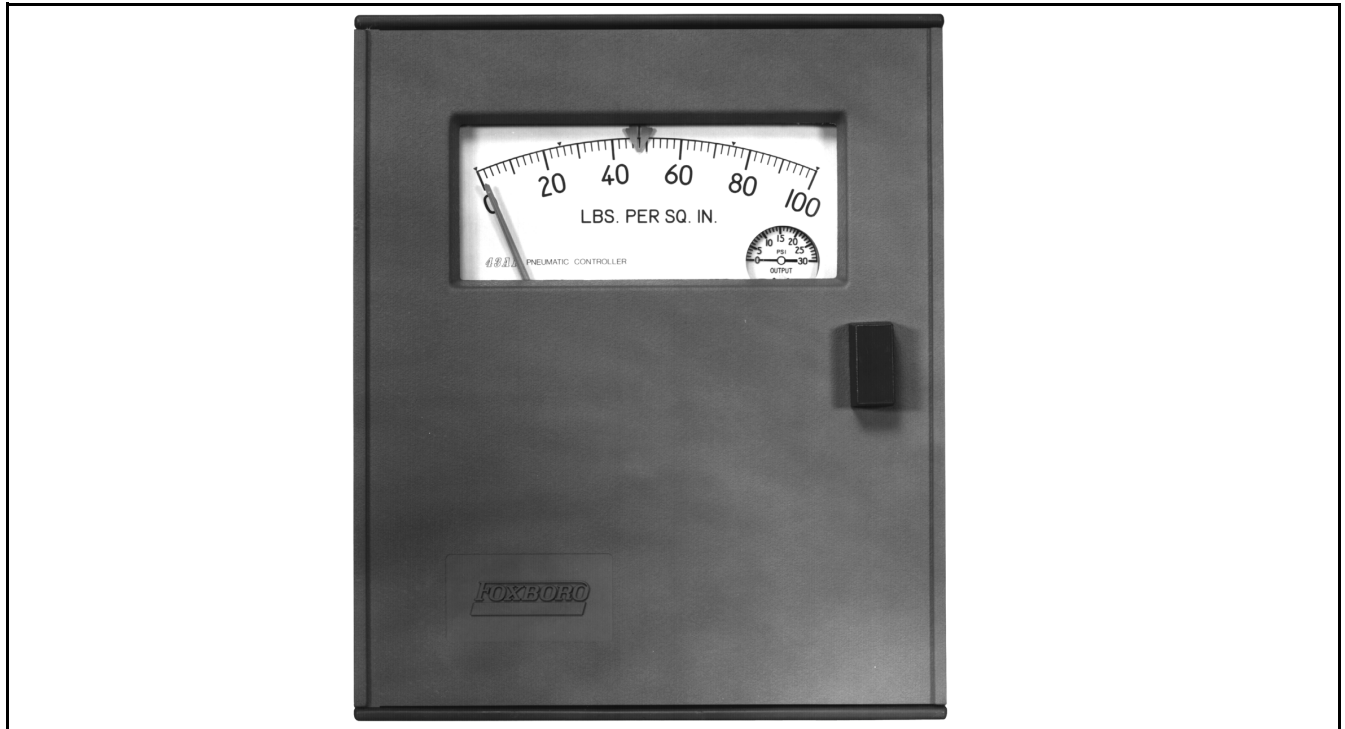


## **43AP Pneumatic Indicating Controllers**



*These instruments indicate and control pressure, temperature, vacuum, and differential pressure. They provide process industries with a highly dependable and versatile group of instruments.*

### **WIDE SELECTION OF MEASURING ELEMENTS**

Invensys Foxboro offers the widest variety of element constructions and ranges in the industry. This versatility enables the 43AP Series Pneumatic Indicating Controllers to be applied to virtually any process.

### **WIDE CHOICE OF CONTROL MODES**

On-off, proportional, proportional plus derivative, proportional plus integral (reset), proportional plus integral plus derivative, differential gap, and automatic shutdown actions are available.

### **BROAD RANGE OF INTEGRAL (RESET) AND DERIVATIVE ADJUSTMENTS**

The integral unit has the complete range from 0.01 to 50 minutes, and the derivative unit from 0.05 to 50 minutes.

### **VARIETY OF OPTIONS**

These controllers are available with an extensive list of optional features. Among these are internal bumpless automatic-manual transfer stations (two types), "batch" function, remote pneumatic set point, Type 70 electric contacts, and control valve mounting.

### **ACCURACY UNAFFECTED BY MOUNTING STRESSES**

Both the control unit and the measurement element are mounted on a rigid steel plate. Thus, these components are isolated from case stresses due to mounting, and dependable accuracy is ensured.

### **POWER FAILURES DO NOT INFLUENCE PROCESS-DRIVEN INDICATION**

A power failure and the likely subsequent loss of supply pressure do not influence the process-driven indication.

### **WEATHERPROOF CONSTRUCTION**

A glass fiber reinforced case and a gasketed door with a shatterproof polycarbonate window meet IEC IP53 and provide the environmental protection of NEMA® Type 3.

### **VERSATILE MOUNTING**

Instruments may be mounted in a panel, on a flat surface, on a continuous vertical pipe, or on a vertical pipe stub.

### **INTERNAL BUMPLESS AUTOMATIC-MANUAL TRANSFER STATION**

This option provides bumpless-balanceable transfer between automatic and manual control by simple 2-step procedure. Accidental transfer is avoided because the door must be opened to gain access to the transfer station.

## **OPERATING CONDITIONS**

<b>Influence</b>	<b>Reference Operating Conditions</b>	<b>Normal Operating Condition Limits</b>	<b>Operative Limits</b>
Ambient Temperature	24 ±2°C (75 ±3°F)	–30 and +80°C (–20 and +180°F)	–40 and +80°C (–40 and +180°F)
Relative Humidity	50% ± 10%	No Limit	No Limit
Supply Pressure	140 ± 1.4 kPa (20 ± 0.2 psi)	115 and 155 kPa (17 and 23 psi)	210 kPa (30 psi)

## **PERFORMANCE SPECIFICATIONS**

(UNDER REFERENCE OPERATING CONDITIONS UNLESS OTHERWISE SPECIFIED)

### **Accuracy**

#### **INPUT TO POINTER**

±0.5% of span for qualified elements.

#### **INPUT TO OUTPUT**

Depends on measuring element used.

### **Repeatability**

0.2% of span.

### **Deadband**

0.1% of span.

### **Ambient Temperature Effect**

Maximum control point shift at midspan per 55°C (100°F) change within normal operating conditions is 1% of input span.

### **Supply Pressure Effect**

Maximum control point shift at midspan per 7 kPa (1 psi) change within normal operating conditions is 0.2% of input span.

## FUNCTIONAL SPECIFICATIONS

### Elements

Refer to Measuring Element Specifications section for types, materials, and ranges.

### Controller Action

Output signal either increases or decreases with increasing measurement, as specified; action is reversible in the field.

### Output Signal

20 to 100 kPa, 3 to 15 psi, or 0.2 to 1.0 bar or kg/cm<sup>2</sup>, as specified.

### Air Consumption (Under normal operation)

0.5 m<sup>3</sup>/h (0.3 cfm) at standard conditions.

### Output Gauge

0 to 200 kPa, 0 to 30 psi, or 0 to 2 bar or kg/cm<sup>2</sup>, as specified.

### Set Point Adjustment

By means of a knob mounted inside the case.

### Pointers

Set point and measurement pointers are fluorescent red.

### Scale

Black markings on white background; sector-shaped with nominal effective length of 150 mm (6 in). (Refer to Chart and Dial Catalog 600 for available ranges.)

### Connections (Located in Bottom of Case.)

#### PRESSURE AND VACUUM

- ▶ For upper range-values up to 14 MPa (2000 psi, or 140 bar or kg/cm<sup>2</sup>): Connections tapped for R1/4 or 1/4 NPT, as specified.
- ▶ For upper range-values from 14 MPa (2000 psi, or 140 bar or kg/cm<sup>2</sup>) up to 70 MPa (10 000 psi, or 700 bar or kg/cm<sup>2</sup>): Connections threaded for R1/2 or 1/2 NPT, as specified.
- ▶ For upper range-values above 70 MPa (10 000 psi, or 700 bar or kg/cm<sup>2</sup>): 9/16-18 Aminco<sup>®</sup> fitting used.

#### PNEUMATIC

Supply and output connections tapped for 1/4 NPT.

### Mounting

#### PANEL

Flush in a panel up to 16 mm (0.6 in) thick.

#### SURFACE

Suitable for all controllers having internally-mounted elements. Note that this mounting is not available with heavy duty helical elements. (These elements extend through the back of the case.)

#### PIPE

A kit of parts to fit a DN 50 or 2 in vertical pipe.

#### YOKE

Kit of parts to fit a vertical DN 50 or 2 in pipe stub. This mounting scheme is designed specifically for controllers having rear-mounted differential pressure elements.

## **PHYSICAL SPECIFICATIONS**

### **Enclosure**

The case is a glass fiber reinforced polyester molding, compounded for superior corrosion resistance. The door is glass fiber reinforced phenylene oxide, and has a shatterproof polycarbonate window, ultraviolet resistant. The overall construction is weatherproof, meets IEC IP53, and provides the environmental protection of NEMA Type 3.

### **Finish**

Case, gray polyester; door, blue textured polyurethane.

### **Data Label**

Aluminum data label fastened to inside of door with pressure sensitive adhesive. Includes space for Customer Tag data up to a maximum of 72 characters and spaces. For additional space, see optional Customer Tag.

### **Approximate Mass**

4.8 kg (10.6 lb), excluding element.

**MEASURING ELEMENT SPECIFICATIONS**  
(TO ACHIEVE STATED PERFORMANCE SPECIFICATIONS)

**Differential Pressure Elements** (Refer to PSS 3-4A2 A)

Element Code(a)	Element Type	Span Available Between(b)			Maximum Operating Pressure		
		kPa $\Delta P$	inH <sub>2</sub> O $\Delta P$	mbar $\Delta$	MPa	psi	bar or kg/cm <sup>2</sup>
DE-A,B	Type 37	5 and 50	20 and 200	50 and 500	14	2000	140

(a) Body and cover material for DE-A is zinc-cobalt; material for DE-B is 316 ss.

(b) These are zero-based elements. The lower range value is zero and the upper range value is as shown (100% of span). Zero differential pressure can be elevated (compound range) so that lower range value is as low as -50% of span; or suppressed so that upper range value is as high as either -150% of span or 50 kPa (200 inH<sub>2</sub>O)  $\Delta P$ , whichever is less.

**Temperature Elements—Filled Thermal Systems** (Refer to PSS 3-3A1 A)

Element Code	System Class	Range Limits		Spans Available Between	
		°C	°F	°C	°F
TA-1A	IA	-130 and +315	-200 and +600	25 and 330	40 and 600
TA-2A and 2B	IIA and IIB	-45 and +315	-50 and +600	Varies with operating temperature(a)	
TA-3B	IIIB	-195 and +760	-320 and +1400	70 and 550	120 and 1000

(a) Does not include temperature overrange values. Narrow spans are at low end of range. The maximum span is 215°C (400°F).

**MEASURING ELEMENT SPECIFICATIONS (CONT.)**  
(TO ACHIEVE STATED PERFORMANCE SPECIFICATIONS)

**Pressure Elements (Refer to PSS 3-2A1 A)**

Element Code	Element Type	Element Material	Spans Available Between(a)	
			kPa or MPa(b)	psi(c)
PA-CA(d) PA-CC(d)	Absolute Bellows	316 ss Bronze	170 and 240 kPa abs 13 and 270 kPa abs	2.5 and 35 psia 1.9 and 39 psia
PA-MA	Absolute Double Spiral	316 ss	140 and 700 kPa abs	20 and 100 psia
PB-AA PB-AM(e)	Helical	316 ss K-Monel	1.4 and 40 MPa 1.7 and 14 MPa	200 and 6000 psi 200 and 2000 psi
PB-BA PB-BM(e)	Spiral	316 ss K-Monel	82 and 1400 kPa 140 and 1400 kPa	12 and 200 psi 20 and 200 psi
PB-CA	Bellows	316 ss	35 and 200 kPa	4.5 and 29 psi
PB-CC	Bellows	Brass	34 and 100 kPa vac 30 and 180 kPa	4.9 and 15 psi 4 and 26 psi
PB-DF	Diaphragm 50 mm (2 in)	Cu-Ni-Sn Alloy	6 and 35 kPa vac 6 and 70 kPa	0.9 and 5 psi 0.9 and 10 psi
PB-PF	Diaphragm 75 mm (3 in)	Cu-Ni-Sn Alloy	2 and 6 kPa vac 2 and 10 kPa	0.3 and 0.9 psi 0.3 and 1.5 psi
PB-GA(f)	Heavy-Duty Helical	316 ss	0.5 and 200 MPa	75 and 30 000 psi
PC 3 to 15 PC 3 to 18 PC 3 to 27	Receiver (Bellows)	Brass	20 to 100 kPa Range 20 to 120 kPa Range —	3 to 15 psi Range 3 to 18 psi Range 3 to 27 psi Range

(a) All elements except Code PC have zero-based ranges. Therefore, the lower range values are zero and the upper range values are as listed.

(b) To convert kPa to bar or kg/cm<sup>2</sup>, divide kPa value by 100. To convert MPa to bar or kg/cm<sup>2</sup>, multiply MPa value by 10.

(c) To convert psi to inH<sub>2</sub>O, multiply psi value by 27.73. To convert psi to inHg, multiply psi value by 2.036.

(d) Replacement element not calibrated.

(e) K-Monel elements comply with NACE Standard MR-01-75.

(f) Element extends through back of case. Replacement element not recommended. Return instrument to Invensys Foxboro.

### MODEL CODE

<u>Description</u>	<u>Model</u>
Indicating Controller	43AP
Mounting	
Field (Pipe or Yoke, as specified in complete element code)	– F
Panel or Surface	– P
Control	
On-Off	A1
Proportional 4 to 400%	A2
Proportional plus Derivative 0.05 to 50 minutes	A3
Proportional plus Integral (Reset) 0.01 to 50 minutes per repeat	A4
Proportional plus Integral plus Derivative	A5
Differential Gap 1 to 100%	A7
Automatic Shutdown	A8
Output Signal and Gauge	
20 to 100 kPa signal; 200 kPa gauge	5
3 to 15 psi signal; 30 psi gauge	2
0.2 to 1.0 bar signal; 2 bar gauge	6
0.2 to 1.0 kg/cm <sup>2</sup> signal; 2 kg/cm <sup>2</sup> gauge	4
Automatic Manual Internal Transfer Switching	
None	N
Bumpless with 2-position switch, balance gauge, regulator	C
2-position nozzle seal switch for manual control	D
Optional Suffix	
Remote Pneumatic Set Point (Not available with pressure element	– P
Codes PA–CA, PA–CC, PB–GA, Type 70 Contacts, or AS Reference “BATCH-H”).	
Elements Available (Refer to element specifications tables)(a)	
Differential pressure, Type 37 Diaphragm (43AP–F only)	/DE–A, –B
Absolute pressure, bellows	/PA–CA, –CC
Absolute pressure, double spiral	/PA–MA
Pressure, helical	/–PB–AA, –AM
Pressure, spiral	/–PB–BA, –BM
Pressure, bellows	/–PB–CA, –CC
Pressure, diaphragm	/–PB–DF, –PF
Pressure, heavy-duty helical (43AP–F only)	/–PB–GA
Pressure receiver, bellows	/–PC
Temperature, Filled Thermal System	/–TA–1A, –2A, –2B, –3B
Examples: 43AP–PA12N–P/PB–AA; 43AP–FA25C/DE–E	

(a) The 43AP also uses the /E Electronic Servo Element. Refer to PSS 3-1B3 B.

## OPTIONAL FEATURES

Optional Feature	Description	AS (a) Reference
Bumpless Automatic-Manual Transfer Station	Consists of precision balance tube, regulator, and 2-position switch located within enclosure. A simple 2-step procedure provides bumpless transfer between automatic and manual control. A shutoff valve is supplied to allow automatic controller and relay to be serviced while retaining manual control.	See Model Code
Nozzle Seal Switch for Manual Control	An internally mounted 2-position switch provides a simple and inexpensive method of achieving manual control. In the manual position, the switch seals the nozzle circuit and the output can be changed by varying the controller supply pressure with an external regulator.	See Model Code
Remote Pneumatic Set Point	Enables the set point to be positioned from a remote source using a standard pneumatic signal. Available over the full span or part of the span.	See Model Code
Integral Air Supply Set	Fixed or adjustable combination pressure regulator and filter with 50 mm (2 in) gauge mounted and piped to controllers. Fixed pressure regulator available without gauge. Maximum input 1 MPa, 150 psi, or 10 bar or kg/cm <sup>2</sup> . NOTE: Not available with panel mounted controllers.	IAS
Type 70 Electric Alarm Contacts	This option comprises a rotor unit with up to 5 contacts. Relays are located in a separate external sheet metal housing. One relay may be supplied to energize on increasing or decreasing measurement, as specified. Or two relays may be provided, one energizing on increasing measurement and one on decreasing measurement. Relay contacts rating (noninductive load): 5 A at 120 V ac, 2 A at 240 V ac, and 5 A at 24 V ac or dc. Electrical classification: ordinary locations.	C-T/70
Control Valve Mounting	A 43AP Controller without elements extending from back of case may be assembled by Foxboro on a control valve fitted with a P50 or P110 Actuator.	CVM
External Connection to Integral Bellows	Used when an external feedback signal must be applied to prevent integral circuit saturation.	ECRB
External Set Point	A knob is fitted on door and engages set point adjustment mechanism.	ESP
High "Batch" Modification	For processes involving discontinuous control, the integral (reset) function is modified to prevent overshoot and to initiate immediate corrective action when control is resumed.	BATCH-H
Gas Tight Case	Special case machining and a gasketed 1/2 NPT vent connection permits operation of the controller with clean, noncorrosive process gas.	GTC
External Phenolic Nameplate	Laminated plastic nameplate 38 X 76 mm (1.5 X 3 in) with white characters on a black background. Maximum of 5 lines with 28 characters or spaces 3 mm (0.13 in) high, or 24 characters or spaces 4 mm (0.16 in) high per line.	N/P
Glass Window in Door	Shatterproof glass window used in areas where abrasive dust can cause scratching of standard polycarbonate window under frequent wiping conditions.	GID

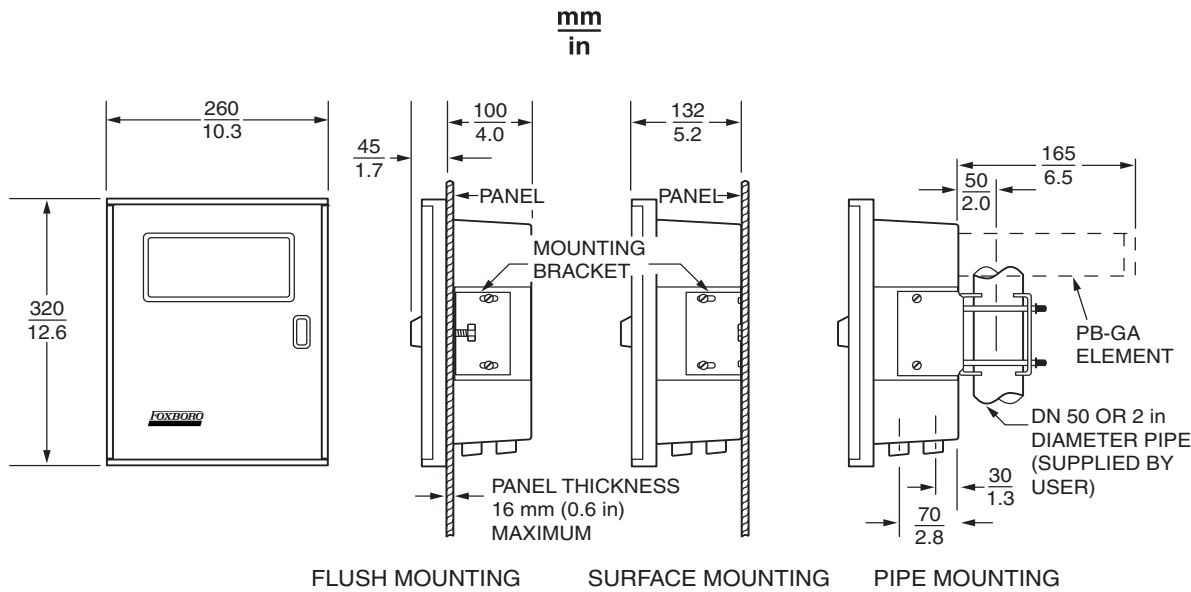
(a) AS is Auxiliary Specification.



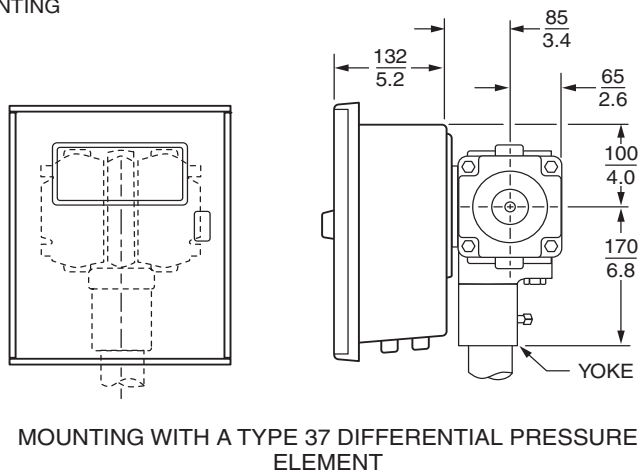
**OPTIONAL FEATURES (Cont.)**

Optional Feature	Description	AS Ref.
Stainless Steel Data Plate	A stainless steel data plate 36 X 40 mm (1.4 X 1.6 in). Maximum of 4 lines with 11 characters or spaces per line.	SCT
Customer Tag	Stainless steel tag attached to instrument for customer tag data that doesn't fit on data plate. There can be a maximum of 10 lines of data with 40 characters per line.	MTS
Tamper-Proof Knob	The door knob is removed to prevent unauthorized access to control adjustments. The door is opened with a specially shaped knob.	TPK
External Subpanel for Automatic-Manual Switching	For use only with controllers not having internal transfer switching. Consists of pressure regulator, nominal 40 mm (1.5 in) gauge, and 2-position transfer switch completely piped and assembled to external subpanel mounted to bottom surface of enclosure. Subpanel is finished in gray. The 1 in AS Code is for Control Codes A1, A2, A3, A7, and A8. The 2 in AS Code is for Control Codes A4 and A5. The S in AS Code is gauge in kPa, the E is psi, and the M is kg/cm <sup>2</sup> .	SD-1S SD-1E SD-1M SD-2D SD-2E SD-2M

DIMENSIONS-NOMINAL



NOTE:  
REFER TO DP 011-476  
FOR PANEL CUTOUT  
AND SURFACE MOUNTING  
INFORMATION.



## **ORDERING INSTRUCTIONS**

- |                                      |                                      |
|--------------------------------------|--------------------------------------|
| 1. Model Number                      | 6. Scale Range                       |
| 2. Mounting                          | 7. Supply Pressure and Output Signal |
| 3. Element Type, Material, and Range | 8. Controller Action                 |
| 4. Measurement Range                 | 9. Optional Features                 |
| 5. Measurement Connection            | 10. Tag and Application              |

## **OTHER M&I PRODUCTS**

Invensys provides a broad range of measurement and instrument products, including solutions for pressure, flow, analytical, positioners, temperature, controlling and recording. For a listing of these offerings, visit the Invensys Operations Management web site at:

[www.iom.invensys.com/m&i](http://www.iom.invensys.com/m&i).

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