

Type 846 and Model 3311 Current-to-Pressure Transducers

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Type 846 and Model 3311

Section 1 Introduction

Scope of Manual

This instruction manual provides installation, operating, calibration, maintenance, and parts ordering information for the Type 846 and Model 3311 current-to-pressure transducers. Refer to separate manuals for instructions covering equipment used with the transducers.

Only personnel qualified through training or experience should install, operate, or maintain these transducers. If there are any questions concerning the instructions in this manual, contact your Fisher sales office or sales representative before proceeding.

CAUTION

The products described in this document are NOT designed for nuclear-qualified applications. Using non-nuclear qualified products in applications that require nuclear-qualified hardware or products may cause inaccurate readings.

Description

The Type 846 or Model 3311 current-to-pressure transducer, shown in figure 1-1, accepts an electrical input signal and produces a proportional pneumatic output. Typically, 4 to 20 mA is converted to 0.2 to 1.0 bar (3 to 15 psi). Models are available in direct or reverse action and field-selectable full or split range inputs. See Section 3 Calibration for more information on input/output combinations.

The most common application of the transducer is to receive an electrical signal from a controller and produce a pneumatic output for operating a control valve actuator or positioner. The Type 846 and Model 3311 may also be used to transduce a signal for a pneumatic receiving instrument.

The Type 846 and Model 3311 are electronic I/P transducers. They have a single electronic circuit board, as shown in figure 1-2. The circuit contains a solid-state pressure sensor that monitors output pressure and is part of an electronic feedback



Figure 1-1. Type 846 and Model 3311 Current-to-Pressure Transducer

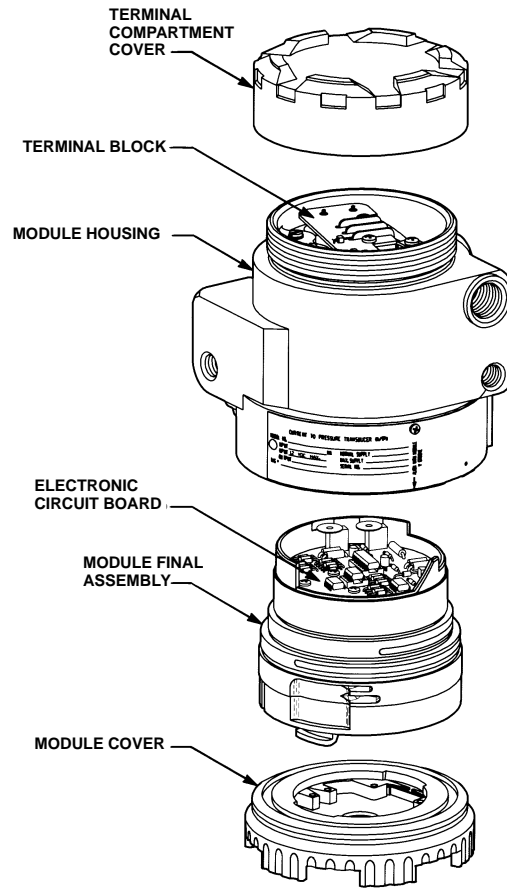
network. The self-correcting ability provided by the sensor/circuit combination allows the transducer to produce a very stable and responsive output signal.

All active mechanical and electrical components of the Type 846 and Model 3311 are incorporated into a single, field-replaceable module called the module final assembly, shown in figure 1-2. The module final assembly contains the electronic circuit board, pilot/actuator assembly, and booster stage. The module final assembly is easily removed by unscrewing the module cover. Its design minimizes parts and reduces the time required for repair and troubleshooting.

The terminal compartment and module compartment are separated by a sealed compartment wall. This multi-compartment housing also protects the electronics from contaminants and moisture in the supply air.

Specifications

Specifications for the Type 846 and Model 3311 transducer are listed in table 1-1.



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Figure 1-2. Transducer Modular Construction

Table 1-1. Specifications

<p>Input Signal⁽¹⁾</p> <p>Standard Performance: 4 to 20 mA dc, 4 to 12 mA dc, or 12 to 20 mA dc. Field adjustable split ranging</p> <p>10 to 50 mA dc. Consult factory for split range input. Direct action only</p> <p>Multirange Performance: 4 to 20 mA dc. Consult factory for split range input.</p> <p>10 to 50 mA dc. Consult factory for split range input. Direct action only.</p> <p>Output Signal⁽¹⁾⁽⁵⁾</p> <p>Standard Performance: <i>(Consult factory for split range output)</i></p> <p>Direct Action (Minimum span of 6 psi) Typical outputs: 0.2 to 1.0 bar (3 to 15 psi). Rangeability between 0.1 and 1.2 bar (1 and 18 psi).</p> <p>Reverse Action (Minimum span of 11 psi) Typical outputs: 1.0 to 0.2 bar (15 to 3 psi) Rangeability between 1.2 and 0.1 bar (18 and 1 psi).</p> <p>Multirange Performance:</p> <p>Direct Action (Minimum span of 6 psi) Typical outputs: 0.2 to 1.9 bar (3 to 27 psi), 0.4 to 2 bar (6 to 30 psi), and 0.3 to 1.7 bar (5 to 25 psi). Rangeability between 0.03 and 2.3 bar (0.5 and 33 psi).</p> <p>Reverse Action (Minimum span of 11 psi) Typical outputs: 1.9 to 0.2 bar (27 to 3 psi), 2 to 0.4 bar (30 to 6 psi), and 1.7 to 0.3 bar (25 to 5 psi) Rangeability between 2.3 and 0.03 bar (33 and 0.5 psi).</p> <p>Supply Pressure⁽¹⁾</p> <p>Standard Performance 1.2 to 1.6 bar (18 to 24 psi)</p> <p>Multirange Performance Minimum: 0.2 bar (3 psi) greater than the maximum calibrated output pressure Maximum: 2.4 bar (35 psi)</p> <p>Standard and Multirange Performance Minimum: 0.2 bar (3 psi)⁽⁴⁾ greater than the maximum calibrated output pressure Maximum: 2.4 bar (35 psi)</p>	<p>Output Air Capacity⁽²⁾</p> <p>Standard: 6.7 normal m³/hr (4.0 scfm) at 1.4 bar (20 psi) supply pressure Multirange: 9.0 normal m³/hr (6.0 scfm) at 2.5 bar (35 psig) supply pressure</p> <p>Steady-State Air Consumption⁽¹⁾⁽²⁾ 0.3 normal m³/hr (0.20 scfm) at 1.4 bar (20 psi) supply pressure</p> <p>Temperature Limits</p> <p>Operating:⁽¹⁾ -40 to 85°C (-40 to 185°F). Storage:⁽¹⁾ -40 to 93°C (-40 to 200°F).</p> <p>Humidity Limits 0 to 100% condensing relative humidity.</p> <p>Performance⁽³⁾</p> <p>Note: <i>The performance of all Type 846 and Model 3311 I/Ps is verified using computer automated manufacturing systems to ensure every unit shipped meets its performance specifications.</i></p> <p>Linearity⁽¹⁾, Hysteresis⁽¹⁾, and Repeatability: ±0.3% of span. Reference SAMA PMC 31.1.</p> <p>Temperature Effect (total effect including zero and span): ±0.07%/°C (0.045%/°F) of span</p> <p>Vibration Effect: ±0.3% of span per g during the following conditions: 5 to 15 Hz at 4 mm constant displacement 15 to 150 Hz at 2 g. 150 to 2000 Hz at 1 g. per SAMA Standard PMC 31.1-1980, Sec. 5.3, Condition 3, Steady State</p> <p>Shock Effect: ±0.5% of span, when tested per SAMA Standard PMC 31.1, Sec. 5.4.</p> <p>Supply Pressure Effect: Negligible</p> <p>EMC Effects: These instruments have the CE mark in accordance with the European Electromagnetic Compatibility (EMC) Directive. They meet the emissions requirements of IEC 61326-1 (Edition 1.1) for Class A equipment for use in industrial locations and Class B equipment for use in domestic locations. They also meet the immunity requirements listed in table 1-2. This table is in accordance with Annex A of IEC 61326-1 for equipment intended for use in industrial locations.</p> <p>Leak Sensitivity:⁽²⁾ Less than 1.0% of span for up to 5.0 normal m³/hr (3.0 scfm) downstream leakage.</p>
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Table 1-1. Specifications (continued)

<p>Performance (continued)</p> <p>Overpressure Effect: Less than 0.25% of span for misapplication of up to 7.0 bar (100 psi) supply pressure for less than 5 minutes to the input port.</p> <p>Reverse Polarity Protection: No damage occurs from reversal of normal supply current (4 to 20 mA) or from misapplication of up to 100 mA.</p> <p>Connections</p> <p>Supply Air, Output Signal, and Output Gauge: 1/4–18 NPT female connection.</p> <p>Electrical: 1/2–14 NPT female conduit connection</p> <p>Adjustments</p> <p>Zero and Span: screwdriver adjustments located in terminal compartment.</p> <p>Remote Pressure Reading (RPR) Jumper selectable, ON or OFF, if unit includes option</p> <p>Frequency Range: 5,000 to 8,000 Hz. Amplitude: 0.4 to 1.0 V_{p-p}</p> <p>Required Operating Voltage with Remote pressure Reading Off Min. 6.0 V (at 4 mA) Max. 7.2 V (at 20 mA)</p> <p>Required Operating Voltage with Remote Pressure Reading On Min 6.4 V (at 4 mA) Max. 8.2 V (at 20 mA)</p> <p>Hazardous Locations Certifications Refer to the following specifications and the transducer nameplate (see figure 1-3).</p> <p>Factory Mutual (FM) Approvals K5 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 and Class III, Division 1, hazardous locations. Factory Sealed.</p> <p>Intrinsically safe for Class I, Division 1,</p>	<p>Groups A, B, C, and D; Class II, Division 1, Groups E, F, and G; and Class III, Division 1, hazardous locations.</p> <p>Non-incendive for Class I, Division 2, Groups A, B, C, and D.</p> <p>Canadian Standards Association (CSA) Approvals C6 Explosion-proof for Class I, Division 1, Groups C and D; Class II, Division 1, Groups E, F, and G; and Class III, Division 1, hazardous locations. Factory Sealed.</p> <p>Intrinsically safe for Class I, Division 1, Groups A, B, C, and D. Temperature Code T4. Class I, Division 2, Groups A, B, C, and D.</p> <p>BASEEFA/CENELEC Intrinsically Safe Approval I1 EEx ia IIC T5 (T_{amb}=40°C) EEx ia IIC T4 (T_{amb}=80°C) Parameters: U_{max:in}=30 V dc, I_{max:in}=200 mA, W_{max:in}=0.8 W (T5)/1.0 W (T4), C_{eq}=0, L_{eq}=0.02 mH.</p> <p>BASEEFA Type N Approval N1 Ex N II T5 (T_{amb}=70°C) Parameter: U_{max}=10 V dc</p> <p>ISSEP/CENELEC Flameproof Approval E9 EEx d IIC T6</p> <p>Standards Association of Australia (SAA) Approvals K7 Flameproof: Ex d IIC T6; Class I, Zone 1.</p> <p>Intrinsic Safety: Ex ia IIC T4 (T_{amb}=80°C); Class I, Zone 0 Parameters: U_i=30 V dc, I_i=200 mA, C_i=8 nf, L_i=20 μH</p> <p>Non-sparking Ex n IIC T4 (T_{amb}=80°C); Class I, Zone 2. Parameter: U_{max}=12 V dc</p> <p>Russian (GOST) Approvals EG Flameproof: 1 ExdIICT6X IG Intrinsically Safe: 0ExialICT6 (T_{amb} = 40°C) 0ExialICT5 (T_{amb}=40°C) 0ExialICT4 (T_{amb}=80°C)</p>
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Table 1-1. Specifications (continued)

<p>Enclosure Rating</p> <p>NEMA 4X (FM, Factory Mutual) CSA Enclosure Type 4X (CSA, Canadian Standards Association) IP66 (BASEEFA) IP65 (SAA, Standards Association of Australia) IP65 (GOST) Tropicalization (Fungus test per MIL-STD-810)</p> <p>Construction Materials</p> <p>Housing: Low-copper aluminum or 316 stainless steel</p>	<p>O-Rings: Nitrile except silicone for sensor O-rings</p> <p>Options</p> <p>Type 67CFR filter regulator, supply and output gauges or tire valve remote pressure reading, module cover with multiple stroke ports, stainless steel housing, or stainless steel mounting bracket.</p> <p>Weight</p> <p>Aluminum: 2.9 kg (6.5 lb) excluding options Stainless Steel: 6.7 kg (14.8 lb) excluding options</p>
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1. This term is defined in ISA Standard S51.1-1979.
2. Normal m³/hr—Normal cubic meters per hour (0°C and 1.01325 bar, absolute). Scfm—Standard cubic feet per minute (60°F and 14.7 psia).
3. Reference Conditions: 4.0 to 20 mA dc input, 0.2 to 1.0 bar (3 to 15 psi) output, and 1.4 bar (20 psi) supply pressure.
4. 0.14 bar (2 psi) for a 2.3 bar (33 psi) output
5. Metric calibration also available.

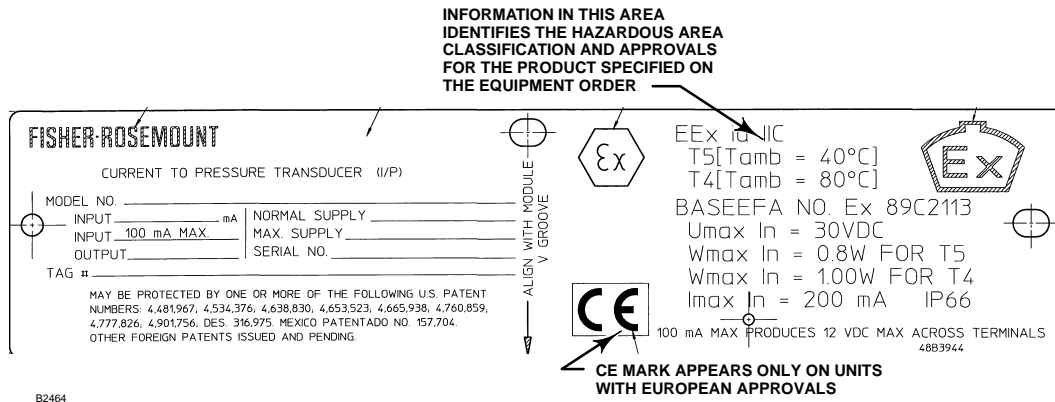


Figure 1-3. Typical Nameplate

Table 1-2. EMC Immunity Performance Criteria

Port	Phenomenon	Basic Standard	Test Level	Performance Criteria
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, 10 V/m 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)	B
	Conducted RF	IEC 61000-4-6	150 kHz to 80 MHz at 3 volts	B

Specification limit = ±1% of span

Table 1-3. Model Number Table

Model	Product Description
3311/0846	Current-to-Pressure Transducer
Code	Action
D	Direct—Output changes directly with input
R	Reverse—Output changes inversely with input
Code	Performance
S	Standard (Typical Output: 3–15 psi; Wide rangeability between 1 and 18 psi)
M	Multirange (Typical Outputs: 3–27 psi, 6–30 psi, and 5–25 psi; Wide rangeability between 0.5 and 33.0 psi)
Code	Input
1	4–20 mA dc
2	4–12 mA dc
3	12–20 mA dc
4	Specify (Consult factory for other input ranges between 4–20 mA and 10–50 mA)
Code	Output
J	3–15 psi for direct action (15–3 psi for reverse action)
K	0.2–1.0 bar for direct action (1.0–0.2 bar for reverse action)
L	0.2–1.0 kg/cm ² for direct action (1.0–0.2 kg/cm ² for reverse action)
M	3–27 psi for direct action (27–3 psi for reverse action) Multirange performance units only
W	6–30 psi for direct action (30–6 psi for reverse action) Multirange performance units only
H	Specify (Consult factory for other calibration requirements; minimum span is 6 psi for direct and 11 psi for reverse-acting units)
Code	Electrical Connections/Housing Material
1	1/2–14 NPT/Aluminum
2	1/2–14 NPT/316 stainless steel
Code	Options
B1	Universal mounting bracket, epoxy painted carbon steel, carbon steel nuts and bolts
B2	Universal mounting bracket, epoxy painted carbon steel, stainless steel nuts and bolts
B3	316 SST universal mounting bracket, SST nuts and bolts for use with SST housing
B4	316 SST universal mounting bracket, SST nuts and bolts for use with aluminum housing
F2	Filter-regulator, SST bolts
F3	SST Filter-regulator, SST bolts
G1	Supply gauge (0–60 psi/0–400 kPa/0–4 bar)
G2	Output gauge (0–30 psi/0–200 kPa/0–2 bar)
G7	Supply gauge (0–60 psi/0–4 kg/cm ²)
G8	Output gauge (0–30 psi/0–2 kg/cm ²)
G9	Output gauge (0–60 psi/0–400 kPa/0–4 bar)
GA	SST Supply gauge (0–60 psi/0–400 kPa/0–4 bar)
GB	SST Output gauge (0–60 psi/0–400 kPa/0–4 bar)
GE	SST Output gauge (0–60 psi/0–4 kg/cm ²)
GF	SST Supply gauge (0–60 psi/0–4 kg/cm ²)
GG	Output gauge (0–60 psi/0–4 kg/cm ²)
P1	Module Cover with Multiple Ports
R1 ⁽³⁾	Remote pressure reading feature
A1 ⁽¹⁾	Attach all applicable options at the factory (i.e., filter-regulator and gauges)
Q4	Calibration data sheet
K5	Factory Mutual (FM) explosion-proof and intrinsic safety approval
C6	Canadian Standards Association (CSA) explosion-proof and intrinsic safety approval
I1	BASEEFA/CENELEC intrinsic safety certification
N1	BASEEFA Type N certification
E9 ⁽²⁾	ISSeP/CENELEC flameproof certification
K7	Standards Association of Australia (SAA) flameproof intrinsic safety, and Type n certification
EG ⁽²⁾	Russian GOST flameproof certification
IG	Russian GOST intrinsic safety certification
Typical Model Number: 3311 D S 1 J 1 B1	
<p>1. Not available with stainless steel housing 2. Hazardous location approval options E9 and EG are currently not available on multirange performance units. 3. With option R1, the Type 846 and Model 3311 circuit board contains the Remote Pressure Reading feature. The Remote Pressure Reading jumper is placed in the ON position prior to shipment.</p>	

Companion Product: Model 272 Field Calibrator
 The Rosemount Model 272 Field Calibrator can be used to calibrate the I/P transducer. A battery-operated, portable calibrator designed for

field use, the Model 272 features an adjustable 4–20 mA range, and selectable indication/simulation modes. See product data sheet 00813-0100-4372.

Type 846 and Model 3311

Instruction Manual

Form 5739

February 2002

Section 2 Installation

This section presents information on installing the Type 846 and Model 3311 current-to-pressure transducer. Figures 2-1, 2-2, 2-3, and 2-4 can be used as references for instructions contained in this section.

When a control valve is ordered with a Type 846 or Model 3311 transducer specified to be mounted on the actuator, the factory-mounted transducer is connected to the actuator with the necessary tubing and calibrated to the specifications on the order.

If the transducer is purchased separately for mounting on a control valve already in service, all the necessary mounting parts are furnished, if ordered. This includes the appropriate bracket for attaching the unit to an actuator boss (with tapped holes) or for attaching it to the diaphragm casing.

If preferred, mounting parts can be supplied for mounting the transducer on a 2-inch (51 mm) diameter pipestand, a flat surface, or a bulkhead.

Transducers also can be ordered separately for mounting on a control valve assembly already in service. The transducer may be ordered with or without mounting parts. Mounting parts include the appropriate bracket and bolts for attaching the unit to an actuator boss (with tapped holes) or for attaching it to the diaphragm casing.

Mounting

The transducer is designed for mounting on a control valve, 2-inch (51 mm) diameter pipestand, wall, or panel. Figures 2-2, 2-3 and 2-4 show recommended mounting configurations. The mounting positions shown allow any moisture buildup in the terminal compartment to drain to the signal wire conduit entrance. Any moisture in the pilot stage area will be expelled through the stroke port without affecting pilot stage operation. In applications with excessive moisture in the supply air, vertical mounting allows the most effective drainage through the stroke port.

Mounting is accomplished with an optional universal mounting bracket. Before mounting the transducer, note the following recommendations:

- Ensure that all bolts are fully tightened. The recommended torque is 22 N•m (16 lbf•ft).

- Bolts that connect to the transducer and to a valve actuator should have the lock washer placed directly beneath the bolt head and the flat washer placed between the lock washer and bracket. All other bolts should have the lock washer next to the nut, and the flat washer placed between the lock washer and bracket.

- Do not mount the transducer in a location where foreign material may cover the stroke port or exhaust port. See the descriptions of the stroke port and exhaust port later in this section.

Pressure Connections

As shown in figure 2-1, all pressure connections are 1/4-18 NPT female connections. Use 3/8-inch (9.5 mm) outside diameter tubing for the supply and output connections.

Supply Pressure

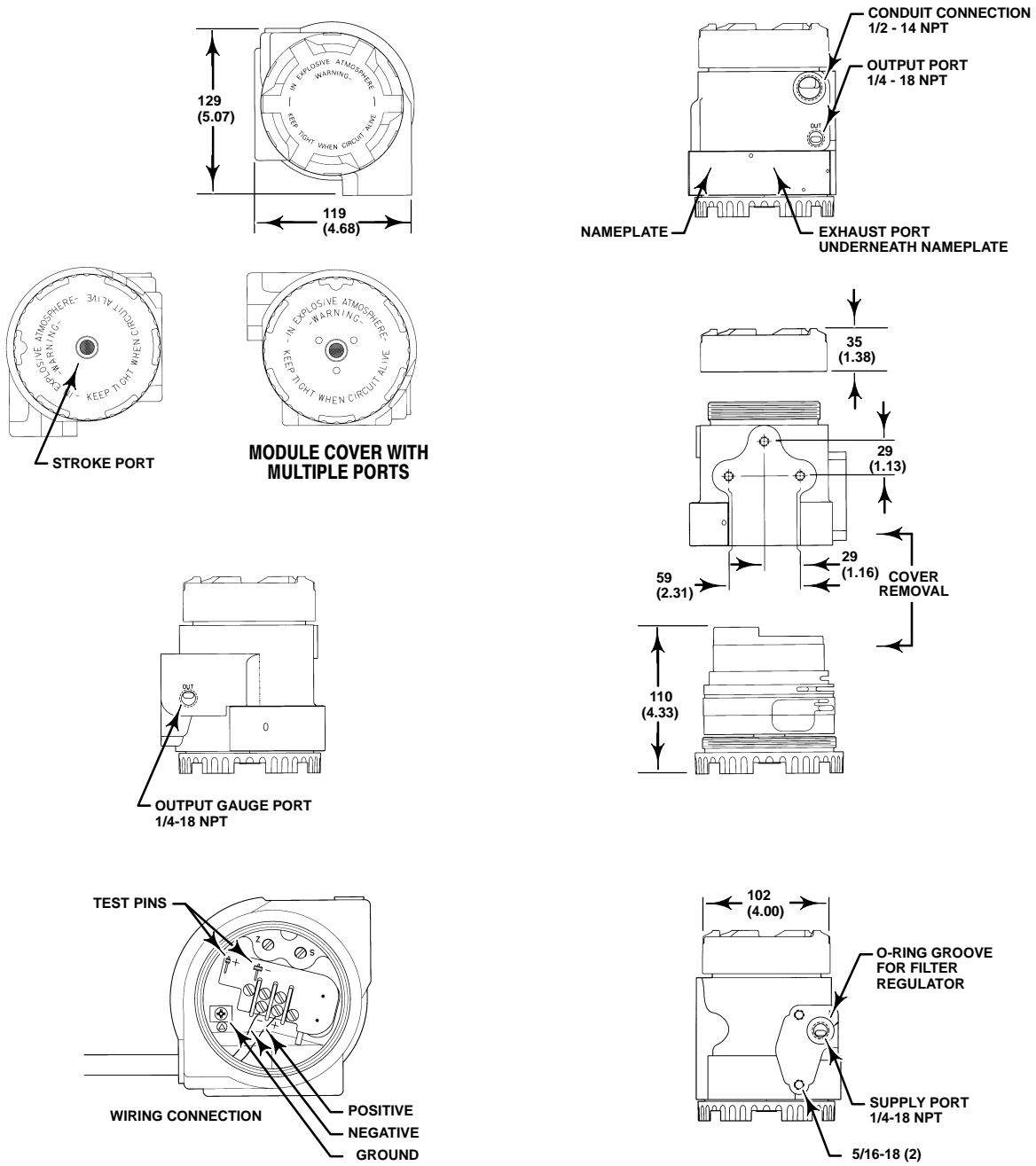
WARNING

Personal injury or property damage may occur from an uncontrolled process if the supply medium is not clean, dry, oil-free, or non-corrosive gas. Industry instrument air quality standards describe acceptable dirt, oil, and moisture content. Due to the variability in nature of the problems these influences can have on pneumatic equipment, Fisher Controls has no technical basis to recommend the level of filtration equipment required to prevent performance degradation of pneumatic equipment. A filter or filter regulator capable of removing particles 40 microns in diameter should suffice for most applications. Use of suitable filtration equipment and the establishment of a maintenance cycle to monitor its operations is recommended.

WARNING

Personal injury or property damage could result from fire or explosion. Do not operate transducers with the CENELEC flameproof options at a supply pressure in excess of 1.4 bar

Type 846 and Model 3311



(mm)
INCHES

B2473-1/IL

Figure 2-1. Dimensions and Connection Locations

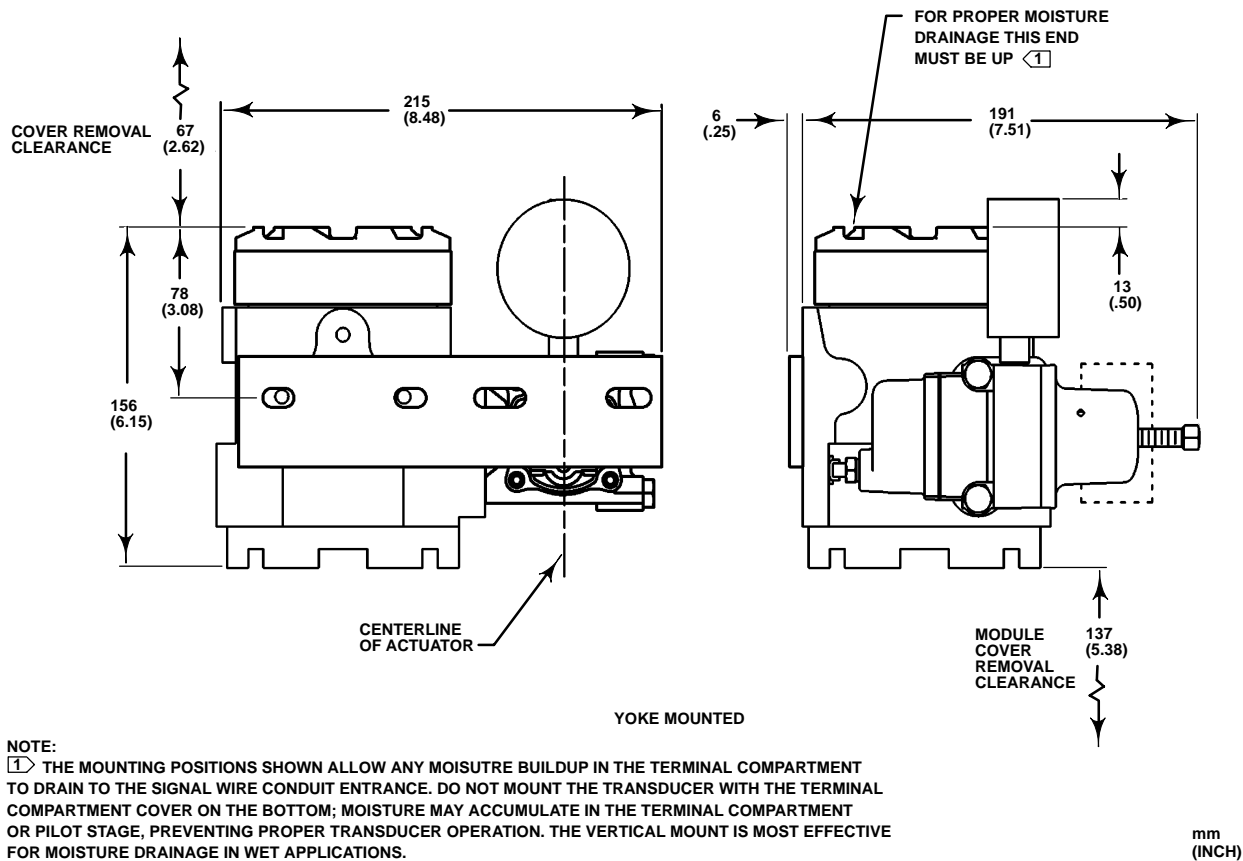


Figure 2-2. Typical Dimensions with Type 67CFR Filter/Regulator and Gauges

(20 psi). Doing so invalidates the CENELEC flameproof certifications and could allow flames to spread from the unit potentially igniting and causing an explosion.

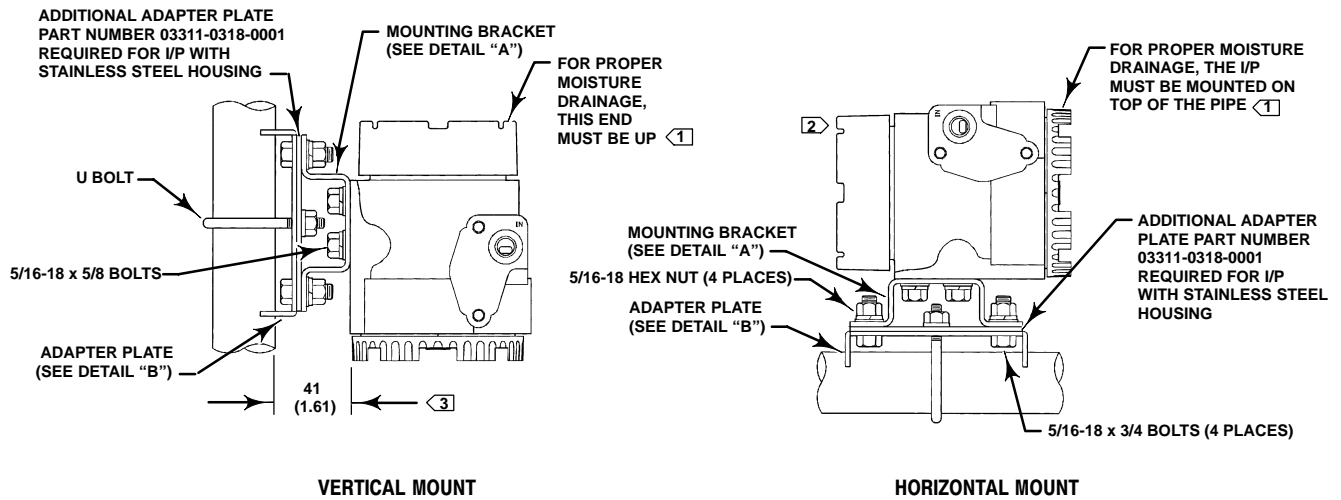
The supply medium must be clean, dry air or noncorrosive gas that meets the requirements of ISA Standard S7.3-1975. An output span of 0.2 to 1.0 bar (3 to 15 psi) requires a nominal supply pressure of 1.4 bar (20 psi) and a flow capacity not less than 0.11 m³/min (4 SCFM). For multirange performance units with higher output spans, the supply pressure should be at least 0.2 bar (3 psi) greater than the maximum calibrated output pressure.

The air supply line can be connected to the 1/4-18 NPT supply port, or to the supply port of a filter-regulator mounted directly to the transducer.

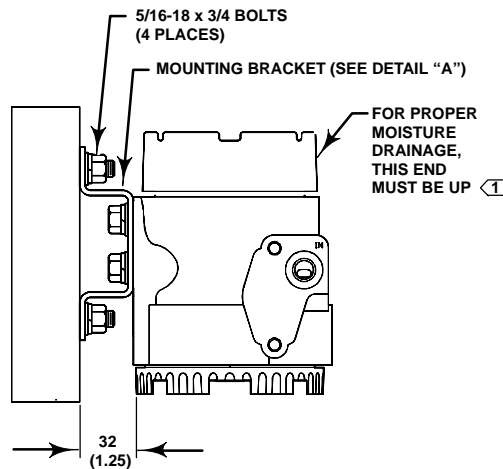
Figures 2-2, 2-3, and 2-4 show all the installation options.

The mounting boss for the air supply connection contains two 5/16-18 UNC tapped holes that are 2-1/4 inches apart. The tapped holes allow direct connection (integral mount) of a Type 67CFR filter-regulator, if desired. When the filter-regulator is factory mounted, the mounting hardware consists of two 5/16-18 x 3-1/2 inch stainless steel bolts and one O-ring. When the filter-regulator is field mounted, the mounting hardware consists of two 5/16-18 x 3-1/2 inch stainless steel bolts, two spacers (which may or may not be required) and two O-rings (of which only one will fit correctly into the housing O-ring groove and the other may be discarded). This is due to the fact that the current housing has been slightly modified from its original design, hence, the additional hardware (if needed) when field mounting the Type 67CFR filter-regulator.

Type 846 and Model 3311



2-INCH PIPESTAND MOUNTING



WALL/PANEL MOUNTING

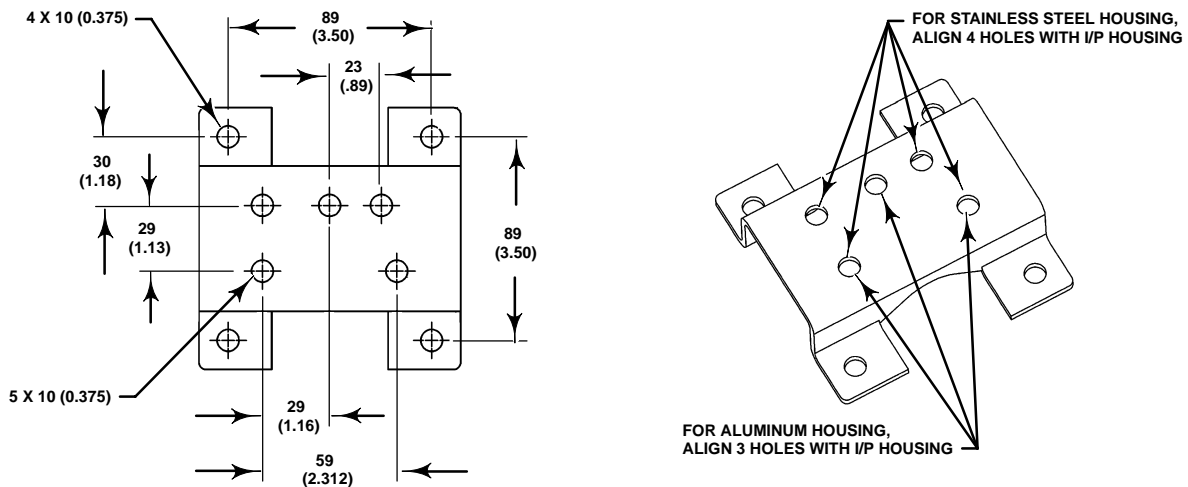
NOTES:

- 1 THE MOUNTING POSITIONS SHOWN ALLOW ANY MOISUTRE BUILDUP IN THE TERMINAL COMPARTMENT TO DRAIN TO THE SIGNAL WIRE CONDUIT ENTRANCE. DO NOT MOUNT THE TRANSDUCER WITH THE TERMINAL COMPARTMENT COVER ON THE BOTTOM; MOISTURE MAY ACCUMULATE IN THE TERMINAL COMPARTMENT OR PILOT STAGE, PREVENTING PROPER TRANSDUCER OPERATION. THE VERTICAL MOUNT IS MOST EFFECTIVE FOR MOISTURE DRAINAGE IN WET APPLICATIONS.
- 2 IF MOUNTED ON HORIZONTAL PIPE, THE I/P MUST BE ON TOP OF THE PIPE FOR PROPER MOISTURE DRAINAGE.
- 3 THIS DIMENSION IS 44 (1.74) FOR STAINLESS STEEL HOUSING.

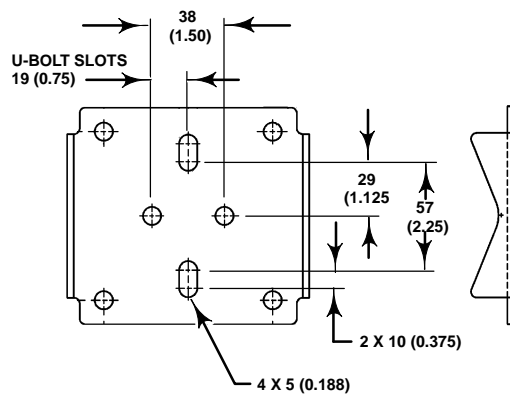
14B7332
19B9484-B
E0786/IL

mm
(INCH)

Figure 2-3. Typical Transducer Mounting with Universal Mounting Bracket



DETAIL "A" MOUNTING BRACKET



DETAIL "B" ADAPTER PLATE

NOTE:

1. ATTACH THE BRACKET SHOWN IN DETAIL "A" TO THE TRANSDUCER
2. ATTACH THE ADAPTER PLATE SHOWN IN DETAIL "B" TO THE VALVE OR PIPE.
3. CONNECT THE TWO PIECES.

34B4990-C
34B5000-B
E0787

mm
(INCH)

Figure 2-3. Typical Transducer Mounting with Universal Mounting Bracket (Continued)

Output Pressure

Connect the output signal line to the transducer at the output port. The output port is 1/4–18 NPT, as shown in figure 2-1. The output gauge port can be used as an alternate signal port. If the gauge port is used as a signal port, a threaded plug must be installed in the output port.

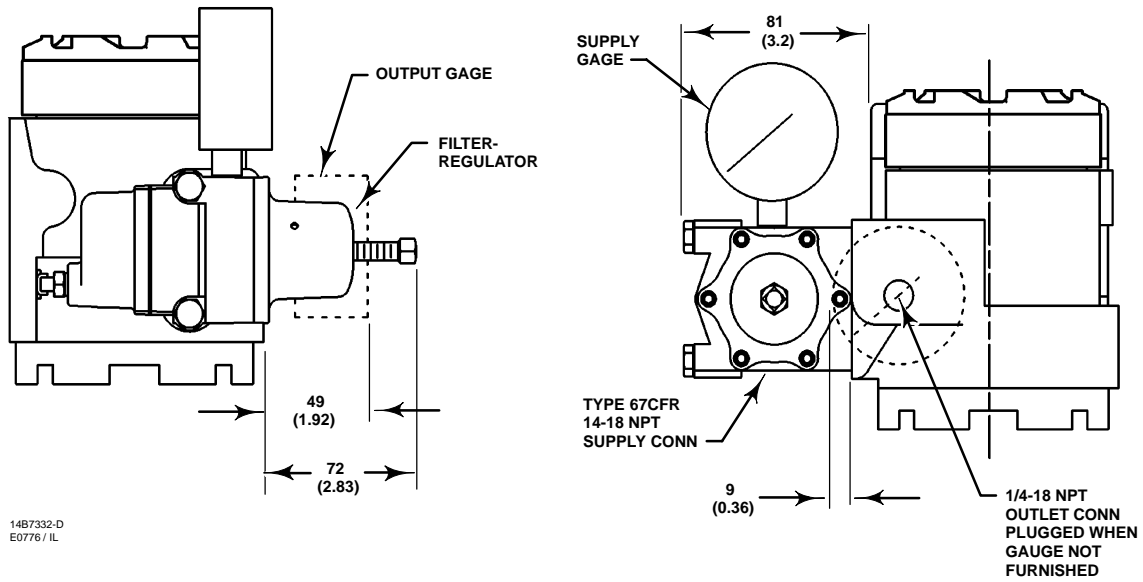
The output gauge port allows connection of an output gauge to provide local output signal indication. The output gauge port is 1/4–18 NPT. If an output gauge is not specified, a threaded plug is

shipped with the transducer. The plug must be installed in the output gauge port when the port is not used.

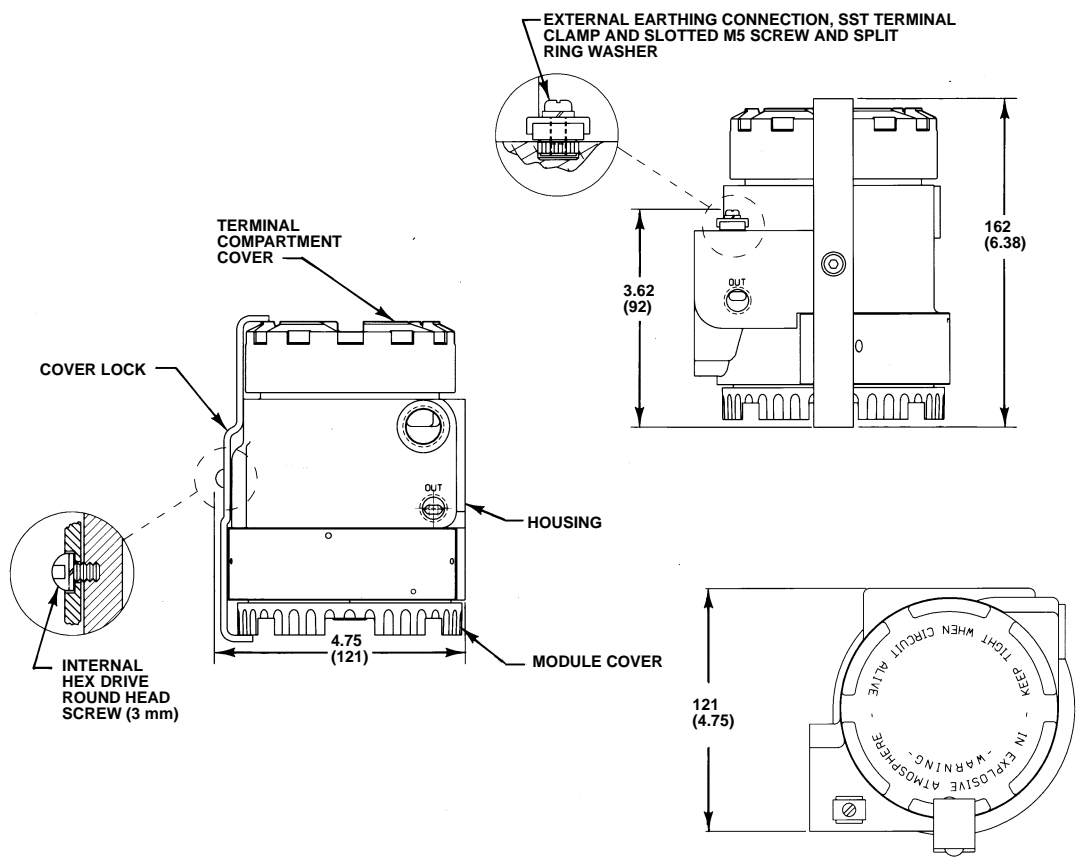
WARNING

The following conditions may cause failure of the output gauge resulting in personal injury, and damage to the transducer and other equipment:

- pressure beyond the top of the gauge scale.



TRANSDUCER WITH GAUGES



TRANSDUCER WITH CENELEC CERTIFICATION

Figure 2-4. Transducer Dimensions with CENELEC Certifications and Gauges

- excessive vibration.
- pressure pulsation.
- excessive instrument temperature.
 - corrosion of the pressure containing parts.
 - other misuse.

Refer to ANSI B40.1-1980. Do not use on oxygen service.

Electrical Connections

WARNING

Personal injury or property damage could result from fire or explosion. In explosive atmospheres, remove power and shut off the air supply to the I/P unit before attempting to remove the terminal compartment cover or module cover. Failure to do so could result in an electrical spark or explosion.

Personal injury or property damage may occur from an uncontrolled process. Unscrewing the module cover removes power from the electronics and the output signal will be 0.0 psi. Before removing the module cover, ensure the process is properly controlled.

CAUTION

Excessive current can damage the transducer. Do not connect an input current of more than 100 mA to the transducer.

Signal wiring is brought to the terminal compartment through a 1/2–14 NPT housing conduit connection, shown in figure 2-1. Where condensate is common, use a conduit drip leg to help reduce liquid buildup in the terminal compartment and avoid shorting of the input signal. Electrical connections are made at the terminal block. An internal grounding lug is provided to facilitate a separate ground when required. As shown in figure 2-4, units with CENELEC certification also have an external earthing

connection. The use of shielded cable will ensure proper operation in electrically noisy environments.

Connect the positive signal lead to the positive terminal, marked +. Connect the negative signal lead to the negative terminal, marked –.

Note

Units with the Remote Pressure Reading (RPR) option may cause interference with the analog output signal from some instrumentation systems. This problem may be solved by placing a 0.2 microfarad capacitor or a HART filter across the output terminals.

WARNING

Personal injury or property damage could result from an uncontrolled process. Unscrewing the module cover removes power from the electronics and the output signal will be 0.0 psi. Before removing the module cover, ensure the process is properly controlled.

Stroke Port

WARNING

Personal injury or property damage could result from fire or explosion of accumulated gas. During normal operation, supply air is vented to the atmosphere through the stroke port in the module cover and exhaust port (located under the nameplate). If a flammable gas is used as the supply air, the area into which it is vented must be classified as a Division I hazardous area. Adding a remote vent to the stroke port is not sufficient to permit safe operation in a hazardous area.

The constant bleed of supply air from the pilot stage is directed out the stroke port, which is a screened hole located at the center of the module cover. Figure 2-1 shows the location of the stroke port. Before installing the transducer, ensure the stroke

Type 846 and Model 3311

port is clear. Do not mount the transducer in a location where foreign material may cover the stroke port. For information on using the stroke port, refer to Section 5 – Troubleshooting.

Exhaust Port

The transducer exhausts through a screened port located beneath the instrument nameplate. Figure 2-1 shows the location of the exhaust port. The nameplate holds the screen in place. Exhaust will occur with a reduction in output pressure. The transducer should not be mounted in a location where foreign material may clog the exhaust port.

Signal Interruption

Upon loss of input current, or if input current decreases below 3.3 ± 0.3 mA, the output of the direct action unit will decrease to less than 0.1 bar (1 psi).

In the same situation, the output of the reverse action unit will increase to near supply pressure.

Section 3 Calibration

Calibration of the Type 846 and Model 3311 requires either an accurate current generator or an accurate voltage generator with a precision 250-ohm, 1/2-watt resistor. Figure 3-1 shows how to connect either device.

Calibration also requires a precision output indicator and a minimum nonsurging air supply of 5.0 Normal m³/hr (3 SCFM) at 1.4 bar (20 psi) for standard performance units. For multirange performance units, the air supply must be at least 0.2 bar (3 psi) greater than the maximum calibrated output pressure, up to 2.4 bar (35 psi) maximum.

For ease of calibration, the output load volume, including the output tubing and output indicator, should be a minimum of 33 cm³ (2 cubic inches). Review the information under **Signal Interruption** in Section 2 before beginning the calibration procedure.

Before calibration, determine the type of input (full or split range), and the type of output action (direct or reverse). Consult the factory for split range output calibration. Also, determine if the unit offers standard or multirange performance. The unit supports eight basic input/output combinations:

Standard Performance

- Full Range Input, Direct Action
- Split Range Input, Direct Action
- Full Range Input, Reverse Action
- Split Range Input, Reverse Action

Multirange Performance

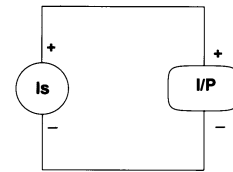
- Full Range Input, Direct Action
- Split Range Input, Direct Action⁽¹⁾
- Full Range Input, Reverse Action
- Split Range Input, Reverse Action⁽¹⁾

Table 3-1 lists the various input and output ranges over which the unit may be calibrated.

The input range is selected by changing the position of a jumper located on the electronic circuit board.

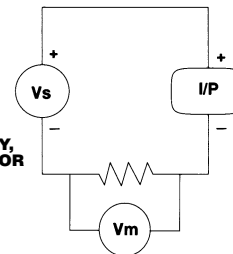
1. Consult factory for calibration of multirange performance units with split range input or split range output, or both.

ADJUST THE CURRENT SOURCE TO PROVIDE THE 4 AND 20 mA SET POINTS



CALIBRATION USING A CURRENT SOURCE

TO OBTAIN THE 4 AND 20mA SET POINTS, ADJUST THE VOLTAGE SOURCE (Vs) SO THE VOLTMETER (Vm) READS 1 AND 5 VOLTS, RESPECTIVELY, ACROSS THE 250 ohm RESISTOR



A6644-1 / IL

CALIBRATION USING A VOLTAGE SOURCE

Figure 3-1. Connecting a Current or Voltage Source for Calibration

Refer to **Electronic Circuit Board** in Section 6, and figure 6-5 for the location and instruction on placement.

CAUTION

Excessive current can damage the transducer. Do not connect an input current of more than 100 mA to the transducer.

Standard Performance: Full Range Input, Direct Action

Use the following procedure to achieve a standard 0.2 to 1.0 bar (3 to 15 psi) output span for a 4 to 20 mA input signal:

1. Remove the module final assembly from the housing. Refer to **Removing the Module Final Assembly** in Section 6 for an explanation of how to disengage the module final assembly.
2. Confirm that the unit is direct acting. A green electronic circuit board identifies direct-acting units. Refer to **Action** under the heading **Electronic Circuit Board** in Section 6 for more information on direct acting units.
3. Position the range jumper in the Hi position for High Range. Figure 6-5 shows the circuit board jumper positions.
4. Replace the module final assembly in the housing. Refer to **Replacing the Module Final**

Type 846 and Model 3311

Table 3-1 Type 846 and Model 3311 I/P Rangeability Matrix

Input Range	Output Pressure Range (psi) (Performance Code)															
	Common Ranges					Misc.		Std. Split			High Range Splits					
	3-15 (S,M)	.5-30 (M)	3-27 (M)	6-30 (M)	5-25 (M)	0.5-6 (S,M)	.5-18 (S,M)	3-9 (S,M)	9-15 (S,M)	.5-15 (S,M)	15-30 (M)	15-27 (M)	6-18 (S,M)	18-30 (M)	5-15 (S,M)	15-25 (M)
4-20	✓	✓	✓	✓	✓	D	✓	D	D	✓	U	U	✓	U	✓	U
4-12	✓	✓	✓	✓	✓	D	✓	D	D	✓	U	U	✓	U	✓	U
12-20	✓		J	J	J	D	J	D	D	J	✓	✓	✓	✓	✓	✓
4-8	✓					✓		✓	✓				✓		✓	
8-12	✓					✓		✓	✓				✓		✓	
12-16	J					J		J	✓				J		J	
16-20	J					J		J	J				J		J	
10-50	Consult I/P Marketing															
S=Standard Performance Unit M=Multirange Performance Unit ✓=Available in Direct or Reverse Action D=Available in Direct Action Only J=Available, but if the desired calibration cannot be achieved by adjusting the zero/span screws, unit may require Hi/Lo jumper to be moved. The jumper is located on the circuit board assembly, and is usually in the Hi position. Disengaging the master module and moving the jumper to the Lo position will allow calibration to the desired range. U=Special Build Required.																

Assembly in Section 6 for an explanation of how to engage the module final assembly.

5. Connect the air supply to the air supply port.
6. Connect a precision output indicator to the output signal port.
7. Make sure that the output gauge port has an output gauge or a threaded plug installed. A threaded plug is provided for units shipped without output gauges.
8. Remove the terminal compartment cover.
9. Connect the current source (or voltage source) positive lead (+) to the terminal block positive (+) and the current source (250-ohm resistor lead) negative lead (-) to the terminal block negative (-). Refer to figure 3-1.

CAUTION

Excessive current can damage the transducer. Do not connect an input current of more than 100 mA to the transducer.

10. Apply a 4.0 mA ($V_m = 1.0$ V) signal, and adjust the zero screw to achieve a 0.2 bar (3.0 psi) output. The output increases with clockwise rotation of the zero screw.

11. Apply a 20.0 mA ($V_m = 5.0$ V) signal, and adjust the span screw to achieve a 1.0 bar (15.0 psi) output. The output increases with clockwise rotation of the span screw.

12. Repeat Steps 10 and 11 to verify and complete the calibration.

Multirange Performance: Full Range Input,⁽²⁾ Direct Action

Use the following procedure with a multirange performance unit to achieve the desired direct action output span for a 4 to 20 mA input signal:

1. Perform steps 1 through 9 of the calibration procedure for **Standard Performance: Full Range Input, Direct Action**.
2. Apply a 4.0 mA ($V_m = 1.0$ V) signal, and adjust the zero screw to achieve the desired lower limit of the output range. The lower limit must be between 0.03 and 0.6 bar (0.5 and 9.0 psi). The output increases with clockwise rotation of the zero screw.
3. Apply a 20.0 mA ($V_m = 5.0$ V) signal, and adjust the span screw to achieve the desired upper limit of the output range. The span must be at least 0.4 bar (6.0 psi). The maximum upper limit is 2.0 bar (30.0 psi). The output increases with clockwise rotation of the span screw.
4. Repeat steps 2 and 3 to verify and complete the calibration.

² Consult factory for calibration of multirange performance units with split range input.

Standard Performance: Split Range Input, Direct Action

4 to 12 mA Input Signal

Use the following calibration procedure to produce a 0.2 to 1.0 bar (3 to 15 psi) output span for a 4 to 12 mA input signal:

1. Perform steps 1 through 9 of the calibration procedure for **Standard Performance: Full Range Input, Direct Action**.
2. Apply an input of 4.0 mA ($V_m = 1.0$ V), and adjust the zero screw to achieve an output of 0.2 bar (3.0 psi).
3. Apply an input of 12.0 mA ($V_m = 3.0$ V), and adjust the span screw to achieve an output of 1.0 bar (15.0 psi).
4. Repeat steps 2 and 3 to verify and complete the calibration.

12 to 20 mA Input Signal

Use the following calibration procedure to produce a 0.2 to 1.0 bar (3 to 15 psi) output span for a 12 to 20 mA input signal:

Note

There may be some span interaction with zero in this range, and the following steps compensate for this.

1. Perform steps 1 through 9 of the calibration procedure for **Standard Performance: Full Range Input, Direct Action**.
2. Apply an input of 4.0 mA ($V_m = 1.0$ V), and adjust the zero screw to achieve an output of 0.2 bar (3.0 psi).
3. Apply an input of 12.0 mA ($V_m = 3.0$ V), and adjust the span screw to achieve an output of 1.0 bar (15.0 psi).
4. Maintain the input of 12.0 mA ($V_m = 3.0$ V), and adjust the zero screw to achieve an output of 0.2 bar (3.0 psi). The unit may not turn down this low; if it does not, go to step 7.
5. If the output reaches 0.2 bar (3.0 psi) in step 4, apply an input of 20.0 mA ($V_m = 5.0$ V) and note the error (the actual reading versus 15.0 psi). Adjust the span screw to overcorrect the error by a factor of two. For example, if the reading was 0.9 bar (14.95 psi), adjust the span screw to achieve an output of 1.1 bar (15.05 psi).

6. Repeat steps 4 and 5 to verify and complete the calibration.
7. Turn off the air supply. Remove the module final assembly from the housing. Place the range jumper in the Lo position for Low Range, as indicated in figure 6-5. Replace the module final assembly. Turn on the air supply.
8. Apply an input of 12.0 mA ($V_m = 3.0$ V), and adjust the zero screw to achieve an output of 0.2 bar (3.0 psi).
9. Apply an input of 20.0 mA ($V_m = 5.0$ V), and note the error (the actual reading versus 15.0 psi). Adjust the span screw to overcorrect the error by a factor of two. For example, if the reading was 0.9 bar (14.95 psi), adjust the span screw to achieve an output of 1.1 bar (15.05 psi).
10. Repeat steps 8 and 9 to verify and complete the calibration.

Standard Performance: Full Range Input, Reverse Action

Use the following procedure on reverse action units to achieve a 1.0 to 0.2 bar (15 to 3 psi) output span for a 4 to 20 mA input signal:

1. Perform steps 1 through 9 under **Standard Performance: Full Range Input, Direct Action**, except for step 2. In place of step 2, confirm that the unit is reverse acting. A red electronic circuit board identifies reverse-acting units. Refer to **Action** under the heading **Electronic Circuit Board** in Section 6 for more information on reverse acting units.
2. Apply an input of 4.0 mA ($V_m = 1.0$ V), and adjust the zero screw to achieve an output of 1.0 bar (15.0 psi).
3. Apply an input of 20.0 mA ($V_m = 5.0$ V), and adjust the span screw to achieve an output of 0.2 bar (3.0 psi).
4. Repeat steps 2 and 3 to verify and complete the calibration.

Multirange Performance: Full Range Input⁽²⁾, Reverse Action

Use the following procedure with a multirange unit to achieve the desired reverse action output span for a 4 to 20 mA input signal:

1. Perform steps 1 through 9 of the calibration procedure for **Standard Performance: Full Range Input, Direct Action**, except for step 2. In place of step 2, confirm that the unit is reverse acting. A red

Type 846 and Model 3311

electronic circuit board identifies reverse-acting units. Refer to **Action** under the heading **Electronic Circuit Board** in Section 6 for more information on reverse acting units.

2. Apply an input of 4.0 mA ($V_m = 1.0$ V), and adjust the zero screw to achieve the desired upper limit of the output range. The 4 mA point must be between 0.6 and 2.0 bar (9.0 and 30.0 psi). The output increases with clockwise rotation of the zero screw.

3. Apply an input of 20.0 mA ($V_m = 5.0$ V), and adjust the span screw to achieve the desired lower limit of the output range. The span must be at least 0.7 bar (11.0 psi). The lower limit of the 20.0 mA setting is 0.03 bar (0.5 psi). The output increases with clockwise rotation of the span screw.

4. Repeat steps 2 and 3 to verify and complete the calibration.

Standard Performance: Split Range Input, Reverse Action

4 to 12 mA Input Signal

Use the following procedure on reverse action units to achieve a 1.0 to 0.2 bar (15 to 3 psi) output signal for a 4 to 12 mA input signal:

1. Perform steps 1 through 9 of the calibration procedure for **Standard Performance: Full Range Input, Direct Action**, except for step 2. In place of step 2, confirm that the unit is reverse acting. A red electronic circuit board identifies reverse-acting units. Refer to **Action** under the heading **Electronic Circuit Board** in Section 6 for more information on reverse acting units.

2. Apply an input of 4.0 mA ($V_m = 1.0$ V), and adjust the zero screw to achieve an output of 1.0 bar (15.0 psi).

3. Apply an input of 12.0 mA ($V_m = 3.0$ V), and adjust the span screw to achieve an output of 0.2 bar (3.0 psi).

4. Repeat steps 2 and 3 to verify and complete the calibration.

12 to 20 mA Input Signal

Use the following procedure on reverse action units to achieve a 1.0 to 0.2 bar (15 to 3 psi) output signal for a 12 to 20 mA input signal:

Note

There may be some span interaction with zero in this range, and the following steps compensate for this.

1. Perform steps 1 through 9 of the calibration procedure for **Standard Performance: Full Range Input, Direct Action**, except for step 2. In place of step 2, confirm that the unit is reverse action. A red electronic circuit board identifies reverse-acting units. Refer to **Action** under the heading **Electronic Circuit Board** in Section 6 for more information on reverse acting units.

2. Apply an input of 4.0 mA ($V_m = 1.0$ V), and adjust the zero screw to achieve an output of 1.0 bar (15.0 psi).

3. Apply an input of 12.0 mA ($V_m = 3.0$ V), and adjust the span screw to achieve an output of 0.2 bar (3.0 psi).

4. Maintain the input of 12.0 mA ($V_m = 3.0$ V), and adjust the zero screw to achieve an output of 1.0 bar (15.0 psi). The unit may not turn up this high; if it does not, go to step 7.

5. If the output reaches 15.0 psi in step 4, apply an input of 20 mA, and adjust the span screw to achieve a 3.0 psi output. Apply an input of 20 mA ($V_m = 5.0$ V), and note the error (the actual reading versus 3.0 psi). Adjust the span screw to overcorrect the error by a factor of two. For example, if the reading was 2.95 psi, adjust the span screw to achieve an output of 3.05 psi.

6. Repeat steps 4 and 5 to verify and complete the calibration.

7. If the 12.0 mA ($V_m = 3.0$ V) cannot be adjusted to 1.0 bar (15.0 psi) in step 4, turn off the air supply. Remove the module final assembly from the housing. Place the range jumper in the Lo position for Low Range, as shown in figure 6-5. Replace the module final assembly. Turn on the air supply.

8. Apply an input of 12.0 mA ($V_m = 3.0$ V), and adjust the zero screw to achieve an output of 1.0 bar (15.0 psi).

9. Apply an input of 20 mA ($V_m = 5.0$ V), and note the error (the actual reading versus 3.0 psi). Adjust the span screw to overcorrect the error by a factor of two. For example, if the reading was 2.95 psi, adjust the span screw to achieve and output of 3.05 psi.

10. Repeat steps 8 and 9 to verify and complete the calibration.

10–50 mA Input Signal

Use the previous procedures and replace 4–20 mA references with the appropriate 10–50 mA numbers; for example:

- 4 mA = 10 mA
- 12 mA = 30 mA
- 20 mA = 50 mA

Note

10–50 mA available only with direct acting units.

Transporting the Module Final Assembly

The transducer allows the module final assembly to be removed while the housing is in its installed position. In the event the transducer does not function properly, an operational module final assembly can be taken to the field and exchanged with the nonfunctional module.

After the transducer is calibrated in the shop, the module final assembly can be removed from the housing. At the time the span and zero screws disengage, there will be minimal effect on the calibrated span. The calibrated module can now be taken to the field. Ensure that the span and zero potentiometers are not moved from their calibrated positions.

Type 846 and Model 3311

Instruction Manual

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Section 4 Principle of Operation

The following paragraphs describe the functional parts of the Type 846 and Model 3311. Figure 4-1 shows the block diagram.

Electronic Circuit

During operation, the input current signal is received by the transducer's electronic circuit and compared to the output pressure from the booster stage. A solid-state pressure sensor is part of the electronic circuit and monitors the booster stage output. The silicon-based sensor uses strain gauge thin film technology.

The sensor's pressure signal is fed to a simple internal control circuit. By using this patented technique, the transducer's performance is set by the sensor/circuit combination. Changes in output load (leaks), variations in supply pressure, or even component wear are sensed and corrected by the sensor/circuit combination. Electronic feedback allows crisp dynamic performance and readily compensates for output changes induced by vibration.

Note

Because the transducer is electronic in nature, it is not well-modeled in the loop as a simple resistor in series with an inductor. Also it is better thought of as a 50-ohm resistor in series with a 6.0 V voltage drop, with negligible inductance.

This is important when calculating the loop load. When the transducer is used in series with a microprocessor-based transmitter, the noninductive nature of the transducer allows digital signals to successfully pass through undistorted.

Magnetic Actuator

The electronic circuit controls the level of current flowing through the actuator coil, which is located in the pilot/actuator assembly. A change to the level of coil current is made by the electronic circuit when it senses a discrepancy between the pressure measured by the sensor and the pressure required by the input signal.

The actuator performs the task of converting electrical energy (current) to motion. It uses a patented, coaxial moving magnet design optimized for efficient operation and is highly damped at its mechanical resonance. A silicone rubber diaphragm protects its working magnetic gaps from contamination.

Pilot Stage

The patented pilot stage contains two opposed fixed nozzles: the supply nozzle and the receiver nozzle. It also contains the deflector, which is the moving element. See figures 4-2 and 4-3. The supply nozzle is connected to the supply air and provides a high-velocity air stream. The receiver nozzle captures the air stream and converts it back to pressure. The receiver nozzle pressure is the output pressure of the pilot stage.

To vary the pilot output pressure, the high-velocity stream is diverted away from the receiver nozzle by the deflector, which is a cylindrical, aerodynamic body located between the two nozzles.

In response to a change in actuator coil current, the deflector is repositioned between the nozzles. There is a linear relationship between the coil current and the pilot stage output pressure. For direct action units, the power-off, or fail-safe, position of the top of the deflector is near the center of the stream and results in nearly zero pilot output pressure. As the coil is energized, the deflector is drawn out of the stream.

For reverse action units, the power-off, or fail-safe, position of the deflector is completely out of the stream. The result is maximum pilot output pressure. As the coil is energized, the deflector moves into the stream, resulting in a decreased pilot output pressure.

The deflector material is tungsten carbide, and the nozzles are 316 stainless steel. The nozzles have a large bore of 0.41 mm (0.016 inches), which provides good resistance to plugging.

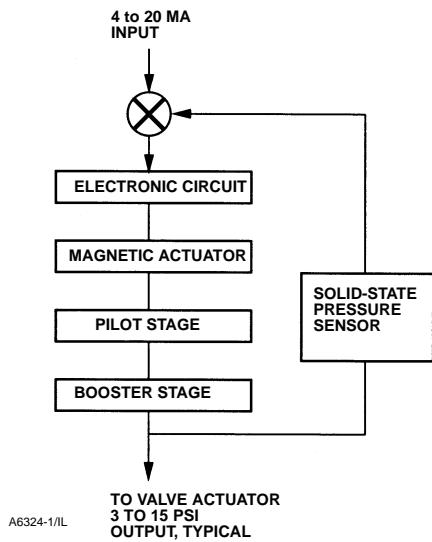


Figure 4-1. Functional Parts Block Diagram

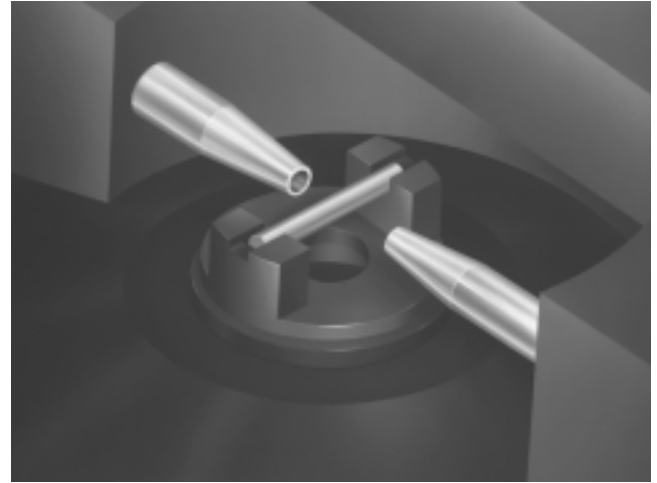


Figure 4-2. Detail of Deflector/Nozzle Pilot Stage

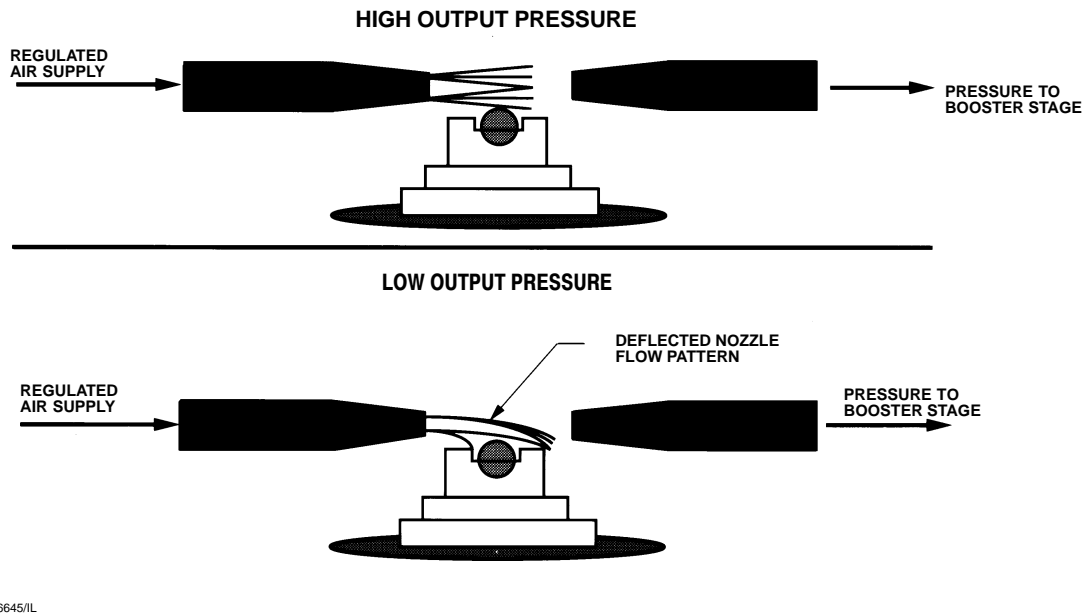


Figure 4-3. Deflector/Nozzle Pilot Stage Operation (Direct Action)

Booster Stage

The receiver nozzle pressure controls the booster stage, which has a poppet valve design. An increase in receiver nozzle pressure positions the valving in the booster stage to produce an increase in the transducer output signal. A decrease in the receiver nozzle pressure positions the valving in the booster stage to allow exhaust to occur, decreasing the output signal.

The booster stage operates using a 3:1 pressure gain from the pilot stage. High flow rate capability is achieved by large flow area poppet design and internal porting having low flow resistance. The booster stage design provides very good stability in high vibration applications, and the poppet valve technology provides resistance to plugging.

Section 5 Troubleshooting

The modular design and unitized subassemblies of the Type 846 and Model 3311 allow for quick and easy troubleshooting and repair. This section presents information on the diagnostic features and procedures for troubleshooting both models in service or in the shop.

Diagnostic Features

If a control loop does not perform properly and the cause of malfunction has not been determined, two features of the transducer can be used to determine if the transducer is at fault: the stroke port and Remote Pressure Reading.

Stroke Port

The stroke port provides a way to quickly increase the transducer output, giving a rough measure of the unit's functionality. A hole in the module cover vents the constant bleed from the pilot stage. When the hole is covered, pressure at the pilot stage receiver nozzle increases, which in turn increases the output. Output pressure will increase to within 2 psi of supply pressure for either direct or reverse action. If output pressure does not increase to this level, it may indicate that supply air is not reaching the pilot stage or that a pilot stage nozzle is plugged.

Note

If the stroke port diagnostic feature is not desired, the transducer is available with an optional cover that contains multiple stroke ports, as shown in figure 2-1. This prevents increasing the output by covering the stroke port.

Remote Pressure Reading (RPR)

Remote Pressure Reading (RPR) is an optional diagnostic feature that enables the user to determine the output pressure from any location along the signal wire path. For loop troubleshooting, this allows the user to confirm the functionality of the transducer from a remote location.

A frequency signal directly proportional to the output pressure is superimposed on the input signal loop. The frequency range of the RPR function is 5,000 to 8,000 Hz.

A jumper on the circuit board activates the Remote Pressure Reading function. Section 6 Maintenance provides instruction on positioning the jumper. The jumper, shown in figure 6-5, has two positions: N for ON, or D for OFF. The RPR jumper is in the N (ON) position when the unit ships from the factory, unless otherwise specified.

Using the HART® Communicator to Read the RPR Signal

The RPR frequency signal can be measured at any location along the two input wires using a HART Communicator. The HART Communicator displays both the output frequency in Hertz and the transducer output pressure in psi. Figure 5-1 shows the wiring connections.

The transducer is not a microprocessor-based transmitter and therefore does not identify itself to the HART Communicator. For this reason, the HART Communicator displays a screen telling the user it cannot verify that the transducer is on the loop.

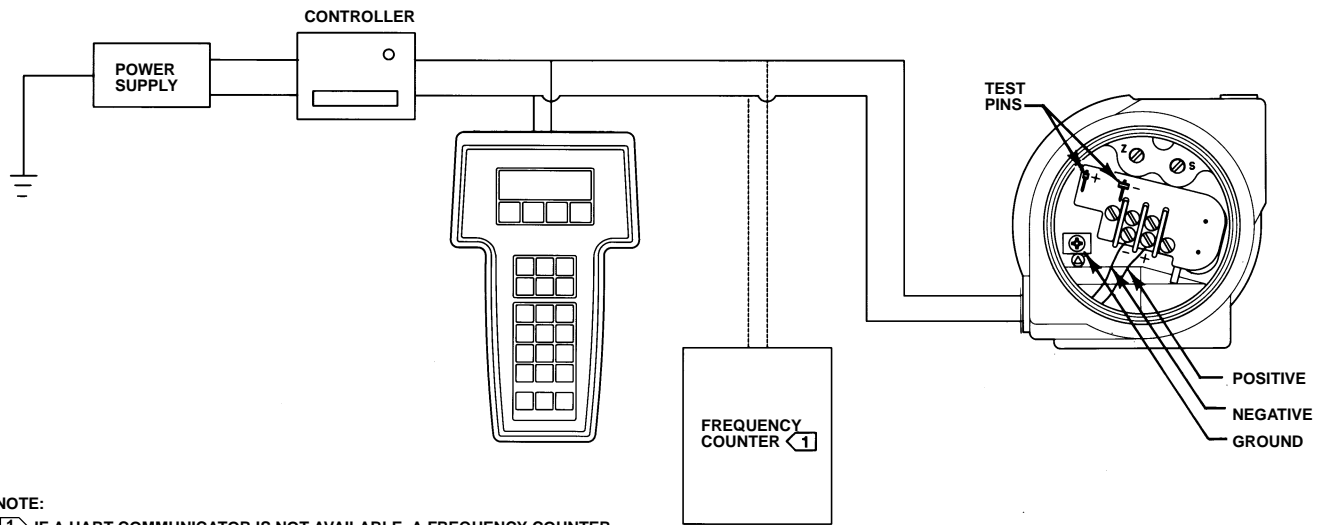
Neither the HART Communicator nor the Remote Pressure Reading function are intended to be used for calibration. They are intended as a diagnostic feature. The accuracy of the Remote Pressure Reading function when used in conjunction with the HART Communicator is typically $\pm 3\%$ of span and guaranteed to be a maximum of $\pm 6\%$ of span.

Note

When the output of a smart transmitter is used as the input to the transducer, the HART Communicator will not recognize the frequency signal of the transducer. Enabling the RPR feature on the transducer can also cause errors when trying to communicate with a smart transmitter using a HART Communicator. For these reasons, you should disable the RPR feature on the transducer when using this type of loop.

Use the ON/OFF key (figure 5-2) to turn the HART Communicator on and off. When the communicator is turned on, it searches for a HART compatible device on the 4 to 20 mA loop. If a device is not found, then the communicator displays the message, "No Device Found. Press OK." Press **OK** (F4) to display the **Main** menu (figure 5-3).

If a HART-compatible device is found, the communicator displays the **Online** menu.

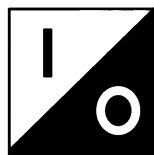


NOTE:

1 IF A HART COMMUNICATOR IS NOT AVAILABLE, A FREQUENCY COUNTER CAN BE USED IN ITS PLACE. SEE TEXT TO CONVERT THE FREQUENCY DISPLAY TO OUTPUT PRESSURE

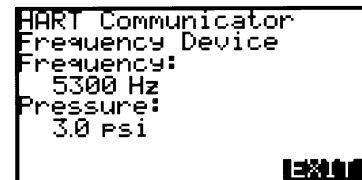
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Figure 5-1. Wiring Connections for the HART[®] Communicator or a Frequency Counter



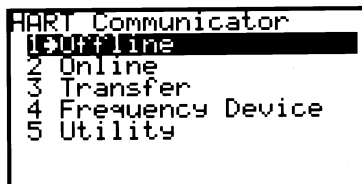
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Figure 5-2. HART Communicator ON/OFF Key



A6648/IL

Figure 5-4. HART Communicator Frequency Device Menu



A6647/IL

Figure 5-3. HART Communicator Main Menu

When the HART Communicator is not connected to a HART compatible device, the first menu to appear after powering is the **Main** menu.

From within the **Main** menu, you can access the **Frequency Device** menu (figure 5-4) by pressing the 4 key.

Using a Frequency Counter to Read the RPR Signal

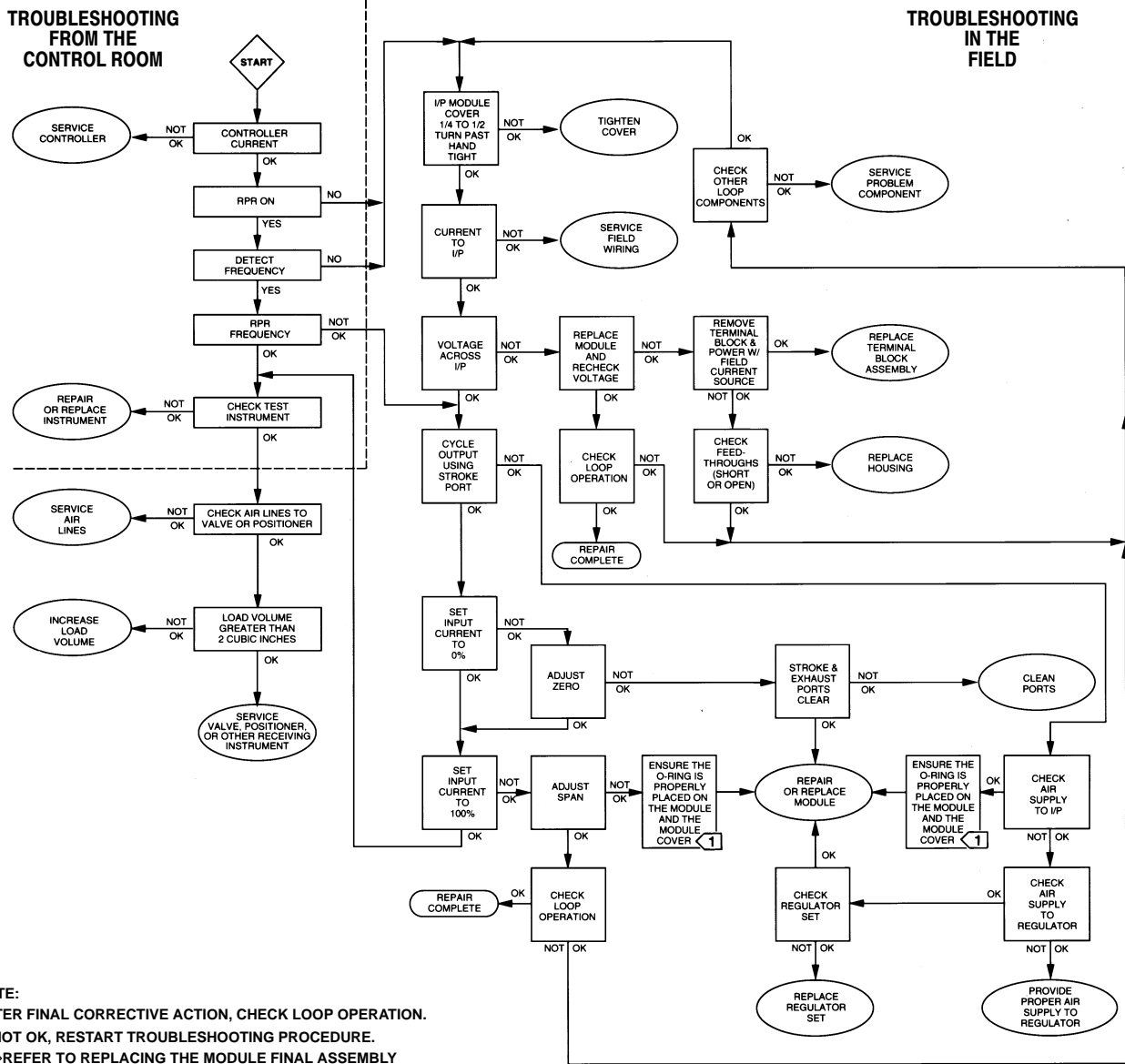
A frequency counter also can be used for Remote Pressure Reading. The frequency counter displays the RPR output in the same manner as the HART communicator, but the output frequency must be converted to output pressure using a simple mathematical formula. To determine the output pressure, subtract 5,000 Hz from the frequency displayed on the frequency counter, and then divide by 100.

Conversion Formula

$$\frac{\text{Display Hz} - 5,000 \text{ Hz}}{100} = \text{psig}$$

Example:

$$\frac{5,311 \text{ Hz} - 5,000 \text{ Hz}}{100} = 3.11 \text{ psig}$$



NOTE:
AFTER FINAL CORRECTIVE ACTION, CHECK LOOP OPERATION.
IF NOT OK, RESTART TROUBLESHOOTING PROCEDURE.
1 REFER TO REPLACING THE MODULE FINAL ASSEMBLY
IN SECTION 6.

C0789/IL

Figure 5-5. Field Troubleshooting Flowchart

Note

The Remote Pressure Reading (RPR) frequency signal has an amplitude of 0.4 to 1.0 V peak-to-peak. If other noise (frequency) with a comparable or greater amplitude is present on the line, it may make the RPR frequency signal unreadable.

In-service Troubleshooting

A number of simple checks can be made on the transducer while the unit is in service. Figure 5-5 shows a troubleshooting flowchart.

1. Make sure that the module cover is tight. The cover should be hand-tightened and then advanced 1/4 to 1/2 turn (24 to 27 N•m) (18 to 20 lbf•ft).

Type 846 and Model 3311

2. Confirm the general functionality of the unit by using the diagnostic features described earlier in this section.
3. Confirm that the filter-regulator is not full of water or oil and that supply air is reaching the unit. The air supply pressure should be at least 0.2 bar (3 psi) greater than the maximum calibrated output pressure.
4. Confirm that there are no major leaks in the output signal line or from the output gauge port.
5. Confirm that there are no obstructions and the screens are clean in the stroke port or the exhaust port.

WARNING

Personal injury or property damage could result from an uncontrolled process. Unscrewing the module cover removes power from the electronics and the output signal will be 0.0 psi. Before removing the module cover, ensure the process is properly controlled.

WARNING

Personal injury or property damage could result from fire or an explosion. In explosive atmospheres, remove power and shut off the air supply to the transducer before attempting to remove the terminal compartment cover or module cover. Failure to do so could result in an electrical spark or explosion.

6. If applicable, remove the cover lock and screw to allow access to the terminal compartment cover.
7. Remove the terminal compartment cover (see Warning above), and use a milliammeter, or a digital voltmeter to confirm that proper input current is supplied to the transducer.
8. Remove the terminal compartment cover (see Warning above), and short the loop across the positive (+) and the negative (–) terminals to check the output. The output should be nearly 0 psi. If the output is not 0 psi, replace the module final assembly.

9. Remove the terminal compartment cover (see Warning above), and, using a digital voltmeter, check the voltage between the transducer positive (+) and negative (–) terminals. The voltage should measure 6.0 to 8.2 V. A lower voltage can indicate a short in the input wires or defective controller. No voltage can indicate an open circuit in the control loop. A voltage of greater than 8.5 volts indicates a problem with the transducer, a faulty or corroded connection at the transducer, or an overcurrent condition. Replace the module final assembly. If the voltage is still not in the proper range (6.0 to 8.2 V), remove the terminal block and terminal block connection board. Apply power to the electrical feedthroughs. (Note the polarity of the feedthroughs, shown in figure 6-9.) Recheck the voltage. If the voltage is in the proper range, replace the terminal block and terminal block connection board. If the voltage is still not in the proper range, replace the housing.

10. Prepare to remove the module final assembly from the housing, or to remove the transducer from its mounting bracket. Refer to **Module Final Assembly** in Section 6 for instructions on removing the module final assembly from the module housing.

WARNING

Personal injury or property damage could result from an uncontrolled process. Unscrewing the module cover removes power from the electronics and the output signal will be 0.0 psi. Before removing the module cover, ensure the process is properly controlled.

With the module final assembly removed from the housing, the following checks can be made.

1. Review the position of the Remote Pressure Reading jumper (if so equipped) and range jumper to confirm that they are placed in the desired position. Refer to **Electronic Circuit Board** in Section 6, and figure 6-5 for the location of these jumpers and instructions on placement.
2. Observe the position and condition of the three module O-rings to confirm they make a tight seal.
3. Verify that the O-ring is correctly positioned in the groove on the flat face of the module cover. Refer to figure 6-9 for an exploded view.
4. Inspect the porting on the module final assembly to determine if large amounts of contaminants have entered the transducer.

Before making the following checks, disconnect both signal wires from the transducer, and ensure the module final assembly is removed from the housing.

1. Using an ohmmeter, check the electrical connections in the housing terminal compartment. The circuit should show an open between the positive (+) and negative (-) terminals. If not, replace the housing or terminal block and connection board.
2. Use a wire jumper to connect the two electrical feedthroughs located in the module compartment. The resistance between the positive (+) and negative (-) terminals in the terminal compartment should be 10 ohms. If not, check the electrical feedthroughs for short or open circuits. If a short or open circuit is found, replace the housing.
3. With the electrical feedthroughs jumpered as stated above, connect the ohmmeter to either the positive (+) or negative (-) terminal and the grounding lug. The circuit should show an open. If not, check for a short to the housing.
4. Remove the module from the module cover and inspect the pilot/actuator assembly for damage or clogging.

Some of the previous troubleshooting steps may be inconvenient to perform in the field. It may be best to make use of the modular design of the Type 846 or Model 3311, and keep a spare, calibrated module final assembly available for exchange. If the module final assembly is to be transported to the shop for repair, first remove it from the module cover. Attach the spare module final assembly to the module cover. Refer to **Module Final Assembly** in Section 6 for complete instructions. The nonfunctioning module can then be returned to the shop for troubleshooting.

Troubleshooting in the Shop

If the entire transducer is brought to the shop for troubleshooting, then the preceding sequence applies. If only the module final assembly has been brought to the shop, then use another Type 846 or Model 3311 housing as a test fixture. Insert the module into the test fixture. Perform the previous steps (as they apply) of the **In-service Troubleshooting** procedure.

To further aid troubleshooting, the module final assembly can be broken down into three subassemblies. The troubleshooting sequence consists of exchanging the subassemblies with known working ones to determine which is at fault.

The three subassemblies are the pilot/actuator assembly, the electronic circuit board, and the module subassembly. The module subassembly consists of the module final assembly with both the pilot/actuator assembly and electronic circuit board removed.

1. Remove the pilot/actuator assembly. Refer to **Pilot/Actuator Assembly** in Section 6 for complete removal information.
 - a. Inspect the nozzles and deflector. If they show a buildup of contaminants, clean the nozzles by **gently** inserting a wire with a maximum diameter of 0.38 mm (0.015 inches). Clean the deflector, if necessary, by spraying with contact cleaner.

CAUTION

Do not apply force to the deflector bar while cleaning the nozzles. Doing so could alter the alignment or disable the deflector bar mechanism.

CAUTION

Do not use chlorinated solvents for cleaning the pilot/actuator assembly. The chlorinated solvents will deteriorate the rubber diaphragm.

- b. Make sure the O-rings are lightly lubricated with silicone grease and properly seated.
- c. Reassemble and check operation.
- d. If after cleaning the transducer does not function, replace the pilot/actuator assembly with a new one.
- e. Reassemble and check operation.

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2. Remove the electronic circuit board from the module final assembly. Section 6—Maintenance describes how to remove the board.
 - a. Inspect the O-rings around the sensor for damage and replace them if necessary.
 - b. Check the sensor port and areas around the sensor for foreign material, and clean if necessary.
 - c. Reassemble and check operation.
 - d. If the transducer does not function, replace the electronic circuit board with a new one. Refer to **Electronic Circuit Board** in Section 6 for complete removal information.
 - e. Reassemble and check operation.
3. The module subassembly is aligned at the factory and should not be further disassembled. If the above steps fail to produce a working unit, the module subassembly is faulty and should be replaced.

Section 6 Maintenance

Section 6 describes the major components, assembly, and disassembly of the Type 846 and Model 3311 current-to-pressure transducers.



WARNING

Use only the procedures and new parts specifically referenced in this manual. Unauthorized procedures or parts can affect product performance and the output signal used to control a process, and may render the instrument dangerous.

Module Final Assembly

The active mechanical and electrical components of the transducer are incorporated into a single, field-replaceable module called the module final assembly, as shown in figure 6-1. Electrical connection between the terminal compartment and module final assembly is made by electrical feedthroughs that extend into the module compartment. The feedthroughs enter sockets on the electronic circuit board. The span and zero screws extend through the terminal compartment wall into the module compartment. Connection to the span and zero potentiometers on the electronic circuit board is made by Velcro®.

The module final assembly has three separate radial ports. The upper port is for supply air, the middle port for the output signal, and the lower ports for exhaust. Three O-rings separate the ports. The two lower O-rings are the same size, and the upper O-ring is slightly smaller. Table 6-1 shows O-ring sizes.

The module final assembly is attached to the module cover, which allows insertion and removal, and can be separated from the module cover for further disassembly. A module cover O-ring provides a seal between the module cover and module final assembly. Table 6-1 shows the O-ring sizes. A slip ring is located around the module feet. It allows the module cover to turn easily when the module final assembly is being removed from the housing.

Table 6-1. O-Ring Sizes

Description	Qty.	Size
Module O-rings	1	043
	2	042
Pilot/Actuator O-rings	2	006
Circuit Board O-rings	2	016
	1	005
Module Cover O-ring	1	238
Terminal Cover O-ring	1	238
Filter-Regulator O-ring	1	114

The module final assembly consists of three major subassemblies, as shown in figure 6-1. They are the electronic circuit board, pilot/actuator assembly, and module subassembly.

Removing the Module Final Assembly

The module final assembly is attached to the module cover. Removing the module cover automatically removes the module final assembly from the housing. When the module cover is unscrewed, the electrical feedthroughs and span and zero adjustments automatically disengage. The internal air ports are also disengaged. The air supply to the transducer should be turned off to prevent uncontrolled air loss through the housing.



WARNING

Personal injury or property damage could result from an uncontrolled process. Unscrewing the module cover removes power from the electronics and the output signal will be 0.0 psi. Before removing the module cover, ensure the process is properly controlled.

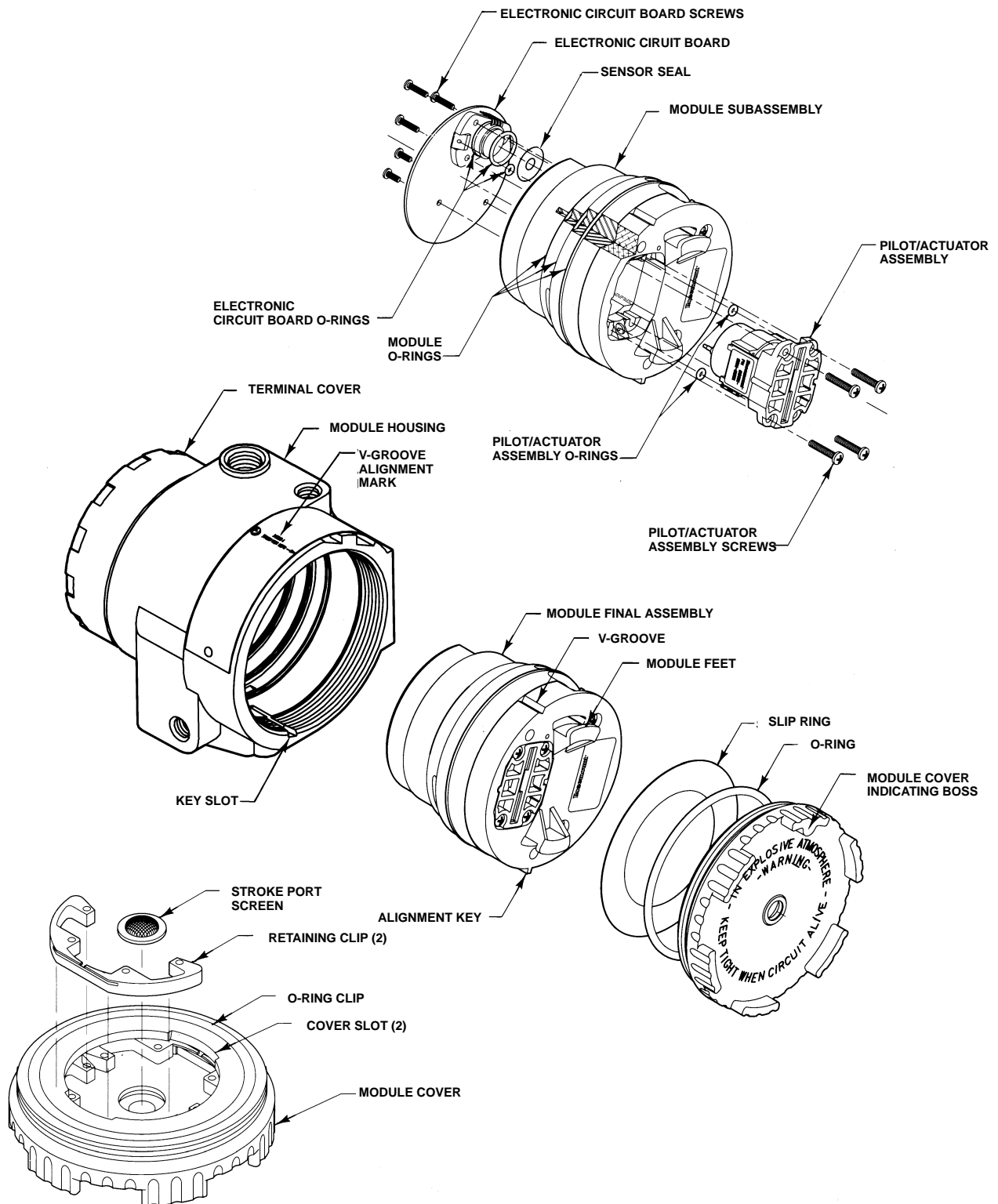


WARNING

Personal injury or property damage could result from fire or an explosion. In explosive atmospheres, remove power and shut off the air supply to the transducer before attempting to remove the terminal compartment cover or module cover. Failure to do so could result in an electrical spark or explosion.

Use the following steps to remove the module final assembly from the housing and module cover:

1. Shut off the air supply. If applicable, remove the cover lock and screw to allow access to the terminal



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Figure 6-1. Type 846 and Model 3311 Exploded View

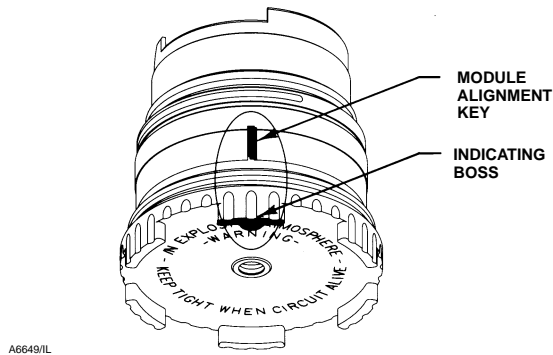


Figure 6-2. Alignment Key Above Module Cover Indicating Boss

compartment cover. Unscrew the module cover. When the module cover threads clear the housing, slowly pull on the cover, and the module final assembly will gradually come out of the housing.

Note

The module and the housing are designed for minimal clearance; therefore, patience may be required while pulling on the cover. Time must be allowed for release of the vacuum effect between the housing and module. If the module becomes tilted and cannot be removed, reinsert it completely into the housing and fully engage the module cover threads. Then proceed again with removal, ensuring that you pull slowly in a straight line.

Support both the module cover and the module final assembly as it comes out of the housing. This is to prevent dropping them, should they become detached accidentally.

CAUTION

Do not grip the module cover threads. The threads are sharp and may cause minor injury. Wear gloves when removing the module cover.

2. Prepare to remove the module final assembly from the module cover. Align the module feet with the two interior cover slots. To accomplish this, identify the indicating boss on the module cover, shown in figure 6-2.

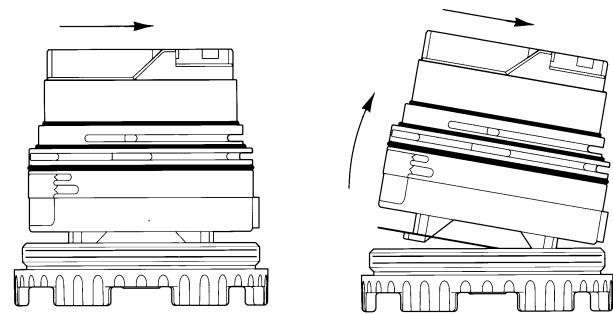


Figure 6-3. Removing the Module Final Assembly from the Module Cover

Grasp the module cover with one hand and the module final assembly with the other hand. Rotate the module final assembly so that the module alignment key is directly above the indicating boss on the module cover. Figure 6-2 shows the module alignment key and the indicating boss. The module feet are now aligned with the cover slots.

3. Remove the module final assembly from the module cover. To accomplish this, hold the cover steady, and push the module final assembly in the direction of the module cover indicating boss. At the same time, lift the opposite foot of the module final assembly out of the cover slot, as shown in figure 6-3.

Replacing the Module Final Assembly

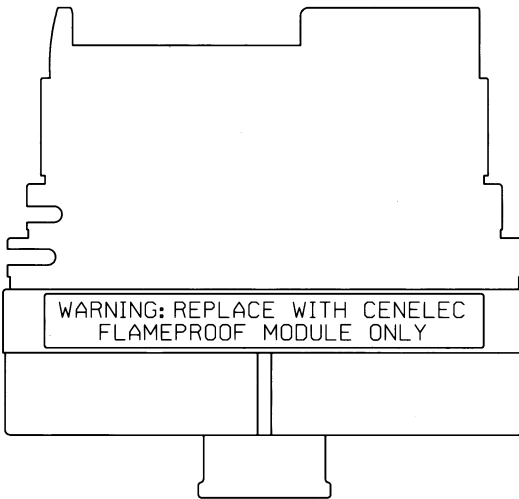
Use the following procedure to attach the module cover and replace the module final assembly:

1. Ensure that the electronic circuit board and the pilot actuator assembly provide the desired action (direct or reverse). See the **Electronic Circuit Board** and **Pilot/actuator Assembly Action** descriptions later in this section.
2. Ensure that the slip ring is in place around the feet of the module final assembly. The module cover O-ring should be lightly lubricated with silicone grease and placed in the O-ring gland. The stroke port screen should be clean and in place.

WARNING

Personal injury and property damage could result from fire or explosion. Do not operate the transducer with the CENELEC flameproof options at a supply pressure in excess of 1.4 bar (20 psi). Doing so invalidates the

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Figure 6-4. CENELEC Flameproof Module

CENELEC flameproof certification and could allow flames to spread from the unit potentially igniting and causing an explosion (see figure 6-4).

Note

The module cover O-ring must be in the O-ring gland, not down on the threads of the cover. This will ensure proper sealing of the pilot pressure area.

3. Position the retaining clips in the module cover so they are ready to accept the feet of the module final assembly. Ensure the leaves on the retaining clips are facing up. Figure 6-1 shows the correct orientation.
4. Insert one of the module feet into a cover slot, and push on the module final assembly to compress the retaining clip. Insert the opposite foot into the opposite cover slot, and rotate the module 90 degrees in the module cover to secure it in place.
5. Ensure that the three module O-rings are in the O-ring glands and are lightly lubricated with silicone grease. Inspect the O-rings to ensure that they are not twisted or stretched.
6. Apply lubricant to module cover threads for ease of assembly.
7. Prepare to insert the module into the housing. Align the V-groove located on the module final assembly with the indicating mark located on the nameplate. This positions the alignment key with the

key slot. Figure 6-1 shows the location of the V-groove and the indicating mark.

8. Insert the module, engage the module cover threads, and screw on the module cover. The module final assembly will automatically engage the electrical feedthroughs and span and zero screws.
9. Hand tighten the module cover as much as possible. Use a wrench or long screwdriver shaft to tighten the module cover an additional 1/4 to 1/2 turn (24 to 27 N•m) (18 to 20 lbf•ft). For units with CENELEC Flameproof Certification, make sure the cover lock and screw have been securely re-installed. The screw accepts a 3 mm hex drive.

Note

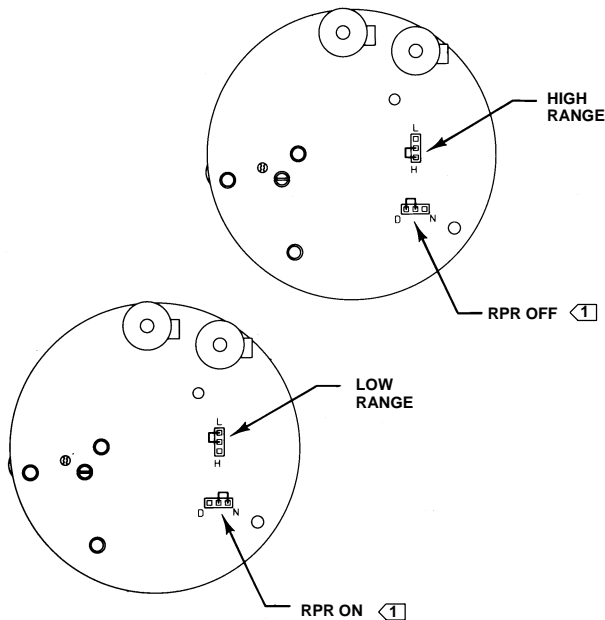
When the module cover is tightened, connection is made with the electrical feedthroughs and span and zero screws, and the module final assembly O-rings become seated. Failure to fully tighten the module cover may prevent the transducer from operating properly.

Electronic Circuit Board

The electronic circuit board is located on top of the module final assembly, as shown in figure 6-1. Beneath the circuit board and permanently attached to it is the pressure sensor. Two jumpers on the circuit board control various functions of the transducer. Figure 6-5 shows the location of these jumpers.

Optional Remote Pressure Reading (RPR) Jumper

Remote Pressure Reading (RPR) is an optional diagnostic feature that enables the operator to determine the transducer output signal from any location along the signal wire path. The transducer generates a frequency signal that can be received by a HART Communicator or a frequency counter. Operation of the RPR feature is jumper-selectable, in units so equipped. The RPR feature operates when the jumper is located in the N position on the circuit board. With the jumper in the D position, the RPR feature does not operate. When the RPR feature is included, the transducer is shipped with the RPR jumper in the N position, unless otherwise specified. For more information about the RPR feature, refer to **Remote Pressure Reading (RPR)** in Section 5.



NOTE:

① RPR JUMPER ONLY ON UNITS WITH REMOTE PRESSURE READING (RPR) OPTION

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Figure 6-5. Circuit Board Jumper Positions

Note

When operating Type 846 and Model 3311 transducers in series, only one unit may be configured for Remote Pressure Reading. Activating the RPR feature in two units will result in an unusable RPR signal.

Range Jumper

The range jumper is positioned according to the calibration specified. All full span calibrations and some split range calibrations can be accomplished with the range jumper in the High Range position. Some split range calibrations require the jumper to be in the Low Range position. For more information about the range jumper, refer to **Standard Performance: Split Range Input, Direct Action** in Section 4.

Action

For direct action units, output changes directly with a corresponding change in input. For example, as the input increases from 4 to 20 mA the output increases from 0.2 to 1.0 bar (3 to 15 psi). Direct action circuit boards are green in color.

For reverse action units, output changes inversely with a change in input. For example, as the input increases from 4 to 20 mA the output decreases from 1.0 to 0.2 bar (15 to 3 psi). Reverse action circuit boards are red in color.

Upon loss of input current, or if input current decreases below 3.3 ± 0.3 mA, the output of the direct action unit decreases to less than 0.1 bar (1 psi). In the same situation, the output of the reverse action unit increases to near supply pressure.

Removing the Electronic Circuit Board

The electronic circuit board is connected to the module final assembly by five mounting screws. The circuit board must be removed to inspect the pressure sensor located beneath it. To remove the circuit board, remove the five mounting screws and pull upward on the plastic board standoff (black=multirange; white=standard).

CAUTION

Standard electronic assembly handling procedures apply. Do not attempt to remove the circuit board by pulling on the components. Doing so could weaken the connections and disable the electronics.

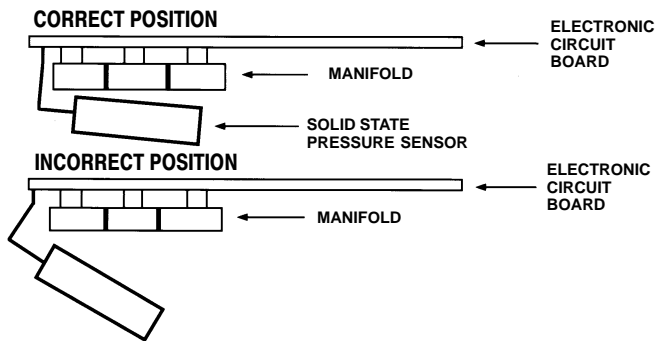
Be careful when handling the pressure sensor located beneath the circuit board. The pressure sensor lead frame is bent to allow the pressure sensor to fit properly in the sensor cavity of the module final assembly, and to maintain flush contact with the pressure sensor manifold.

Three O-rings accompany the pressure sensor. Two O-rings of the same size are located on each side of the pressure sensor. A third, smaller O-ring is positioned in the beveled O-ring gland of the module sub-assembly. Table 6-1 shows the O-ring sizes. The pressure sensor may be gently bent away from the pressure sensor manifold to access the sensor O-ring and confirm that the pressure ports are clear.

Product Change

Previous electronic circuit boards have the two sensor O-rings positioned on the shoulders of the sensor. They also have a sensor seal washer that is positioned in the bottom of the pressure sensor cavity of the module subassembly. Both the previous and the current designs are compatible

Type 846 and Model 3311



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Figure 6-6. Positioning the Pressure Sensor

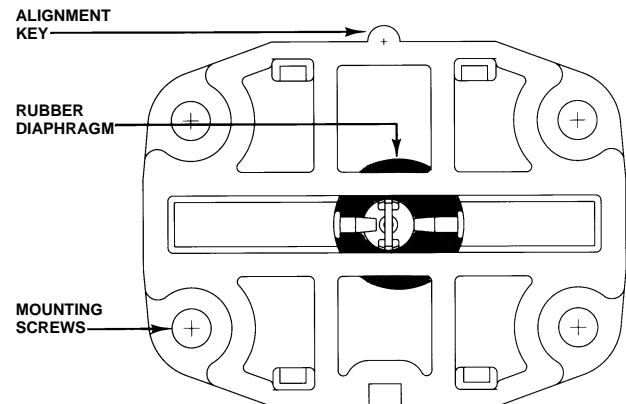
with the cavity in the module subassembly. The current design does not require the sensor seal washer; therefore, the sensor seal washer may be discarded when switching from the previous design electronic circuit board to the current design.

Replacing the Electronic Circuit Board

1. Verify that the circuit board is green for assembly into a direct action unit, or red for assembly into a reverse action unit.
2. Ensure that the three O-rings are in the proper position. The small O-ring is positioned in the beveled O-ring gland of the module subassembly. The two sensor O-rings are each positioned on the shoulders of the sensor. They should be lightly lubricated with silicone grease.
3. Ensure that the pressure sensor is correctly positioned against the manifold. The pressure sensor should be centered and in contact with the manifold, as shown in figure 6-6.
4. Position the circuit board on the module subassembly. Ensure that the circuit board mounting holes match those on the module subassembly. Place the three long screws in the mounting holes adjacent to the pressure sensor.
5. Place the two short screws in the remaining mounting holes. Tighten the three long screws first, then tighten the remaining two screws.

Pilot/Actuator Assembly

The pilot/actuator assembly is located at the bottom of the module final assembly, as shown in figure 6-1. It is a unitized assembly consisting of the coil, magnet, and spring of the actuator, and the deflector and nozzles of the pilot stage. Two O-rings are part of the pilot/actuator assembly. Table 6-1 shows the O-ring sizes. They are located in the beveled O-ring



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Figure 6-7. Pilot/Actuator Assembly (Bottom View)

glands of the module subassembly, adjacent to the nozzles. The pilot/actuator assembly is held in place by four mounting screws.

Action

A blue rubber diaphragm under the deflector bar and nozzle area identifies the direct action pilot/actuator assembly. A red diaphragm under the nozzle area identifies the reverse action pilot/actuator assembly. Figure 6-7 shows the bottom view of the pilot/actuator assembly.

Removing the Pilot/Actuator Assembly

To remove the pilot/actuator assembly, disengage the four mounting screws, and gently pull the assembly out of the module subassembly. To aid removal, the pilot/actuator framework may be gently gripped with a pair of pliers.

WARNING

Personal injury or property damage could result from an uncontrolled process. Do not attempt to remove the pilot/actuator assembly by gripping or pulling on the deflector or nozzles. Doing so could alter the alignment or disable the deflector/nozzle mechanism.

Inspect the assembly for a buildup of foreign material. The nozzle passageways should be clear, and the deflector should be clean. The deflector can be cleaned by spraying it with contact cleaner. Clean the nozzles by gently inserting a wire with a maximum diameter of 0.38 mm (0.015 inches).

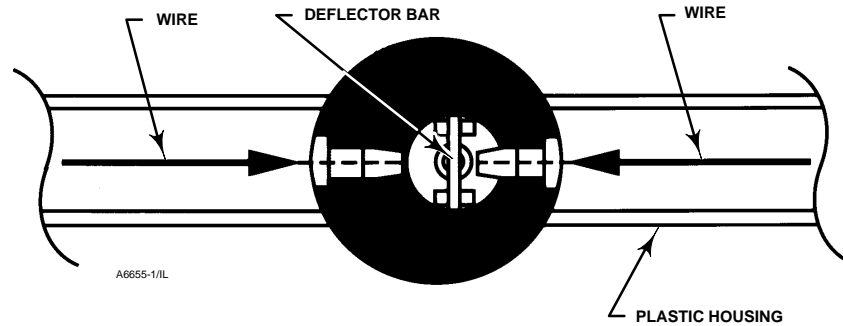


Figure 6-8. Cleaning the Nozzles

- Insert the wire into each nozzle **separately** from the outside as shown in figure 6-8.
- **Do not** try to put the wire through both nozzles simultaneously.
- **Do not** push the wire on the deflector bar.

4. Prepare to insert the assembly by aligning the key on the pilot/actuator assembly with the key slot in the module subassembly.
5. Insert the assembly into the module subassembly, and engage the four mounting screws.

CAUTION

Do not apply force to the deflector bar while cleaning the nozzles. Doing so could alter the alignment or disable the deflector mechanism.

CAUTION

Do not use chlorinated solvents for cleaning the pilot/actuator assembly. The chlorinated solvents will deteriorate the rubber diaphragm

Module Subassembly

The module subassembly, shown in figure 6-1, consists of the module final assembly with both the electronic circuit board and pilot/actuator assembly removed. The module subassembly contains the porting and valving for the booster stage.

Note

The module subassembly is aligned at the factory and should not be further disassembled. Disassembling the module subassembly may result in performance outside specifications.

Replacing the Pilot/Actuator Assembly

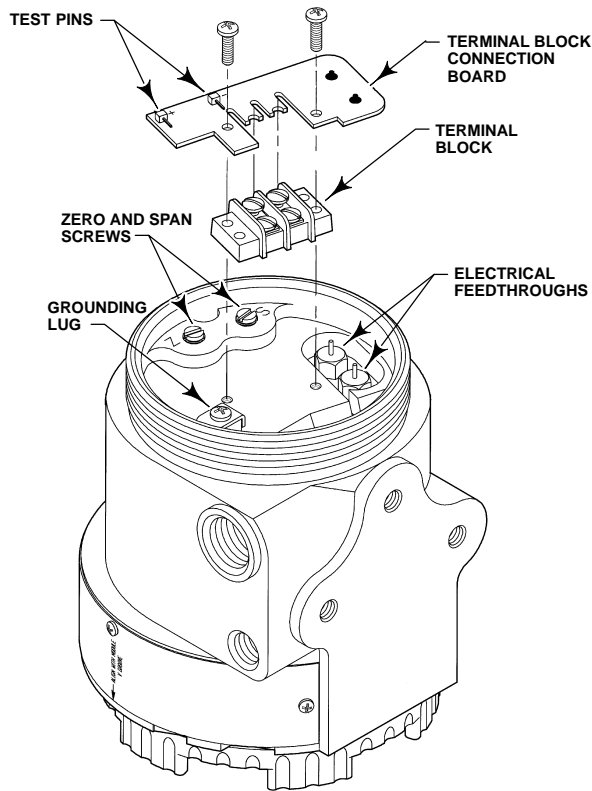
1. Verify that the rubber diaphragm under the nozzle area is blue for pilot/actuators inserted into a direct action unit, or red for pilot/actuators inserted into a reverse action unit.
2. Inspect the pilot/actuator assembly cavity in the module final assembly to ensure that it is clean.
3. Lightly lubricate the two O-rings with silicone grease, and place them in the beveled O-ring glands. O-rings between the pilot/actuator assembly and the module should be installed justified to the lower portion of the O-ring gland. When properly positioned, the air passageway should be visible through the O-ring inside diameter.

Terminal Compartment

The terminal compartment contains the terminal block, terminal block connection board, span and zero screws, electrical feedthroughs, and internal grounding lug, as shown in figure 6-9. The terminal block connection board is attached to the terminal block and to the electrical feedthroughs.

Separate test points are provided that have a 10-ohm resistor in series with the signal negative (-) terminal. The test points allow the input current to be determined with a voltmeter without disconnecting a signal lead. A 4 to 20 mA span produces a 40 to 200 mV dc voltage drop across the 10-ohm resistor. The test points can accommodate different connections, including alligator clips and E-Z hooks.

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Figure 6-9. Terminal Compartment Exploded View

The terminal block and terminal block connection board can be removed by disengaging the two terminal block mounting screws. Lubricate the terminal compartment cover threads with anti-seizing paste or a low temperature lubricant. See table 6-1 for the size of the terminal compartment cover O-ring.

Exhaust and Stroke Port Screens

Two identical screens, the exhaust port screen and the stroke port screen, allow air to vent to the outside environment. The exhaust port screen is located behind the nameplate. Removing the two nameplate screws and rotating the nameplate to the side allows access to the exhaust port screen. Figure 7-1 shows an exploded parts view.

The stroke port screen is located at the center of the module cover. Removing the module final assembly from the housing and then from the module cover allows access to the stroke port screen. **Removing the Module Final Assembly** earlier in this section describes this procedure. Figure 7-1 shows an exploded parts view.

Section 7 Parts List

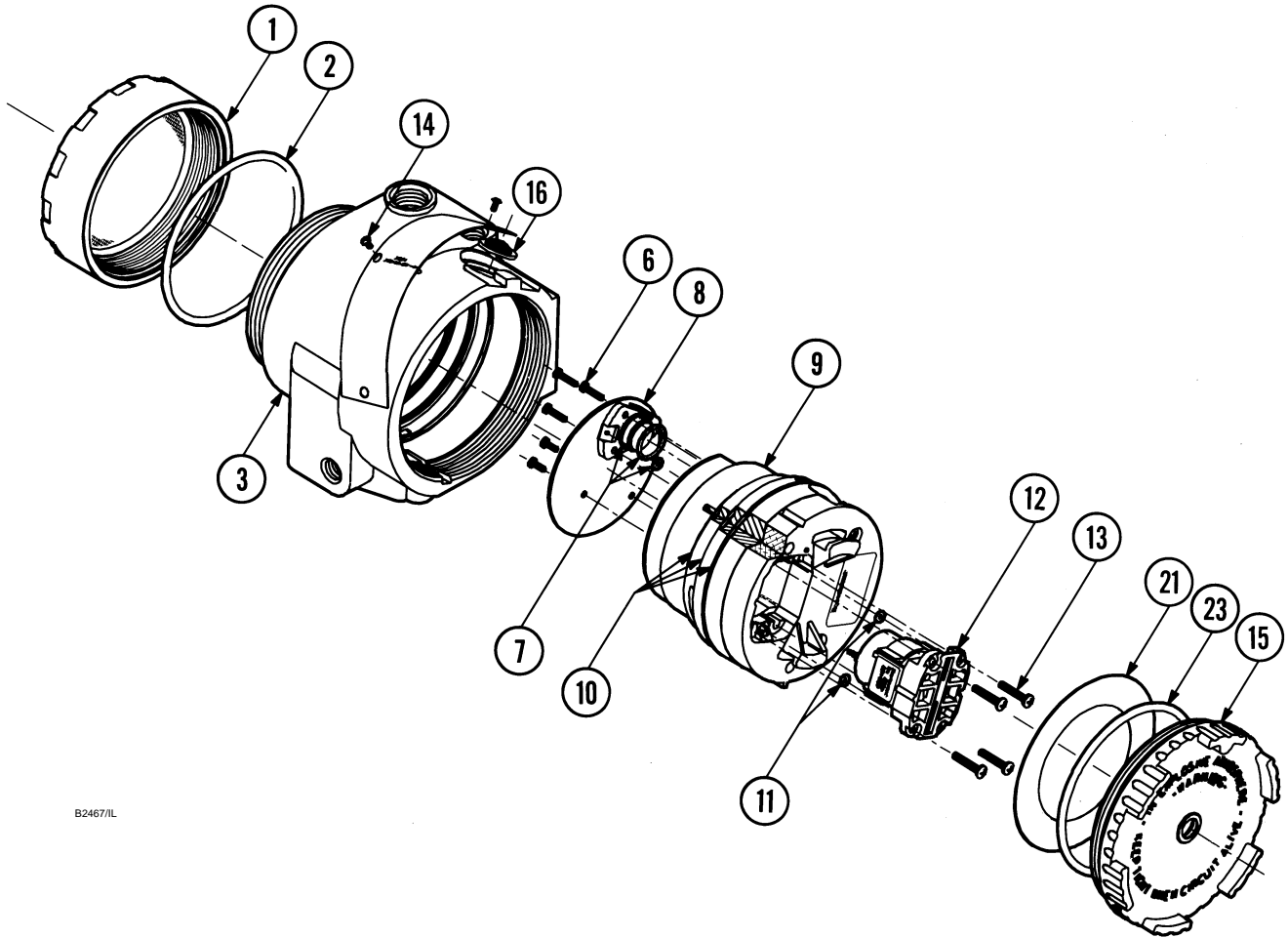
Whenever corresponding with the Fisher sales office or sales representative about this equipment, always mention the transducer serial number. When ordering replacement parts, refer to the 11-character

Fisher part number of each required part. Figure 7-1 shows the key numbers for all replaceable parts.

Table 7-1. Parts List Cross Reference

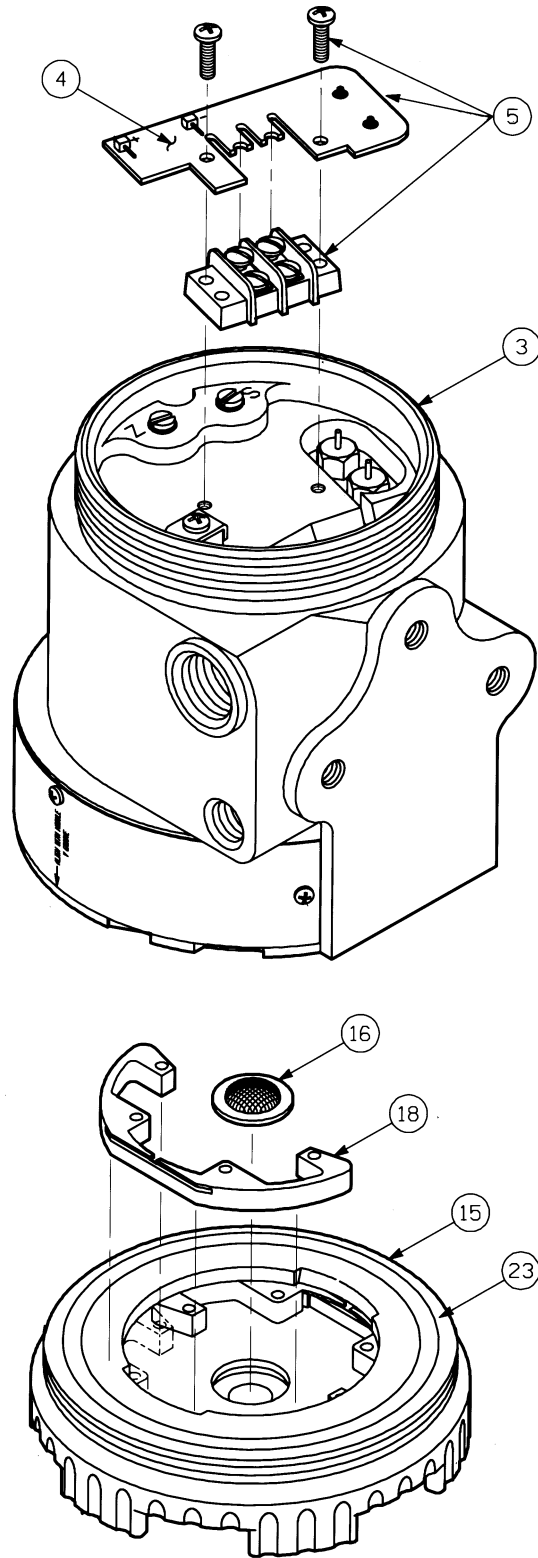
Key No.	Description	Rosemount Part No.	Fisher Part No.	Spares Category ⁽⁶⁾
	Module Final Assembly ⁽⁴⁾ Standard Performance Direct Action 4–20 mA Direct Action 10–50 mA Reverse Action 4–20 mA CENELEC Flameproof Direct Action 4–20 mA Direct Action 10–50 mA Reverse Action 4–20 mA Multirange Performance Direct Action 4–20 mA Direct Action 10–50 mA Reverse Action 4–20 mA	03311-0298-0004 03311-0298-0010 03311-0298-0005 03311-0298-0006 03311-0298-0011 03311-0298-0007 03311-0298-0008 03311-0298-0012 03311-0298-0009	13B8788 X012 14B5026 X013 13B8789 X012 18B4646 X012 18B5800 X012 18B6514 X012 13B8790 X012 18B5801 X012 13B8791 X012	B B B B B B B B B
9	Module Subassembly ⁽¹⁾⁽⁴⁾ Standard Performance (Direct or Reverse Action) CENELEC Flameproof (Direct or Reverse Action)	03311-0409-0002 03311-0409-0003	13B8792 X012 18B5802 X012	B B
12	Pilot/Actuator Assembly ⁽¹⁾ Standard Performance Only Direct Action Reverse Action	03311-0410-0001 03311-0410-0002	13B8793 X012 13B8794 X012	B B
8	Circuit Board Assembly ⁽¹⁾ Standard Performance Only Direct Action Reverse Action Direct Action 10–50 mA	03311-0411-0005 03311-0411-0006 03311-0411-0007	13B8795 X012 13B8796 X012 18B5803 X012	B B B
3	Housing ⁽²⁾ Standard CENELEC Flameproof	03311-0412-0003 03311-0412-0004	18B5804 X022 18B5805 X022	C C
15	Module Cover Single Stroke Port Multiple Ports Threaded Stroke Port	03311-0341-0001 03311-0341-0002 03311-0434-0001	18B5806 X012 18B5807 X012 18B5808 X012	C C C
1	Terminal Compartment Cover	03311-0413-0001	18B5809 X012	C
5	Terminal Block Kit ⁽³⁾	03311-0414-0002	13B8801 X012	B
16	Screens (12/pkg)	03311-0415-0001	13B8802 X012	B
10 11 7 2, 21, & 23	O-Rings Module (5/kit) ⁽⁵⁾ Pilot/Actuator (5/kit) ⁽⁵⁾ Circuit Board (5/kit) ⁽⁵⁾ Cover [12 O-rings, 12 slip rings] ⁽⁵⁾ Filter-Regulator (10/kit) ⁽⁵⁾⁽⁶⁾	03311-0416-0001 03311-0417-0001 03311-0418-0004 03311-0421-0001 03311-0428-0001	13B8803 X012 13B8804 X012 13B8805 X012 13B8806 X012 18B5815 X022	B B B B B
13 6 14	Screws Pilot/Actuator (3/kit) ⁽⁵⁾ Circuit Board (3/kit) ⁽⁵⁾ Nameplate (3/kit) ⁽⁵⁾	03311-0417-0002 03311-0418-0001 03311-0419-0001	13B8807 X012 13B8808 X012 13B8809 X012	C C C
18	Retaining Clips (3/kit) ⁽⁵⁾	03311-0420-0001	13B8810 X012	C
22	Module Cap (5/pkg) ⁽⁵⁾	03311-0424-0001	18B5810 X012	B

(continued)



B2467/IL

Figure 7-1. Exploded Parts Drawing



B2468 / IL

Figure 7-1. Exploded Parts Drawing (continued)

Type 846 and Model 3311

Table 7-1. Parts List Cross Reference (continued)

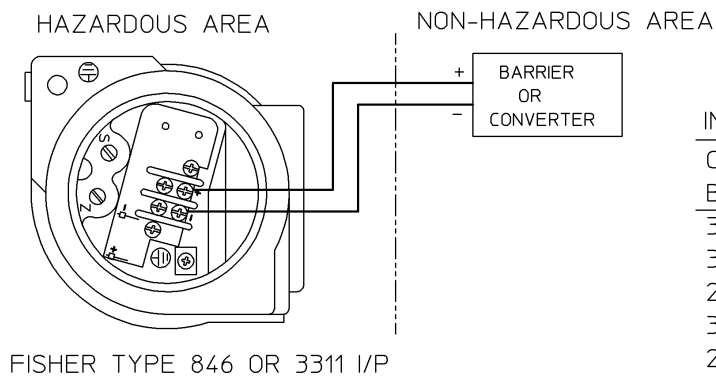
Gauges	0-60 psi/bar/kPa (supply)	03311-0258-0001	19B3088X012	B
	0-30 psi/bar/kPa (output)	03311-0258-0002	19B3086X012	B
	0-60 psi/bar/kPa (supply)	03311-0258-0003	19B3088X012	B
	0-30 psi/bar/kPa (output)	03311-0258-0004	19B3086X012	B
	0-60 psi/kg/cm ² (supply)	03311-0258-0007	19B3090X012	B
	0-30 psi/kg/cm ² (output)	03311-0258-0008	19B3087X012	B
	0-60 psi/bar/kPa (output)	03311-0258-0009	19B3089X012	B
	SST 0-60 psi/kg/cm ² (supply)		19B3109X012	B
	SST 0-60 psi/bar/kPa (supply)	03311-0258-0010	19B3091X012	B
	SST 0-60 psi/bar/kPa (output)	03311-0258-0011	19B3092X012	B
	SST 0-60 psi/bar/kPa (output)	03311-0258-0013	19B3092X012	B
SST 0-60 psi/bar/kPa (supply)	03311-0258-0012	19B3091X012	B	
Filter-Regulator Direct Mounting Kit ⁽⁷⁾ (9) F2 SST Bolts 20 Yr	03311-0422-0002	18B5811 X022	B	
Filter-Regulator with Direct Mounting Kit ⁽⁷⁾ (9) SST Bolts 62 Yr	03311-0425-0002	18B5813 X022	B	
Universal Mounting Bracket Epoxy Painted Carbon Steel, Carbon Steel Nuts/Bolts	Epoxy Painted Carbon steel, SST Nuts/Bolts	03311-0404-0001	18B5816 X012	C
	316 SST, SST Nuts/Bolts for use with SST Housing	03311-0404-0002	18B5817 X012	C
	316 SST, SST Nuts/Bolts for use with Aluminum	03311-0404-0003	14B4979 X012	C
	Housing	03311-0404-0004	14B4977 X012	C
<p>1. Includes O-rings. 2. Includes housing, span and zero screws, electrical feedthroughs, and grounding lug. 3. Includes terminal block, connection board, and screws. 4. For units with approvals other than CENELEC Flameproof, use standard module. 5. #/kit indicates number of transducers that may be serviced.</p> <p>6. Spares Categories Category A - Recommend 1 spare part per 25 transducers Category B - Recommend 1 spare part per 50 transducers Category C - None normally required.</p> <p>7. Filter-Regulator Direct Mounting Kit includes O-ring. 8. Contains O-rings for both housing styles. 9. Extra O-ring and spacer included for both housing styles.</p>				

**Section 8
Loop Schematics**

This section includes loop schematics required for wiring of intrinsically safe installations. If you have any questions, contact your Fisher Controls sales representative or sales office.

CSA Schematics

CSA INTRINSIC SAFETY APPROVALS
846 AND 3311 CIRCUIT CONNECTION WITH
INTRINSIC SAFETY BARRIERS



NO CHANGE IN PART OR VENDOR OF PART ALLOWED
WITHOUT PRIOR APPROVAL OF: **CSA**

"Exia"	
INTRINSICALLY SAFE /	SECURITE INTRINSEQUE
CSA APPROVED SAFETY BARRIER PARAMETERS	APPROVED FOR CLASS I, DIV I
30V OR LESS	GROUPS A,B,C & D
330 OHMS OR MORE	
28V OR LESS	
300 OHMS OR MORE	
22V OR LESS	GROUPS C & D
180 OHMS OR MORE	
30V OR LESS	
150 OHMS OR MORE	

FM Schematics

FM ENTITY CONCEPT APPROVALS

THE FISHER TYPE 846 AND 3311 CURRENT TO PRESSURE (I/P) TRANSDUCER ARE FM APPROVED AS INTRINSICALLY SAFE FOR USE IN CLASS I, II AND III, DIVISION I, GROUPS A,B,C,D,E,F AND G HAZARDOUS LOCATIONS WHEN CONNECTED IN ACCORDANCE WITH THIS DOCUMENT. THE TYPE 846 AND 3311 ARE ALSO FM APPROVED AS NONINCENDIVE FOR CLASS I, DIVISION 2, GROUPS A,B,C AND D HAZARDOUS LOCATIONS.

TO MAINTAIN THE INTRINSIC SAFETY OF THE 846 OR 3311. IT MUST BE CONNECTED TO AN FM APPROVED BARRIER THAT SATISFIES THE FOLLOWING CONDITIONS:

CLASS I, II AND III, DIV I GROUPS A,B,C,D,E,F AND G

APPARATUS PARAMETER	BARRIER PARAMETER
$V_{MAX} = 40 \text{ Vdc}$	V_{OC} MUST BE LESS THAN OR EQUAL TO 40 Vdc
$I_{MAX} = 185 \text{ mA}$	I_{SC} MUST BE LESS THAN OR EQUAL TO 185 mA
$L_I = 20 \text{ uH}$	L_A MUST BE GREATER THAN 20 MICROHENRIES
$C_I = 0.016 \text{ uF}$	C_A MUST BE GREATER THAN 0.016 MICROFARADS

WHERE: V_{MAX} = MAXIMUM 846 OR 3311 INPUT VOLTAGE

I_{MAX} = MAXIMUM 846 OR 3311 INPUT CURRENT

C_I = TOTAL UNPROTECTED INTERNAL CAPACITANCE OF THE 846 OR 3311

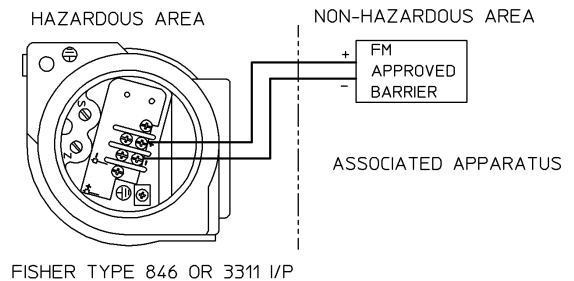
L_I = TOTAL UNPROTECTED INTERNAL INDUCTANCE OF THE 846 OR 3311

V_{OC} = OPEN CIRCUIT VOLTAGE OF THE BARRIER

I_{SC} = SHORT CIRCUIT CURRENT OF THE BARRIER

C_A = ACCEPTABLE CONNECTED CAPACITANCE OF THE BARRIER

L_A = ACCEPTABLE CONNECTED INDUCTANCE OF THE BARRIER



FISHER TYPE 846 OR 3311 I/P

NO CHANGE IN PART OR VENDOR OF PART ALLOWED
WITHOUT PRIOR APPROVAL OF: FM

HP C.

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Type 846 and Model 3311

Instruction Manual
Form 5354
February 2002

These products may be covered by one or more of the following patents (4,481,967; 4,534,376; 4,638,830; 4,653,523; 4,665,938; 4,760,859; 4,777,826; 4,901,756) or under pending patent applications.



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