

Instruction Manual

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646 Transducer

646 Electro-Pneumatic Transducers

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Introduction

Scope of Manual

This instruction manual provides installation, operation, maintenance, and parts ordering



Figure 1. Electro-Pneumatic Transducer Mounted on a Sliding-Stem Actuator

information for the 646 transducer. Refer to separate manuals for instructions covering equipment used with the transducer.

Do not install, operate or maintain a 646 electro-pneumatic transducer without first • being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance, and • carefully reading and understanding the contents of this manual. If you have any questions about these instructions, contact your Emerson Process Management™ sales office.




Description

The transducer, shown in figure 1, receives a 4 to 20 milliamper DC input signal and transmits a proportional 0.2 to 1.0 bar (3 to 15 psig) pneumatic output pressure to a final control element. A typical application is in electronic control loops where the final control element is a control valve assembly that is pneumatically operated. The input signal and output pressure range of the transducer is indicated on the nameplate, shown in figure 13, attached to the housing.



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Table 1. Specifications

<p>Input Signal 4 to 20 mA DC, constant current with 30 VDC maximum compliance voltage</p> <p>Equivalent Circuit The 646 equivalent circuit is a series circuit consisting of a constant voltage drop (battery) of approximately 2.1 VDC and a total resistance of 143 ohms. Input is shunted by three 6.8 V zener diodes (see figure 6).</p> <p>Output Signal 0.2 to 1.0 bar (3 to 15 psig) direct acting only</p> <p>Supply Pressure⁽¹⁾ Recommended: 1.4 bar (20 psig) Minimum: 1.4 bar (20 psig) Maximum: 3.4 bar (50 psig)</p> <p>Maximum Steady-State Air Consumption⁽²⁾ Air consumption is proportional to output pressure. Maximum consumption at 1.0 bar (15 psig) output is 0.2 normal m³/hr (7.8 scfh).</p> <p>Maximum Output Air Capacity⁽²⁾ 8.0 normal m³/hr (300 scfh) at 1.4 bar (20 psig) supply pressure</p> <p>Performance⁽³⁾ Reference Accuracy: ±0.5% of full scale output span; includes combined effects of hysteresis, linearity, and deadband Independent Linearity: ±0.5% of full scale output span Hysteresis: 0.4% of full scale output span Frequency Response: Gain is attenuated 3 dB at 10 Hz with transducer output signal piped to a typical instrument input Temperature Effect: ±4% of full scale output span per 55°C (100°F) change Supply Pressure Effect: 0.2% of full scale output span per psi supply pressure change Vibration Effect: Less than 1% of full scale output span when tested to SAMA PMC 31.1, Condition 3</p>	<p>Electromagnetic Interference (EMI): Tested per IEC 61326-1 (Edition 1.1). Conforms to the European EMC Directive. Meets emission limits 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 is shown in table 1.</p> <p>Operating Ambient Temperature Limits⁽¹⁾ -40 to 71°C (-40 to +160°F)</p> <p>Housing CSA Type 3 Encl., NEMA 3, IP54 per IEC 60529; Mount instrument with vent on side or bottom if weatherproofing is a concern.</p> <p>Electrical Classification</p> <p> Intrinsic Safety, Explosion proof, Type n Dust-Ignition proof, DIV 2</p> <p> Intrinsic Safety, Explosion proof, Type n Non-incendive, Dust-Ignition proof</p> <p>ATEX Intrinsic Safety, Flameproof, Type n</p> <p> Intrinsic Safety, Flameproof</p> <p>Refer to Special Instructions for the Safe-Use and Installation in Hazardous Locations, tables 2, 3, 4, and 5, and figures 12, 13, 14, and 15 for additional information.</p> <p>Connections Supply and Output Pressure: 1/4 NPT internal connection Vent: 1/4 NPT internal Electrical: ■ Standard 1/2 NPT or, ■ Optional M20 conduit adapter (see figure 3) Wire Size: 18 to 22 AWG</p> <p>Adjustments Zero and Span: Trim potentiometers (20 turn) for zero and span adjustments are located under the housing cap (see figure 7).</p>
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(continued)

Table 1. Specifications (Continued)

<p>Mounting Position Any position is acceptable for standard pipestand, panel, or actuator mounting. For weatherproof housing, mount the transducer so the vent can drain.</p> <p>Approximate Weight (Transducer Only) 1.6 kg (3.5 pounds)</p> <p>Actuator Stroking Time See figure 2</p>	<p>Declaration of SEP</p> <p>Fisher Controls International LLC declares this product to be in compliance with Article 3 paragraph 3 of the Pressure Equipment Directive (PED) 97 / 23 / EC. It was designed and manufactured in accordance with Sound Engineering Practice (SEP) and cannot bear the CE marking related to PED compliance.</p> <p>However, the product <i>may</i> bear the CE marking to indicate compliance with <i>other</i> applicable European Community Directives.</p>
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NOTE: Specialized instrument terms are defined in ANSI/ISA Standard 51.1 – Process Instrument Terminology.
 1. The pressure and temperature limits in this document and any applicable standard or code limitation should not be exceeded.
 2. Normal m³/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. Performance values are obtained using a transducer with a 4 to 20 mA DC input signal and a 0.2 to 1.0 ba (r3 to 15 psig) output signal at an ambient temperature of 24°C (75°F).

Table 1. 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
	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	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	A

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

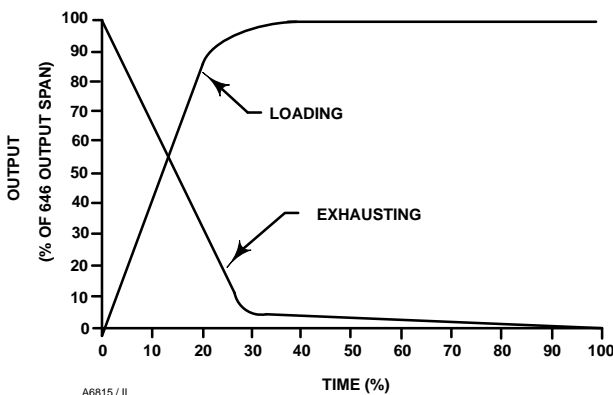


Figure 2. Output-Time Relationships for 646 Transducer

WARNING

This product *does not* meet third party approvals (CSA, FM or ATEX) for use with natural gas as the supply medium. Use of natural gas as the supply medium can damage the instrument and result in personal injury or property damage from fire or explosion.

Should you need an instrument for use with natural gas, Fisher® 846 and i2P-100 electro-pneumatic transducers both meet third party approvals for use with natural gas as the supply medium. Contact your Emerson Process Management sales office for information on these products.

CAUTION

Dropping or rough handling of the transducer can cause damage to the converter module resulting in a shifted output or a minimum output.

Specifications

Specifications for the 646 transducer are listed in table 1.

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Table 2. Hazardous Area Classifications—CSA (Canada)

CERTIFICATION BODY	CERTIFICATION OBTAINED	ENTITY RATING	TEMPERATURE CODE	ENCLOSURE RATING
CSA	(Intrinsic Safety) Zone Ex ia IIC T4/T5 per drawing GE28591 Class/Division Class I, II, Division 1 GP A,B,C,D,E,F,G T4/T5 per drawing GE28591	$V_{max} = 30$ VDC $I_{max} = 150$ mA $P_i = 1.0$ W $C_i = 0$ nF $L_i = 0$ mH	T4 ($T_{amb} \leq 71^{\circ}\text{C}$) T5 ($T_{amb} \leq 40^{\circ}\text{C}$)	CSA Type 3 Encl.
	(Explosion Proof) Zone Ex d IIC T6 Class/Division Class I, Division I, GP A,B,C,D T6	---	T6 ($T_{amb} \leq 71^{\circ}\text{C}$)	CSA Type 3 Encl.
	(Type n) Zone Ex nL IIC T6 Class I, Division 2, GP A,B,C,D T6 Class II, Division 1, Groups E,F,G T6 Class II, Division 2, GP F,G T6	---	T6 ($T_{amb} \leq 71^{\circ}\text{C}$)	CSA Type 3 Encl.
	---	T6 ($T_{amb} \leq 71^{\circ}\text{C}$)	CSA Type 3 Encl.	

Educational Services

For information on available courses for the 646 electro-pneumatic transducer, as well as a variety of other products, contact:

Emerson Process Management
Educational Services, Registration
P.O. Box 190; 301 S. 1st Ave.
Marshalltown, IA 50158-2823
Phone: 800-338-8158 or
Phone: 641-754-3771
FAX: 641-754-3431
e-mail: education@emersonprocess.com

Special Instructions for “Safe Use” and Installation in Hazardous Locations

Certain nameplates may carry more than one approval, and each approval may have unique installation/wiring requirements and/or conditions of “safe use”. These special instructions for “safe use” are in addition to, and may override, the standard installation procedures. Special instructions are listed by approval.



WARNING

Failure to follow these conditions of “safe use” could result in personal injury or property damage from fire or explosion, and area re-classification.

Installation



WARNING

Always wear protective clothing, gloves, and eyewear when performing any installation operations to avoid personal injury.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the WARNING at the beginning of the Maintenance section in this instruction manual.

CSA

Special Conditions of Use

No conditions of safe use.

Refer to table 2 for additional information, figure 12 for CSA loop schematics, and figure 13 for the CSA/FM approvals nameplate.

FM

Special Conditions of Use

No conditions of safe use.

Refer to table 3 for additional information, figure 14 for the FM loop schematic, and figure 13 for the CSA/FM approvals nameplate.

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

CERTIFICATION BODY	CERTIFICATION OBTAINED	ENTITY RATING	TEMPERATURE CODE	ENCLOSURE RATING
FM	(Intrinsic Safety) Zone Class 1 Zone 0 AEx ia IIC T4/T5 per drawing GE28590 Class/Division Class I, II, III Division 1 GP A,B,C,D,E,F,G T4/T5 per drawing GE28590	$V_{max} = 30 \text{ VDC}$ $I_{max} = 150 \text{ mA}$ $P_i = 1.0 \text{ W}$ $C_i = 0 \text{ nF}$ $L_i = 0 \text{ mH}$	T4 ($T_{amb} \leq 71^\circ\text{C}$) T5 ($T_{amb} \leq 40^\circ\text{C}$)	NEMA 3, IP54
	(Explosion Proof) Zone Class 1 Zone 1 AEx d IIC T6 Class/Division Class I, Division I, GP A,B,C,D T6	---	T6 ($T_{amb} \leq 71^\circ\text{C}$)	NEMA 3, IP54
	(Type n) Zone CL 1 Zone 2 AEx nL IIC T6	---	T6 ($T_{amb} \leq 71^\circ\text{C}$)	NEMA 3, IP54
	Class I, Division 2, GP A,B,C,D T6 Class II, Division 1, Groups E,F,G T6 Class II, Division 2, GP F,G T6	---	T6 ($T_{amb} \leq 71^\circ\text{C}$)	NEMA 3, IP54

Table 4. Hazardous Area Classifications—ATEX

CERTIFICATE	CERTIFICATION OBTAINED	ENTITY RATING	TEMPERATURE CODE	ENCLOSURE RATING
ATEX	II 1 G Gas EEx ia IIC T4/T5 —Intrinsic Safety	$U_i = 30 \text{ VDC}$ $I_i = 150 \text{ mA}$ $P_i = 1.0.25\text{W}$ $C_i = 0 \text{ nF}$ $L_i = 0 \text{ mH}$	T4 ($T_{amb} \leq 71^\circ\text{C}$) T5 ($T_{amb} \leq 40^\circ\text{C}$)	IP54
	II 2 G Gas EEx d IIC T6 —Flameproof	---	T6 ($T_{amb} \leq 71^\circ\text{C}$)	IP54
	II 3 G Gas EEx nL IIC T6 —Type n	---	T6 ($T_{amb} \leq 71^\circ\text{C}$)	IP54

ATEX Intrinsic Safety

Special Conditions for Safe Use

This equipment is intrinsically safe and can be used in potentially explosive atmospheres.

The electrical parameters of certified equipment which can be connected to the device must not exceed the following values:

$U_0 \leq 30 \text{ VDC}$
 $I_0 \leq 150 \text{ mA}$
 $P_0 \leq 1 \text{ W}$

Ambient temperature:

T5, at $T_{amb} = 40^\circ\text{C}$
T4, at $T_{amb} = 71^\circ\text{C}$

Refer to table 4 for additional information and figure 15 for the ATEX approvals nameplate.

ATEX Flameproof

Special Conditions for Safe Use

Electrical connections are typically made using either cable or conduit.

- If using a cable connection, the cable entry device shall be certified in type of explosion protection flameproof enclosure “d”, suitable for the conditions of use and correctly installed.

For ambient temperatures over 70°C , cables and cable glands suitable for at least 90°C shall be used.

- If using a rigid conduit connection, an EEx d certified sealing device such as a conduit seat with setting compound shall be provided immediately to the entrance of the enclosure.

For ambient temperatures over 70°C , the wiring and setting compound in the conduit seal shall be suitable for at least 90°C .

Refer to table 4 for additional information and figure 15 for the ATEX approvals nameplate.

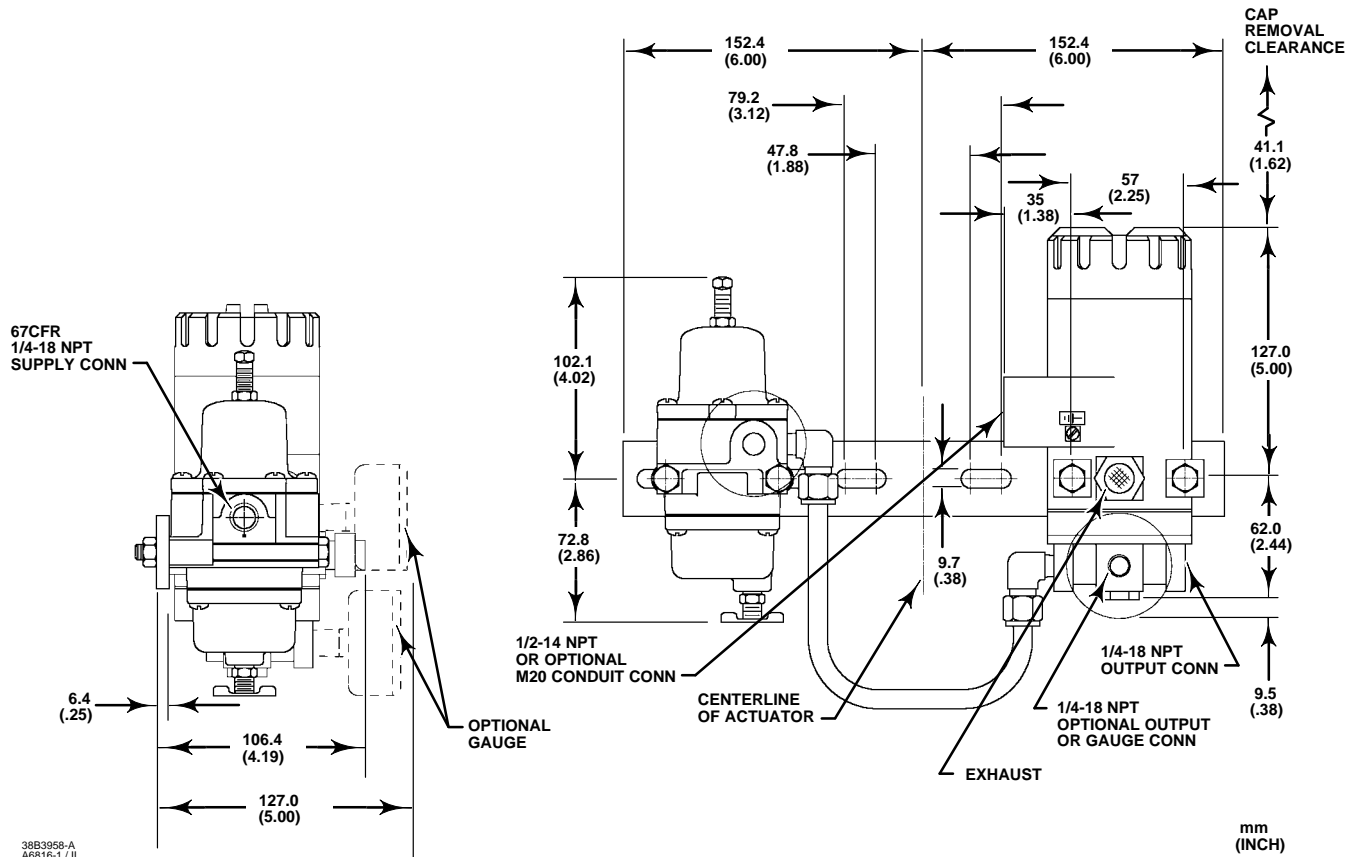


Figure 3. Dimensions and Connections

Table 5. Hazardous Area Classifications—INMETRO

CERTIFICATE	CERTIFICATION OBTAINED	ENTITY RATING	TEMPERATURE CODE	ENCLOSURE RATING
INMETRO	BR-Ex ia IIC T6/T5/T4—Intrinsic Safety	$U_i = 60 \text{ V}$	T4 ($T_{amb} \leq 70^\circ\text{C}$) T5 ($T_{amb} \leq 45^\circ\text{C}$) T6 ($T_{amb} \leq 40^\circ\text{C}$)	---
	Br-Ex d IIC T6—Flameproof	---	T6 ($T_{amb} \leq 50^\circ\text{C}$)	---

ATEX Type n

Special Conditions for Safe Use

No conditions of safe use.

Refer to table 4 for additional information and figure 15 for the ATEX approval nameplates.

INMETRO

Special Conditions of “Safe Use”

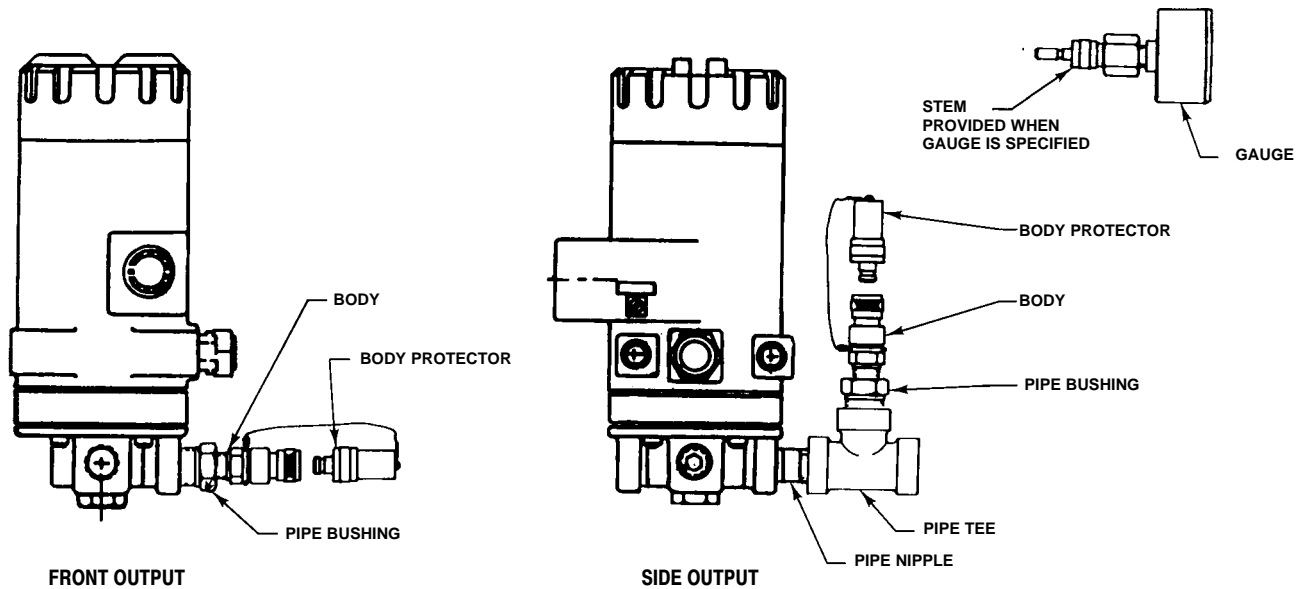
Refer to table 5 for approval information.

Contact your Emerson Process Management sales office for additional “safe use” information.

Mounting

When a transducer is ordered as part of a control valve assembly, the factory mounts the transducer on the actuator and connects the necessary tubing, then adjusts the transducer as specified on the order.

Transducers also can be ordered separately for mounting on a control valve assembly already in service, or for mounting on a 2-inch diameter pipestand, a flat surface, or a bulkhead. The transducer may be ordered either with or without mounting parts. Mounting parts include a mounting plate and bolts and, if ordered for pipestand mounting, a pipe clamp. Tubing is not included if the transducer is not factory mounted. Use 10 mm (3/8-inch) diameter tubing for all input and output



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B2395-1/L

Figure 4. Diagnostics Hookup for the 646 Transducer

connections. The length of tubing between the transducer output and the final control element should be as short as possible. Transducer overall dimensions are shown in figure 3. If weatherproofing is required, mount the transducer so that the vent can drain. Do not allow moisture or condensate to collect in the vent.

Pneumatic Connections

As shown in figure 3, all pressure connections on the transducer are 1/4 NPT internal connections. Use 10 mm (3/8-inch) tubing for all pressure connections. Refer to the vent subsection below for remote vent connections.

Supply Pressure Requirements

air supply is not clean, dry and oil-free. While use and regular maintenance of a filter that removes particles larger than 40 microns in diameter will suffice in most applications, check with an Emerson Process Management field office and industry instrument air quality standards for use with corrosive air or if you are unsure about the proper amount or method of air filtration or filter maintenance.

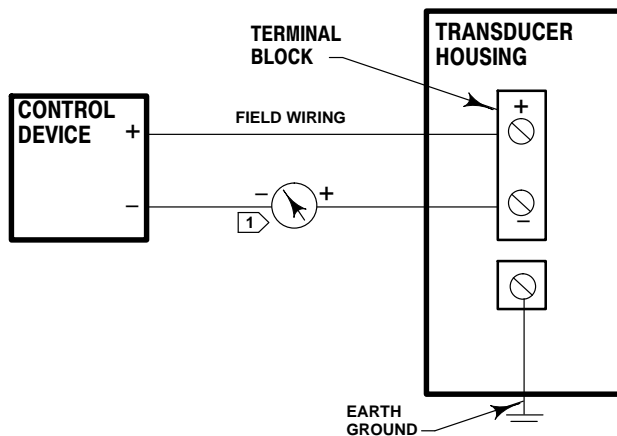
Supply pressure must be clean, dry air. Use a 67CFR filter regulator, or equivalent, to filter and regulate supply air. The filter regulator can be mounted on a bracket with the transducer as shown in figure 11 or mounted on the actuator mounting boss. An output pressure gauge may be installed on the regulator to indicate the supply pressure to the transducer. Also, as an aid for calibration, a second gauge may be installed on the transducer to indicate transducer output pressure.

Connect the nearest suitable supply source to the 1/4 NPT IN connection on the filter regulator (if furnished) or to the 1/4 NPT SUPPLY connection on the transducer case (if the filter regulator is not attached).



Severe personal injury or property damage may occur if the instrument

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NOTE:
 1. FOR TROUBLESHOOTING OR MONITORING OPERATION, AN INDICATING DEVICE CAN BE A VOLTMETER ACROSS A 250 OHM RESISTOR OR A CURRENT METER.
A3875/IL

Figure 5. Typical Field Wiring Diagram

Diagnostic Connections

To support diagnostic testing of valve/actuator/positioner packages, special connectors and hardware are available. Typical connector installations are shown in figure 4. The hardware used includes a 1/4 NPT pipe nipple and pipe tee with a 1/8 NPT pipe bushing for the connector. The connector consists of a 1/8 NPT body and body protector.

Note

If the 646 transducer is used in a valve assembly with a positioner, no hook-up for diagnostic testing is required for the 646. The hook-up for diagnostic testing should be installed at the positioner.

Install the connectors and hardware between the 646 transducer and the actuator.

1. Before assembling the pipe nipple, pipe tee, pipe bushings, actuator piping, and connector body, apply sealant to all threads.
2. Turn the pipe tee to position the connector body and body protector for easy access when doing diagnostic testing.

Vent

If a remote vent is required, the vent line must be as short as possible with a minimum number of bends

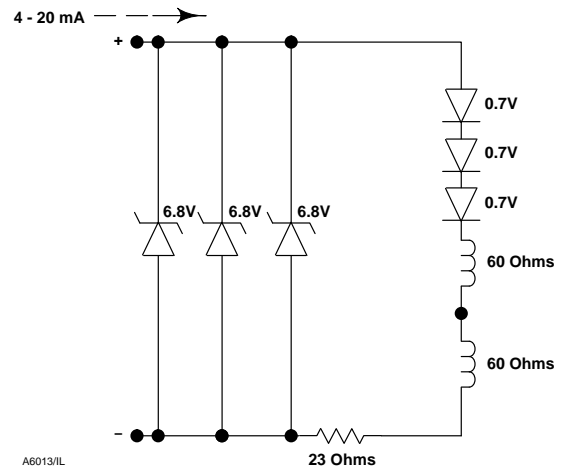


Figure 6. Equivalent Circuit

and elbows. To connect a remote vent, remove the plastic vent (key 41, figure 10). The vent connection is 1/4 NPT internal. Use 3/8-inch tubing to provide a remote vent.

Electrical Connections

WARNING

For explosion-proof applications, disconnect power before removing the housing cap.

For explosion-proof Class 1, Division 1 applications using metal conduit, install a conduit seal no more than 457 mm (18 inches) from the transducer. Personal injury or property damage may result from explosion if the seal is not installed. For other explosion-proof applications, install the transducer in accordance with applicable codes.

For proper wiring and installation for intrinsically safe installations, refer to the nameplate (figure 13) and loop schematics for CSA and FM (figures 12 and 14), or to instructions provided by the barrier manufacturer.

Select wiring and/or cable glands that are rated for the environment of use (such as hazardous area, ingress protection, and temperature). Failure to use properly rated wiring and/or cable glands can result in personal injury or property damage from fire or explosion.

Wiring connections must be in accordance with local, regional, and national codes for any given hazardous area approval. Failure to follow the local, regional, and national codes could result in personal injury or property damage from fire or explosion.

Use the 1/2 NPT conduit connection, shown in figure 3, for installation of field wiring. For Class I, Division I explosion-proof applications, install rigid metal conduit and a seal no more than 457 mm (18 inches) from the transducer. Also, install conduit using local and national electrical codes which apply to the application.

Refer to figures 5, 6, and 7 when connecting field wiring from the control device to the transducer. Connect the positive wire from the control device to the transducer “+” terminal and, the negative wire from the control device to the transducer “-” terminal. Do not overtighten the terminal screws. Maximum torque is 0.45 N•m (4 lbf•in.). Connect the transducer grounding terminal to earth ground. Grounding terminals are provided both inside and outside the transducer housing.

Operating Information

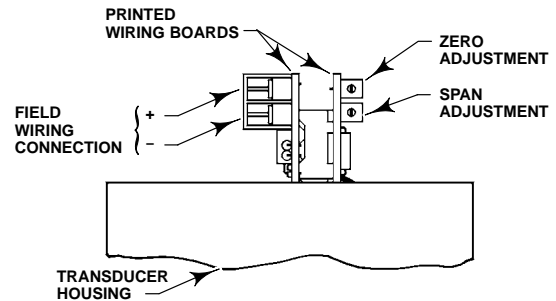
The normal mode of operation for the 646 transducer requires that the pneumatic output pressure be piped to the final control element. If this is not done the resulting pneumatic output will vent to the atmosphere.

Calibration

WARNING

On explosion-proof instruments, remove electrical power before removing the housing cap in a hazardous area. Personal injury or property damage may result from fire or explosion if power is applied to the transducer with the cap removed in a hazardous area.

For intrinsically safe areas, current monitoring during operation must be with a meter approved for use in hazardous areas.



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Figure 7. Zero and Span Adjustments and Terminal Block Connections (Cap Removed)

Equipment Required

Choose a current or voltage source that is capable, without switching ranges, of driving the transducer through its entire input range. Switching ranges on a current or voltage source will produce spikes or mid-scale reverses in the input signal presented to the transducer, causing errors. The current source should be capable of delivering 30 mA with 30 VDC maximum compliance voltage.

Calibration Procedure

WARNING

For critical processes, this calibration procedure requires taking the final control element out of service. To avoid personal injury or property damage due to an uncontrolled process, provide some temporary means of process control before beginning the calibration procedure.

Refer to figure 7 for adjustment locations.

1. If a current source other than the control device is used as the input source, disconnect the control device and connect the current source positive terminal to the transducer “+” terminal and the current source negative terminal to the transducer “-” terminal.

If an external meter is used, connect the current source positive terminal to the transducer “+” terminal. Connect the meter positive terminal to the transducer “-” terminal and the meter negative terminal to the current source negative terminal as shown in figure 5.

2. Check the supply pressure to ensure it is at the recommended pressure listed on the transducer nameplate.

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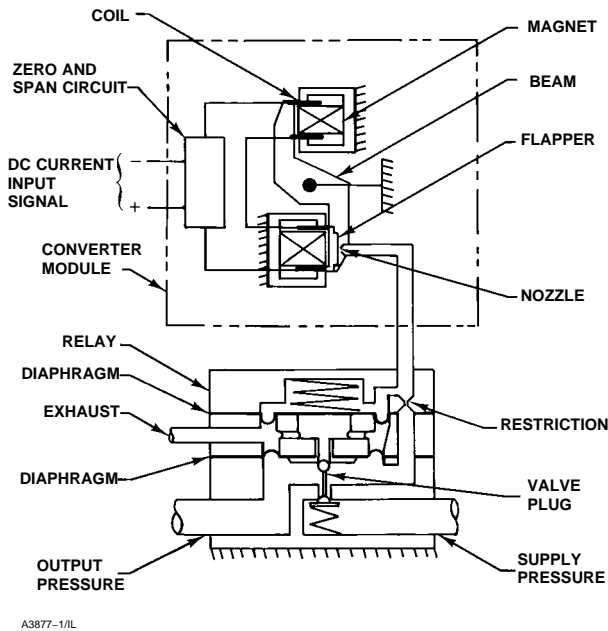


Figure 8. 646 Transducer Schematic

3. Adjust the input current to 4.00 milliamperes DC.
4. The output pressure should be 0.2 bar (3 psig). If not, adjust the ZERO potentiometer until the output pressure is 0.2 bar (3 psig).
5. Adjust the input current to 20.00 milliamperes DC.
6. The output pressure should be 1.0 bar (15 psig). If not, adjust the SPAN potentiometer until the output pressure is 0.8 bar (15 psig).
7. Repeat steps 2 through 6 until the output pressure is within the referenced accuracy requirements without further adjustment.
8. If a current source other than the control device was used, disconnect the current source and reconnect the control device.

Principle of Operation

The converter module receives a standard DC current input signal from a control device to operate coils in a force balanced beam system which in turn, controls bleed air through an integral nozzle/flapper arrangement. The nozzle pressure provides the input signal to operate the relay as shown in figure 8. Relay output pressure is applied, through tubing, directly to the final control element or valve/actuator assembly.

Maintenance

The normal mode of operation for the 646 transducer requires that the pneumatic output pressure be piped to the final control element. If this is not done the resulting pneumatic output will vent to the atmosphere.

Due to normal wear or damage from external sources such as debris in the supply medium, periodic maintenance or repair of the transducer may be necessary. Maintenance of the transducer consists of troubleshooting, removal for inspection, and replacement of component parts.

WARNING

To avoid personal injury or property damage from the sudden release of pressure:

- Always wear protective clothing, gloves, and eyewear when performing any maintenance operations.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure on both sides of the valve.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

WARNING

For explosion proof applications, disconnect power before removing the housing cap. Personal injury or property damage may result if power is not disconnected.

**WARNING**

The presence of Emerson Process Management personnel and approval agency personnel may be required if you service (other than normal, routine maintenance, such as calibration) or replace components on a 646 transducer that carries a third-party approval. When you replace components, use only components specified by the factory. Substitution with other components may void the third-party approval and result in personal injury or property damage. Also, always use proper component replacement techniques, as presented in this manual. Improper techniques can cause poor quality repairs and impair the safety features of the device.

The converter module should never be disassembled because the magnetism in the coils will decrease permanently. If troubleshooting or alignment attempts indicate a faulty converter module, replace the module or return the transducer to your Emerson Process Management sales office for repair.

Troubleshooting**Electrical**

The following procedures require taking the control valve/actuator assembly out of service. Provide some temporary means of process control before taking the control valve out of service.

1. Ensure terminal lug connections from the control device to the transducer are of the correct polarity (refer to the electrical connection procedures in the Installation section).
2. At the transducer, ensure that the milliampere DC signal is applied, and ensure that it is within the 4 to 20 milliampere range.

Pneumatic

Provide a 4 to 30 milliampere DC current source, supply pressure, and a gauge to monitor the output pressure when checking transducer operation. Refer to figure 10 for key number locations.

1. Ensure that supply pressure to the transducer is a consistent 1.4 bar (20 psig).
2. If a filter/regulator is used, ensure that it is working correctly. If not, ensure the dripwell is not plugged because of excessive moisture accumulation. If necessary, drain off any moisture, and clean or replace the filter element.
3. Force the converter module to maximum output pressure with a 30 milliampere DC signal. Output pressure should build up to the approximate value of the supply pressure.
4. When the input current is removed, the transducer output pressure should drop to less than 0.14 bar (2 psig). If it does not, check to ensure the vent and exhaust air passageway is free from foreign material.
5. To inspect the relay assembly, refer to the relay maintenance procedures.

Converter Module Replacement**Removal**

Refer to figure 10 for key number locations.

1. Remove the housing cap (key 4).
2. Note the location of the wires, then remove the electrical wiring from the terminal block mounted on the printed wiring board.
3. Remove the two screws (key 19) and remove the converter module and wire guide (key 42) from the housing.
4. Inspect the O-ring (key 18) and replace if necessary.

Replacement

1. Lubricate the O-ring (key 18) with a lubricating compound such as key 20 before replacing the converter module in the housing.
2. Insert the converter module and wire guide (key 42) into position in the housing (key 3). Replace the two screws (key 19) and tighten them.
3. Replace the electrical wiring removed in step 2 of the removal procedures. Do not overtighten the terminal screws. Maximum torque is 0.45 N•m (4 lbf•in).
4. Electrically calibrate the module following the procedures in the Calibration section.
5. Replace the housing cap (key 4).

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Relay Maintenance

Refer to figure 10 for key number locations.

Removal

1. Remove the four mounting screws (key 7) and remove the relay from the transducer. Be careful not to lose the bias spring (key 13) and input diaphragm (key 9).
2. Remove the body block (key 2) from the relay body assembly (key 1).
3. Remove the exhaust port assembly (key 10) from the relay assembly.
4. Remove the body plug (key 5) that holds the inner valve spring (key 12) and valve plug (key 14) in place.
5. Inspect the springs, exhaust seat, valve plug, and other parts for wear or damage; replace as necessary. Note: the valve plug supply seat is an insert in the relay body (key 1). If this insert is bad, replace the relay body.
6. Ensure that the fixed restriction in the transducer housing is clear of foreign matter.
7. Make sure all parts of the relay are clean and that all passages are clear of foreign matter.

Assembly

1. Assemble the inner valve spring (key 12) onto the body plug (key 5) and fit the valve plug (key 14) onto the inner valve spring as shown in figure 9. To assure best alignment between the valve plug, inner valve spring, and body plug; fit the valve plug onto the inner valve spring so that one of the three tabs at the base of the valve plug sets at the end of the last coil of the inner valve spring.
2. Insert the assembled valve plug, inner valve spring, and body plug into the relay body (key 1). Compress the spring and thread the body plug (key 5) into place. Then, tighten the body plug.
3. Insert two of the mounting screws (key 7) into two opposite holes of the relay body (key 1). Hold the screws in place while assembling the following parts on the relay body. The screws serve as studs to align the parts as they are being assembled.

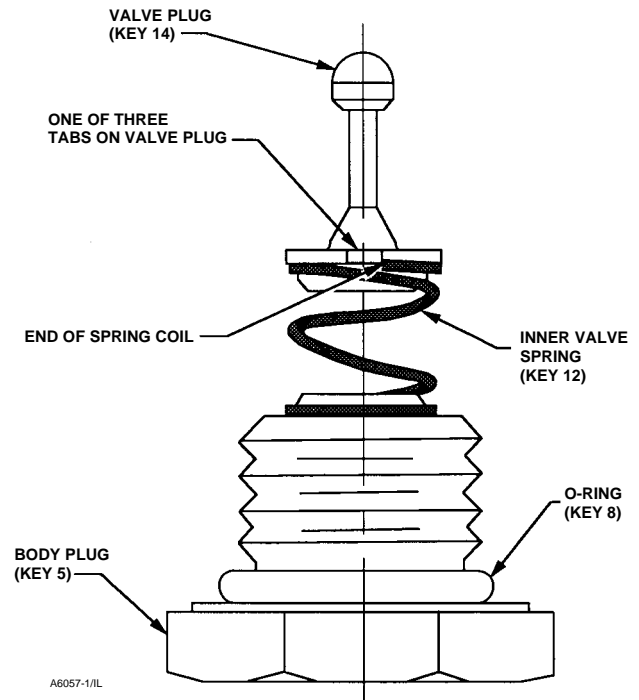


Figure 9. Valve Plug, Inner Valve Spring and Body Plug Assembly

4. When replacing the exhaust port assembly (key 10), make sure all passages and screw holes are aligned and that the hole in the center of the exhaust port assembly fits over the valve plug (key 14). Place the exhaust port assembly on the relay body (key 1). Hold assembled parts in place.
5. Make sure the tabs on the body block (key 2) align with the tabs on the relay body (key 1) and that the side with 5 holes faces the relay body. Place the body block on the assembled parts. Hold assembled parts in place.
6. When replacing the input diaphragm (key 9), make sure all passages and screw holes are aligned. Place the input diaphragm on the body block (key 2). Hold assembled parts in place.
7. Install the bias spring (key 13) into the transducer housing assembly (key 3). Make sure the tabs on the body block and relay body align with the tab on the transducer housing assembly. Place the assembled parts onto the transducer housing assembly. Thread the two mounting screws (key 7) into the transducer housing assembly. Install the remaining two mounting screws. Tighten all mounting screws to 2 N•m (20 lbf•in).
8. Perform the procedures in the Calibration section.

Parts Ordering

A serial number is assigned to each transducer and stamped on the nameplate. Always refer to this serial number when corresponding with your Emerson Process Management sales office regarding spare parts or technical information. When ordering replacement parts, also specify the complete 11-character part number from the Parts list.



WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Process Management should not, under any circumstances, be used in any Fisher instrument. Use of components not supplied by Emerson Process Management will void your warranty, might adversely affect the performance of the instrument, and could result in personal injury or property damage.

Note

Neither Emerson, Emerson Process Management, nor any of their affiliated entities assumes responsibility for the selection, use, and maintenance of any product. Responsibility for the selection, use, and maintenance of any product remains with the purchaser and end-user.

Parts Kits

646 Transducer Repair Kit

Includes keys 6, 8, 9, 10, 12, 13, 14, and 18. The O-ring for the converter module is also included in the kit.

R646X000012

Parts List

Note

Part numbers are shown for recommended spares only. For part numbers not shown, contact your Emerson Process Management sales office.

Key	Description	Part Number
1	Relay body assembly	
2	Body block, aluminum	
3	Housing assembly 1/2 NPT conduit connection	
4	Housing Cap, aluminum	
5	Body plug, aluminum	
6*	O-ring, nitrile	1E5477X0062
7	Machine screw, stainless steel (4 req'd)	
8*	O-ring, nitrile	1H8762X0012
9*	Input diaphragm, nitrile	21B2362X012
10	Exhaust port assembly	
12	Inner valve spring, stainless steel	
13	Bias spring, steel pl	
14*	Valve plug, stainless steel	21B2370X012
15	Wire retainer, steel pl (2 req'd)	
16	Nameplate, w/o approvals, aluminum	
17	Screw, stainless steel (2 req'd)	
18*	O-ring, nitrile	1C8538X0162
19	Screw, stainless steel (2 req'd)	
20	Anti-seize lubricant (not furnished with transducer)	
21	Pipe plug, use when gauge is not specified (not shown) Alloy steel pl Stainless steel	
21*	Gauge, 0–30 psig/0–0.2 MPa/0–2 bar (not shown)	11B8579X022
22	Anti-seize sealant (not furnished with transducer)	
41	Vent, plastic	
42	Wire guide, SST	
43	Wire lug	
44	Set Screw (LCIE)	
49	Cable gland, plastic M20 thread conduit connection (not shown)	
---	Converter module	

646 Transducer

Diagnostic Connections

Note

Part numbers are shown for recommended spares only. For part numbers not shown, contact your Emerson Process Management sales office.

FlowScanner™ diagnostic system hook-up

Includes pipe tee, pipe nipple, pipe bushings, connector body, and body protector. See figure 4 for part identification.

Note

If the 646 transducer is used in a valve assembly with a positioner, no hook-up for diagnostic testing is required for the 646. The hook-up for diagnostic testing should be installed at the positioner.

Front Output

For units with gauges
SST fittings
Brass fittings

For units without gauges
SST fittings
Brass fittings

Side Output

For units with gauges
SST fittings
Brass fittings
For units without gauges
SST fittings
Brass fittings

Mounting Parts

Yoke Mounting With 67CFR Filter Regulator

Key Description

Note

Contact your Emerson Process Management sales office for 646 mounting FS Numbers.

For the following actuator types and sizes:
480 sizes 30-130; 585C all sizes; 656, sizes 40 & 60; 657 & 667, sizes 30-100; 1051 & 1052, sizes 30-60; 061 sizes 30-100; 1066 all sizes

- 23 Cap screw, steel pl (4 req'd)
- 24 Washer, carbon steel pl (6 req'd)
- 25 Hex nut, steel pl (4 req'd)
- 26 Mounting plate, steel
- 27 Cap screw, steel pl (2 req'd)
(Not req'd for 585C)

Key Description Part Number

- 28 Washer, carbon steel pl (6 req'd)
585C only
- 36 Elbow, brass for 3/8-inch copper tubing (4 req'd)
657, 1051, 1052, 1061, 1066 and 1066SR only
- 37 Connector, brass for 3/8-inch copper tubing (2 req'd)
480, 585C, and 667 only
- - - Spacer (2 req'd)
For 667 size 30
- - - Cap Screw (2 req'd)
For 585C only
For 667 size 30

Yoke Mounting w/o 67CFR Filter Regulator

For the following actuator types and sizes:
480 sizes 30-130; 585C all sizes; 657 sizes 30-100; 667 sizes 40-100; 1051 & 1052 sizes 30-60; 1061 sizes 30-100; 1066 all sizes

- 23 Cap screw, steel pl (2 req'd)
- 36 Elbow, brass for 3/8-inch copper tubing
For 657, 1051, 1052, 1061, 1066, and 1066SR only
- 37 Connector, brass for 3/8-inch copper tubing
For 657, 1051, 1052, 1061, 1066, and 1066SR (1 req'd)
For 480, 585C and 667 (2 req'd)

Casing Mounting

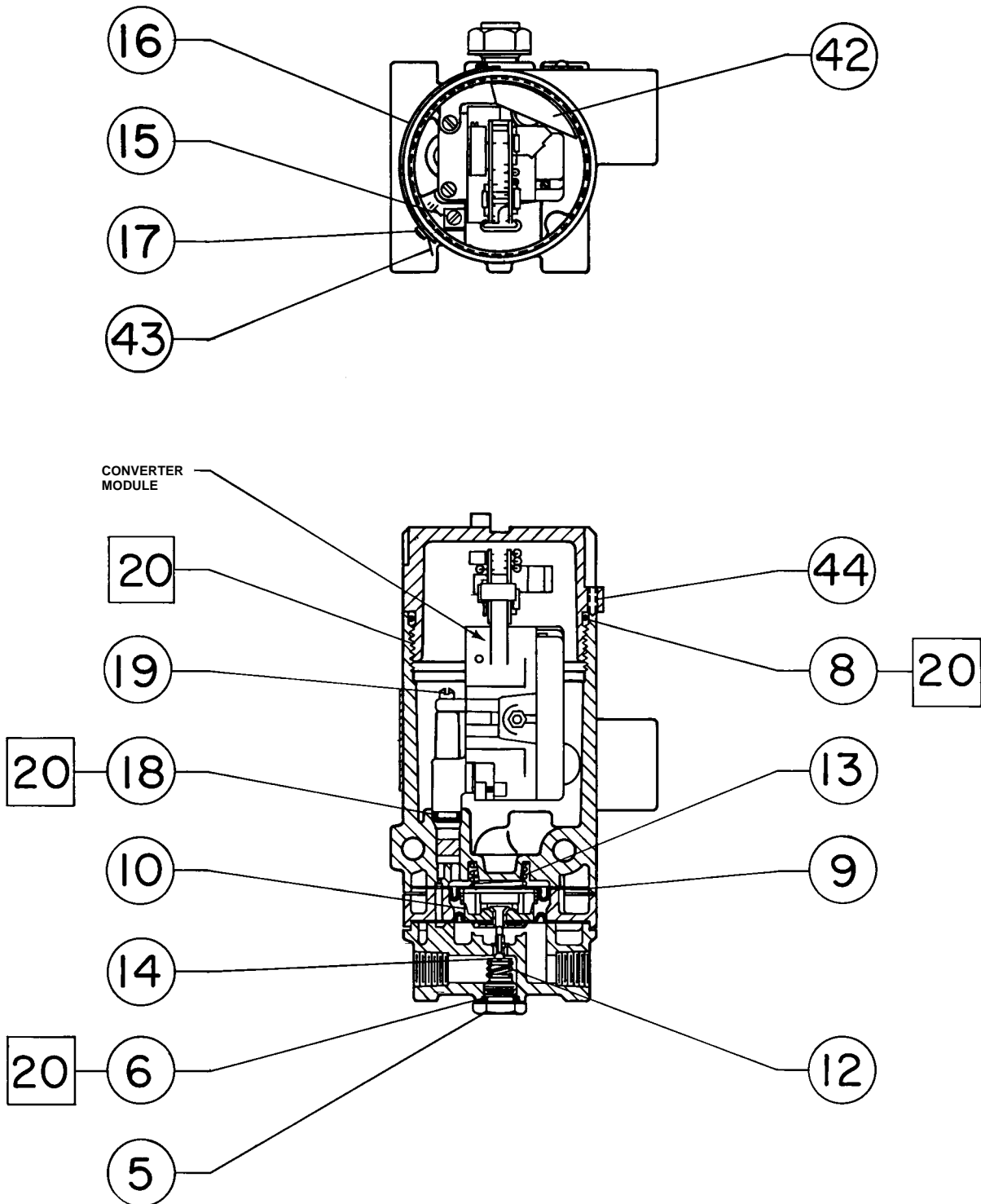
For the following actuator types and sizes:
657 & 667 all sizes; 1051 sizes 30-60; 1052 sizes 20-70

- 23 Cap screw, steel pl
With 67CFR (4 req'd)
Without 67CFR (2 req'd)
- 24 Washer, carbon steel pl
With 67CFR (4 req'd)
Without 67CFR (2 req'd)
- 25 Hex nut, steel pl
With 67CFR (4 req'd)
Without 67CFR (2 req'd)
- 26 Mounting plate, steel pl
For 657 & 667 sizes 80 & 100 only
With 67CFR (2 req'd)
Without 67CFR (1 req'd)
- 26 Mounting plate, steel pl
For other actuators
With 67CFR (2 req'd)
Without 67CFR (1 req'd)
- 36 Elbow, brass for 3/8-inch copper tubing
With 67CFR (2 req'd)
Without 67CFR (1 req'd)
- 37 Connector, brass for 3/8-inch copper tubing
With 67CFR (2 req'd)
Without 67CFR (1 req'd)

Key	Description	Part Number	Key	Description	Part Number
<i>Pipestand and Panel Mounting</i>					
23	Cap screw, steel pl Pipestand with 67CFR (4 req'd) Pipestand without 67CFR & panel (2 req'd) 45° multiple panel ⁽¹⁾ (2 req'd)		26	Mounting plate, steel Pipestand with 67CFR Pipestand without 67CFR 45° multiple panel ⁽¹⁾	
24	Washer, carbon steel pl Pipestand with 67CFR (4 req'd) without 67CFR (2 req'd) Panel (2 req'd) 45° multiple panel ⁽¹⁾ (4 req'd)		27	Cap screw, steel pl 45° multiple panel ⁽¹⁾ (2 req'd)	
			32	Hex nut, steel pl Pipestand with 67CFR (4 req'd) Pipestand without 67CFR & panel (2 req'd) 45° multiple panel ⁽¹⁾ (4 req'd)	
			33	Pipe clamp, carbon steel pl (pipestand only)	
			36	Elbow, brass for 3/8-inch copper tubing Pipestand & Panel W/67CFR (2 req'd)	

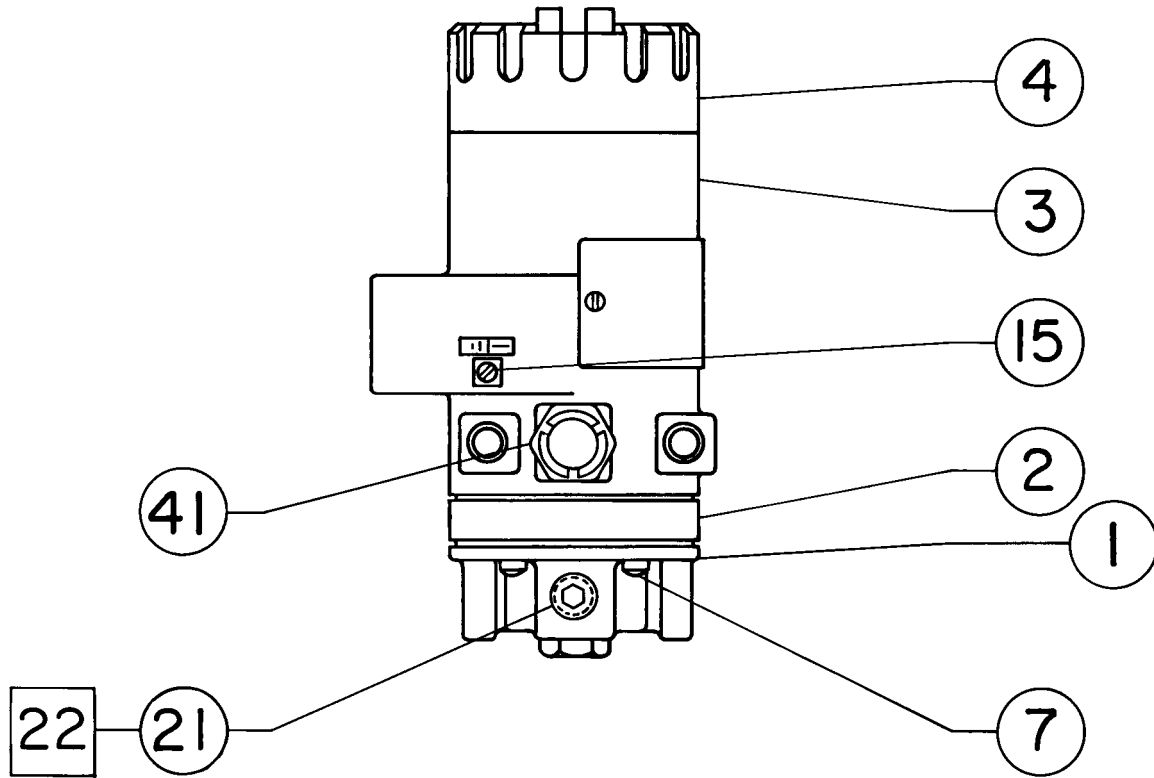
1. For panel mounting at 45° to allow close mounting of multiple transducers.

646 Transducer



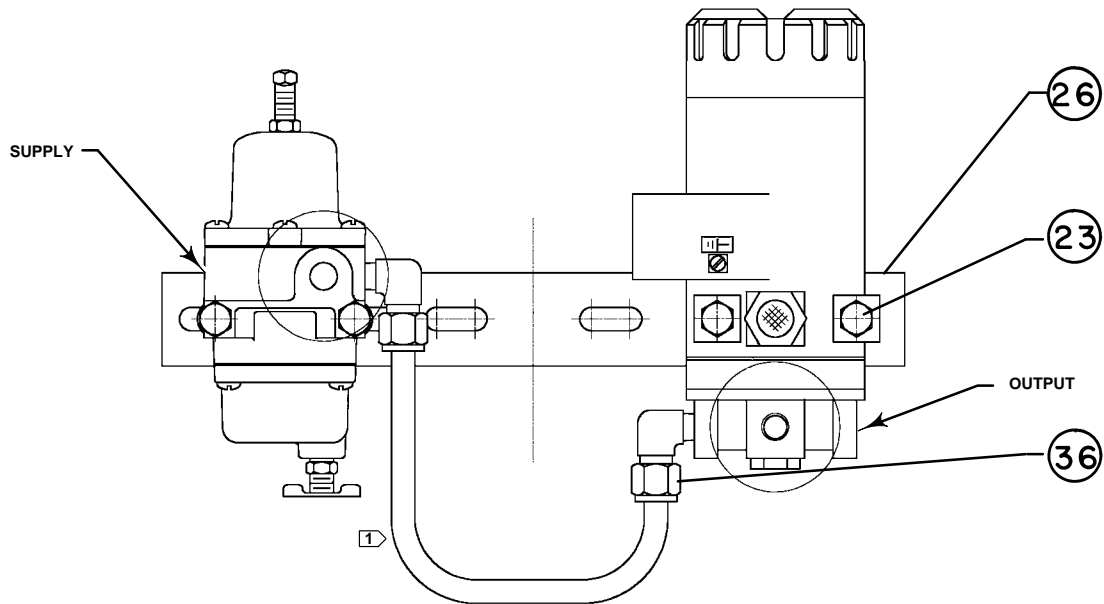
NOTE:
KEY NUMBER 49 IS NOT SHOWN
□ APPLY LUB/SEALANT
41B2373-E/DOC

Figure 10. 646 Transducer Assembly (continued on next page)



41B2373-E/DOC

Figure 10. 646 Transducer Assembly (continued)



NOTES:

1 3/8-INCH TUBING SUPPLIED ONLY WHEN 646 IS FACTORY MOUNTED

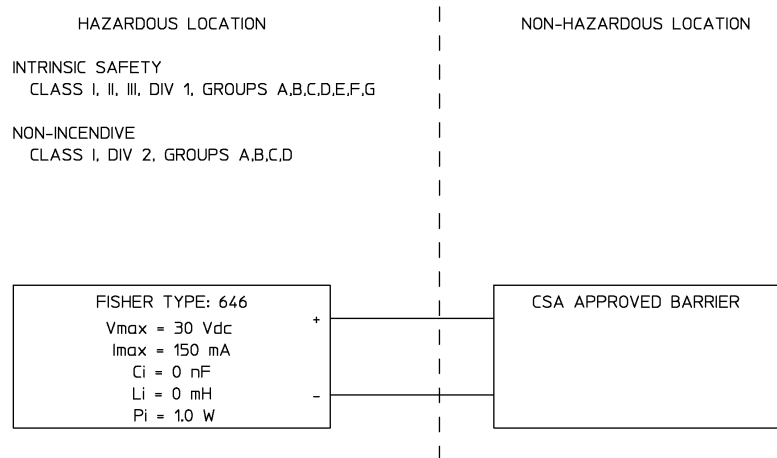
KEY NUMBERS 24, 25, 27, 32, 33, 37, 38, 39 ARE NOT SHOWN.

38b3958-A
B2381-2 / IL

Figure 11. Typical 646 Mounting With 67CFR Filter Regulator

646 Transducer

Loop Schematics / Nameplates



NOTES:

1. BARRIERS MUST BE CSA CERTIFIED WITH ENTITY PARAMETERS AND ARE TO BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURERS I.S. INSTALLATION INSTRUCTIONS.
2. EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE, PART I.
3. FOR ENTITY INSTALLATION (I.S. AND NI): $V_{max} > V_{oc}$, $I_{max} > I_{sc}$, $C_i + C_{cable} < C_a$, $L_i + L_{cable} < L_a$.

GE28591
E1088

Figure 12. CSA Loop Schematic

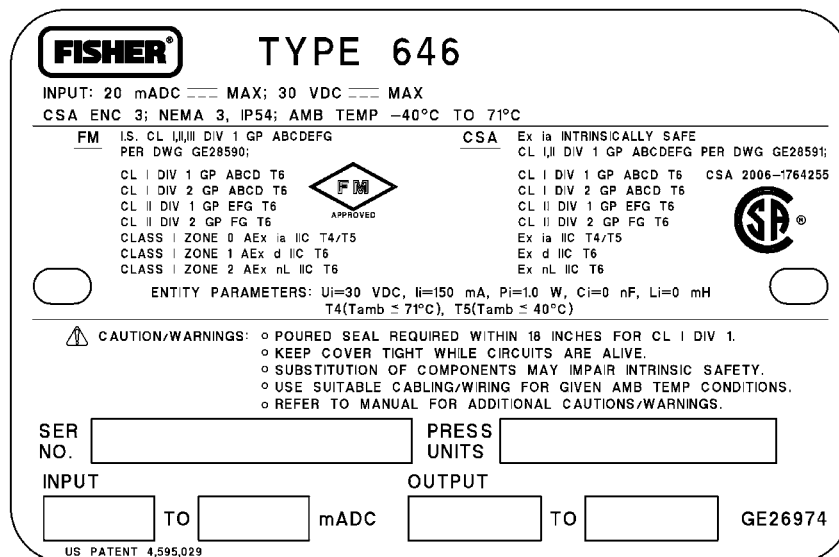
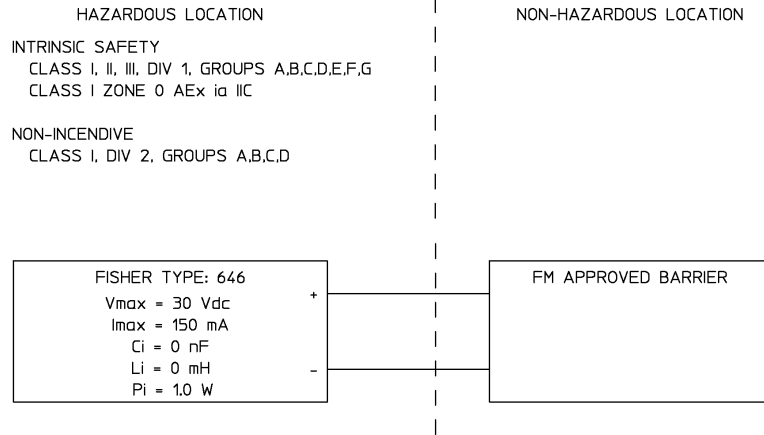


Figure 13. CSA and FM Approvals Nameplate



NOTES:

1. THE INSTALLATION MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE (NEC), NFPA 70, ARTICLE 504 AND ANSI/ISA RP12.6 OR ARTICLE 505.
2. CLASS 1, DIV 2 APPLICATIONS MUST BE INSTALLED AS SPECIFIED IN NEC ARTICLE 501-4(B). EQUIPMENT AND FIELD WIRING IS NON-INCENDIVE WHEN CONNECTED TO APPROVED BARRIERS WITH ENTITY PARAMETERS.
3. LOOPS MUST BE CONNECTED ACCORDING TO THE BARRIER MANUFACTURER'S INSTRUCTIONS.
4. MAXIMUM SAFE AREA VOLTAGE SHOULD NOT EXCEED 250 Vrms.
5. RESISTANCE BETWEEN BARRIER GROUND AND EARTH GROUND MUST BE LESS THAN ONE OHM.
6. NORMAL OPERATING CONDITIONS 30 Vdc 20 mADC.
7. FOR ENTITY INSTALLATION (I.S. AND N.I.):
 $V_{max} > V_{oc}$, or V_t $C_i + C_{cable} < C_a$
 $I_{max} > I_{sc}$, or I_t $L_i + L_{cable} < L_a$
 $P_i > P_o$, or P_i

GE28590
E1089

Figure 14. FM Loop Schematic

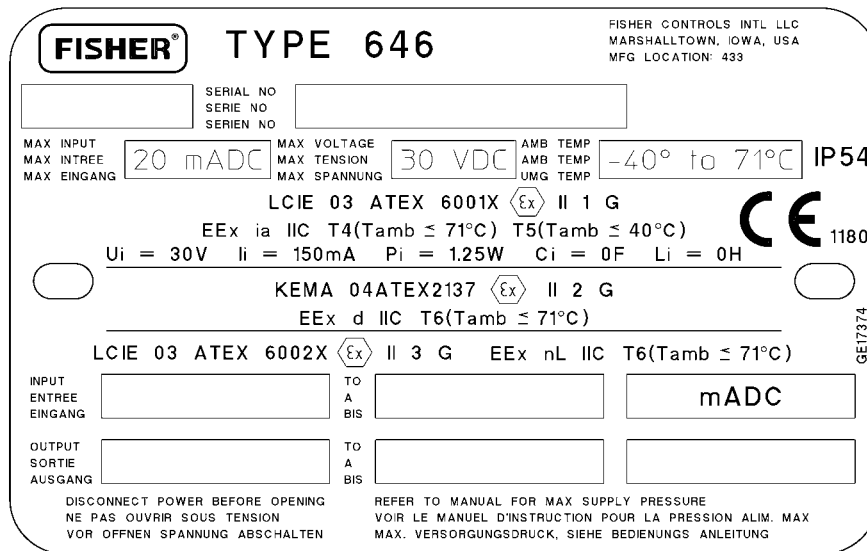


Figure 15. ATEX Approvals Nameplate

**Errata Sheet
February 2009**

**Errata Sheet
for**

646 Electro-Pneumatic Transducers,
D101351X012, July 2008

This errata sheet includes updated electromagnetic compatibility (EMC) information for 646 electro-pneumatic transducers.

- Replace *Table 2. Immunity Performance* with the updated table 2 below.

- Replace the portion of the **Performance** section titled **Electromagnetic Interference (EMI)**, found in *Table 1. Specifications*, with the following updated information:

Note

The Immunity Performance table is incorrectly labeled as Table 1 in the instruction. It is the table immediately after Table 1. Specifications.

Note

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Electromagnetic Compatibility

Meets EN 61326-1 (First Edition)

Immunity—Industrial locations per Table 2 of the EN 61326-1 standard. Performance is shown in table 2 below.

Emissions—Class A

ISM equipment rating: Group 1, Class A

Table 2. EMC Summary Results—Immunity

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% 1400 to 2000 MHz @ 3V/m with 1 kHz AM at 80% 2000 to 2700 MHz @ 1V/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	A
Specification limit = ±1% of span 1. A = No degradation during testing. B = Temporary degradation during testing, but is self-recovering.				

646 Transducer

Errata Sheet

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