Fisher® 546 Electro-Pneumatic Transducer

Fisher 546 transducers receive a direct-current input signal and use a torque motor, nozzle-flapper, and pneumatic relay to convert the signal to a proportional pneumatic output signal. Nozzle pressure, which operates the relay, is also piped to the torque motor feedback bellows. This provides a comparison between input signal and nozzle pressure and reduces errors in nozzle pressure.

The transducer can be mounted on a pneumatic diaphragm control valve actuator to provide accurate operation of the valve. The integrated high-capacity pneumatic relay eliminates the need for additional boosters or relays for operation of control valves.

The transducer also can be used to provide stable operation when its output signal is transmitted to small terminal volume chambers such as control bellows in pneumatic valve positioners.

Fisher 546 Transducer Mounted on 657 Pneumatic Diaphragm Actuator

W2115

Features

- Vibration Resistance—High natural frequency of torque motor moving parts results in negligible vibration influence.
- Easy Adjustment—Screwdriver adjustments for span and zero are conveniently located and have arrows indicating rotation to increase settings (as shown in figure 1).
- Field-Reversible Action—No additional parts required to reverse action.
- Simple Relay Removal—Integrated pneumatic relay is mounted outside case and can be removed without disturbing electrical or pressure connections or impairing explosion safety.

Specifications

Available Configuration

Electro-pneumatic signal transducer with explosion-proof case and cover

The 546 can ordered ■ with or ■ without a Fisher 67CFR filter regulator. The 51 mm (2 inch) supply pressure gauge mounted on the regulator may be ■ 0 to 30 psig or ■ 0 to 60 psig range

Input Signals

■ 4 to 20 mA DC, ■ 10 to 50 mA DC, ■ 1 to 9 V DC, or ■ Two-way split range using either half of one of the standard input signal spans

Internal Resistance of Torque Motor

4 to 20 mA DC Input Signal: 176 ±10 ohms
10 to 50 mA DC Input Signal: 90 ±10 ohms
1 to 9 VDC Input Signal: 1300 ±50 ohms (temperature compensated circuit)

Output Signals

Ranges:
■ 0.2 to 1.0 bar (3 to 15 psig), ■ 0.4 to 2.0 bar (6 to 30 psig), ■ 0 to 1.2 bar (0 to 18 psig) or ■ 0 to 2.3 bar (0 to 33 psig)
Action: Field-reversible between ■ direct and ■ reverse

Supply Pressure(1)

Recommended: 0.3 bar (5 psi) higher than upper range limit of output signal
Maximum: 3.5 bar (50 psig)

Average Steady-State Air Consumption(2)(3)

0.44 m^3/hr (16.5 scfh) at 1.4 bar (20 psi) supply pressure

Maximum Output Air Capacity(2)

At 1.4 bar (20 psig) Supply Pressure:
12.9 m^3/hr (480 scfh)
At 2.4 bar (35 psig) Supply Pressure:
18.5 m^3/hr (690 scfh)

Performance(4)

Actuator Loading Time: see figure 3
Reference Accuracy: ±0.75% of output signal span
Independent Linearity: ±0.50% of output signal span
Open Loop Gain: 26
Frequency Response: Gain is attenuated 3 dB at 20 Hz with transducer output signal piped to a typical instrument bellows with 305 mm (12 inch) of 1/4 inch tubing
Electromagnetic Interference (EMI): Tested per IEC 61326-1 (Edition 1.1). Meets emission levels for Class A equipment (industrial locations) and Class B equipment (domestic locations). Meets immunity requirements for industrial locations (Table A.1 in the IEC specification document). Immunity performance shown in table 1.

Operative Ambient Temperature Limits(1)

-40 to 66°C (-40 to 150°F)

Electrical Classification

Hazardous Area:

CSA—Explosion-proof, Dust Ignition-proof, Div 2

FM—Explosion-proof, Non-incendive

Refer to table 2 for specific approval information.

NEMA 3R, CSA Enclosure 3

NEMA 3R mounting orientation requires vent location to be below horizontal.

Adjustments

Zero and Span Adjustments: Screwdriver adjustments located inside case (see figure 1)

Connections

Supply Pressure: 1/4 NPT internal located on side of case (located on filter-regulator if a 67CFR is mounted to transducer)
Output Pressure: 1/4 NPT internal located on side of case
Vent: 1/4 NPT internal with screen located on relay
Electrical: 1/2 NPT internal located on bottom of case

-continued-

Specifications (continued)

Construction Materials

Case and Cover: Aluminum
O-Rings: Nitrile
Flame Arrestors: Stainless steel
Supporting Bracket/Torsion Member: Stainless steel
Magnets: Alloy steel
Nozzle: Stainless steel
Feedback Bellows: Brass
Relay Body: Aluminum
Relay Restriction: Aluminum/Stainless steel
Relay Diaphragm: Nitrile
Relay Valve Plug and Seat Ring: Brass

Mounting

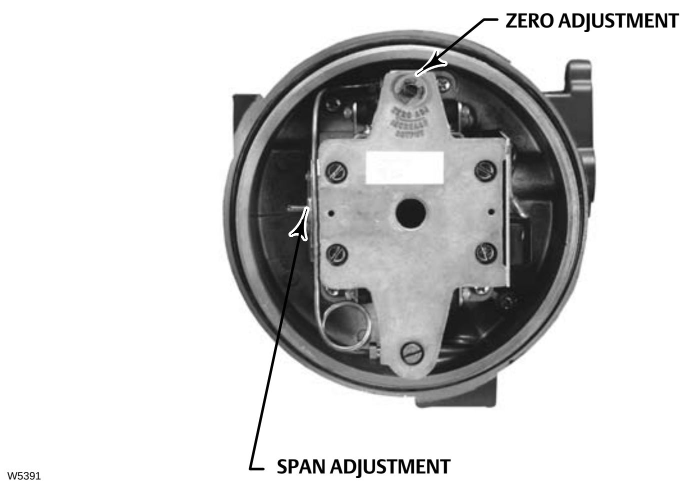
Mounting parts are available for ■ control valve actuator mounting, ■ pipestand (2 inch nominal) mounting, or ■ surface mounting

Approximate Weight

4.1 kg (9 lb)

NOTE: Specialized instrument terms are defined in ANSI/ISA Standard 51.1 - Process Instrument Terminology.
1. The pressure/temperature limits in this document and any applicable standard or code limitation should not be exceeded.
2. Normal m^3/hr--Normal cubic meters per hour (0°C and 1.01325 bar, absolute). Scfh--Standard cubic feet per hour (60°F and 14.7 psia).
3. Average flow rate determined at 12 mA and 0.6 bar (9 psig) output.
4. Performance values are obtained using a transducer with a 4 to 20 mA DC input signal and a 0.2 to 1.0 bar (3 to 15 psig) or a 0.4 to 2.0 bar (6 to 30 psig) output signal. Ambient temperature is 24°C (75°F). A transducer with other input or output signals may exceed these values.

Figure 1. Zero and Span Adjustments (Cover Removed)



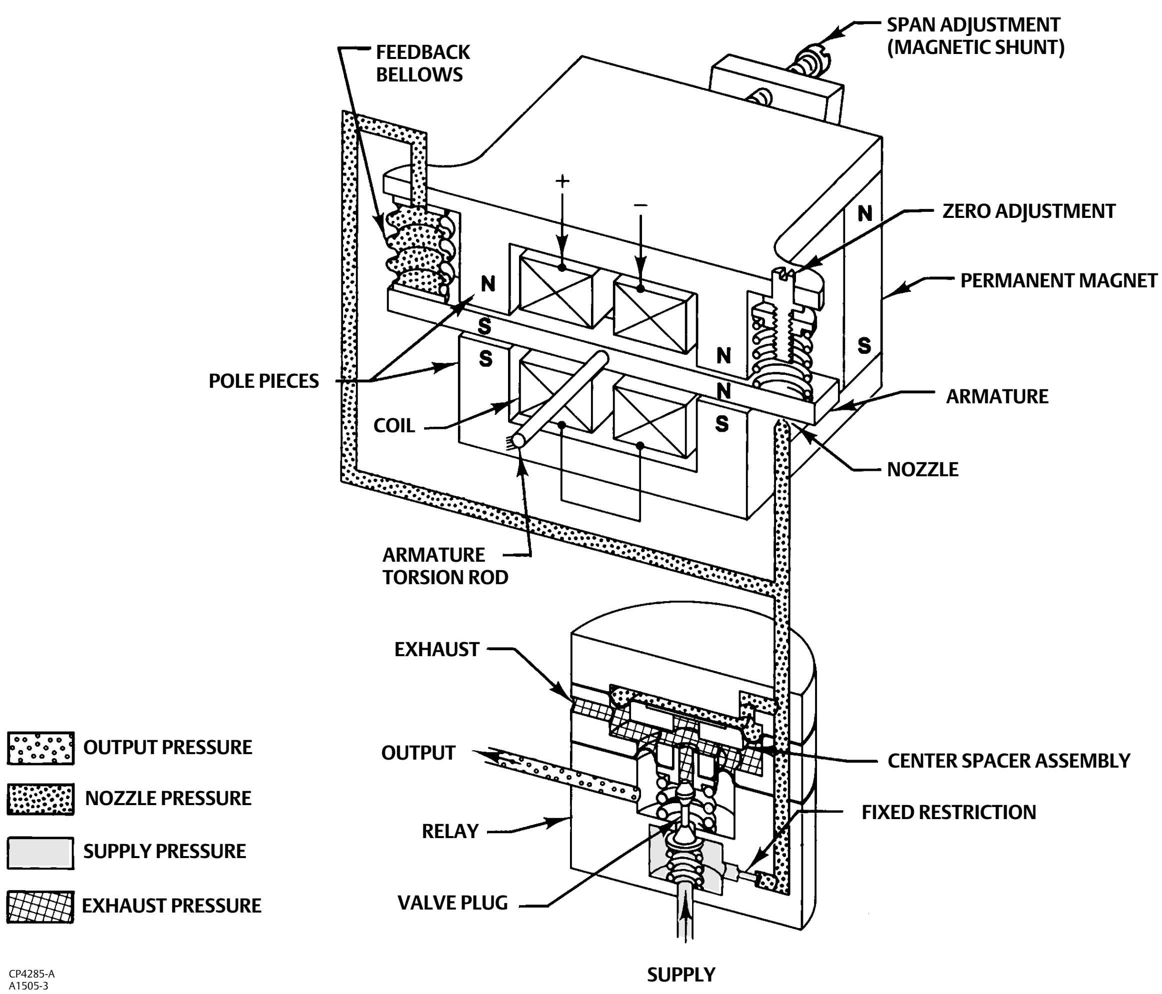
Principle of Operation

Refer to figure 2, and assume that the transducer is direct acting. As the DC milliamp signal increases, so does the magnetic field around the coils. This results in an increased magnetic attraction between the armature and the pole pieces. The armature rotates slightly clockwise to cover the nozzle, increasing pressure in the nozzle, the upper chamber of the relay, and the feedback bellows. Increased nozzle pressure and increased pressure in the upper chamber of the relay cause the relay supply port to open, increasing the output pressure to the actuator and the control valve. At the same time, the increased pressure in the feedback bellows acts to move the armature back to the equilibrium position. In this way, the new nozzle pressure is compared to the DC input signal by the force balance principle.

As the DC input signal decreases, magnetic attraction is reduced and the armature rotates slightly in the counterclockwise direction to uncover the nozzle. Decreased nozzle pressure and decreased pressure in the upper chamber of the relay cause the relay exhaust port to open and allow output pressure to bleed to atmosphere. Pressure to the control valve is reduced until equilibrium is attained.

Reverse-acting transducers operate in a similar manner except that when the DC input signal increases, pressure to the actuator and control valve decreases.

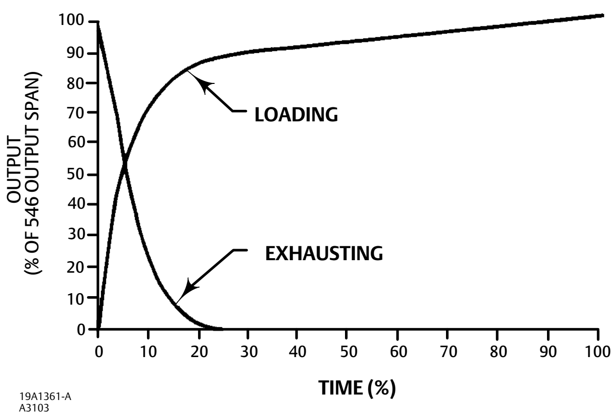
Figure 2. Transducer Schematic



Valve Stroking Time

Figure 3 shows relative times for loading and exhausting an actuator. Exhausting times are nominally 25 percent of the loading times. Stroking time depends upon the size of the actuator, travel, relay characteristics and the magnitude and rate of change of the input signal. If stroking time is critical, contact your Emerson Process Management sales office.

Figure 3. Output-Time Relationship



Installation

Standard positions for actuator mounting and pipestand mounting are shown on the front cover and figure 4, respectively. Dimensions are shown in figure 4.

Ordering Information

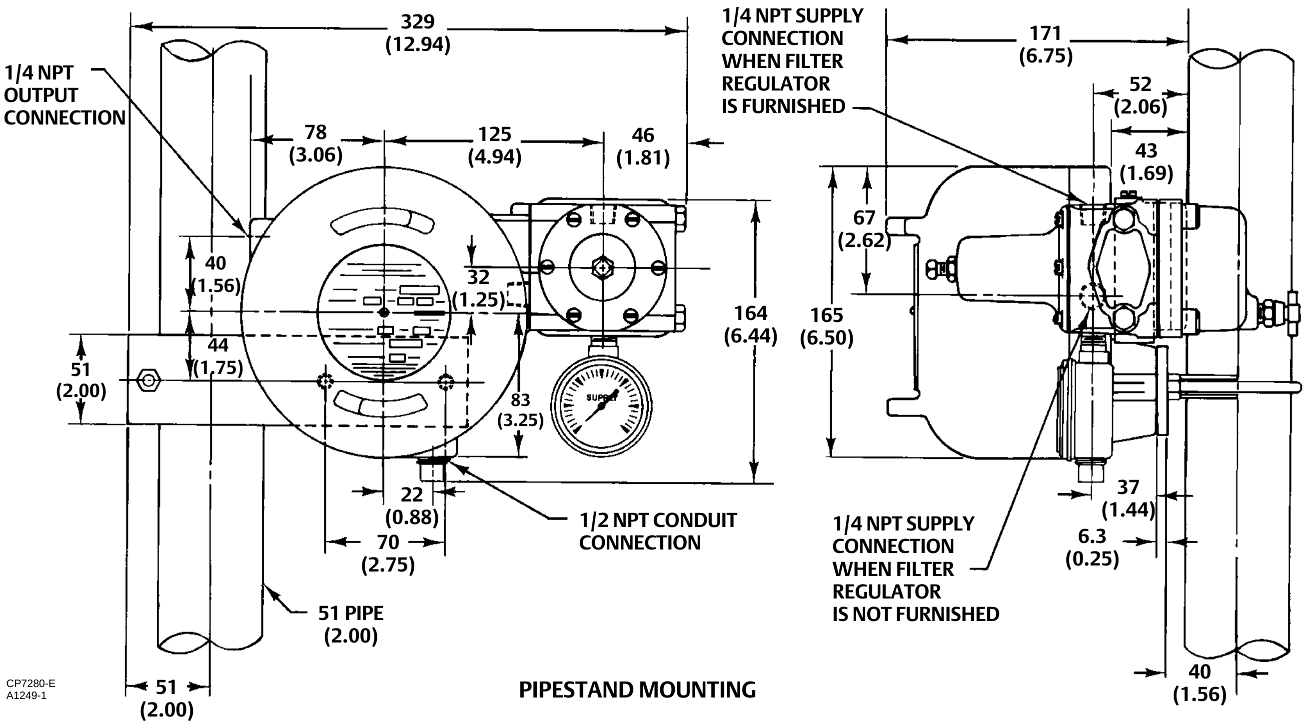
To determine what ordering information is required, refer to the Specifications table. Carefully review the information under each specification and in the referenced table. Specify the desired choice wherever there is a selection to be made. Always specify the type number as identified in the Available Configurations specification.

For transducers that are to be used in intrinsically safe installations, specify the rating required and the system with which the unit will be used.

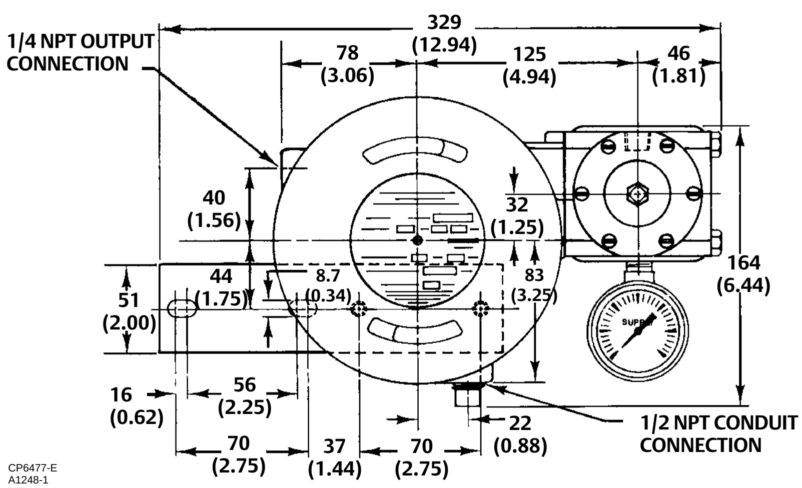
When ordering actuator mounting parts, specify the actuator type, size, travel, and diaphragm pressure range. For all Fisher 657 and 667 actuators except size 80, specify whether actuator yoke or actuator casing mounting is desired (yoke mounting is only available on size 80 actuators).

For split-range operation, specify the portion of input signal to be used; e.g. 4 to 12 milliamps of a standard 4 to 20 milliamp signal.

Figure 4. Dimensions



PIPESTAND MOUNTING



ACTUATOR MOUNTING

mm
(INCH)

Table 1. Electromagnetic Immunity Performance

Port	Phenomenon	Basic Standard	Test Level	Performance Criteria(1)
Enclosure	Electrostatic discharge (ESD)	IEC 61000-4-2	4 kV contact 8 kV air	A
	Radiated EM field	IEC 61000-4-3	80 to 1000 MHz @ 10V/m with 1 kHz AM at 80%	A
	Rated power frequency magnetic field	IEC 61000-4-8	60 A/m at 50 Hz	A
I/O signal/control	Burst (fast transients)	IEC 61000-4-4	1 kV	A
	Surge	IEC 61000-4-5	1 kV (line to ground only, each)	B
	Conducted RF	IEC 61000-4-6	150 kHz to 80 MHz at 3 Vrms with 1kHz AM at 80%	A

Specification limit = ±1% of span
1. A=No degradation during testing. B = Temporary degradation during testing, but is self-recovering.

Table 2. Hazardous Area Classifications—CSA (Canada)

Certification Body	Certification Obtained	Temperature Code	Enclosure Rating
CSA	Explosion-proof Class I, Division 1, Group C,D	T5 (Tamb = 66°C)	CSA ENC 3
	Class II, Division 1, Groups E,F,G Class I, Division 2, Groups A,B,C,D Class II, Division 2, Groups F,G	T5	CSA ENC 3

Table 3. Hazardous Area Classifications—FM (United States)

Certification Body	Certification Obtained	Temperature Code	Enclosure Rating
FM	Explosion-proof Class I, Division 1, Groups C,D	T5 (Tamb = 60°C)	NEMA 3R
	Class II, Division 1, Groups E,F,G Class I, Division 2, Groups A,B,C,D Class II, Division 2, Groups F,G	T5	NEMA 3R

Emerson Process Management
Marshalltown, Iowa 50158 USA
Sorocaba, 18087 Brazil
Chatham, Kent ME4 4QZ UK
Dubai, United Arab Emirates
Singapore 128461 Singapore

www.Fisher.com

EMERSON
Process Management