

P3300 Series

**Instruction Manual**

Pneumatic Valve Positioners

# 1 MOUNTING

## 1.1 Mounting

1. Mount the positioner mounting plate to the actuator yoke using two 5/16" UNC screws.
2. Mount the positioner to the mounting plate using three M6 screws.
3. Check the positioner action. (See Fig. 1.3)  
 Direct Action: Increasing input signal gives increasing output  
 Reverse Action: Increasing input signal gives decreasing output.

### Switching between Direct and Reverse Action

For direct action ensure that the switch position on the nozzle is set at 'D' – See Fig. 1.1.

For reverse action ensure that the switch position on the nozzle is set at 'R' – See Fig. 1.1.

4. Check Actuator Action – see Fig 1.3  
 Direct actuators (air to close/air fail open )  
 Cam should be positioned with side 'A' facing outwards.  
 – See Fig. 1.2.  
 Reverse actuators (air to open/air fail closed)  
 Cam should be positioned with side B' facing outwards  
 – See Fig. 1.2.

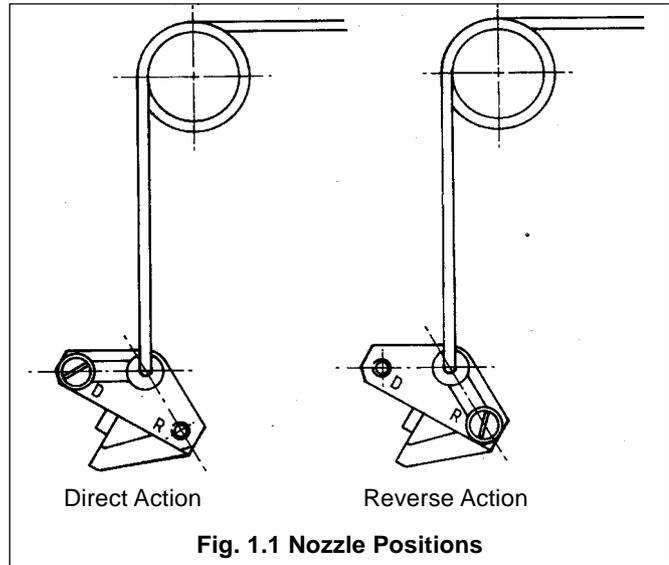
### 5. Check Cam Characteristic

A/B1 = Linear

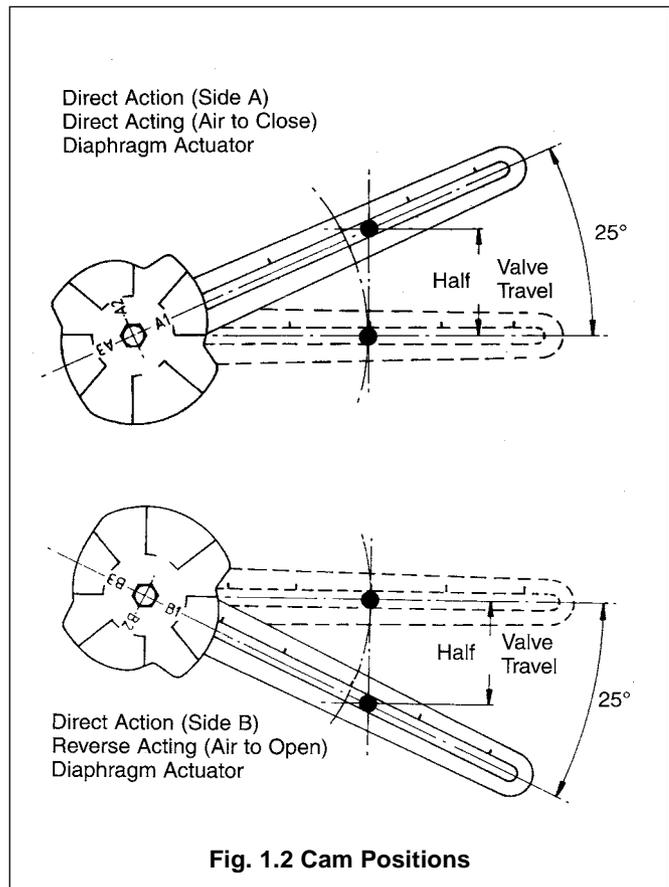
A/B2 = Delayed

A/B3 = Advanced

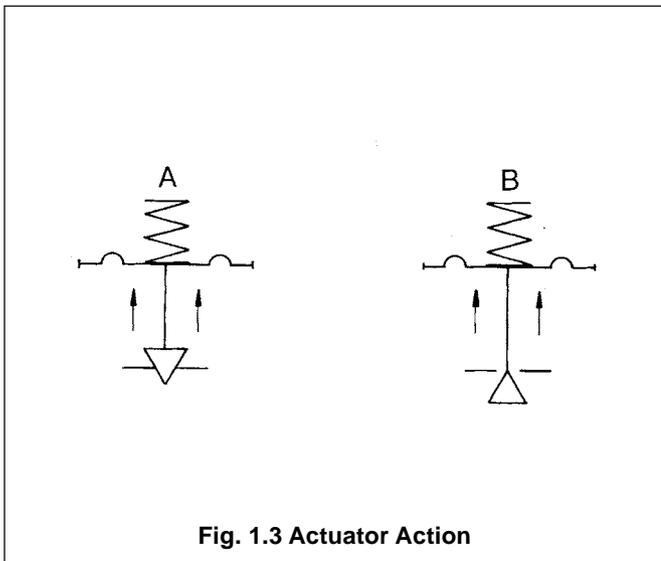
6. Before piping positioner output to the output to the actuator apply a pressure value to the actuator to stroke the actuator to 50% of its rated travel.
7. With the positioner feedback arm horizontal fix the drive pin from the stem coupling to the feedback arm, so that the position of the pin corresponds to the valve travel on the feedback arm graduations. Lock the pin in position.
8. The positioner supply and output connections should now be made. The supply pressure to the positioner should be constant and not exceed 4.0 Bar G. If the supply exceeds this limit a filter regulator must be used to avoid damage to the actuator diaphragm.



**Fig. 1.1 Nozzle Positions**



**Fig. 1.2 Cam Positions**



**Fig. 1.3 Actuator Action**

Act Type	Instrument Action	Switch Position	Cam Position
A	Direct	D	B
	Reverse	R	A
B	Direct	D	A
	Reverse	R	B

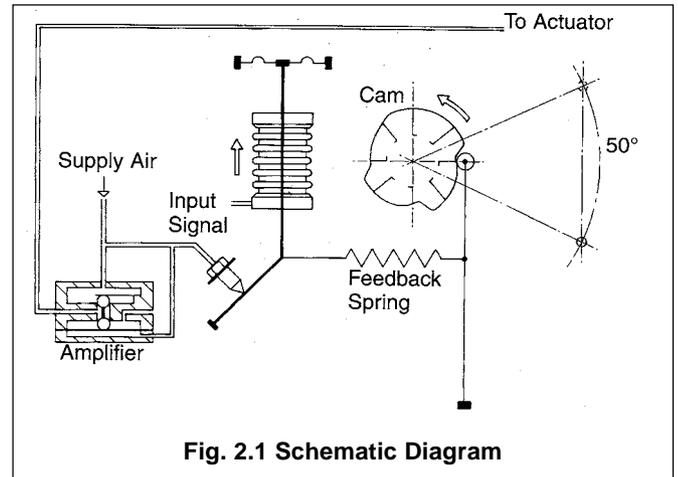
**Table 1.3 Actuator Action**

## 2 OPERATION

### 2.1 Principle of Operation – Fig 2.1

A variation of the 4 to 20 mA input signal causes a variation in the force generated by the bellows unit. This changes the state of equilibrium of the mechanism and produces a change in the modulated signal from the flapper/nozzle/capillary system. This change in signal is amplified in flow and pressure and acts on the diaphragm of the actuator to produce a movement of the valve stem proportional to the change in value of the mA signal. The cam transmits the movement of the stem to a feedback spring.

The stem continues to move until the force generated by the bellows unit is balanced by the force generated by the feedback spring. A new equilibrium condition is thus established as a relation between position of the stem and the input signal.



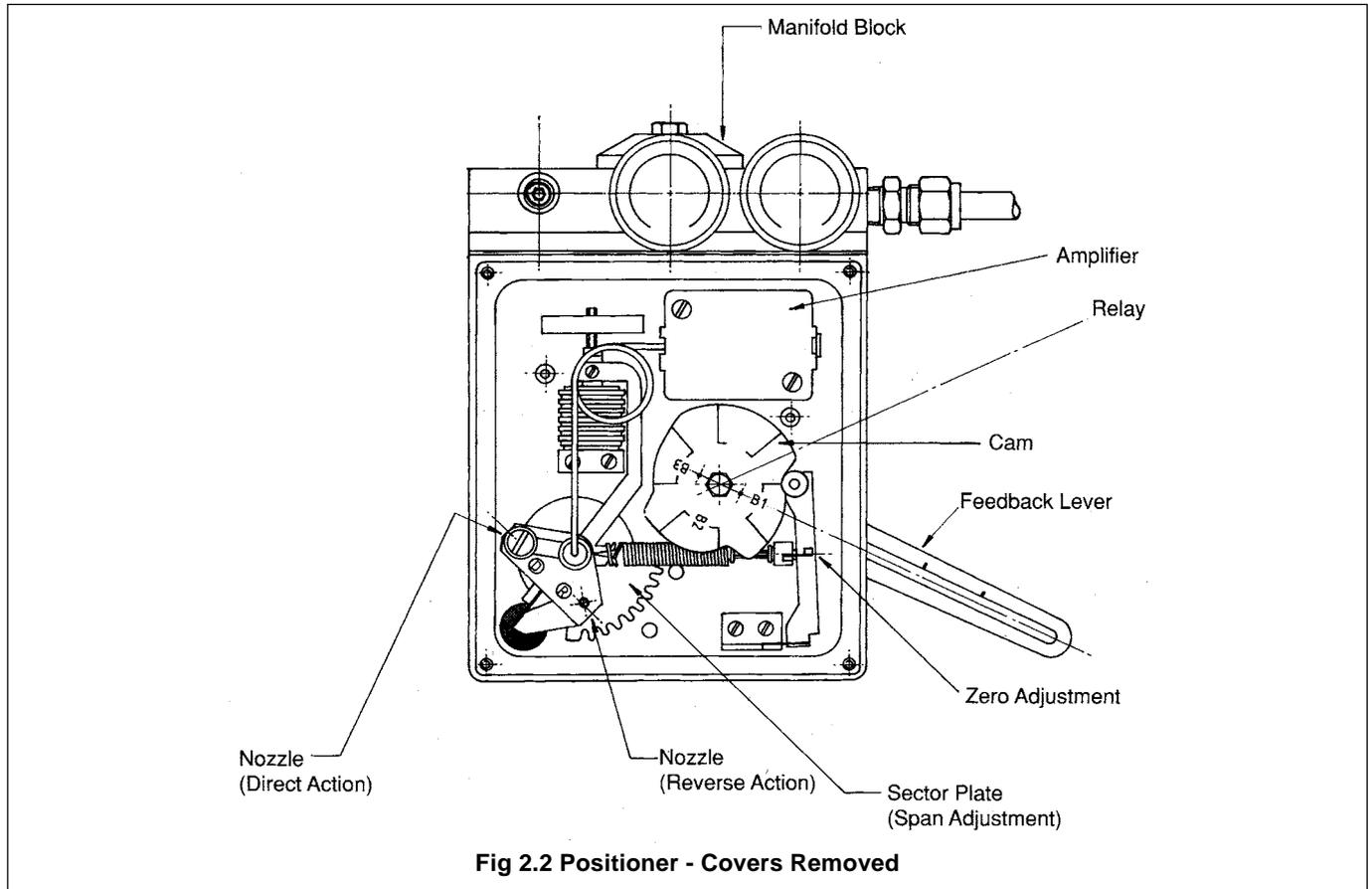
### 2.2 Adjustments – Fig 2.2

1. Supply the positioner with dry, clean air up to a maximum pressure of 60 PSI (4.0 bar).
2. **Zero Adjustment** – Apply minimum signal pressure to the signal connection and adjust the zero adjustment screw until the output gauge reads a slight positive pressure (approx. 1/2 PSI).
3. **Span Adjustment** – Apply maximum signal pressure and adjust the toothed sector plate until the actuator fully strokes.
4. Re-check zero and adjust if necessary.
5. Re-check span and adjust if necessary.

### 2.3 By-pass Switching

If the positioner is fitted with a by-pass switch, the switch should be set to 'Positioner' for automatic operation.

If the switch is set to 'By-pass', the input signal is fed directly to the actuator.





*Specification DataFile*

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- Single acting, force-balance operating principle
- Excellent dynamic response, short positioning time and negligible positioning error
- Field adjustable for valve strokes between 14 mm and 102 mm (1/2 in and 4 in)
- Single feedback cam with three standard characteristics
- Convenient, no range spring changing required and accurate means of split-ranging the signal and/or the valve action.
- Compatible with all spring and diaphragm-operated control valves
- Set and forget reliability
- Complies with relevant international standards for test procedures and environmental protection against harsh plant conditions



## Introduction

Model W-PP, the pneumatic valve positioner of the P3300 Series of field mounting instruments, ensures that the control valve plug position is always directly proportional to the pneumatic input signal, regardless of diaphragm actuator hysteresis, packing-box friction or off-balance force on the valve plug.

The valve responds to infinitely small changes in the controller output signal when process lags require the use of wide proportional band.

Problems usually associated with plant instability due either to oversized valves or non-linear trim characteristics are minimized by selecting one of the three feedback cam alternative positions.

By-pass option allows positioner to be removed without disturbing the control valve operation.

Turn-down ratio 5 to 1 by a single controller output signal split ranging for sequential operation of two or more control valves is standard.

## Functional Specifications

### Input Pressure Range

0.2 - 1 bar, 20 - 100 kPa, 3 - 15 lb/in\*  
0.4 - 2 bar, 40 - 100 kPa, 6 - 30 lb/in\*

### Auxiliary Supply Pressure

1.4 - 4 bar, 140 - 400 kPa, 20 - 60 lb/in\*

### Start Point and Span Adjustments

Separate, internal, continuous.

### Split-range

Any value down to 20% of specified input range.

### Stroke Length

Any value between 14 mm and 102 mm (1/2 in and 4 in) providing feedback lever rotation is 50Q.

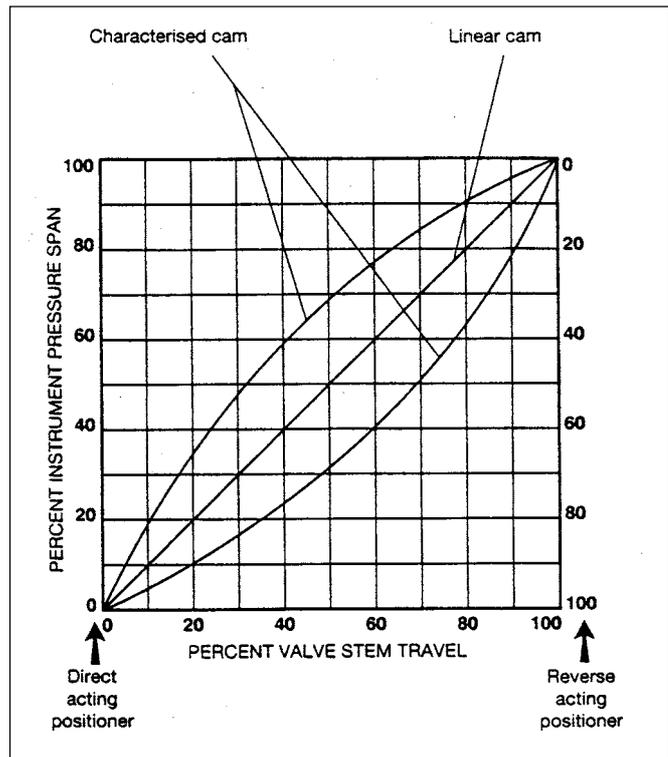
### Output to Actuator

Up to 95% of auxiliary supply pressure, direct or reverse acting.

Supply bar	Auxiliary supply consumption (static) NI/h (scfm)	Flow capacity (dynamic) NI/h (scfm) as input pressure	
		Increases	Decreases
1.4	max. 350 (0.21)	up to 9000 (5.54)	9000 (5.54)
4	max. 600 (0.36)	up to 15600 (9.6)	9000 (5.54)

## Environmental Conditions

	Auxiliary Supply (bar)	Temperature °C	Relative Humidity %	Barometric Pressure (mbar abs)	Vibration (according IEC 654-3)
Reference	min. 1.4 ± 1 % max. 4 ± 1 %	+15 to +35	45 to 75	860 to 1080	None
Normal	min. 1.4 ± 5 % max. 4 ± 5 %	-25 to +85	0 to 100 condensing	700 to 1080	f <sub>1</sub> = 1 to 10 Hz (Amp. 1.5 mm) f <sub>2</sub> = 10 to 60 Hz (Amp. 0.15 mm) f <sub>3</sub> = 60 to 500 Hz (Acc. 19.6 m/s <sup>2</sup> )
Extreme	min. 1.4 ± 15 % max. 4 ± 15 %				-43 to +120
Transport to Storage	—			660 to 1080	f = 1 to 150 Hz (Vel. 2300 mm/s) accidental



Cam Characteristics

## Physical Specifications

### Construction

#### Case and by-pass assembly

Standard: die-case aluminium alloy (low copper and magnesium).

Optional: AISI 316 ss.

#### Case cover

Standard: P.B.T. 20, glass fibre reinforced polybutylentereftalathe.

Impact-resistant self-extinguishing polyester.

Epoxy-resin painted - RAL 1001.

Optional: AISI 316 ss.

#### Input bellows

Standard: brass.

Optional: AISI 316 ss.

#### Flapper/Nozzle

AISI 303 ss.

#### Cam and Feedback lever:

AISI 304 ss.

## ...Physical Specifications

### Spring

AISI 302 ss.

### Internal connections

AISI 316 ss.

### Identification tag

AISI 316 ss permanently mounted - 20 characters max.  
(legend to be specified).

### Gauges

Brass with plastic case or AISI 316 ss, as specified.

### Pneumatic connection

Supply, output and instrument: 1/4in. NPT female.

### Natural gas exhaust

1/2 in NPT female.

### Net Weight

2.5 Kg approx. without optional extras

### Optional Extras

### Positioner by-pass switch

Externally operated.

### Gauges

Supply and Output: 0 to 4 bar/0 to 60 PSI, 0 to 4 kg.cm<sup>2</sup>  
Signal: 0 to 2 bar/0 to 30 PSI 0 to 2kg.cm<sup>2</sup>

### Natural gas auxiliary supply

For applications where instrument air is not available.  
Tapped 1/2 in. NPT.

## Performance Specifications

Unless otherwise stated performance specifications are given at reference environmental condition, 0.2 to 1 bar or 0.4 to 2 bar input pressure standard ranges, with standard linear cam and direct acting positioner. All errors are quoted as percentage of the associated actuator stroke. Test procedures are in accordance with relevant international standards.

### Accuracy

±1% (includes combined effects of non-linearity, hysteresis and repeatability).

### Terminal based linearity

±0.5%

### Repeatability

Better than 0.3%

### Hysteresis

Better than 0.5%.

### Indication accuracy

±2% f.s.d.

### Environmental protection

IP 55 according to IEC 529.

### Operating Influences

#### Ambient temperature over the range -25 to +55° C:

Better than ±0.3%/10K

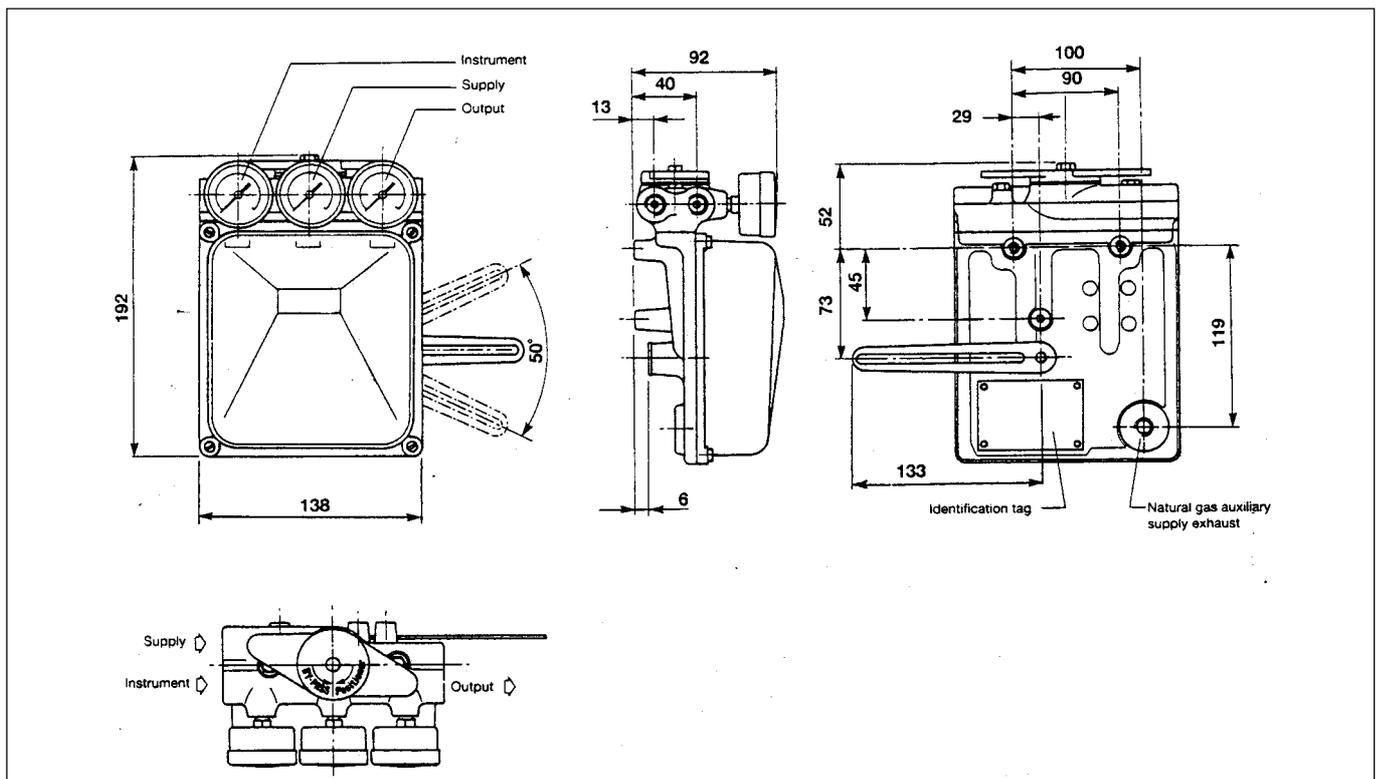
#### Auxiliary supply:

±0.65%/0.1 bar.

#### Humidity and barometric pressure:

No influence.

## Outline Dimensions



## Ordering Information

<b>Order no.</b>				<b>P3300</b>	X	X	X	X	X	X	X	X	X	X
<b>Materials of Construction</b>														
	Input Bellows and Relevant Parts	Case	Case Cover											
	Brass	Aluminium	Polyester	1										
	AISI 316 SS	Aluminium	Polyester	3										
	AISI 316 SS	AISI 316 SS	AISI 316 SS	5										
<b>Auxiliary Supply</b>														
	Instrument Air			1										
	Dry Natural Gas			5										
<b>Use Code</b>														
														1
<b>By-Pass Switch (*)</b>														
	Without													1
	With													2
<b>Pressure Gauges</b>														
	Input	Output	Supply	Material of Gauges										
	No	No	No	—										1
	Yes	Yes	No	Brass										2
	Yes	Yes	Yes	Brass										3
	Yes	Yes	No	AISI 316 SS										4
	Yes	Yes	Yes	AISI 316 SS										5
<b>Cam Characteristic</b>														
	Standard													1
	Special (**)													9
<b>Use Code</b>														
														1
<b>Use Code</b>														
														1
<b>Input Pressure Range (***)</b>														
	3 to 5 lb/in <sup>2</sup>													1
	20 to 100 kPA/0.2 to 1 bar													2
	6 to 30 lb/in <sup>2</sup>													5
	40 to 200 kPA/0.4 to 2 bar													6
	Split Range (*)													9
<b>Use Code</b>														
														0

(\*) Not recommended for split range or reverse action applications.

(\*\*) Percent of input pressure / percent of valve stem travel relationship must be specified with the order.

(\*\*\*) Input pressure range must be specified with order.

Note. Unless otherwise stated the positioner will be pre-set for direct action.