APPROVAL REPORT

TFXPD-6000 SERIES
CURRENT TO PRESSURE TRANSDUCERS
FOR HAZARDOUS (CLASSIFIED) LOCATIONS

Prepared For:

Fairchild Industrial Products 3920 West Point Boulevard Winston-Salem, North Carolina

J.I. 2R2A4.AE (3615) August 16, 1990



Factory Mutual Research

1151 Boston-Providence Turnpike P.O. Box 9102 Norwood, Massachusetts 02062



Factory Mutual Research

1151 Boston-Providence Turnpike P.O. Box 9102 Norwood, Massachusetts 02062

> J. I. 2R2A4.AE (3615)

August 16, 1990

TFXPD-6000 SERIES CURRENT TO PRESSURE TRANSDUCERS FOR HAZARDOUS (CLASSIFIED) LOCATIONS

from

Fairchild Industrial Products 3920 West Point Boulevard Winston-Salem, North Carolina

I INTRODUCTION

- 1.1 Fairchild Industrial Products Company requested Factory Mutual Research Corporation (FMRC) Approval of their TFXPD-6000 Series Current to Pressure Transducers as explosion proof for Class I, Division 1, Groups B, C and D; dust-ignition proof for Class II, Division 1, Groups E, F and G; indoor and outdoor (NEMA Type 4X) hazardous (classified) locations.
 - 1.2 The specific models described by this report are identified as follows:

Current to Pressure Transducer Model TFXPD6000-ab

a = Range: 0, 3, 4, 5, 7, 9, or 0. b = Output: 1, 2, 3, 4, 5, or 6.

1.3 Approval of the TFXPD-6000 Series Current to Pressure Transducers is based on the applicable requirements of the following standards.

TITLE

<u>AUTHOR-NUMBER</u>

DATE

Electrical Equipment For Use In FM 3600 Hazardous (Classified) Locations General Requirements

1989

JOB IDENTIFICATION 2R2A4.AE

TITLE	AUTHOR-NUMBER	DATE
Explosionproof Electrical Equipment	FM-3615	1989
Electrical and Electronic Test, Measuring, and Process Control Equipment	FM-3810	1989
Classification of Degrees of Protection Provided by Enclosures	IEC-529	1983
Enclosures for Electrical Equipment	ANSI/NEMA-250	1985

1.4 As described in this report, the construction of these units provides the degree of protection against electrical shock, fire, and injury required for hazardous locations.

II DESCRIPTION

- 2.1 The TFXPD-6000 series I/P Transducers are process control devices which convert a milliampere input to a pressure flow output. This output can be used to control dampers or comparable mechanisms.
- 2.1.1 The explosion proof transducer enclosure is constructed of cast aluminum and consists of a cover and base, in which the Current to Pressure electronics are installed. The cover threads to the base with at least 10 full threads of engagement. The base has machined holes for input / output process and electrical connections. Two flame arrestors are installed in the base. A breather assembly threads into the base and utilizes two flame arrestors. The cylindrical flame arrestor in the breather is not relied upon for explosion protection, and was subsequently removed for ignition tests. Wiring provisions are furnished by a 1/2 inch NPT connection. The enclosure cover has an o-ring seal to prevent the ingress of dust and water. The transducers are rated for installation in ambient temperatures up to 66 °C.
- 2.2 For additional descriptive information and operating specifications refer to the attached product specification sheets.

III MARKING

The manufacturer's label drawing EC-18015 Rev. D is included as an attachment to this report.

IV EXAMINATION AND TESTS

- 4.1 A sample TFXPD-6000 Current to Pressure Transducer which was considered to be representative of production models was examined, tested, and compared to the manufacturer's drawings. All data is on file at FMRC along with other documents and correspondence applicable to this program.
- 4.2 **EXPLOSIONPROOF TESTS** The following tests verify the suitability of the TFXPD-6000 Series Current to Pressure Transducers as explosionproof for Class I, Division 1, Groups B, C, and D hazardous locations.

JOB IDENTIFICATION 2R2A4.AE

The sample was prepared for tests by removing all o-rings. Due to the use of flame arrestors a safety factor was added to the testing by increasing the flame arrestor pore size from 40 micron to 60 micron, a 50% increase. The cylindrical type flame arrestor in the breather plug was removed as it is not relied upon for explosion protection.

- 4.2.1 Ignition Tests Room Temperature Three series of ten tests each were performed on the sample with 5, 10 and 15 foot lengths (in turn) of 1/2" rigid metal conduit installed in the provided conduit entry. The test gas used was hydrogen, representative of Group B, ranging in concentrations from 22.6% to 38.9% by volume, in air. Ignition was initiated by a spark plug located 4 inches from the far end of each of the conduit length. Ignition internal to the enclosure did not result in propagation to an identical external atmosphere surrounding the enclosure during any of these tests, nor was any visible permanent deformation of the enclosure observed. The highest ignition pressure was recorded when using 10 feet of conduit and found to be 200 psi (1379 kPa) at a gas concentration of 27.6%.
- 4.2.1 <u>Ignition Tests Elevated Temperature -</u> Three series of ten tests each were performed on the sample with 5, 10 and 15 foot lengths (in turn) of 1/2" rigid metal conduit installed in the provided conduit entry. The sample was heated to 86 °C for these tests. The test gas used was hydrogen, representative of Group B, ranging in concentrations from 22.6% to 38.9% by volume, in air. Ignition was initiated by a spark plug located 4 inches from the far end of each of the conduit length. Ignition internal to the enclosure did not result in propagation to an identical external atmosphere surrounding the enclosure during any of these tests, nor was any visible permanent deformation of the enclosure observed. The highest ignition pressure was recorded when using 5 feet of conduit and found to be 96 psi (662 kPa) at a gas concentration of 31.2%.
- 4.2.2 Hydrostatic Test- A hydrostatic test was conducted on the sample transducer at a pressure equal to 400% of the maximum ignition pressure. The pressure was increased gradually and held at the test pressure 800 psi (5516 kPa) for one minute. No visible permanent deformation occurred. This is satisfactory.
- 4.2.3 <u>Surface Temperature Tests-</u> The TFXPD-6000 Series Current to Pressure Transducer does not contain components capable of elevating the surface temperature of the device measurably above a 40 °C ambient. No temperature marking is required.
- 4.3 Environmental Protection- The following tests were conducted to the verify the NEMA Type 4X rating as marked on the label of the TFXPD-6000 series transducers.
- 4.3.1 Water Hosedown Test- The sample transducer was subjected to a stream of water from a hose with a 1 inch (25.4 mm) nozzle delivering 65 gallons (246 liters) a minute. The water was directed at the enclosure from all angles from a distance of 10 to 12 feet (3 to 3.7 m) for five minutes. At the conclusion of the test the enclosure was opened and had excluded the entry of water. This is satisfactory.
- 4.3.2 Corrosion Resistance Test—The sample transducer was subjected to a salt spray. The salt solution was prepared by dissolving 5 + 1 parts by weight of salt in 95 parts of water containing less than 200 parts per million of total solids. The salt was sodium chloride which contains (when dry) not more than 0.1% of sodium iodide and not more than 0.3% of impurities. The spray was applied utilizing a 25 psi (172 kPa) air supply and in a chamber temperature of 95 °F (35 °C). The test was run continuously for 200 hours. The sample did not show signs of pitting, cracking, or other deterioration that would affect the characteristics of the assembly. This is satisfactory.

JOB IDENTIFICATION 2R2A4.AE

- 4.3.3 External Icing Test- This test was waived as the TFXPD-6000 Series Transmitter have no external cavities to trap water where ice could then form and damage the enclosure, or any external operators that could become ice laden and consequently damaged.
- 4.4 <u>Dust-Ignitionproof Tests-</u> The following tests verified the suitability of the Current to Pressure Transducer as dust-ignitionproof for Class II, Division 1, Groups E, F and G hazardous (classified) locations
- 4.4.1 Impact Tests The transducer sample was subjected to an impact from a 25 mm spherical tip weight at a 2.7 Joule magnitude. The impact was obtained by dropping a 4 lb (1.8 kg) weight from a height of 6 inches (150 mm) onto all sides of the enclosure. Results where satisfactory in that no damage occurred to the test sample that would impair the samples ability to pass the dust penetration test.
- 4.4.2 <u>Dust Exclusion Test</u> In accordance with International Electrotechnical Commission (IEC) draft standard 31H, the enclosure was suspended in a circulating dust atmosphere of 200 mesh talc. The sample was connected to a vacuum pump adjusted to draw a vacuum a 200 mm of water on the sample. The test lasted a total of eight hours. At the conclusion of the test, the sample was removed from the test chamber, excess dust was removed from the surface and opened. Results are satisfactory as the enclosure was found to have excluded the entry of dust.
- 4.4.3 <u>Surface Temperature Tests-</u> The TFXPD-6000 Series Current to Pressure Transducer does not contain components capable of elevating the surface temperature of the device measurably above a 40 °C ambient when covered with a dust blanket. No temperature marking is required.
- 4.5 <u>Protection from Electrical Shock</u>. The following tests verify the protection afforded by the product against electrical shock.
- 4.5.1 <u>Dielectric Tests-</u> The insulation of the input power circuits of the transducer was tested at a 60Hz, voltage of 500 Vrms with respect to protective ground. During the test the potential held for one minute without dielectric breakdown of the insulation occurring. This is satisfactory.
- 4.5.2 <u>Protective Grounding-</u> A green head grounding screw is supplied inside the enclosure as the internal protective ground terminal. It has been verified by measurement that all accessible conductive parts of the level switch that could be otherwise become energized in the event of a fault are bonded to this point with a resistance of less than one ohm. This is satisfactory.
- 4.5.3 <u>Protection from Accessible Live Parts-</u> There are no live parts accessible on the Current to Pressure Transducer when tested with the IEC rigid and articulated finger probes. This is satisfactory.

V REMARK

Installation shall be in accordance with the manufacturer's instructions and the National Electrical Code ANSI/NFPA-70.

JOB IDENTIFICATION 2R2A4.AE

TESTS AND EXAMINATION BY: -R. L. Haigis

-M. J. Morrow

ATTACHMENTS: -Label Drawing:

EC-18015 Rev. D

-Product Brochure: CS 5000-T6000

ORIGINAL DATA: Test Notebook 90 - 474

REPORT BY: REVIEWED BY:

Michael J. Morrow

Electrical Engineer, Electrical Section

Electrical Section Manager

JOB IDENTIFICATION 2R2A4.AE

VI FACILITIES AND PROCEDURES AUDIT

The manufactures design and manufacturing facilities in Winston-Salem, North Carolina are subject to follow-up audits. The facilities and quality control procedures in place were found satisfactory to manufacture the product identical to that tested and Approved.

VII MANUFACTURER'S RESPONSIBILITIES

- 7.1 The manufacturer shall advise FMRC of all proposed changes to the documents listed in Section IX via form 797, Approved Product Revision Report.
- 7.2 On 100% of production, the TFXPD-6000 Series Current to Pressure Transducer shall be dielectric tested. The power input connections shall withstand for one minute, with no insulation breakdown, the application of 500 Vac with respect to the protective ground conductor. Alternatively, test potentials 20% higher may be applied for at least one second.

WARNING: The dielectric test required may present a hazard of injury to personnel and/or property and should only be performed under controlled conditions, and by persons knowledgeable of the potential hazards of such testing to minimize the likelihood of shock and/or fire.

VIII CONCLUSION

Fairchild Industrial Products Company TFXPD-6000 Series Current to Pressure Transducer, as herein described, meets Approval requirements. Approval is effective when the Approval Agreement is signed and received by FMRC.

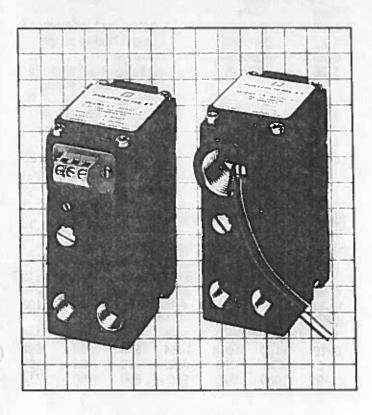
IX DOCUMENTATION FILE

DOCUMENT NUMBER	DOCUMENT TITLE	REVISION
EA-10011	BALL	•
EA-1174	1/4" NPT FLUSH PLUG	E
EA-13784	FLAME ARRESTOR CUP	$\overline{\mathbf{A}}$
EB-130	O-RING SPEC CHART	C
EB-16609	VENT ASSEMBLY	Ā
EB-16964	PLUG	-
EB-16965	BODY ASSEMBLY	В
EB-16974	SCHEMATIC DIAGRAM	_
EB-18057	FLAME ARRESTOR	Α
EB-18147	FITTING MACHINED	1 2 20
EC-16751	NOZZLE BODY ASSEMBLY	Е
EC-16960	BONNET MACHINING	Α
EC-18015	NAMEPLATE	D
EC-18057	FLAME ARRESTOR	A
ED-16801	TFXPD-6000 ASSEMBLY	E
ED-16963	BODY MACHINING	В
ED-18148	BREATHER ASSEMBLY	



MINIATURE ELECTROPNEUMATIC TRANSDUCER (I/P, E/P)

MODEL T6000 SERIES



APPLICATIONS

The T6000 Series of electro-pneumatic transducers transmit a pneumatic signal which is linearly proportional to a DC current or to a DC voltage input from electronic control devices.

These inexpensive high quality rapid response controls are designed for precision applications, and provide maximum versatility in installations requiring operation of actuated valves, final control elements, input signal for pneumatic positioning, or conversion of current to pressure. Modular construction permits use of one basic unit in all applications or use in explosion proof housing.

Compact size and location of adjustments and ports increases accessibility of controls in small spaces and simplifies the piping layout to the unit. External access to the restrictor simplifies unit maintenance.

MAJOR FEATURES

- Compact Size
- F Six input Ranges available
- F Conduit fitting, Terminal Strip or DIN Connectors available
- External zero and span adjustments on same plane
- Input and output ports on both ends
- Optional NEMA 4X Explosion proof housing and intrinsically safe configurations
- F Six output ranges available
- Field Reversible
- # May be wall, panel, DIN rail or Rack or Manifold Mounted
- F Housed in NEMA Type 3R enclosures

BENEFITS

- Permits use in restricted areas
- Covers all standard process inputs
- # Allows easy wiring
- # Increases accessibility in close places
- F Simplifies pneumatic piping
- F Permits use in any environment
- F Allows versatility in output to final control elements
- Provides output which is directly or inversely proportional to input signal
- F Easily suited to most installations
- F Permits outdoor and indoor use

SPECIFICATIONS

Output Range

Psig

3-15

3-27

6-30

0-60

0-120

kPa

(21 - 186)

(42 - 210)

(0-420)

(0 - 840)

(21-105)

PNEUMATIC		SUPPLY F		RE Pressure*
Output				kPa
Psig	kPa		eig 100	(140-840)
3–15	(21-105) .	20	-120	
3–27	(21-186) .			(140-840)
6–30	(42-210)	20	-120	(140-840)
0-30	(0-210)	20	-150	(140–1050)
0-60	(0-420)	20	150	(140-1050)
0-120	(0-840)	20	–150	(140–1050)
INDEPEND	ENT LINEA	RITY		
Output	Range	Li	nearity (% FS)
Psig	kPa			
3-15	(21-105)	+	0.5	
3-27				
6-30		±		
0-30				
0-60	(0-420)			
0-120	(0-840)			
0-120	(0 0-10)		Carrier And 1	
HYSTERES	SIS AND RE	PEATABII	LITY	
Output	Range	H	yster/Re	p. % FS
Psig	kPa			
3-15	(21-105)	0	.25	
3-27		0		
6-30		0		
0-30	(0-210)	<	1.0@350	osi Supply
0-60	(0-420)	<	1.0@65	osi Supply
0-120	(0-840)	<	1.0@12	spsi Supply
0 120	(0 0.0)			
TEMPERA	TURE RAN	GE		Mary and the second
All Ranges	2	0° F to +1	150° F(-3	30° C to +65° C)
FLOW RAT	Œ			
	_		E 1	D-4- (OOFIN

Outpu	it Range	Effect
Psig	kPa	
3-15	(21–105)	0.25psig (1.7kPa) for 25
3-27	(21–186)	psig (170kPa) supply
6-30	(42-210)	change
0–30	(0–210)	0.5psig (4.0kPa) for 25 psig (170kPa) supply change
0–60	(0–420)	1.0psig (7kPa) for 25 psig (170kPa) supply change
0–120	(0–840)	1.5psig (10.5kPa) for 25 psig (170kPa) supply change

Input Signal		Inpu Output		ance (O	HMS)	
mA	3-15	3-27	6-30	0-30	0-60	0-120
4-20	197	204	204	250	256	270
10-50 VDC	79	82	82	100	103	108
0-5	550	532	532	439	469	446
0-10	1100	1064	1064	878	938	893
1-5	500	483	485	400	453	430
1-9	1000	970	970	800	750	714

MAXIMUM AIR CONSUMPTION Output Range Consumption (SCFH) kPa Psig 3-15 (21-105) 1.3 (0.037m3/HR)@15 psig 3-27 (21 - 186)(105kPa) 6-30 (42 - 210)(0-210) 6.0 (0.17m3/HR)@15 psig 0 - 300-60 (0-420)(105kPa) 0 - 120(0-840)

Flow Rate (SCFM)

and 9psi (63kPa) output

2.5 (4.25m3/HR)@25

9.0 (15.3m³/HR)@120 psi (840kPa) supply and 9psi (63kPa) output (1050kPa) supply and 9

psi (63kPa) output

psi (175kPa) supply

Note: Supply pressure must be 5 psig (min) above maximum output.

SPECIFICATIONS

Materials of Construction

Body and Housin	g.		 ÷				÷	aluminum
Orifice					 			stainless steel
Trim		٠.						. stainless steel, brass,
								zinc plated steel

Hazardous Area Classification

Intrinsically Safe

Factory Mutual Approval. The Fairchild I/P and E/P Transducers may be purchased as Factory Mutual Approved, Intrinsically Safe Class I, II, and III, Division 1, Groups A, B, C, D, E, F and G when used with associated apparatus meeting the following entity requirements.

and connected in compliance with Fairchild Drawing EC-16984 Revision 4 where Ci is capacitance contributed by the transducer

Li is inductance contributed by the transducer

CSA Approval (Pending). The Fairchild T6000 transducer may be purchased as CSA approved, intrinsically safe for Class I, Division 1 Groups A, B, C and D and Temperature rating T3C when connected through a shunt zener diode safety barrier as follows:

System type 1: Single channel polarized rated 28V max and 300 ohms min

System type 2: Dual channel polarized rated 28V max, 300 min and 28V diode return

System type 3: Dual channel polarized rated;

a. 28V max 300 ohms min and 10V max 50 ohms min for the return

b. 28.5V max 300 ohms min and 9V max and 50 ohms min return.

BASEFA/CENELEC Approval (Pending). Fairchild I/P and E/P Transducers may be purchased as BASEFA/CENELEC approved for intrinsically safe operation category (EEx ia IIC T5).*This approval is valid for both the transducer plus safety barrrier when connected through certified shunt zener diode barrier rated 28 volts max., 300 ohms min.

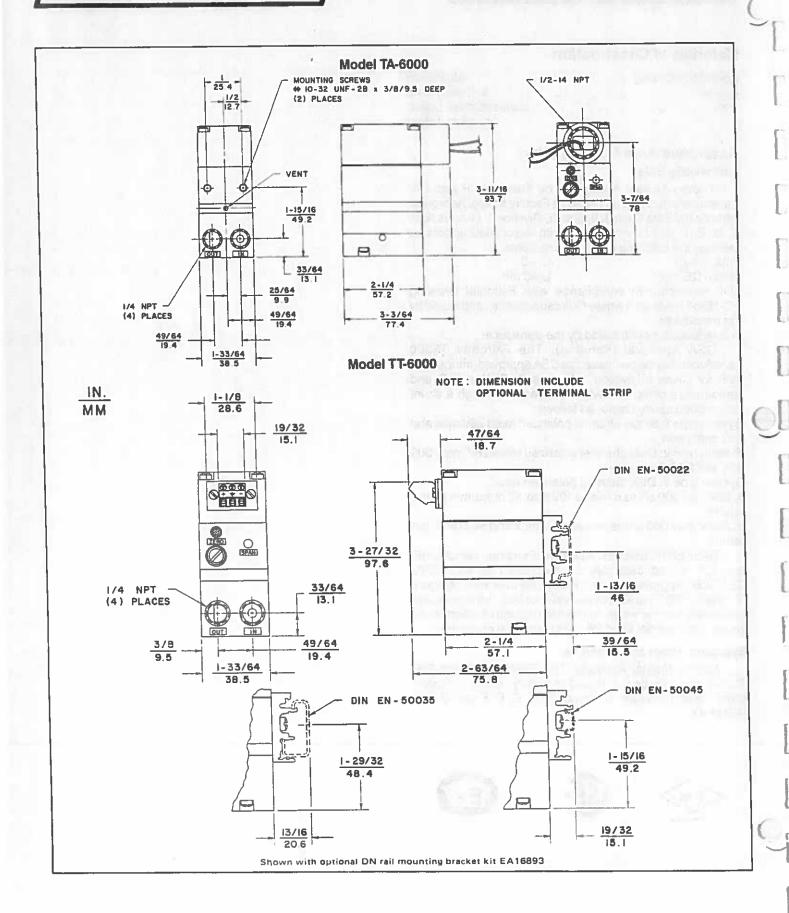
Explosion Proof and NEMA 4X

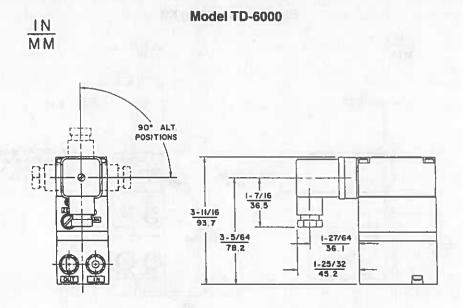
Factory Mutual Approval. The Fairchild I/P and E/P Transducers may be purchased as factory mutual explosion proof Class 1 Division 1, Groups B, C, D, E, F and G and NEMA 4X.





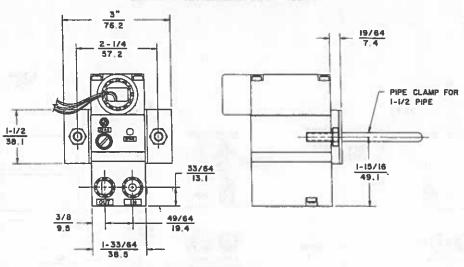




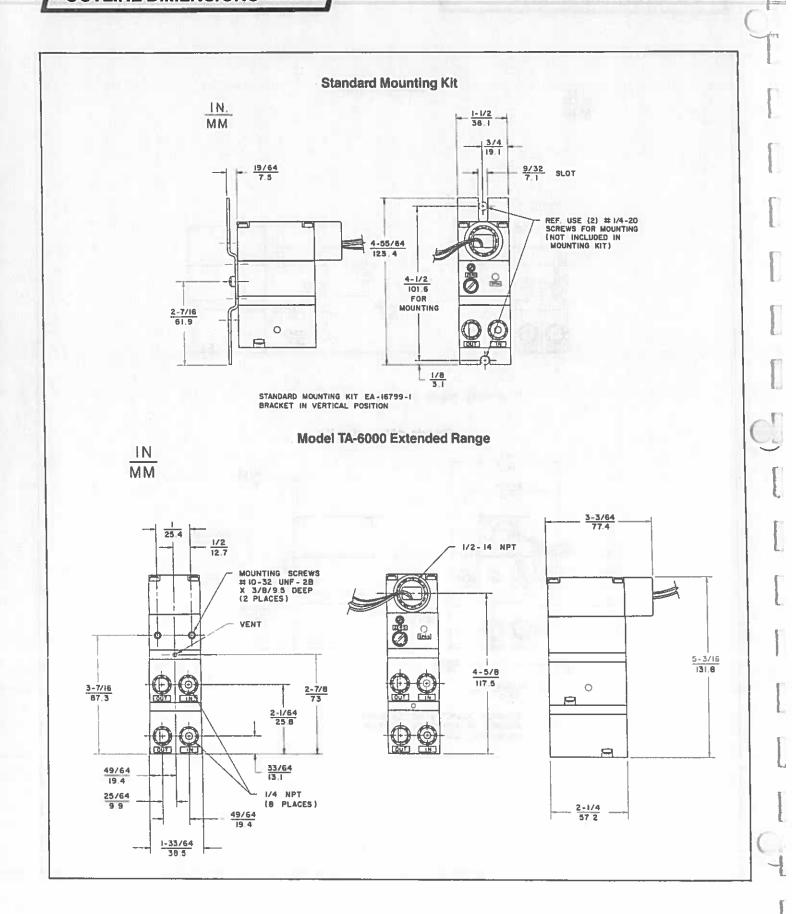


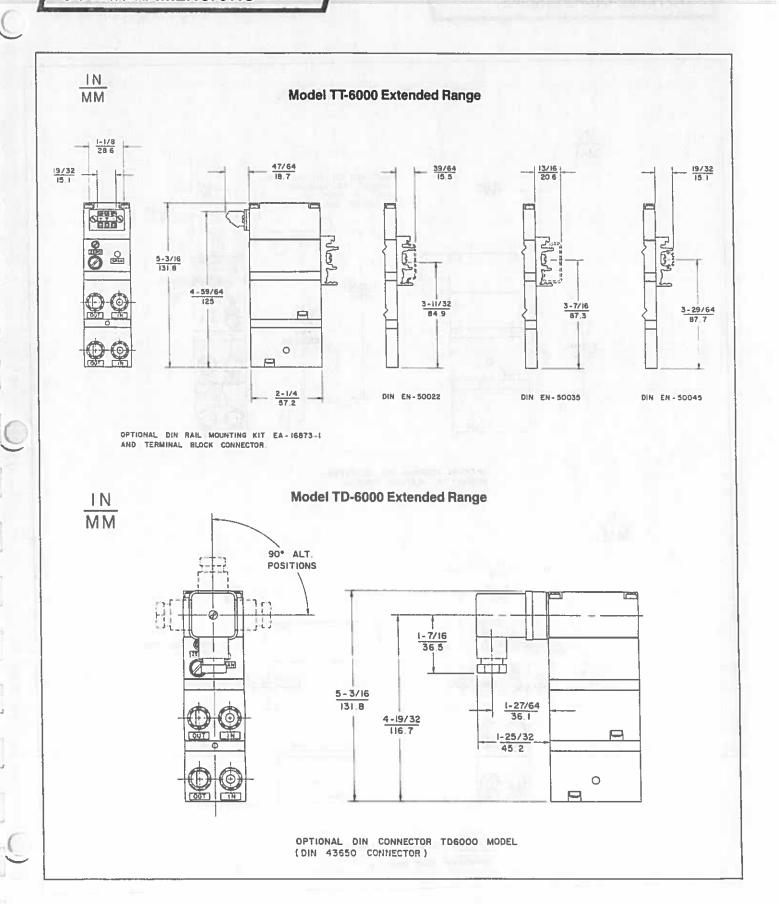
OPTIONAL TOGODO (DIN 43650 CONNECTOR)

Standard Mounting Kit

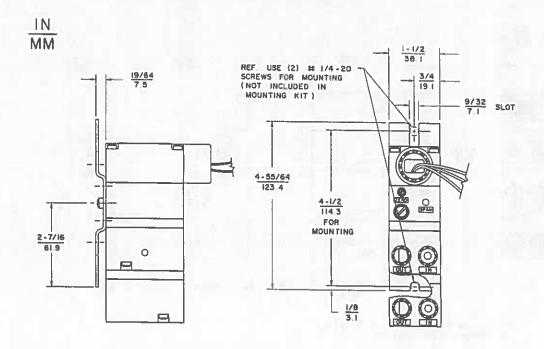


STANDARD MOUNTING KIT EA-16799-1 BRACKET IN HORIZONTAL POSTION BREAKAWAY TABS REMOVED



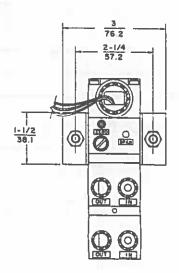


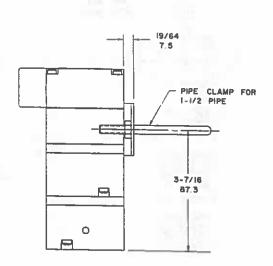
Extended Range Mounting Kits



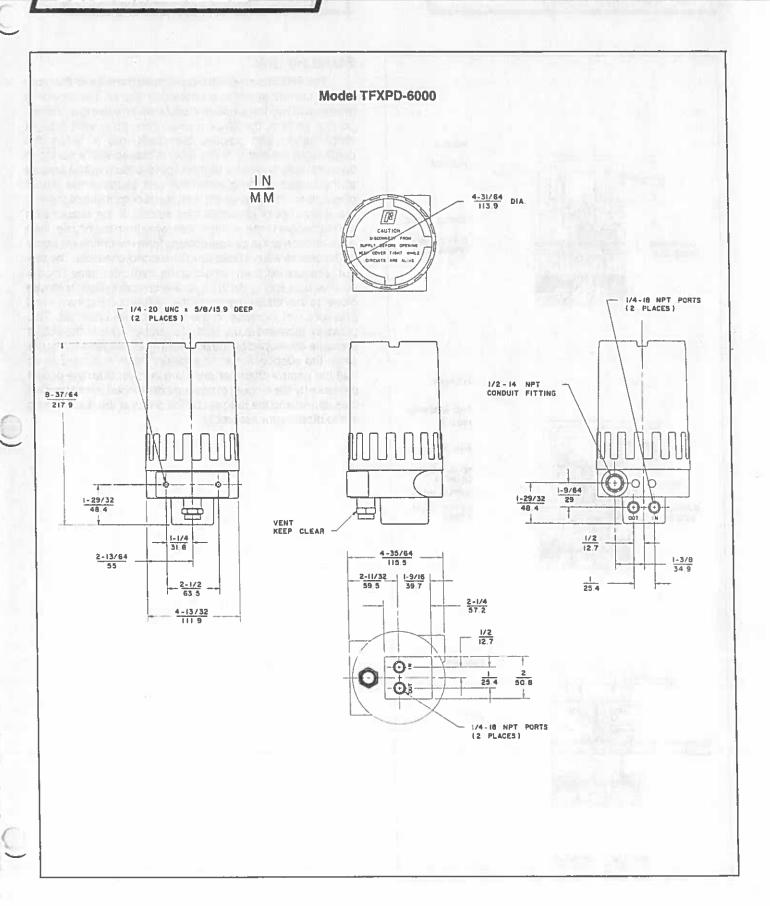
OPTIONAL MOUNTING KIT EA-16799-1 BRACKET IN VERTICAL POSITION

 $\frac{\mathsf{IN}}{\mathsf{MM}}$





OPTIONAL MOUNTING KIT EA-16789-1 BRACKET IN HORIZONTAL POSITION BREAKAWAY TABS REMOVED



CROSS-SECTIONS

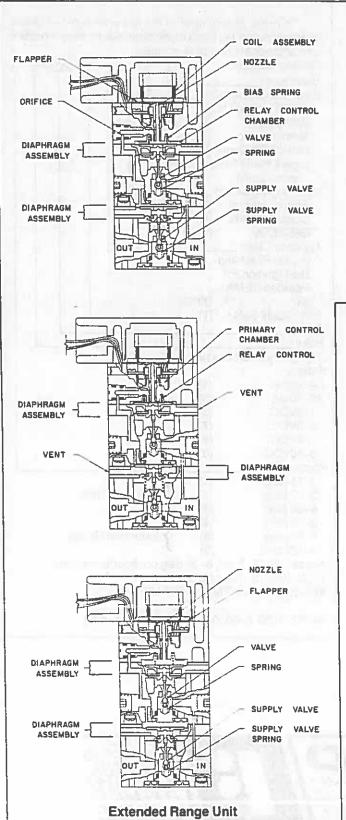
NOZZLE FLAPPER SUPPLY VALVE SUPPLY VALVE DIAPHRAGM SPRING ASSEMBLY FLAPPER COIL ASSEMBLY N0771 F BIAS SPRING RELAY CONTROL CHAMBER ORIFICE SUPPLY VALVE SUPPLY VALVE SPRING DIAPHRAGM ASSEMBLY PRIMARY CONTROL CHAMBER RELAY CONTROL VENT DIAPHRAGM ASSEMBLY MODEL 6000

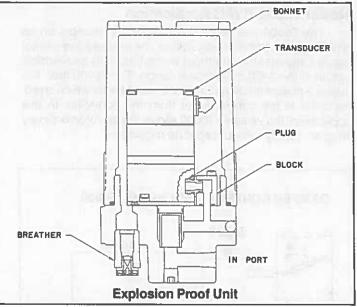
PRINCIPLES OF OPERATION

Standard Unit

The T6000 is an electro-pneumatic transducer that converts a current signal to a pneumatic signal. The device is made up of two force balance sections, one being a primary control section, the other a pneumatic relay with a slight amplification and positive bias built into it. Since the diaphragm assembly in the relay is biased with a spring to open the supply valve, a slight output pressure will be present at the output. Porting within the unit supplies the output pressure to an orifice which then feeds output air pressure to the relay control chamber and nozzle. If the suspension spring/flapper is at a position well away from the nozzle, then no restriction to the air flow coming from the orifice will occur and pressure will not build up in the control chamber. The output pressure will then remain at the level determined by the positive bias spring. As the suspension spring/flapper moves closer to the nozzle, it restricts the air flow coming from it and pressure will increase in the relay control chamber. This pressure increase in the control chamber adds to the output pressure developed by the bias spring. Equilibrium will occur when the suspension spring/flapper vents sufficient air so that the control chamber pressure is lower than the output pressure by the amount of pressure developed by the positive bias spring and the ratio set by the areas of the diaphragms in the diaphragm assembly.

CROSS-SECTIONS





PRINCIPLES OF OPERATION

Extended Range Unit

The T6000 Extended range transducer is made up of 2 force balance sections (the standard T6000 transducer) and a booster section added to the standard unit and ported so that for extended range units the air supply to the transducer is connected to the IN port of the booster and the IN port of the center section is plugged. The OUT port of the center section is also plugged. Air flows through passages in the diaphragm and the spacer ring to the center section IN port. The OUT port of the plugged center section is connected to the top of the booster diaphragm assembly. Operation of the standard unit section of the extended range unit is the same as described for the Standard unit. The output pressure in the relay control chamber will control the pressure at the Booster OUT port.

Explosion Proof Unit

The TT6000 Transducer is isolated from an explosive environment by enclosing it in an explosion proof housing. The body is equipped with a flame arrester and a breather allows access to outside air.

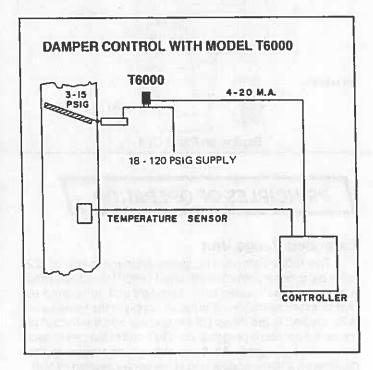
Input signal is applied to the IN port of the housing. The air pressure is ported through a block which is sealed to the base by O rings — and then transmitted through an O ring sealed Plug to the IN port of the transducer. Output pressure from the transducer is transmitted in the same manner from the OUT port of the transducer, through the plug and block and then to the OUT port of the explosion proof housing. An O ring seals the bonnet and the base of the housing.

TYPICAL APPLICATIONS

ORDERING INFORMATION

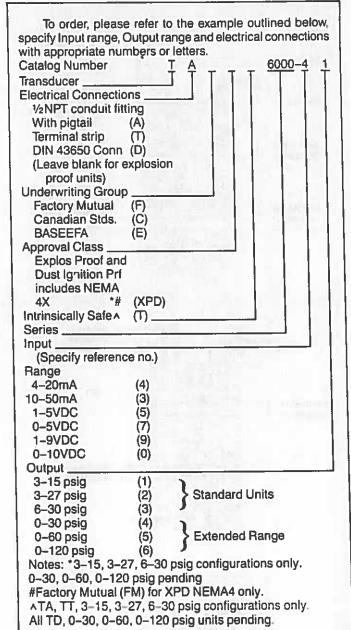
Model T6000 HVAC Application

The T6000 can be used to control the damper on an HVAC system. In this configuration, the temperature sensor sends a signal to the controller, which furnishes an electrical output in the 4–20 milliampere range. The T6000 then furnishes a pneumatic output signal to the damper which is proportional to the current input from the controller. In this application, the versatile T6000 allows the use of an ordinary shop air supply without separate regulation.



SERVICE INFORMATION

A service kit is available for the Model T6000. Please refer to the installation, Operating, and Maintenance Manual for ordering information.





USED ON

ENT. FROM