



**Model 964  
Metal Seat Construction**

## **MODEL 964 PNEUMATIC CONTROL VALVE 2" & 3" Size w/110 Actuator**

The Model 964 is a globe-style, pneumatic control valve for general plant utility services. The design incorporates characterized trim for most pressure, temperature, level or flow applications. Standard metal seat design gives Class IV shutoff; also available in TFE soft seat design for Class VI shutoff. Available in sizes 2" and 3" (DN 50 and DN 80).

### **FEATURES**

- Quick change trim
- Equal percentage trim characterization
- Metal seat or TFE soft seat designs
- Optional stellite metal seating surfaces
- Standard stainless steel trim
- Full or reduced orifice trim
- Field reversible fail safe action
- Stem position indicator
- Standard non-asbestos construction

### **APPLICATIONS**

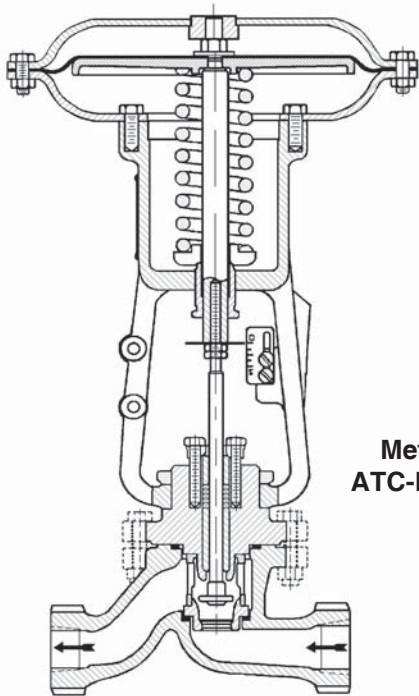
General service utility fluids including air, water, industrial gases and steam.

## GENERAL SPECIFICATIONS

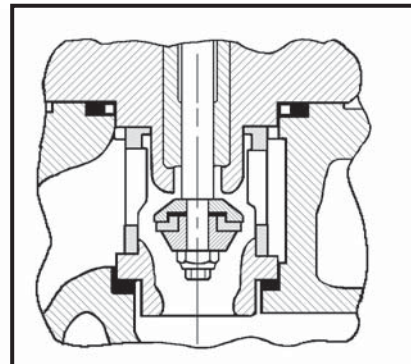
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|---|---|--|---|
| <b>Body Sizes:</b>                                | 2" and 3".<br>(DN50 and DN80).  | <b>Seat Design:</b>                      | Metal or TFE soft seat designs with full and reduced orifices.  |
| <b>Body Pressure/<br/>Temperature<br/>Rating:</b> | <u>Carbon Steel</u> mat'l meets ASME B16.34 for 150# or 300# pressure classes, and meets 300# pressure class for NPT and socket weld conn. <u>Ductile Iron</u> mat'l with NPT conn. meets Cast Iron requirements for ASME B16.4 for 250# pressure class. <u>DI</u> - with 125# or 250# flange conn. meets Cast Iron requirements for ASME B16.1. See Table 1. | <b>Seat Leakage:</b>                     | Meets ANSI/FCI 70-2 (Rev. 1982). Standard – Metal seated, Class IV. Optional – TFE soft seated, Class VI, with metal-to-metal backup. |
| <b>Max. Inlet<br/>Pressure:</b>                   | CS – Up to 740 psig (51 Barg).<br>DI – Up to 500 psig (34.5 Barg).  | <b>Flow Direction:</b>                   | <u>Standard:</u> Flow-to-Open (FTO); required to maintain flow characteristic.  |
| <b>Working<br/>Temperature<br/>Range:</b>         | Standard – all materials:<br>-20°F to +450°F. (-28°C to +232°C.)  | <b>Rangeability:</b>                     | 35:1.   |
| <b>End Connections:</b>                           | <u>Female NPT</u> – 2".<br><u>Flanged</u> – 2" and 3".<br>DI – 125# FF, 250# RF.<br><u>Flanged</u> – 2" and 3".<br>CS – 150# RF, 300# RF, separable type.<br><u>Socketweld</u> – 2".<br>CS material only.   | <b>Inherent Flow<br/>Characteristic:</b> | Equal Percentage; FTO direction only.   |
| <b>Maximum<br/>Pressure Drop:</b>                 | Metal seated – Up to 740 psid (51 Bard).<br>TFE Soft Seated – Up to 400 psid (27.6 Bard). (See Tables 3 and 4).   | <b>Flow Capacity:</b>                    | Up to 83 Cv. See Table 5.   |
|   |   | <b>Actuator/Bench<br/>Setting:</b>       | Spring diaphragm type. Field reversible. See Tables 3 or 4 for proper selection of required bench setting.                            |
|   |   | <b>Painting:</b>                         | <u>Standard:</u> All non-corrosion resistant portions to be painted with corrosion resistant epoxy paint per Cashco Spec #S-1606.     |
|   |   | <b>Body/Bonnet<br/>Materials:</b>        | DI – ASTM A395.<br>CS – ASTM A216, Gr. WCB.   |
|   |   | <b>Separable<br/>Flange:</b>             | CS flanges, ASTM A105, with CS split rings ASTM A106.   |

**Stem Size:**

Body Size	Stem Diameter	
	Inch	(mm)
2" & 3" (DN50 & 80)	0.625	(15.9)



**Metal Seat  
ATC-FO Action**



**TFE Soft Seat  
ATC-FO Action**

**Trim:** SST – See Table 2 for detailed material identification.

**Gaskets:** Standard – Non-Asbestos, spiral wound SST with carbon filler.

**Bonnet Bolting:** Zinc plated carbon steel; ASTM A449, Gr. 5 or ASTM A193, Gr. B7 with ASTM A194, Gr. 2H Nuts.

**Packing Flange Bolting:** Type 18-8 SST studs and nuts

**Packing:** V-Ring TFE live loaded packing.

**Miscellaneous Materials:**

Part	Material
Cage	DI Body – DI CS Body – CS
Guide Bushing	440C SST
Retaining Ring	304 SST
Packing Stop	303 SST
Packing Follower	316 SST
Packing Flange	316 SST

**ACTUATOR SUB-ASSEMBLY SPECIFICATIONS**

**Action:** Air-to-Open, Fail Close. Plug located beneath seat ring. Increase loading pressure pushes stem down, plug opens.  
Air-to-Close, Fail Open. Plug located above seat ring. Increase loading pressure pushes stem down, plug closes.

**Bench Ranges and Operating Pressures:**

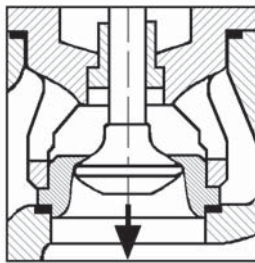
Bench Set		Air Pressure			
		Normal Supply		Design Max.	
psig	(Barg)	psig	(Barg)	psig	(Barg)
3-13	(.20-.90)	20	(1.4)	25	(1.7)
5-15	(.34-1.03)				
6-27	(.41-1.86)	35	(2.4)	40	(2.8)
9-30	(.62-2.07)				

**NOTE:** No springs available for split ranges.  
A positioner is required for split range input signal.

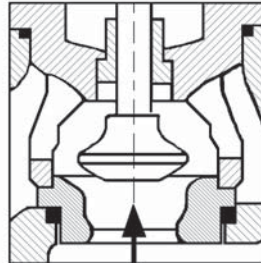
**Ambient Temperature:** -20 to +180°F (-28 to +83°C).  
-20 to +140°F (-28 to +60°C) with electrical accessories.

**Materials:**

PART DESCRIPTION	MATERIAL
Diaphragm	Neoprene
Upper Casing	Steel
Lower Casing	
Yoke	Cl
Yoke Nut	Zn Plated Steel
Spring Button	Cl
Diaphragm Plate	
Stem	
Diaphragm Washer	
Position Indicator	Zn Plated Steel
Diaphragm Washer Nut	
Position Plate	304 SST
Screws	18-8 SST
Nameplate	304 SST
Bolting - Casing	Zn Plated Steel
Bolting - Yoke	
Nuts	
Spring Adjustor	18-8 SST
Spring	Epoxy Coated Steel



Metal Seat-Fail Close, Air-to-Open



Metal Seat-Fail Open, Air-to-Close

**Sizes, Stroke and Volume:**

BODY SIZE in (DN)	ACTUATOR MODEL NO.	DIAPHRAGM AREA		NOMINAL STROKE		VOLUMES CLEARANCE		DISPLACEMENT	
		in <sup>2</sup>	(cm <sup>2</sup> )	in	(mm)	in <sup>3</sup>	(cm <sup>3</sup> )	in <sup>3</sup>	(cm <sup>3</sup> )
2" & 3" (50,80)	110	110	(700)	1.125	(28.6)	105	(1720)	126	(2065)

## OPTION SPECIFICATIONS

<b>Option-3:</b>	<u>MANUAL HANDWHEEL.</u> Overrides the actuator spring force to allow manual stroking of valve. <u>Top mounted</u> – single acting design; functions to push diaphragm plate downwards only. May be utilized as an “up” travel stop.		
<b>Option-12:</b>	<u>REDUCED ORIFICE.</u> For reducing the maximum flow rate or for handling higher pressure drops than the full port orifice.	<b>Option-56:</b>	<u>SPECIAL CLEANING.</u> All body materials. Cleaning per Cashco Spec. #S-1542. Cleaning <u>identical</u> to that of Opt-55, but <u>not</u> labeled for application in oxygen service. Not suitable for oxygen service.
<b>Option-15:</b>	<u>STELLITED TRIM.</u> For metal seated trim design only. Plug and seat material of 316 SST, seating surfaces are covered with Stellite #6 material. Recommended for flashing or partially cavitating liquid	<b>Option-95:</b>	<u>EPOXY PAINT.</u> Special epoxy painting of all non-corrosion resistant external surfaces per Cashco Spec #S-1547. Utilized in harsh atmospheric conditions.

## MOUNTED ACCESSORY SPECIFICATIONS

<b>Positioners:</b>	<p><u>General:</u> PMV Positioners. Aluminum housing with corrosion resistant powder coated epoxy. Pneumatic output load as required by actuator bench range. Field reversible action. Mounting dimensions per IEC 60534-6-1 Standard.</p> <p><b>P/P Pneumatic. Model P5</b> features SST cam with a simple cam locking device, tapped exhaust port for venting media, external zero adjustment. Input signal 3-15 psig, Includes gauge ports, no gauges. Analog only.</p> <p><b>I/P Electro-Pneumatic. Model D20</b> Digital or Hart compatible. Features single button self-calibration. input signal 4-20mA. Optional gauge block with gauges for Models D20 D and D20 I.</p> <p><b>Model D20 D</b> is general purpose.</p> <p><b>Model D20 I</b> is Intrinsically safe, ATEX Ex ia IIC T4, FM CLS 1 DIV 1, FM Non-incendive CLS 1 DIV 2.</p> <p><b>Model D20 E</b> is ATEX EEX d IIB+H<sub>2</sub>, T6 FM Approved. Gauge block is built in, no gauges.</p> <p><b>Model D3</b> Digital, Hart, Profibus, or Fieldbus compatible. Input signal 4-20mA. Features large graphic display. Optional gauge block for Models D3 X and D3 I, no gauges.</p> <p><b>Model D3 X</b> is general purpose.</p> <p><b>Model D3 I</b> is Intrinsically safe, ATEX EEX ia IIC T4.</p> <p><b>Model D3 E</b> is ATEX EEX d IIB+H<sub>2</sub>, T6 CSA CLS 1 DIV 1 FM CLS 1 DIV 1 Gauge block is built in, no gauges.</p> <p>Model PS2 is Hart, Fieldbus and Profibus compatible. Input signal 4-20mA. Features a Makrolon housing, (Aluminum for Explosion Proof.) Mounting dimensions per IEC 60534-6-1 Standard.</p>		<p><b>Model PS2-1</b> is general purpose.</p> <p><b>Model PS2-2</b> is Intrinsically safe, ATEX Ex ia IIC T6/T4, FM CLS 1 DIV 1, CSA CLS 1 DIV 1, SIL 2</p> <p><b>Model PS2-3</b> EX d IIC T6/T4, SIL 2</p>
	<b>Air Tubing:</b>		Instrument air tubing SST with SST fittings.
	<b>Airset:</b>		Model 5200P instrument air supply regulator. Use with positioners. Bracket mounted to actuator casing. Supplied with gauge for P/P positioners; no gauge with I/P positioner. See technical bulletin 5200P-TB.
	<b>Solenoid Valve:</b>		<p><u>Standard Brass:</u> Available in standard weather-proof model. Brass body, 1/4" female NPT connections. Nipple mounted to actuator casing. 120 VAC, 60 Hz power supply, CSA Approved Class 3221-01, NEMA 2,3,3S,4,4X. 8" HF utilizes a direct mount NAMUR mount style.</p> <p><u>X-Proof or SST construction:</u> Consult Factory.</p> <p>Standard installation vents actuator and drives valve to fail-safe position upon loss of electrical power.</p> <p>Consult factory for 230/1/50, or 120 VDC power supplies, or intrinsically safe (IS) service.</p>
	<b>Transducers:</b>		FM, CSA approved NEMA 4X CI 1, Div 1 and CI 1, Div 2
	<b>Other Accessories:</b>		764 P/PD pressure controller. Lockup valve. Position transmitter.
	<b>Limit Switches:</b>		Model D20 and D3 positioners, switches are available, unit is enclosed in the positioner housing.

# TECHNICAL SPECIFICATIONS

<b>TABLE 1 MATERIAL PRESSURE/TEMPERATURE RATINGS</b>						
Body/Bonnet Materials		End Connection	English Units		Metric Units	
General	ASTM Specifications		Pressure (psig)	Temperature (°F)	Pressure (Barg)	Temperature (°C)
Ductile Iron (DI)	A395	NPT	400	-20 to 150	27.5	-28.6 to +65.6
			370	200	25.5	93.3
			310	300	21.3	148.8
			250	406	17.2	207.7
Ductile Iron (DI)	A395	125# Flanged	200	-20 to +150	13.8	-28.6 to +65.6
			190	200	13.1	93.7
			175	250	12.1	121.1
			165	300	11.4	149.2
			140	400	9.7	204.8
			125	450	8.6	232.6
		250# Flanged	500	-20 to +150	34.5	-28.6 to +65.6
			460	200	31.7	93.7
			415	250	28.7	121.1
			375	300	25.8	149.2
			335	350	23.1	177.0
			290	400	20.0	204.8
Cast Carbon Steel (CS)	A216 Grade WCB	150# Flanged	285	-20 to +100	19.7	-28.6 to +38.1
			260	200	17.9	93.7
			230	300	15.8	149.2
			200	400	13.8	204.8
			185	450	12.6	232.6
		NPT or 300# Flanged	740	-20 to +100	51.0	-28.6 to +38.1
			680	200	46.8	93.7
			655	300	45.2	149.2
			635	400	43.8	204.8
			620	450	42.7	232.6

<b>TABLE 2 TRIM MATERIALS</b>		
Seat/Trim Designation	Part	Material Description
Metal / S2	Plug/Stem	17-4PH SST
	Seat Ring	416 SST
	Guide Bushing	440C SST
TFE Soft / S4	Valve Seat	TFE
	Seat Ring	416 SST
	Adapters	303 SST
	Stem	17-4PH SST
	Castle Nut	302 SST
	Cotter Pin	18-8 SST
	Guide Bushing	440C SST

**TABLE 3  
MAXIMUM PRESSURE DROP - psid (Bard)  
METAL SEAT**

Actuator Action	Body Size		Port - Orifice			Maximum Operating Pressure Drop		Actuator			Air Supply Pressure				
	Inch	(DN)	Description	Size		psid	(Bard)	Bench Setting		Model No.	psig	(Barg)			
				Inch	(mm)			psig	(Barg)						
ATO-FC (Reverse)	2"	(50)	Full	1.750	(44.5)	140	(9.6)	5 - 15	(.34 - 1.03)	110	20	(1.4)			
						320	(22.0)	9 - 30	(.62 - 2.07)		35	(2.4)			
			Opt-12 Red.	1.250	(31.8)	320	(22.0)	5 - 15	(.34 - 1.03)		20	(1.4)			
						680	(46.9)	9 - 30	(.62 - 2.07)		35	(2.4)			
	3"	(80)	Full	2.500	(63.5)	65	(4.5)	5 - 15	(.34 - 1.03)	110	20	(1.4)			
						140	(9.6)	9 - 30	(.62 - 2.07)		35	(2.4)			
			Opt-12 Red.	1.750	(44.5)	140	(9.6)	5 - 15	(.34 - 1.03)		20	(1.4)			
						320	(22.0)	9 - 30	(.62 - 2.07)		35	(2.4)			
ATC-FO (Direct)	2"	(50)	Full	1.750	(44.5)	230	(15.8)	3 - 13	(.21 - .90)	110	20	(1.4)			
						270	(18.6)	6 - 27	(.41 - 1.86)		35	(2.4)			
			Opt-12 Red.	1.250	(31.8)	500	(34.5)	3 - 13	(.21 - .90)		20	(1.4)			
						590	(40.7)	6 - 27	(.41 - 1.86)		35	(2.4)			
			3"	(80)	Full	2.500	(63.5)	90	(6.2)		3 - 13	(.21 - .90)	110	20	(1.4)
								120	(8.27)		6 - 27	(.41 - 1.86)		35	(2.4)
	Opt-12 Red.	1.750			(44.5)	230	(15.8)	3 - 13	(.21 - .90)	20	(1.4)				
						270	(18.6)	6 - 27	(.41 - 1.86)	35	(2.4)				

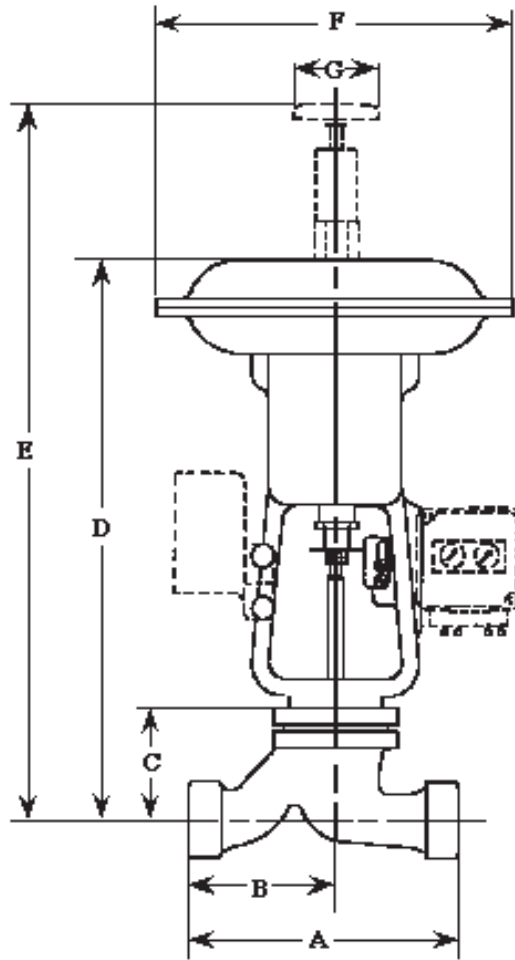
**TABLE 4  
MAXIMUM PRESSURE DROP - psid (Bard)  
COMPOSITION SOFT SEAT**

Actuator Action	Body Size		Port - Orifice			Maximum Operating Pressure Drop		Actuator			Air Supply Pressure				
	Inch	(DN)	Description	Size		psid	(Bard)	Bench Setting		Model No.	psig	(Barg)			
				Inch	(mm)			psig	(Barg)						
ATO-FC (Reverse)	2"	(50)	Full	1.750	(44.5)	180	(12.4)	5 - 15	(.34 - 1.03)	110	20	(1.4)			
						360	(24.8)	9 - 30	(.62 - 2.07)		35	(2.4)			
			Opt-12 Red.	1.250	(31.8)	380	(26.2)	5 - 15	(.34 - 1.03)		20	(1.4)			
						400	(27.6)	9 - 30	(.62 - 2.07)		35	(2.4)			
	3"	(80)	Full	2.500	(63.5)	80	(5.5)	5 - 15	(.34 - 1.03)	110	20	(1.4)			
						170	(11.7)	9 - 30	(.62 - 2.07)		35	(2.4)			
			Opt-12 Red.	1.750	(44.5)	180	(12.4)	5 - 15	(.34 - 1.03)		20	(1.4)			
						360	(24.8)	9 - 30	(.62 - 2.07)		35	(2.4)			
ATC-FO (Direct)	2"	(50)	Full	1.750	(44.5)	270	(18.6)	3 - 13	(.21 - .90)	110	20	(1.4)			
						320	(22.0)	6 - 27	(.41 - 1.86)		35	(2.4)			
			Opt-12 Red.	1.250	(31.8)	400	(27.6)	3 - 13	(.21 - .90)		20	(1.4)			
						400	(27.6)	6 - 27	(.41 - 1.86)		35	(2.4)			
			3"	(80)	Full	2.500	(63.5)	120	(8.2)		3 - 13	(.21 - .90)	110	20	(1.4)
								150	(10.3)		6 - 27	(.41 - 1.86)		35	(2.4)
	Opt-12 Red.	1.750			(44.5)	270	(18.6)	3 - 13	(.21 - .90)	20	(1.4)				
						320	(22.0)	6 - 27	(.41 - 1.86)	35	(2.4)				

**TABLE 5  
THEORETICAL CAPACITY  
METAL OR COMPOSITION SOFT SEAT DESIGN  
EQUAL % CHARACTERISTIC  
FLFactor = 0.90**

Valve Size		Port Size	Minimum Cont. Cv	Cv at 10% Increments									
Inch	(DN)			10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
2"	(50)	Full	1.3	1.6	3.4	5.5	7.4	9.6	18.2	30	38	43	<b>46</b>
		Opt-12 Red.	0.8	1.1	2.1	3.2	4.2	5.6	6.5	11.8	18.7	25	<b>30</b>
3"	(80)	Full	2.4	2.7	5.8	9.3	13.8	23.7	47	64	74	80	<b>83</b>
		Opt-12 Red.	1.8	2.1	2.9	4.4	6.0	7.6	14.1	30	47	58	<b>63</b>

## DIMENSIONS AND WEIGHTS



ENGLISH UNITS – INCH & LBS.			
End Connections	Dimension Identifier	Body Size	
		2"	3"
NPT or SW	A	10.50	12.50
	B	5.88	7.00
Flgd.	A	10.50	12.50
	B	5.88	7.00
ALL	C	6.44	6.56
	D	25.06	25.19
	E	33.06	33.19
	F	15.50	15.50
	G	8.00	8.00
NPT or SW	Ship Wt.*	115	NA
Flgd.		130	186

METRIC UNITS – mm & Kg			
End Connections	Dimension Identifier		
		DN50	DN80
NPT or SW	A	267	318
	B	149	178
Flgd.	A	267	318
	B	149	178
ALL	C	164	167
	D	637	640
	E	840	843
	F	394	394
	G	203	203
NPT or SW	Ship Wt.*	52.0	NA
Flgd.		58.9	84.4

\* Basic valve with actuator, no accessories or manual operator. Add approx. 4 lbs (1.8 kg) for positioner; 3 lbs (1.4 kg) for limit switch; and 8 lbs (3.6 kg) for manual handwheel operator.

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# 2" & 3" MODEL 964 PRODUCT CODER 02/23/16

16 POS 3 — POS 5 POS 6 0 7 — 0 POS 11 POS 12 POS 13 POS 14 POS 15 POS 16 POS 17 D

POSITION 3 - SIZE & BODY MATERIAL			
Body Size	Actuator Size (IN <sup>2</sup> )	Body Material	
		DI	CS
		CODE	CODE
2"	110	5	E
3"	110	6	F

POSITION 5 - END CONNECTIONS	
End Connection	CODE
* NPT - Screwed	1
125 Lb. Flgs. - DI Body	2
150 Lb. CS S.O. Flgs. - CS Body	3
250 Lb. Flgs. - DI Body	4
300 Lb. CS S.O. Flgs. - CS Body	5
* Socket Weld - CS Body	6
* Not available in 3" Size	

POSITION 6 - PORT SIZE / TRIM		
Port Size / Description	TRIM	
	S2	S4
	CODE	CODE
Full	1	5
Opt.-12 Red.	2	6
Full & Opt.-15 Stellite	3	—
Opt.-12 & 15 Red. & Stellite	4	—

POSITION 11 - 110 ACTUATOR			
Action	Fail Position	Bench Set (psig)	CODE
ATO	Close	5 - 15	5
ATO	Close	9 - 30	6
ATC	Open	3 - 13	7
ATC	Open	6 - 27	8

**NOTE:** Consult Tech Bulletin for allowable pressure drop.

POSITION 12 - 764P * (Bracket Mtd) - Airset (Bracket Mtd) & Solenoid Valves			
764P / Action	Solenoid Valve *** Exhaust on Deenergization		
	CODE		
	None	120VAC 60 Hz	24 VDC
None	0	6	C
None W/ Airset	1	7	D
Reverse	2	8	E
Reverse W/ Airset	3	9	F
Direct	4	A	G
Direct W/ Airset	5	B	H
For Special Construction Contact Cashco for Special Code	X		

\* Refer to 764-TB for Product Code of Controller  
\*\*\* Solenoid rated as 4/4X only.

POSITION 13 - DIRECT ACTING POSITIONER with AIRSET (Bracket Mounted) (3-15 psig) 4-20 mA					
Specify Split Range in Special Instructions on the P.O. Split Range Not Available for Model P5 P/P					
Positioner Model	Ratings	Analog/Digital	Hart	Fieldbus	Profibus
		CODE			
P5 P/P *	Gen. Purpose	1			
D20 D I/P	Gen. Purpose	C	#		
D20 I I/P *	Intrinsically Safe	2	5		
D20 E I/P	Explosion Proof	E	F		
D3 X I/P	Gen. Purpose	L	M	N	P
D3 I I/P	Intrinsically Safe	3	6	8	@
D3 E I/P	Explosion Proof	Y	H	J	K
PS2-1 I/P	Gen. Purpose		R	S	T
PS2-2 I/P	Intrinsically Safe		Z	9	\$
PS2-3 I/P	Explosion Proof		U	V	W
None **		0			

\* Stock Item  
\*\* Actuator Assembly includes dimensions for (Namur) Mounting per IEC 60534-6-1.

POSITION 14 - GAUGE BLOCK	
Option for Positioner	Code
None *	0
Gauge Block **	L

\* For P5 gauge ports built in. No gauges.  
\* For D20 E, D3 E & PS2-3 gauge block is standard. No gauges  
\*\* For D20 D & D20 I and PS2-1 & PS2-2- gauge block with gauges.  
\*\* For D3 X & D3 I gauge block only - no gauges.

POSITION 15 - POSITIONER OPTIONS							
Options	POSITIONERS			I/P TRANSDUCERS *			
	Inductive Limit Switches	Micro-switches Limit Switches	Position Transmitter	3-15 PSIG No Airset	3-15 PSIG W/ Airset	0-60 PSIG No Airset	0-60 PSIG W/ Airset
	CODE						
P5				4	5		
D3 & D20	7	T	9				
PS2			8				
No Positioner				C	F	R	S
None	0						

\* For 0-60 Psig Transducer please contact the factory.

POSITION 16 - OPTIONS	
Accessories	CODE
No Handwheel	0
Handwheel	9

POSITION 17 - PAINTING & CLEANING			
Painting	Opt.	Std. Commercial Cleaning	Cleaned to Spec. #S-1542
		CODE	
Standard	—	0	3
Epoxy Painted Per Cashco Spec #S-1547	-95	1	4

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