

Electrical Installation and Operating Instructions - Model 240 Transmitter



1. Safety

1.1 Specific Conditions of Use

- A. The maximum gap permitted between the body and cover is less than the maximum permitted in the standard. Therefore it is the responsibility of the user of this equipment to ensure the maximum gap between the body and the cover is not greater than 0.038mm (0.0015”).
- B. The Cover fasteners are of a non-standard production. For replacement purposes these fasteners shall be obtained from Mid-West Instrument only.
- C. The optional dial gauge may present a potential electrostatic charging hazard. Clean only with a damp cloth.
- D. All potential electrostatic hazards shall be addressed in accordance with the guidance document IEC/TS 60079-32-1



WARNING: *This product should be installed by personnel trained in installation of equipment in Hazardous Locations and meet the representative country's National Electrical Code.*

WARNING: Prior to installation the purchaser should make the manufacturer aware of any External effects or Aggressive substances that the equipment may be exposed to.

WARNING: Verify media compatibility of selected wetted materials of construction (body and elastomer). Chemical reaction / corrosion can cause premature failure of the pressure containing parts. Prior to placement into service the purchaser should make the manufacturer aware of any external effects or aggressive substances that the equipment may be exposed to.

WARNING: *Electrostatic Hazard: The Lens and Plastic Bezel and Dial Chamber may present a potential electrostatic charging hazard. Clean only with a damp cloth. Do not use solvents*

WARNING: *Failure to connect to the protective conductor terminal may result in a shock hazard.*

WARNING: *To meet Hazardous Location's Requirements, torque the cover bolts to the specified values on the Ratings plate.*

WARNING: *The maximum gap permitted between the body and cover is less than the maximum permitted in the standard. Therefore it is the responsibility of the user of this equipment to ensure the maximum gap between the body and the cover is not greater than 0.038mm (0.0015”).*

WARNING: *Do not scratch, nick, or dent mating surfaces of the gauge body and the cover during maintenance. The integrity of the flame-proof enclosure is dependent upon this metal to metal seal.*



CAUTION: *If cover bolts are lost or damaged, they SHALL be purchased from Mid-West Instrument for replacement. The bolts are non-standard and have been designed specifically for the referenced Hazardous Locations in this document.*

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CAUTION: *Clean Metal joint area with non-abrasive cloth after any maintenance activity that requires the cover to be removed. A small amount of non-hardening grease may be applied in the joint area.*

CAUTION: *In dust environments some minor surface layering may occur. Routine cleaning shall be performed for removal of the dust layer.*

CAUTION: *This product utilizes a magnet as part of the sensing element. Magnet particles in the process can cause the piston to stick or become wedged in the bore.*

1.2 Intended use

The indicating / non-indicating differential pressure transmitter is used for monitoring differential pressures in industrial applications and/or Hazardous Locations as defined in this document.

The manufacturer shall not be liable for any claims if the product is used in applications contrary to the intended use.

1.3 Personnel

Personnel installing and putting this instrumentation into service shall be suitably trained and qualified in accordance with local codes, practices and regulations.

1.4 Labeling / Marking

The following Electrical Configurations bear this mark and comply with the relevant European Directives identified on the declaration of conformity: Configurations T.



See Figure 2 and Figure 3

Electrical Configurations T is designed for operation in Division Classified Locations, it has not been evaluated by any 3rd party testing laboratory. See Figure 1

2.0 General Specifications

2.1 Non-electrical

2.2 Electrical:

| Parameter | Division Classification Hazardous Locations Limits | ATEX / IECEx Hazardous Locations Limits |
|------------------------------------|---|--|
| Working Pressure(PSI) | 1500 | 1500 |
| Proof Pressure(PSI) | 6000 | |
| Temperature | T6 -20° F - 150° F | T6 (-30°C ≤ Ta ≤ 65°C)Gb |
| Differential Pressure Range | 0 - 20" H2O to 0 – 100 PSID | |
| Leakage Hi to Lo | None, Diaphragm Isolated Hi to Lo | |
| Indicator Accuracy ASME B40.100 | 2% | |
| DP Over-Range | +/- Proof pressure | |

Table I -

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| | Min | Typ | Max | |
|------------------------------|--|------------|------------|----------------------------------|
| Transmitter Accuracy (FSR) | | | 2% | Upper 80% of Full Scale Range |
| Supply Voltage (3) (Vdc) | 8 | | 28 | Pin 3 Reverse Polarity Protected |
| Output Current (ma) | | | | |
| Zero Floating (2) | 4.0 – 20.1 ma | 4.0 – 21.0 | 4.0 – 22.0 | Pin 2 |
| Zeroed (1 connected to 2) | | 8 | | |
| Voltage (Pin 2 to 1) | 4.8 | | 6.3 | |
| Zero Time (seconds) | 2 | | | |
| Max Loop Resistance (ohms) | | | 1000 | |
| Max Loop Resistance Formula | ((Vs – 8) / 20) * 1000) | | | |
| INTERFACE: | | | | |
| Electrical: | | | | |
| Connections: | 4 Position Terminal Strip; ½" NPT Conduit 1= Rtn, 2= Zero, 3 = 8-28 Vdc In 4= Chassis | | | 22 Awg – 12Awg Wire |
| Environmental Rating: | Explosion-proof Enclosure rated Class I, Div I, Groups B,C,D; Class II, Div I, Groups E, F, & G ** | | | ** No Third Party Certifications |
| Certifications: | Ex db h IIB + H ₂ T6 (-30°C ≤ Ta ≤ 65°C)Gb Ex tb h IIIC* IP65 T85°C (-30°C ≤ Ta ≤ 65°C)Gd* ATEX, IECEx, and KOSHA | | | * IIIC Excluded For KOSHA |

Table II

3.0 Product Description:

A flexible elastomer diaphragm and calibrated range spring are moved by differential pressure. A magnet, coupled with the diaphragm, transmit this motion through the wall of the pressure housing to a follower magnet attached to an indicating pointer. The rotation of the follower magnet causes the pointer to track the movement of the internal magnet and indicate the differential pressure on the dial scale. The pressure transmitter is a 2 wire loop powered microprocessor based 4-20 ma transmitter. The magnetic angle sensor & electronics senses the angle (relative to the transmitter sensor) of the magnet which moves linearly in the bore. Each transmitter is individually calibrated to the gauge using an 11 point calibration linearization technique. This method results in a <2% accuracy for the upper 80% of the range.

4.0 **INSTALLATION:**

4.1 **INSPECTION:**

Upon receipt of your order, please review the ratings plate to verify that the model number and the electrical ratings match the product that you ordered. Electrical configuration option T units are CE marked in accordance with the ATEX directive and Kosha marked.

Please read the Cautions listed on the Rating Plate as they are different for each Electrical Configuration. The markings and warnings identified on each plate are applicable only to their respective Hazardous Locations classification. Ie; if the assembly is installed in an ATEX classified location, then the ATEX ratings plate shall govern.

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INSPECTION (CONT.)

Mid-West Instrument
Sterling Heights, MI USA

Δ P TRANSMITTER - IND. CONT. EQ.
FOR USE IN HAZARDOUS LOCATIONS
CLASS-I, DIVISION 1 GROUPS B, C & D,
CLASS II, DIVISION 1, GROUPS E, F, & G

MODEL NO.

CAUTION: TO PREVENT THE IGNITION OF HAZARDOUS ATMOSPHERES, DISCONNECT DEVICE FROM SUPPLY CIRCUIT BEFORE OPENING. KEEP UNIT TIGHT WHILE CIRCUITS ARE ALIVE. COVER JOINTS MUST BE CLEANED BEFORE REPLACING COVER. TIGHTEN COVER BOLTS TO 60 IN.-LBS MIN, 75 IN.-LBS MAX.

MISE EN GARDE: POUR EMPÊCHER L'INFLAMMATION DES ENVIRONNEMENTS DANGEREUX, DÉBRANCHER L'APPAREIL DU CIRCUIT D'ALIMENTATION ÉLECTRIQUE AVANT DE L'OUVRIR. GARDER L'APPAREIL BIEN FERMÉ LORSQUE LES CIRCUITS SONT SOUS TENSION. NETTOYER LES JOINTS DE COUVERCLE AVANT DE LES REPLACER. SERRER LES BOULONS DU COUVERCLE ENTRE ENVIRON 6.8 N.M. AU MIN. ET ENVIRON 8.5 N.M AU MAX.

PRESSURE ΔP MAX. WORKING

INPUT: ELECTRICAL RATINGS:

OUTPUT:

Figure 1

Mid-West Instrument
Sterling Heights, MI 48314 USA

SHOP ORDER - YEAR

CE ΔP II 2GD IP65

Baseefa04ATEX0366X IECEx BAS 11.0114X

Ex db h IIB+H2
Ex tb h IIIC IP6X

1/2" NPT ENTRY ELECTRICAL RATINGS INPUT: OUTPUT:

WARNING: ELECTROSTATIC HAZARD. CLEAN GAUGE WITH A DAMP CLOTH. DO NOT USE SOLVENTS. DO NOT OPEN WHEN ENERGIZED OR WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT. MAXIMUM INTERNAL CABLE ENTRY TEMP. RISE 15° C - CABLING TO BE SUITABLE.

CAUTION: COVER JOINTS MUST BE CLEANED BEFORE REPLACING COVER. TIGHTEN COVER BOLTS TO 60 IN.-LBS MIN 75 IN.-LBS MAX.

See 4.2.3 below for markings

See Product Bulletin for transmitter ratings

Figure 2

KOSHA

Exd IIB + H2 IP65
T4...T6 - See Documentation

15-AV4BO-0456
15.08.20

Figure 3

4.2 Hazardous Locations

4.2.1 Division 1 Locations: The Transmitter is intended for use in Class 1, Division 1, Group B, C, & D; Class 2 Division 1, Groups E, F, & G Hazardous Locations. The design while not 3rd Party certified uses the same explosion proof enclosure as our certified switch units.

This configuration has T6 Temperature classification for ambient temperatures of 20°F - 150° F.

4.2.2 ATEX Locations: The Transmitter is ATEX and IECEx Certified for Gas & Dust Atmospheres as: (Group II Category 2 Gas & Dust Atmospheres)

Ex db h IIB + H2 T6 (-30°C ≤ Ta ≤ 65°C)Gb
Ex tb h IIIC* IP65 T85°C (-30°C ≤ Ta ≤ 65°C)Gd *

ΔP II 2GD IP65



* Excluded from Kosha Approval. Ex tb h IIIC ratings are not applicable in Korea.

The transmitter assembly as a component has passed numerous European EMC standards (ie; Compliance to IEC EN61326). Contact the factory if additional low pass filtering is necessary.

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4.3 Installation Tools

8mm deep metric socket.
Torque wrench
Adjustable or 1.125" wrench (process connections)

WARNING: *Verify media compatibility with all wetted parts. Range spring is manufactured from 316SS. Media incompatibility with the spring or the body of the gauge can result in an ignition hazard due to corrosion.*

CAUTION: *Do not exceed the maximum rated working pressure stated on the ratings plate.*

CAUTION: *Always use a wrench (1.125") on the switch's process connections to keep them in place while loosening and tightening customer supplied process fittings.*

CAUTION: *Use pressure limiting devices to limit pressure spikes below the proof pressure of the gauge / switch.*

Perform all electrical adjustments with power removed.

4.4 Instrument Location:

On liquid service the instrument should be mounted **below** the process connections to facilitate self-bleeding. On gas service it should be located above the process connections to promote self-draining. If the process contains particulates, a pigtail loop or drop leg (manometer "U-tube" configuration) in the tubing will minimize the possibility of it migrating into the instrument.

4.5 Mechanical Connections:

Connections are either ¼" FNPT or ½" FNPT dependent upon the option selected when the order was placed. There are 2 connections identified on the gauge body as "High" and "Low" for High pressure and Low pressure respectively. Be sure these are plumbed properly in your system. Improper connection will not damage the instrument; however the switch and indicator (if supplied) will not function properly.



Do not allow gauge fittings to rotate when making process connections. Calibration and / or pressure rating of the product may be compromised.

4.6 Temperature Limitations:

Process: For process temperatures higher than the rated temperature of the dp gauge / switch, use process tubing to reduce the temperature. A general "rule of thumb" is that for horizontal tubing runs the temp drop is 100° F/ ft. Another option is to use "cooling towers" to protect the instrument.

Verify the selected elastomer option is appropriate for your operating temperature.

Environment: Locate unit where temperatures will be within the limits of the instrument's hazardous locations ratings.

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4.7 Mounting:

Pipe Mounting: Configuration of the pipe mount option is shown below:

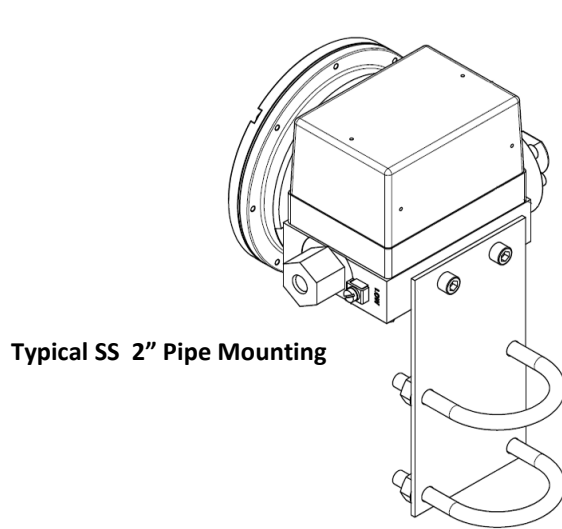


Figure 4

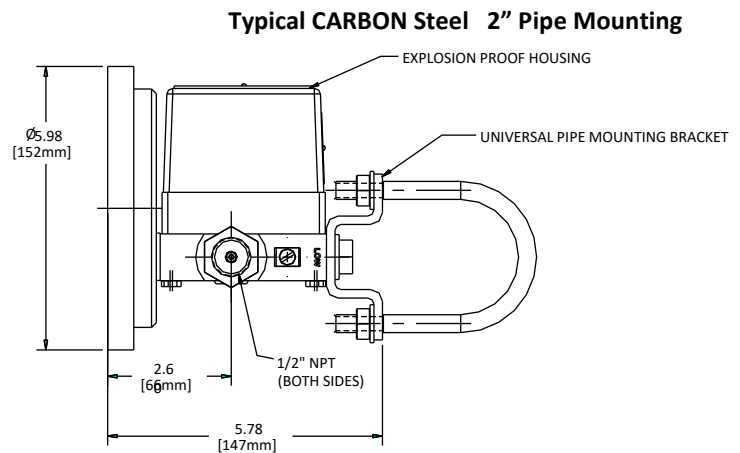


Figure 5

Mounting Holes: The instrument is provided with two(2) 5/16-24 mounting holes on the back of the body. They are spaced 1.75" and are tapped a minimum of 6.2 threads deep. A customer selected bolt must allow for 1 free thread after full engagement with the gauge body. See Figure 8.

4.8 Electrical Connections:



CAUTION: Use cable suitable for the specified temperature class. Maximum internal cable entry temperature rise is 15 °C – Cabling to be suitable.

WARNING: Electrical connection shall be made with a cable entry or stopping box certified for use for the desired hazardous location, certified for condition of use, and correctly installed. The cable entry device and any thread adaptor shall be suitable for the equipment, the cable, and the conditions of use, and shall be certified as equipment (Not an EU component) under the EU Type Examination Certificate to directive 2014/34/EU. (Latter Statement ATEX applicable)

WARNING: When used in an explosive dust atmosphere, the cable entry device and thread adaptor shall maintain the ingress protection of the enclosure.

WARNING: During maintenance do not disconnect from external earth conductor until all power generation systems have been turned off.

WARNING: In Hazardous Locations remove power from the unit before removing the cover.



Warning: Electrical connections should be performed by qualified personnel and meet the representative country's national electrical code.

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- 4.8.1 Cover:** Remove the cover by using an 8mm hex driver to loosen the bolts from the underside of the gauge body. (See previous cautions and warnings). The bolts are captive in the body of the gauge. A deep metric socket is recommended in order to clear interference near the bezel of the gauge. (0.48 diameter min 1" long).

The cover is often shipped with only 4 screws threaded into the body of the gauge to save time for the customer when installing the assembly. When closing the cover all 7 screws need to be tightened to the torque requirements defined on the external tagging and this instruction.

For the non-gasketed assembly, clean both mating metal surfaces prior to re-assembly (see previous cautions and warnings). A small application of suitable, non-hardening grease may be applied to the mating metal surfaces. Replace cover making sure there are no wires pinched between the cover and the gauge body. Re-tighten the screws within the range defined on the Model # Tag.

Caution: *Do not attempt to reposition the transmitter assembly within the enclosure. This voids the warranty and will "knock" the unit out of calibration.*

- 4.8.2 Connections:** Connections to the terminal strip are identified in the following sections. The terminal strip is compatible for wire ranges from 12-22 AWG (3.3 - .32 mm²). Optionally, each connection can be field wired with multiple wires connected to one contact. You may connect two (2) 22 – 16 AWG (0.33 -1.3 mm²) wires into one connection. Recommended screw torque is 6 in.-lbs. (0.113 newton-meter) to tighten the terminal strip screw.

Route field wiring through the provided strain relief clamp. Connect loop power between the connections labeled 8-28 Vdc and RTN. Connect the protective conductor wire to the terminal with the \oplus symbol. Please note that the loop power sensing device can also be located in the ground leg.

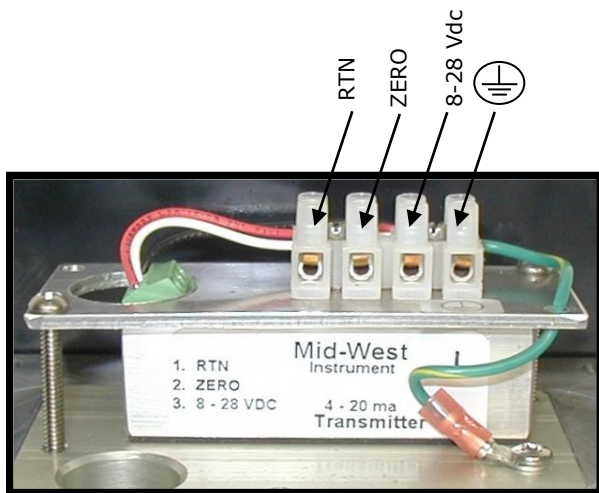
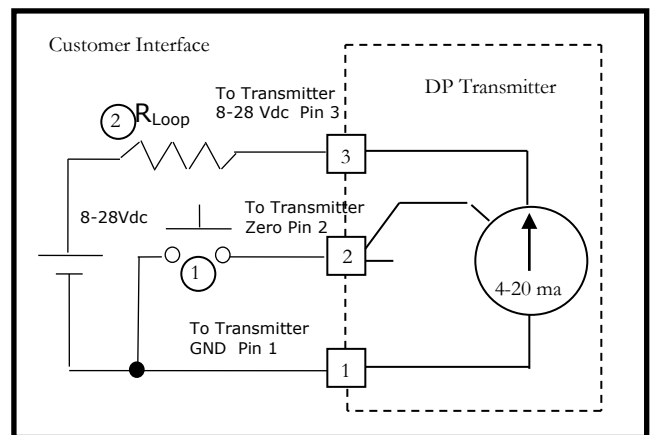


Figure 6



- ① Optional remote zero (customer supplied)
- ② Loop Resistor can be located in the ground leg

Figure 7

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4.8.3 Remote Zero



If necessary, perform remote zero with zero switch located in a non-hazardous location. The re-zero should not be necessary as the transmitter is programmed from the factory to output 4 ma for the first 4% of the Full Scale range.

While probably not necessary, the unit can be re-zeroed by briefly (> 2 seconds) connecting the "Zero" terminal strip connection to "RTN".

While performing the re-zero, perform without pressure applied to the assembly, otherwise the output will have a constant offset equal to the pressure present at the time the zero was performed.

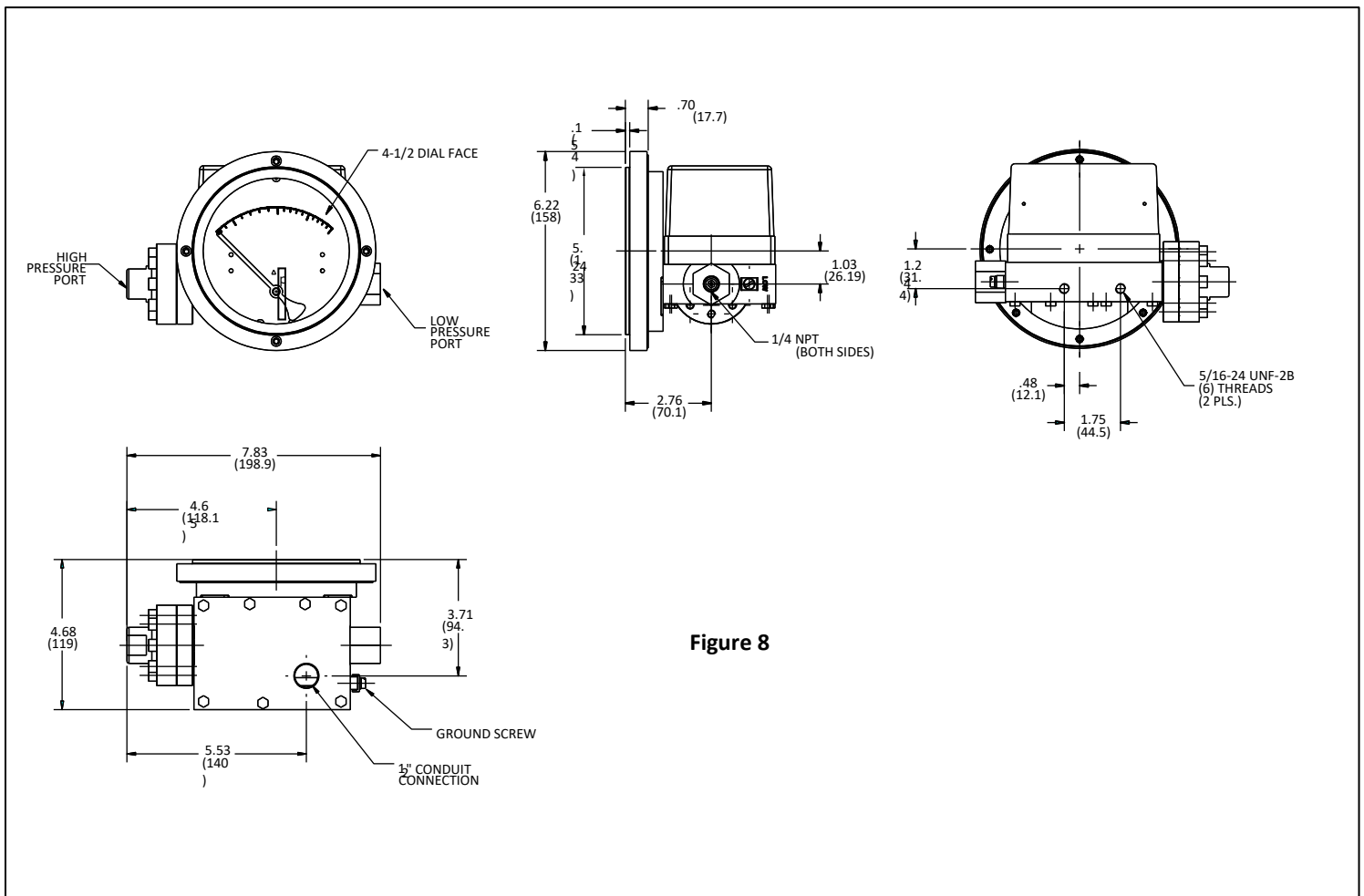
4.8.4 Loop resistance:

The maximum loop resistance is 1000 ohms (@ 28Vdc Input). Use the following formula to determine the maximum loop resistance at other input voltages:

$$((V_s - 8) / 20) * 1000$$

If the loop resistance exceeds the max allowed, the transmitter will no longer meet the accuracy statements particularly when approaching the full scale output (20 ma).

5.0 Dimensions:



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6.0 Troubleshooting

- A. Gauge accuracy and set point problems:
 - i. Verify your process connections are plumbed properly. Check for proper connection to “hi” and “lo” ports.
 - ii. Make certain block valves are open and, if using a 3-valve manifold, that the equalizer (balance) valve is closed.
 - iii. If i and ii check out correctly, loosen or disconnect the high pressure line to determine if there is pressure to the instrument.
 - iv. Verify gauge is not in an electromagnetic / magnetic environment. i.e.; close proximity to high current power lines.
 - v. Verify the pointer has fluid movement as pressure increases. Jumpy movement or no movement may indicate a stuck piston

- B. Transmitter doesn't function
 - i. Make sure you have supplied power (proper voltage) to the unit.
 - ii. Check that you are wiring to the correct Interface terminals.
 - iii. Check the transmitter interfaces to the terminal board for loose connections.
 - iv. Make sure that the loop resistance does not exceed the specified rating.
 - v. All others contact the factory for assistance.

Remaining media may result in a risk to personnel, environment etc. Use sufficient precautionary measures when removing and transporting the product.

7.0 Misc:

CE Marking Statements:

ATEX Directive 2014/34/EU

See Markings and ratings in section 4.2.3

Pressure Equipment Directive :

The Pressure Equipment Directive has been determined to be **non-applicable for CE marking for Group 1 applications below 200 bar or Group 2 applications below 1000 bar**.. These products are manufactured in accordance with article 3, paragraph 3 of the directive, “sound engineering practice”. They fall below category I for non-hazardous gases, hazardous liquids, & non-hazardous liquids. This product also falls below category I for hazardous gases at or below 200 bar.

For Group 1 applications above 200bar, this product has not been evaluated to meet the essential safety requirements of Annex I of the Pressure Equipment Directive. Use of this product in an EU member state shall be limited to less than 200 bar for Group 1 applications.

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ROHS Directive:

The transmitter is CE marked in compliance with the RoHS directive 2011/65/EU .(RoHs2). RoHs3 compliance is still in the evaluation phase.

Warning: *The suitability of the application and installation of this differential pressure transmitter is the responsibility of the end user. The applicable certifications, listings apply to the differential pressure transmitter only.*

STANDARDS: The Model 240 Series differential pressure gauges either conform to and/or are designed to the requirements of the following standards:

| | |
|------------------------------------|---------------------------|
| ASME B1.20.1 | ASME B40.1 |
| NEMA Std. No. 250 | SAE J514 |
| CSA-C22.2 No. 14, 25, and 30 | EN / IEC 60079-0, 60079-1 |
| UL Std. No. 50, 508, 698, and 1203 | EN / IEC 60079-31, |
| ISO 80079-36:2016 | EN50581 |