

ASHCROFT® E2S-INTRINSICALLY SAFE AND NON-INCENDIVE PRESSURE TRANSDUCER INSTALLATION MANUAL



WARNING! READ BEFORE INSTALLATION

A failure resulting in injury or damage may be caused by excessive overpressure, excessive vibration or pressure pulsation, excessive instrument temperature, corrosion of the pressure containing parts, or other misuse. Consult Ashcroft Inc., Stratford, Connecticut, USA before installing if there are any questions or concerns.

OVERPRESSURE:

Pressure spikes in excess of the rated overpressure capability of the transducer may cause irreversible electrical and/or mechanical damage to the pressure measuring and containing elements.

Fluid hammer and surges can destroy any pressure transducer and must always be avoided. A pressure snubber should be installed to eliminate the damaging hammer effects. Fluid hammer occurs when a liquid flow is suddenly stopped, as with quick closing solenoid valves. Surges occur when flow is suddenly begun, as when a pump is turned on at full power or a valve is quickly opened.

Liquid surges are particularly damaging to pressure transducers if the pipe is originally empty. To avoid damaging surges, fluid lines should remain full (if possible), pumps should be brought up to power slowly, and valves opened slowly. To avoid damage from both fluid hammer and surges, a surge chamber should be installed.

Symptoms of fluid hammer and surge's damaging effects:

- Pressure transducer exhibits an output at zero pressure (large zero offset).
- Pressure transducer output remains constant regardless of pressure
- In severe cases, there will be no output.

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FREEZING:

Prohibit freezing of media in pressure port. Unit should be drained (mount in vertical position with electrical termination upward) to prevent possible over- pressure damage from frozen media.

STATIC ELECTRICAL CHARGES:

Any electrical device may be susceptible to damage when exposed to static electrical charges. Additionally these sensors may include a plastic connector, which may increase the risk of static discharge. To avoid damage to the transducer, observe the following:

- Operator/installer should follow the proper ESD (electrostatic discharge) protection procedures before handling the pressure transducer.

NOTE: Checkboxes provided on the label must be marked during installation. Installer - be sure to check each box as appropriate to indicate the protection methods used on a particular installation.

- Ground the body of the transducer BEFORE making any electrical connections

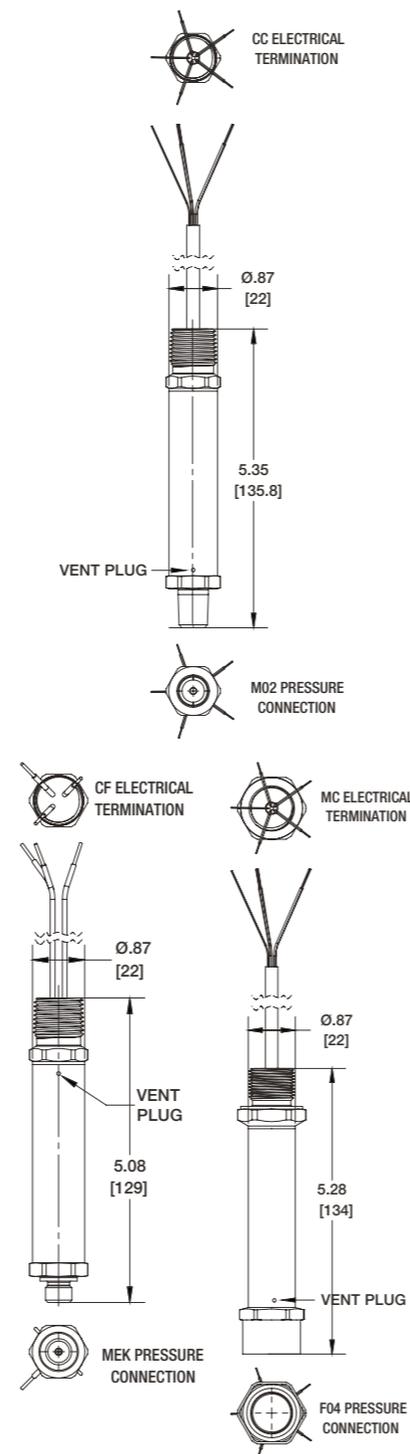
- When disconnecting, remove ground LAST! Note: The shield and drain wire in the cable (if supplied) is not connected to the transducer body, and is not a suitable ground.

VENT

All units with a pressure range less than 500 psi include a small Porex filter in the unit. This is necessary to equalize the internal pressure of the unit with the atmospheric pressure. While the Porex filter is hydrophobic, if it not properly protected it may be a source of water ingress.

| | | | |
|--|---|---|--|
| | | Ashcroft Inc. INDUSTRIAL CONTROL EQUIPMENT 250 East Main Street, Stratford, CT 06614 FOR HAZARDOUS LOCATIONS www.ashcroft.com | |
| RANGE: 0 / 150 PSIG ACCURACY: ± 0.25 % of SPAN PROOF: 290 PSIG OUTPUT: 4 - 20 mA WETTED MAT'L: 17-4PH, 316L SS | RED: V+ BLACK: V- WHITE: N/C GREEN: CASE GND BARE: DRAIN | MODEL: E2SA3NM0242CFX15F150#G SERIAL: EST1805070076 | |
| | | | |
| <input type="checkbox"/> CL I DIV1 GRP ABCD T4 <input type="checkbox"/> CL I Zone 0 AEx ia IIC T4 Ga <input type="checkbox"/> II 1 G Ex ia IIC T4 Ga <input type="checkbox"/> CL I DIV2 GRP ABCD T4 <input type="checkbox"/> CL I Zone 2 AEx ic IIC T4 Gc <input type="checkbox"/> II 3 G Ex ic IIC T4 Gc | | | |
| -40°C < Tamb < 80°C WARNING-SPECIAL CONDITION OF USE-SEE INSTALLATION DWG. 825A030 | | | |
| ZERO-SPAN ADJUST | | | |
| DO NOT USE FOR OXYGEN SERVICE | | | |
| WARNING: A failure resulting in injury or damage may be caused by pressure beyond full scale, excessive vibration or pressure pulsation, excessive instrument temperature, corrosion of the pressure containing parts or other misuse. | | | |

WARNING ASHCROFT® E2S PRESSURE TRANSDUCER, TYPICAL DIMENSIONS AND CONSTRUCTION



DESCRIPTION

The Ashcroft® Model E2S is ideal for a broad range of pressure sensing requirements found in general and heavy industrial applications as well as applications in test and measurement. The E2S offers a wide variety of material, process and electrical connections to meet your application requirements. It is designed for use with both liquids and gases it provides an accurate, reliable and highly repeatable output. This is accomplished through the use of an onboard microprocessor that is programmed during a unique digital compensation process to provide an extremely linear performance over the entire specified pressure and temperature range.

SPECIFICATIONS

- Reference condition:** 70°F (21°C)
- Accuracy:** ±0.25%, ±0.50% or ±1.00% of Span Terminal Point (* includes linearity, hysteresis, repeatability zero offset and span)
- Repeatability:** ≤ ±0.1 % of Span
- Stability:** ±0.25% of Span / Year
- Zero / Span Adjustment:** ±5% of Span
- Standard Ranges:** VAC to 20,000 psi
- ENVIRONMENTAL SPECIFICATIONS**
- Enclosure Rating:** (Self-Certified by Ashcroft, Inc.): IP66, IP67 or NEMA 4X (enclosure rating depending on electrical connector)
- Temperature Limits:**
- Storage Temp:** -50 to 125°C
- Operating Ambient Temp:** See drawing 825A030 Rev. B for ambient temperature limits.
- Media Temp:** See drawing 825A030 Rev. B for media temperature limits.* (0-100% R.H. non-condensing)
- Temperature Coefficients:** Zero & Span ±0.009%/°C within -40 to 80°C
- Vibration: Random:** 10g RMS 20-2000 Hz
- Shock:** 80g Peak, 6 msec, 3 axes, haversine
- Proof pressure:** 1.2X -2X the range
- Burst pressure:** 3X-8X the range mini

- Electrical Connections:** Amp Superseal, Deutsch DT04-3P, Hirschmann EN175301-803 Form A, Hirschmann EN175301-803 Form C, Metri Pak, Mini Hirschmann, M12 (4 Pin), MIL DTL 26482 (4 Pin), Overmolded Cable, ½" MNPT Conduit with Flying Leads, M20 Conduit Connection with Flying Leads, ½" MNPT Conduit Connection with Cable, M20 Conduit Connection with Cable
- Note: Cable can be vented or unvented.
- Diaphragm Materials:** 17-4PH SS, 316SS or A286

- EMC:** Directive 2014/30/EU, and EN61326-1, EN61326-2-3 (Industrial Env.)
- Immunity:**
 - 61000-4-2 (ESD) ±4kV/±8kV (Contact/Air)
 - 61000-4-3 (Radiated RF) 10 V/m to 1GHz, 3 V/m to 2GHz, 1 V/m to 2.7GHz
 - 61000-4-4 (EFT/Burst) ±1kV (5/50ns, 5kHz)
 - 61000-4-5 (Surge) ±1kV, Earth to Shield over all I/O lines
 - 61000-4-6 (Conducted RF) 3V (0.15 to 80MHz)
 - 61000-4-8 (Line Freq. Magnetic) 30A/m
- Emissions:** EN 55011 (CISPR 11) Class A, Group 1 & FCC (47 CFR 15)



FUNCTIONAL SPECIFICATIONS

| EMC | | |
|------------|--|--|
| EMC: | Directive 2014/30/EU, and EN61326-1, EN61326-2-3 (Industrial Env.) | |
| Immunity: | 61000-4-2 (ESD) | ±4kV/±8kV (Contact/Air) |
| | 61000-4-3 (Radiated RF) | 10 V/m to 1GHz, 3 V/m to 2GHz, 1 V/m to 2.7GHz |
| | 61000-4-4 (EFT/Burst) | ±1kV (5/50ns, 5kHz) |
| | 61000-4-5 (Surge) | ±1kV, Earth to Shield over all I/O lines |
| | 61000-4-6 (Conducted RF) | 3V (0.15 to 80MHz) |
| | 61000-4-8 (Line Freq. Magnetic) | 30A/m |
| Emissions: | EN 55011 (CISPR 11) Class A, Group 1 & FCC (47 CFR 15) | |

ELECTRICAL SPECIFICATIONS

Intrinsically Safe and Non-Incendive Installations

NOTE: For Intrinsically Safe and Non-Incendive Installations refer to Entity Parameters on Ashcroft drawing 825A030 (wiring and installation).

Supply Current: <8 mA (Vout)

Response Time (Output): 4msec

Power-Up Response Time: 100msec

Current Source/Sink for Voltage Output: 1 mA (Source) / 0.1mA (Sink) maximum

Withstand/Breakdown: 100 Vdc / 100 Vac. Optional 500Vdc / 500Vac

Insulation Resistance: >100M @ 30V

RoHS2: Yes

MECHANICAL SPECIFICATIONS

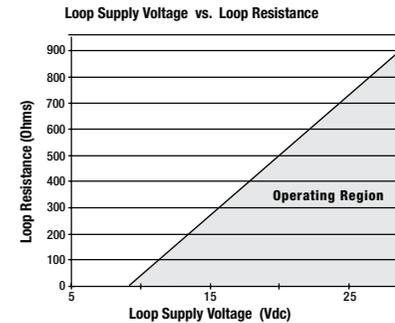
Process Connections: Male NPT (¼, ¼ and ½), Female NPT (¼, ¼ and ½), ¾"-20 UNF SAE (Male and Female), MIL 33656 (UNJF ¾"-20 w/ 37° Cone), G¼" B EN837-1, G½" B EN837-1, G¼" A DIN3852-E, Autoclave HP ¾" (AMINCO), R¼, R ½, ¼" Male VCR, ¼" Female VCR, R½ ISO 7/1, 1.5" Tri-Clamp, 2.0" Tri-Clamp

Electrical Connections: Amp Superseal, Deutsch DT04-3P, Hirschmann EN175301-803 Form A, Hirschmann EN175301-803 Form C, Metri Pak, Mini Hirschmann, M12 (4 Pin), MIL DTL 26482 (4 Pin), Overmolded Cable, ½" MNPT Conduit with Flying Leads, M20 Conduit Connection with Flying Leads, ½" MNPT Conduit Connection with Cable, M20 Conduit Connection with Cable

Note: Cable can be vented or unvented.

Diaphragm Materials: 17-4PH SS, 316SS or A286

FOR TRANSMITTERS WITH 4-20mA OUTPUT SIGNAL, THE MINIMUM VOLTAGE AT THE TERMINAL IS 9VDC



$V_{MIN} = 9V + (0.022 \cdot A \times R_{LOOP})$ (*includes a 10% safety factor)
 $R_{LOOP} = R_{SENSE} + R_{WIRING}$
 R_{LOOP} = Loop Resistance (Ohms)
 R_{SENSE} = Sense Resistance (Ohms)
 R_{WIRING} = Wire Resistance (Ohms)

INSTALLATION AND ASSEMBLY

All supply lines should be arranged so that there are no mechanical forces acting on the device.

For units with NPT type pressure fittings apply Teflon® tape or an equivalent sealant to the threads before installing. When tightening, apply a wrench to the hex wrench flats located just above the pressure fitting. DO NOT tighten by using a pipe wrench on the housing.

Process connection:

- By authorized and qualified personnel only.
- All lines need to be depressurized when the instrument is being connected.
- Appropriate steps must be taken to protect the device from pressure surges.
- Check the suitability of the device for the media to be measured.
- Maximum pressures shall be observed.
- Check that all connections are tight before use.

If during installation the pressure measuring lines are already under pressure, the zero point cannot be checked and no settings can be adjusted. In these cases, the device should only be connected electrically first.

Electrical connection:

Reference: Drawing 825A030

Noise

For minimum noise susceptibility, avoid running the transducers cable in a conduit that contains high current AC power cables. Where possible avoid running the cable near inductive equipment.

Shielded Cable

Units with shielded cable electrical termination, connect the drain wire to the guard terminal on the read out device or measuring instrument, if available. In all other cases connect to the ground or to the power supply negative terminal.

| Range Type | Offset Value | Span Value |
|----------------------------------|---------------|---------------------|
| 0 to Positive Pressure Range | 0 | Full Range |
| 0 to Vacuum | Vacuum | 0 |
| Compound (Vac to pressure range) | Vacuum | Full Range |
| Absolute | Absolute Zero | Full Range Absolute |

Offset and Span adjustments

1. **WARNING!** Disconnect the E2S transducer from the control system prior to performing offset and span adjustments.
2. Activate calibration mode by first cycling power off and on, and then within 30 seconds tap the Ashcroft calibration magnet near the specified area on the E2S label. The initial code to enter the calibration mode is 1-3-1 (Tap the unit for one second, release. Tap unit for three seconds, release, tap unit for one second, release).

- When the calibration mode has been activated the output signal on the transducer will drive from over range to under range.
- At the offset pressure record output offset to be used in the span adjustment in step 4. Increase pressure to 100% of span, this will allow you to adjust the span of the unit. The span is adjustable to +/- 5% of full scale.
- Tap the magnet near specified area on the E2S label. Adjust span to desired span value plus the offset value recorded in step 3. (The span will increase from its current value up to +5% of scale. Once the output has reached the max value, the span will jump to -5% and continue to increase. (Note - holding the magnet in position while adjusting the span will increase the speed at which the span increases or decreases. Once you get close to your desired setting you should tap the magnet against the unit for finer adjustment. If you scroll past your desired value, repeat step three until you have reached your desired span value.
- Decrease the pressure to 0% of span, this will allow you to adjust the zero of the unit. The offset is adjustable to +/- 5% of full scale.
- Tap magnet near specified area on the E2S label. Adjust the offset to the desired value. (The offset will increase from its current value up to +5% of scale. Once the offset output has reached the max value, the zero will jump to -5% and continue to increase. (Note - holding the magnet in position while adjusting the offset will increase the speed at which the offset increases or decreases. Once you get close to your desired setting you should release the magnet and tap it against the unit for finer adjustment. If you scroll past your desired value, repeat step 6 until you have reached your desired offset value.
- Once you have completed step 6, you can repeat step 3 through 6 to adjust or check your calibration
- Once you have verified the calibration, the unit will exit the calibration mode after 30 seconds of magnetic inactivity. This will be signaled by the output of the transducer driving to over range, under range and back to the normally calibrated output.

MAINTENANCE

The device does not require maintenance. In order to ensure reliable operation and a long service life of the device we recommend regular checking of the device as follows:

- Check the function in connection with system components.

- Check the tightness of the pressure connection lines.
 - Check the electrical connections.
- The exact test cycles have to be adapted to the operating and environmental conditions. The operating manuals of all other devices are also to be observed if there is an interaction of different device components. Note: When not installed, ensure that the non-metallic parts avoid exposure to UV sources

TRANSPORT

The product must be protected against severe impacts therefore transport is to be effected only in the packaging intended for transport.

SERVICE

E2S transducers are not for repair. All defective or faulty devices are to be sent directly to Ashcroft Inc. We would ask you to coordinate all device returns with our inside sales department. Our inside sales department will issue an RMA number and give instructions on how to ship the return.

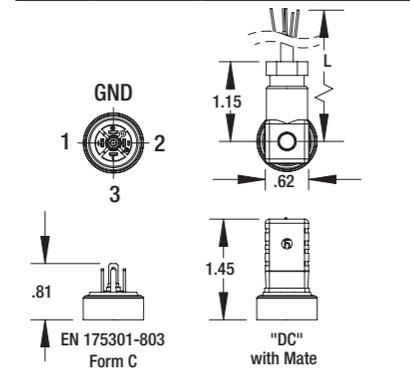
WARNING

Remaining process media in and on dismantled measuring instruments may cause danger to persons, environment and equipment. Take reasonable precautions! Clean the instrument thoroughly if necessary. To return the unit please choose the original packaging or a packaging intended for transport.

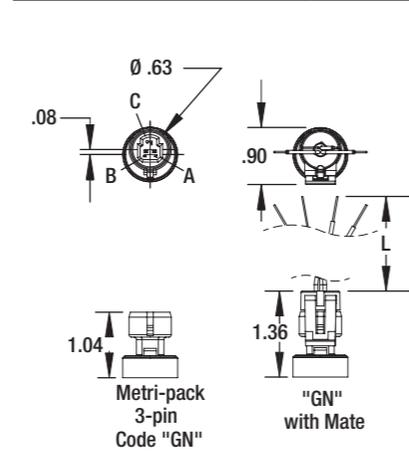
DISPOSAL

Incorrect disposal can put the environment at risk. Kindly help us protecting the environment and dispose of or recycle the used products in accordance with the relevant regulations.

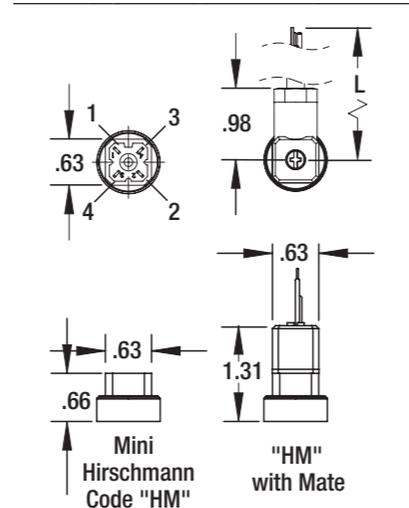
| DC | Hirshman EN 175301-803 Form C | | | |
|-----|-------------------------------|---------------|------------|--|
| Pin | Voltage Output | 4-20mA Output | Wire Color | |
| 1 | V+ | V+ | Red | |
| 2 | Common | V- | Black | |
| 3 | Output | N/A | White | |
| GND | Case GND | Case GND | Green | |



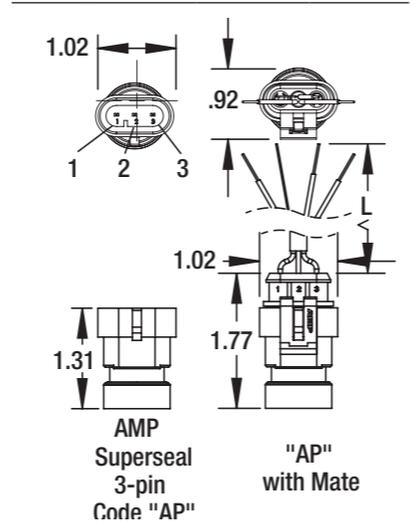
| GN | 3-Pin Metri Pack | | | |
|-----|------------------|---------------|------------|--|
| Pin | Voltage Output | 4-20mA Output | Wire Color | |
| A | Common | V- | Black | |
| B | V+ | V+ | Red | |
| C | Output | V- | White | |



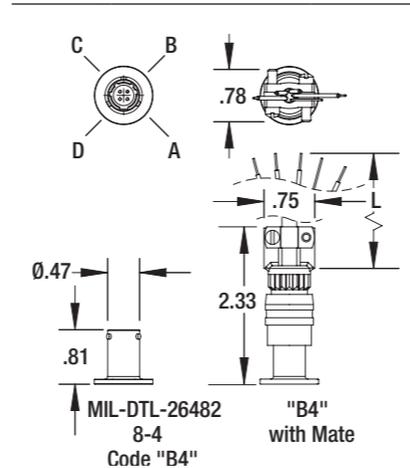
| HM | Mini-Hirschmann GW41F | | | |
|-----|-----------------------|---------------|------------|--|
| Pin | Voltage Output | 4-20mA Output | Wire Color | |
| 1 | V+ | V+ | Red | |
| 2 | Common | V- | Black | |
| 3 | Output | V- | White | |
| 4 | Case GND | Case GND | Green | |



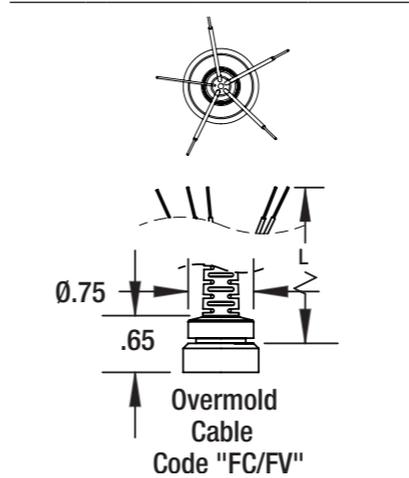
| AP | AMP Superseal 3-Pin | | | |
|-----|---------------------|---------------|------------|--|
| Pin | Voltage Output | 4-20mA Output | Wire Color | |
| 1 | Common | V- | Black | |
| 2 | Output | V- | White | |
| 3 | V+ | V+ | Red | |



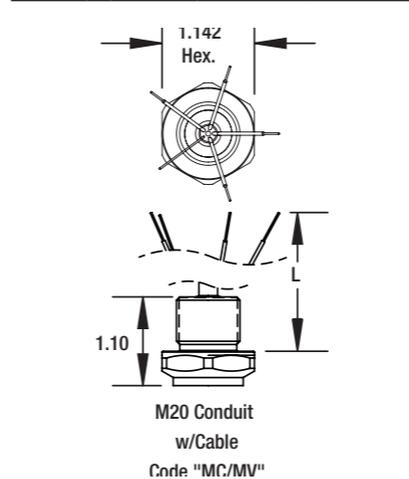
| B4 | MIL DTL 26482 4-Pin | | | |
|-----|---------------------|---------------|------------|--|
| Pin | Voltage Output | 4-20mA Output | Wire Color | |
| A | V+ | V+ | Red | |
| B | Output | N/A | White | |
| C | Case GND | Case GND | Green | |
| D | Common | V- | Black | |



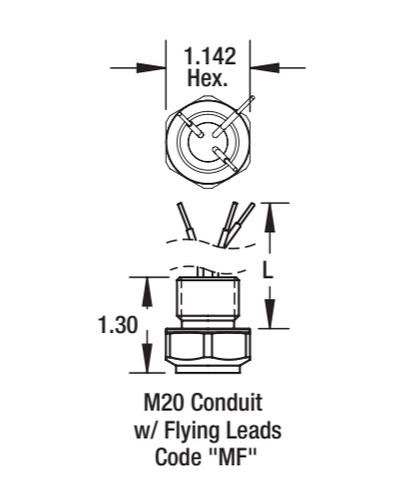
| FC, FV | Over-mold Cable | | | |
|--------|-----------------|---------------|------------|--|
| Pin | Voltage Output | 4-20mA Output | Wire Color | |
| - | V+ | V+ | Red | |
| - | Common | V- | Black | |
| - | Output | N/A | White | |
| - | Case GND | Case GND | Green | |



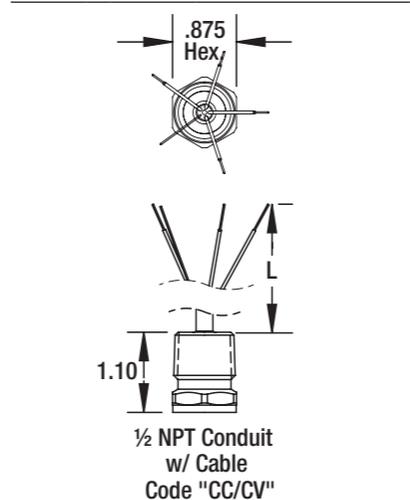
| MC, MV | M20 Conduit With Cable | | | |
|--------|------------------------|---------------|------------|--|
| Pin | Voltage Output | 4-20mA Output | Wire Color | |
| - | V+ | V+ | Red | |
| - | V- | V- | Black | |
| - | Output | Output | White | |
| - | Case GND | Case GND | Green | |
| - | N/C | N/C | Drain | |



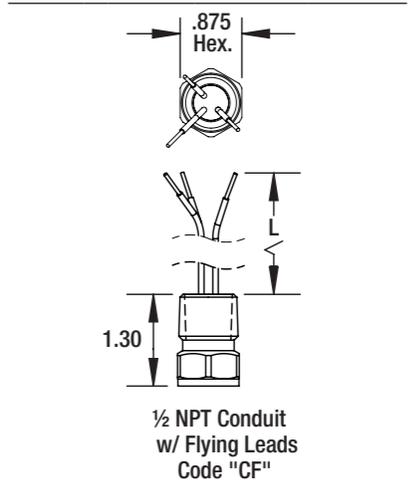
| MF | M20 Conduit Flying Leads | | | |
|-----|--------------------------|---------------|------------|--|
| Pin | Voltage Output | 4-20mA Output | Wire Color | |
| - | V+ | V+ | Red | |
| - | Common | V- | Black | |
| - | Output | N/A | White | |
| - | Case GND | Case GND | Green | |



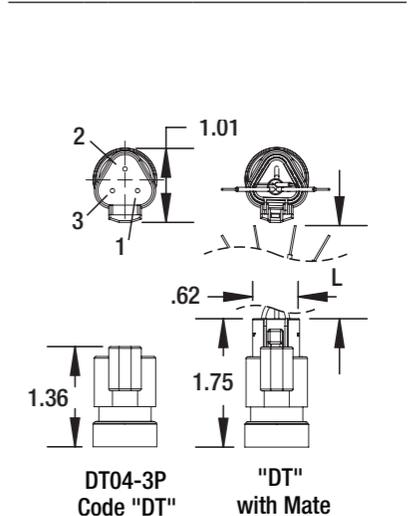
| CC, CV | 1/2" NPT Conduit With Cable | | | |
|--------|-----------------------------|---------------|------------|--|
| Pin | Voltage Output | 4-20mA Output | Wire Color | |
| - | V+ | V+ | Red | |
| - | V- | V- | Black | |
| - | Case GND | Case GND | Green | |
| - | N/C | N/C | Drain | |



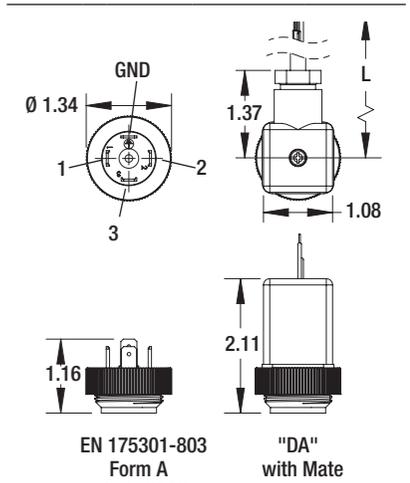
| CF | 1/2" NPT Conduit With Flying Leads | | | |
|-----|------------------------------------|---------------|------------|--|
| Pin | Voltage Output | 4-20mA Output | Wire Color | |
| - | V+ | V+ | Red | |
| - | Common | V- | Black | |
| - | Case GND | Case GND | Green | |
| - | Ouput | N/A | White | |



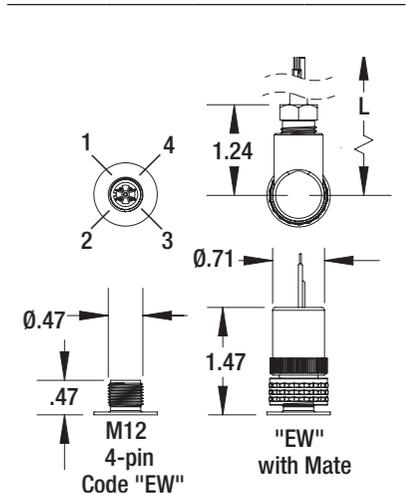
| DT | Deutsch DT04-3P | | | |
|-----|-----------------|---------------|------------|--|
| Pin | Voltage Output | 4-20mA Output | Wire Color | |
| 1 | V+ | V+ | Red | |
| 2 | Output | V- | White | |
| 3 | Common | V- | Black | |



| DA | Hirschmann EN 175301-803 Form A | | | |
|-----|---------------------------------|---------------|------------|--|
| Pin | Voltage Output | 4-20mA Output | Wire Color | |
| 1 | V+ | V+ | Red | |
| 2 | Common | V- | Black | |
| GND | Case GND | Case GND | Green | |
| 3 | Output | N/A | White | |



| EW | M12 4-PIN | | | |
|-----|----------------|---------------|------------|--|
| Pin | Voltage Output | 4-20mA Output | Wire Color | |
| 1 | V+ | V+ | Red | |
| 2 | Output | N/A | White | |
| 3 | Case GND | Case GND | Green | |
| 4 | Common | V- | Black | |



WARNING: Special Conditions of Use. See Installation Drawing 825A030 Rev. B

E2S PRESSURE TRANSDUCER

Ashcroft Drawing 825A030 Rev B

General Notes

- Control equipment connected to Associated Apparatus must not use or generate more than 250 Vrms or Vdc.
- Associated apparatus manufacturer's installation drawing must be followed when installing this equipment.
- Run shielded interconnection cable with shield connected to FM approved associated apparatus ground.

Warnings

- Do not disconnect equipment unless area is known to be non-hazardous.
- Substitution of components may impair suitability for hazardous (classified) locations.
- No revision to drawing without prior approval from FM

Special Conditions of Use

- The pressure transducer does not withstand a 500Vrms dielectric strength test between the circuit and the earth ground. This must be taken into account during installation.
- Some of the pressure transducers may include connectors that are constructed of plastic. To prevent the risk of electrostatic sparking, the plastic surfaces should only be cleaned with a damp cloth. The risk of electrostatic discharge shall be minimized at installation, following the direction given in the instruction manual.

E2S INTRINSICALLY SAFE INSTALLATION

Class I, Division 1, Group A, B, C, D T4 -40°C < Ta < 80°C
 Class I, Zone 0, AEx ia IIC T4 Ga -40°C < Ta < 80°C
 Class I, Zone 2, AEx ic IIC T4 Gc -40°C < Ta < 80°C
 II 1 G Ex ia IIC T4 Ga -40°C < Ta < 80°C
 II 3 G Ex ic IIC T4 Gc -40°C < Ta < 80°C

Entity Parameters:

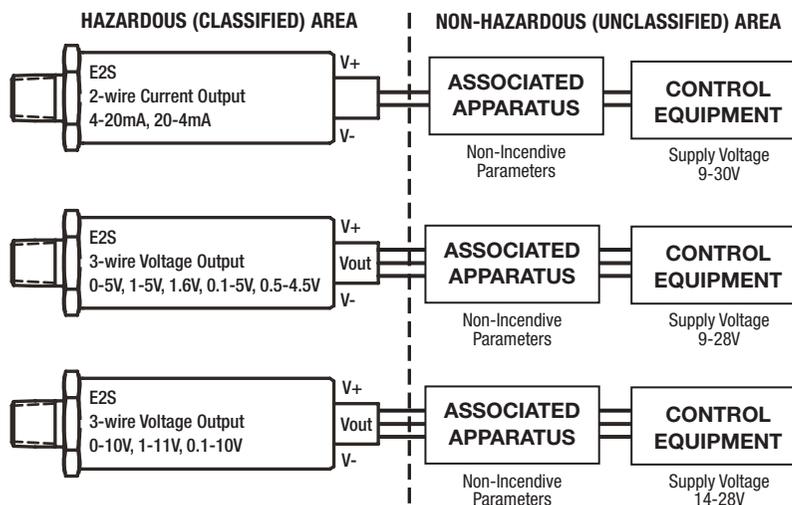
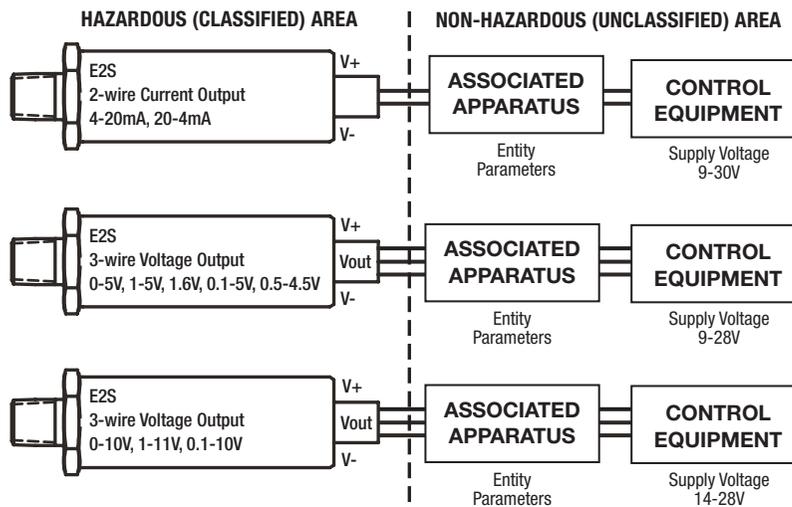
- $U_i < 30Vdc$, $I_i < 100mA$, $P_i < 0.7W$, $L_i = L_i = 32.8\mu H$, $C_i = 36.2nF$ [if $e = 24, 42, Cx$ for 2-wire Current Output]
 $U_i < 28Vdc$, $I_i < 85mA$, $P_i < 0.7W$, $L_i = 36\mu H$, $C_i = 72.9nF$ [if $e = 05, 10, 11, 12, 13, 15, 16, 45, Vx$ for 3-wire Voltage Output]
- The Intrinsic Safety Entity concept allows the interconnection of two intrinsically safe devices with entity parameters not specifically examined in combination as a system when: U_o or $V_{oc} \leq V_{max}$, I_o or $I_{sc} \leq I_{max}$, C_a or $C_o \geq C_i + C_{cable}$, L_a or $L_o \geq L_i + L_{cable}$, $P_o \leq P_i$.
 - The Associated Apparatus must be FM Approved under Intrinsic Safety Entity concept.
 - Installation should be in accordance with ANSI/ISA RP12.6 "Installation of Intrinsically Safe systems for Hazardous (Classified) locations" and the National Electrical Code (ANSI/NFPA80) Section 504 and 505 or in accordance with European Standard EN60079-14 and applicable National regulations.

E2S NON-INCENDIVE INSTALLATION

Class I, Division 2, Group A, B, C, D T4 -40°C < Ta < 80°C

Non-Incendive Parameters:

- $U_i < 30Vdc$, $I_i < 100mA$, $P_i < 0.7W$, $L_i = 32.8\mu H$, $C_i = 36.2nF$ [if $e = 24, 42, Cx$ for 2-wire Current Output]
 $U_i < 28Vdc$, $I_i < 85mA$, $P_i < 0.7W$, $L_i = 36\mu H$, $C_i = 72.9nF$ [if $e = 05, 10, 11, 12, 13, 15, 16, 45, Vx$ for 3-wire Voltage Output]
- The Non-Incendive Field Wiring concept allows the interconnection of two devices with non-incendive parameters not specifically examined in combination as a system when: U_o or $V_{oc} \leq V_{max}$, I_o or $I_{sc} \leq I_{max}$, C_a or $C_o \geq C_i + C_{cable}$, L_a or $L_o \geq L_i + L_{cable}$, $P_o \leq P_i$.
 - The Associated Apparatus must be FM Approved under Intrinsic Safety Entity or Non-Incendive Field Wiring concept
 - Installation should be in accordance with the National Electrical Code (ANSI/NFPA80) Section 504 and 505 or in accordance with European Standard EN60079-14 and applicable National regulations.



FM:
 Intrinsically Safe Installation:
 Class 1, Division 1, Group A, B, C, D
 T4 (-40°C < Ta < 80°C)

Non-Incendive Installation:
 Class I, Division 2, Group A, B, C, D
 T4 (-40°C < Ta < 80°C)



ATEX/IEC:
 Intrinsically Safe Installations:
 Class I, Zone 0, AEx ia IIC T4 Ga -40°C < Ta < 80°C
 Class I, Zone 2, AEx ic IIC T4 Ga -40°C < Ta < 80°C

II 1 G Ex ia IIC T4 Ga -40°C < Ta < 80°C
 II 3 G Ex ic IIC T4 Gc -40°C < Ta < 80°C