81D6	P+F SJ2N sensors assy.comp.	
15	D2-SP40	Gauge block B 1/4" NPT, 1/4" NPT, 1/8" NPT, no gauges	
15	D2-SP40	Gauge block C 1/4" NPT, 1/4" NPT, 1/8" G, no gauges	
15/16	D2-SP40	Gauge block B 1/4" NPT, 1/4" NPT, 1/8" NPT, 1 gauge (SS/brass)	
15/16	D2-SP40	Gauge block C 1/4" NPT, 1/4" NPT, 1/8" G, 1 gauge (SS/brass)	
15/16	D2-SP40	Gauge block B 1/4" NPT, 1/4" NPT, 1/8" NPT, 2 gauges (SS/brass)	
15/16	S2-SP40	Gauge block C 1/4" NPT, 1/4" NPT, 1/8" G, 2 gauges (SS/brass)	
17	30144	Flowtop mounting kit incl. O-ring, screws	
18	30145	VDI/VDE 3847 mounting assy. incl. O-rings, screws	
19	30395	Double acting module incl. 2xGauges	
21	30738	Plug and cable gland kit, black	
	30737	Seal and O-ring kit	
	30135	Screw and washer kit	

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