



E A S T E R N I N S T R U M E N T S

QVT MULTIVARIABLE TRANSMITTER

QVT INSTALLATION & OPERATION MANUAL



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REVISION VERSION 0.5.2

ORIGINAL LANGUAGE

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E A S T E R N I N S T R U M E N T S

SAFETY

SAFE OPERATION

PLEASE READ BEFORE OPERATING YOUR NEW MULTIVARIABLE TRANSMITTER

- For personal/system safety as well as for optimum performance reasons, please read and understand this manual before working with the transmitter.
- Check for damaged parts before operating the transmitter. Any damaged part should be properly repaired or replaced by trained personnel. Do not operate the transmitter if any component does not appear to be functioning correctly. Contact Eastern Instruments for assistance or for repair components.
- Ensure that only trained personnel perform installation of the transmitter.
- Ensure that assembly of the transmitter to a flange or manifold of some kind is done properly as improper assembly could lead to damage of the sensors of the transmitter or could render the transmitter dangerous. **Failure to follow the installation guidelines within this manual could cause serious injury or death.**
- If the transmitter is installed in a high-voltage environment, it is possible that a fault or installation error could cause high voltage to be present on the transmitter leads and terminals. **Electrical shock could cause serious injury or death.**
- Use only replacement components or installation bolts supplied by Eastern Instruments as **non-approved components or installation hardware may render the transmitter dangerous and could lead to serious injury or death.**
- For Technical Assistance, please contact us:

Eastern Instruments
416 Landmark Drive
Wilmington, NC 28412

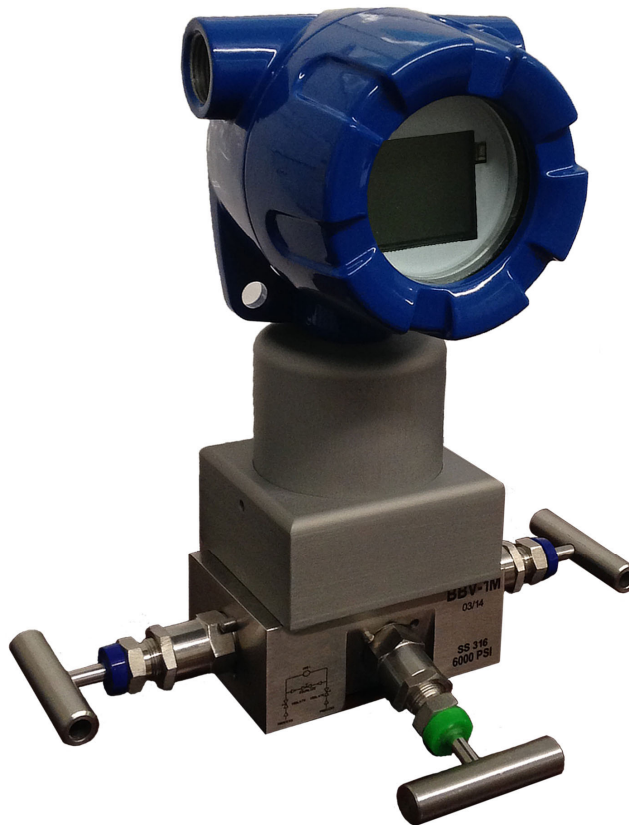


E A S T E R N I N S T R U M E N T S

INTRODUCTION

THE QVT MULTIVARIABLE TRANSMITTER

The QVT™ Multivariable Transmitter from Eastern Instruments is a Smart Transmitter that can be used for the accurate measurement of up to four separate process variables including Differential Pressure, Temperature and Absolute Pressure. When coupled with any DP based flow measurement element, the QVT™ will calculate the fully compensated mass flow of air/gas travelling through any process which is at or near atmospheric pressure (5 - 25 psia). The QVT will accept a Process Temperature signal from an external RTD and will simultaneously measure the Differential Pressure and Absolute Pressure from a coupled flow element. The QVT will be as accurate whether coupled with an Eastern Instruments flow element or whether it is coupled with a flow element from the manufacturer of your choosing. Using these inputs, the QVT will calculate a compensated mass flow rate and will give an output proportional to this compensated mass flow rate via a 4-20 mA signal. Please note that the 4-20 mA signal can be fully compensated (live measurement of DP, AP and Temperature), partially compensated (live measurement of DP only) or the values for the Process Variables (DP, AP or Temperature) can be output via the 4-20 mA signal as well.

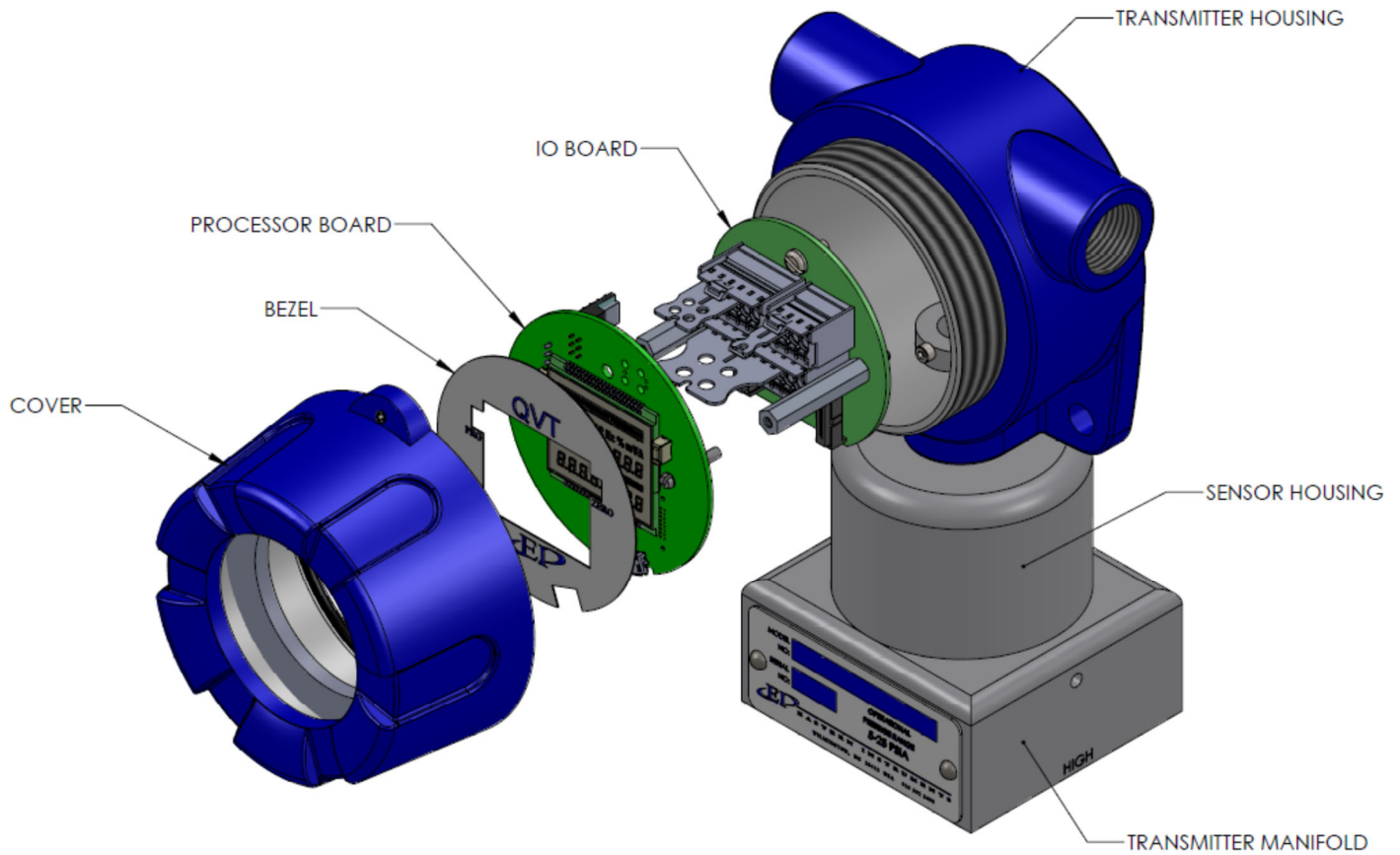




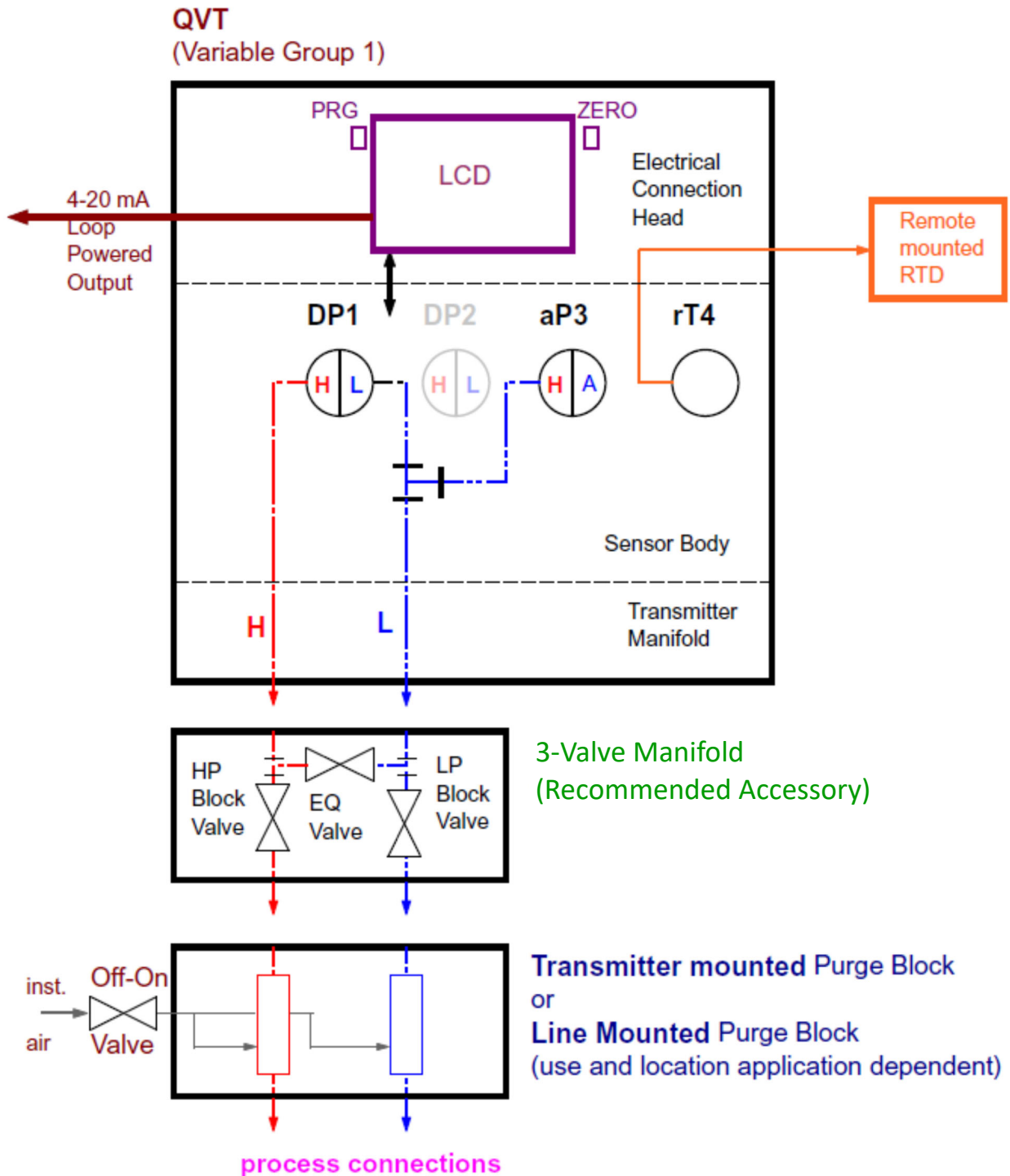
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GETTING TO KNOW THE QVT

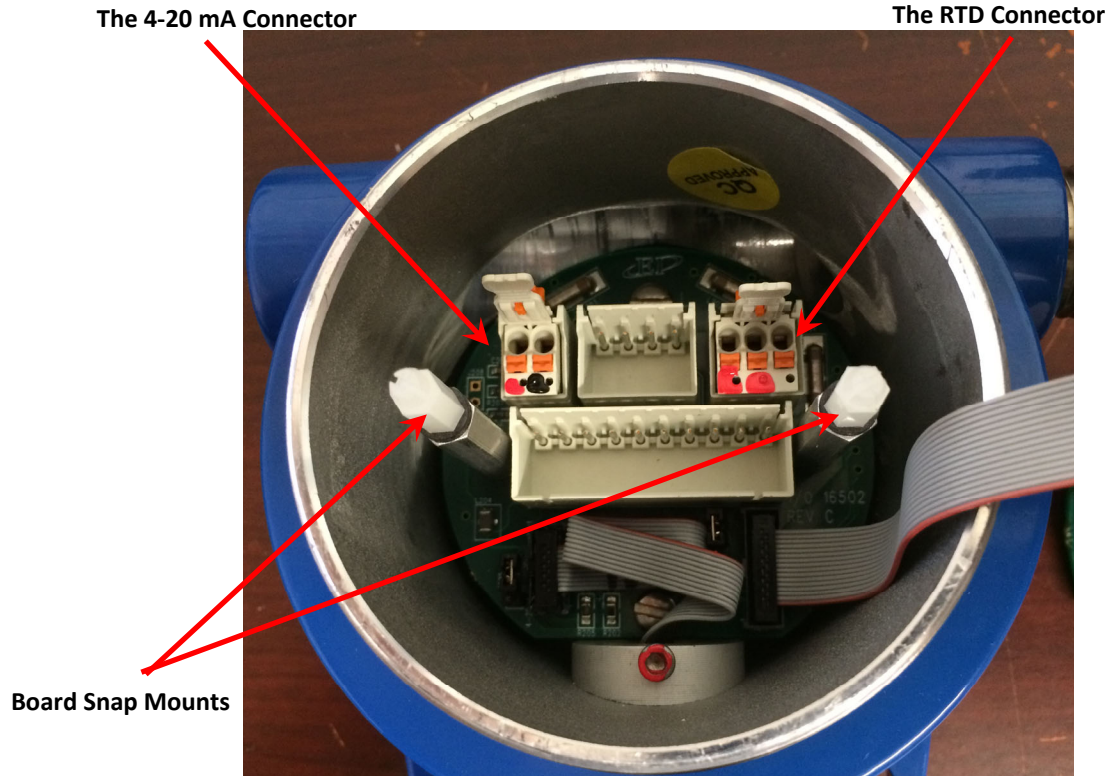
Exploded View of QVT Transmitter



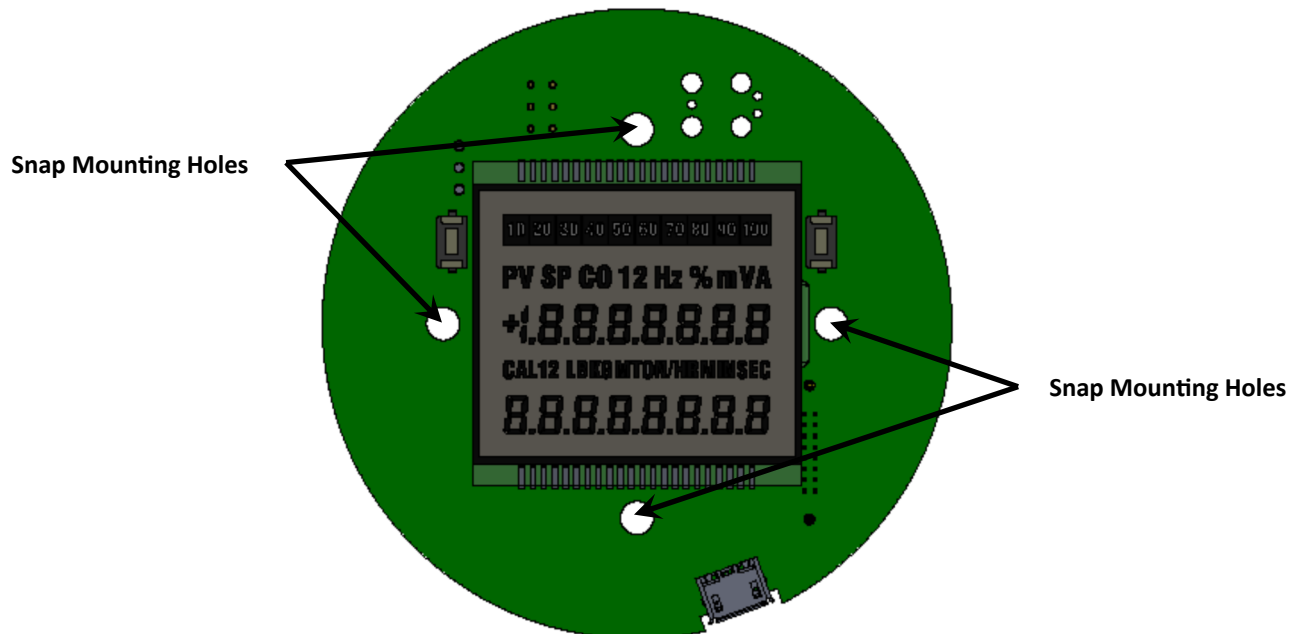
QVT Transmitter Schematic - Shown with optional 3-Valve Manifold and Purge System



Close-up of the IO Board - Wiring Terminals



Close-up of the Processor Board/LCD Board





QUICK START UP GUIDE

VERIFY PROPER MECHANICAL INSTALLATION

- Verify that the QVT is properly mounted (See “Mechanical Installation: Mounting the QVT” section of the QVT I&O Manual for Additional Info)
- Verify that the High and Low Ports of your flow element are properly tubed to the transmitter/manifold/purge system (See “Tubing the QVT” section of the QVT I&O Manual for Additional Info)

VERIFY PROPER WIRING OF THE QVT

- Verify that the proper power has been supplied to the QVT (See “Wiring the QVT: 4 -20 mA Loop Power” section of the QVT I&O Manual for Additional Info)
- If using an RTD to measure the process temperature, verify that the RTD is properly wired (See “Wiring the QVT: RTD Temperature Sensor Input” section of the QVT I&O Manual for Additional Info)

PERFORM ZERO OF THE DP1 DIFFERENTIAL PRESSURE

- (See “Procedures: Zero DP1 Differential Pressure Measurement” section of the QVT I&O Manual for Additional Info)

VERIFY COMMUNICATION (4-20 mA OUTPUT)

- Compare the readings on your PLC/DCS with the values of the output variable shown of the QVT screen. (Example: 0 lb/hr on the QVT would equate to 4 mA of output)



E A S T E R N I N S T R U M E N T S

BOOT SEQUENCE

After powering on the QVT, the transmitter will proceed through a boot sequence followed by an automated scrolling of key values and settings within the QVT.

BOOT SEQUENCE

Upon Boot/Reboot the software version (left) will be displayed, followed by a Pass/Fail screen denoting whether the software has loaded properly (right). Upon a successful Boot (Pass), the Auto Scroll Sequence (below) will begin.



AUTO SCROLL SEQUENCE

Upon a successful Boot Sequence (Above), the Auto Scroll Sequence will begin. Each value will be shown sequentially for 1.5 seconds each. Upon completion, the sequence will start over again automatically.

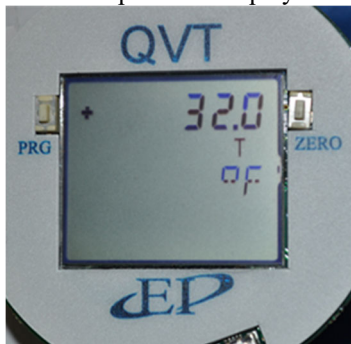
dP Display



AP Display



Temperature Display



Mass Flow Display



4-20 mA Full Scale



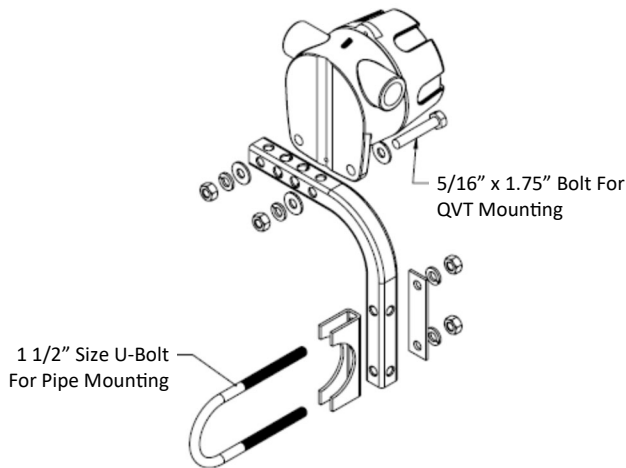
Manual Scrolling of the displays shown in the Auto Scroll Sequence is possible by pressing the "PRG" Button repeatedly until the desired display is shown. The display will be shown for approximately 2 hrs before returning to the Auto Scroll Sequence.

MECHANICAL INSTALLATION

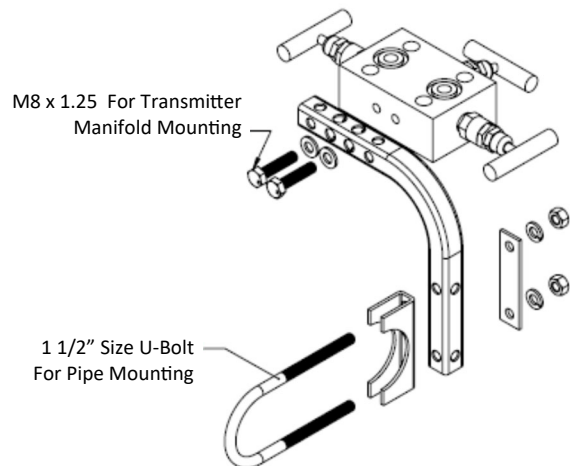
MECHANICAL INSTALLATION: MOUNTING THE QVT

The QVT can either be mounted via an optional mounting bracket which allows the transmitter to be mounted to either a vertical or horizontal 2" pipe, or, if the transmitter is purchased with flow elements from Eastern Instruments, the transmitter will be mounted directly to the flow element (VAP Pitots, DSV Duct Section or HBP High Beta Flow Conditioner). Detailed dimensional drawings are included within this section of the manual. The suggested installation location depends upon the process, but in general, for air and gas flow measurement, the transmitter is suggested to be located above the tap for the air/gas flow measurement so that condensate that may collect in the impulse lines, can drain away from the transmitter.

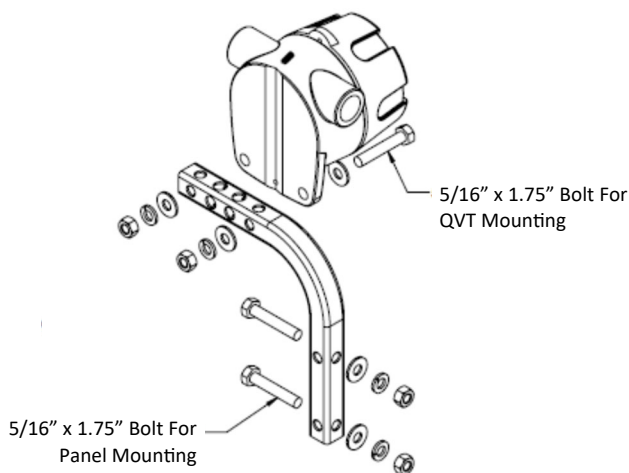
Mount Bracket for QVT: Pipe Mount



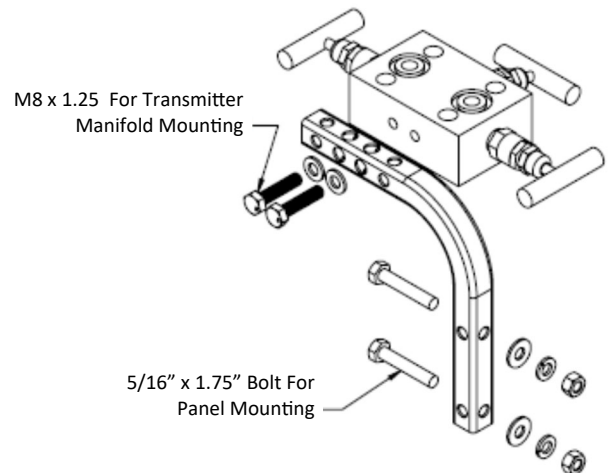
Mount Bracket for QVT w/ Manifold: Pipe Mount



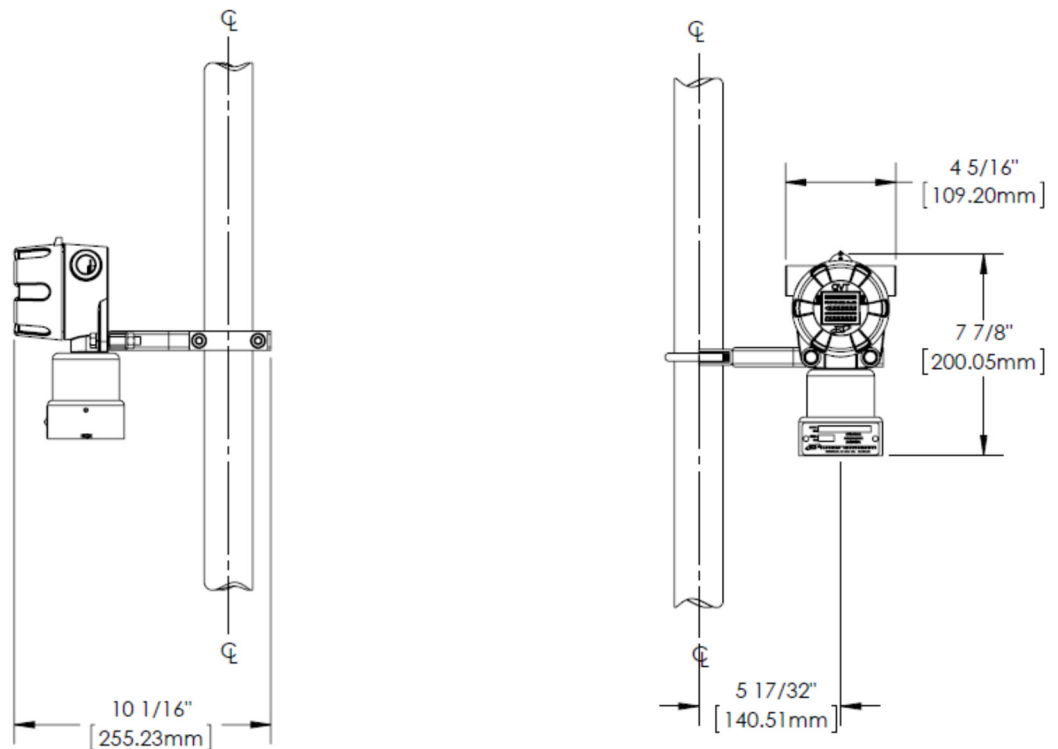
Mount Bracket for QVT: Panel Mount



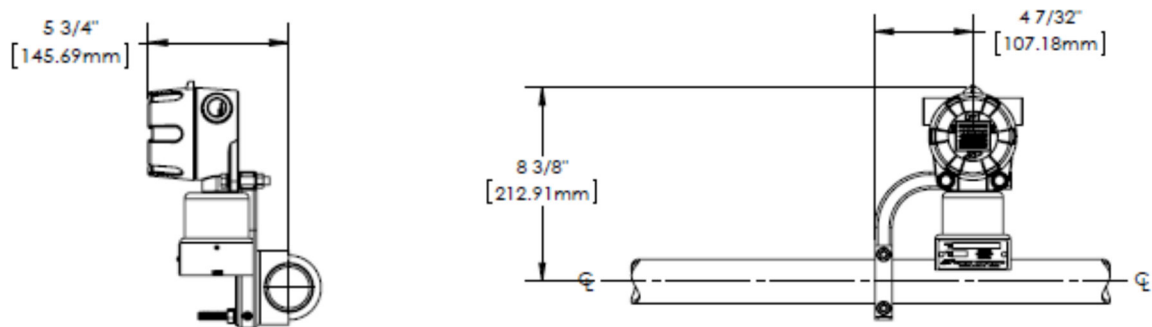
Mount Bracket for QVT w/ Manifold: Panel Mount



Vertical Pipe Mount - Transmitter Only



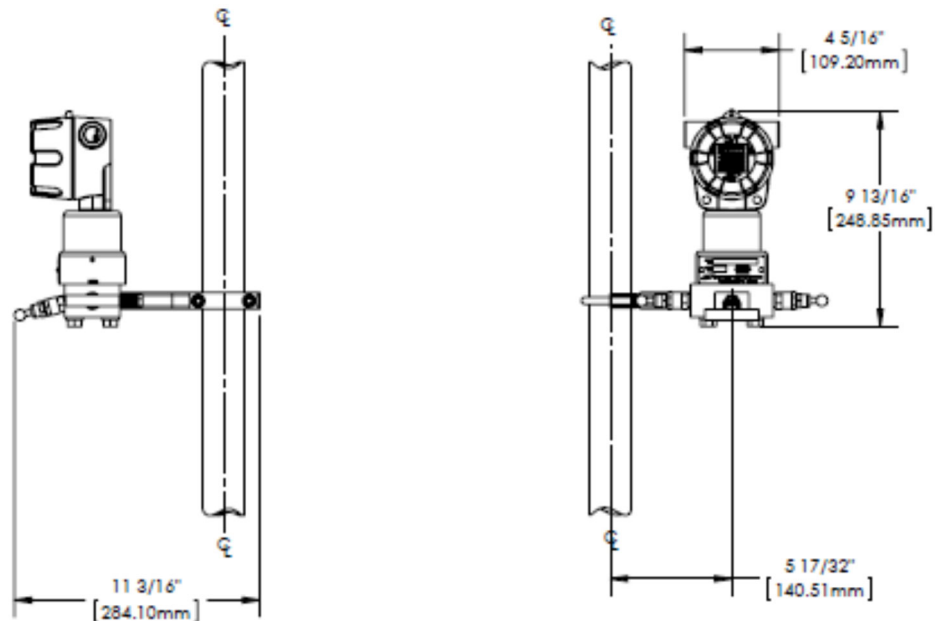
Horizontal Pipe Mount - Transmitter Only



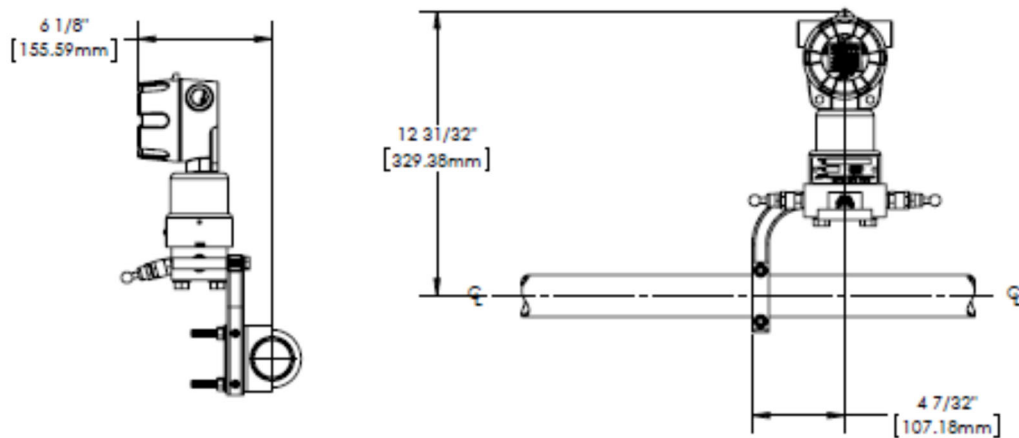


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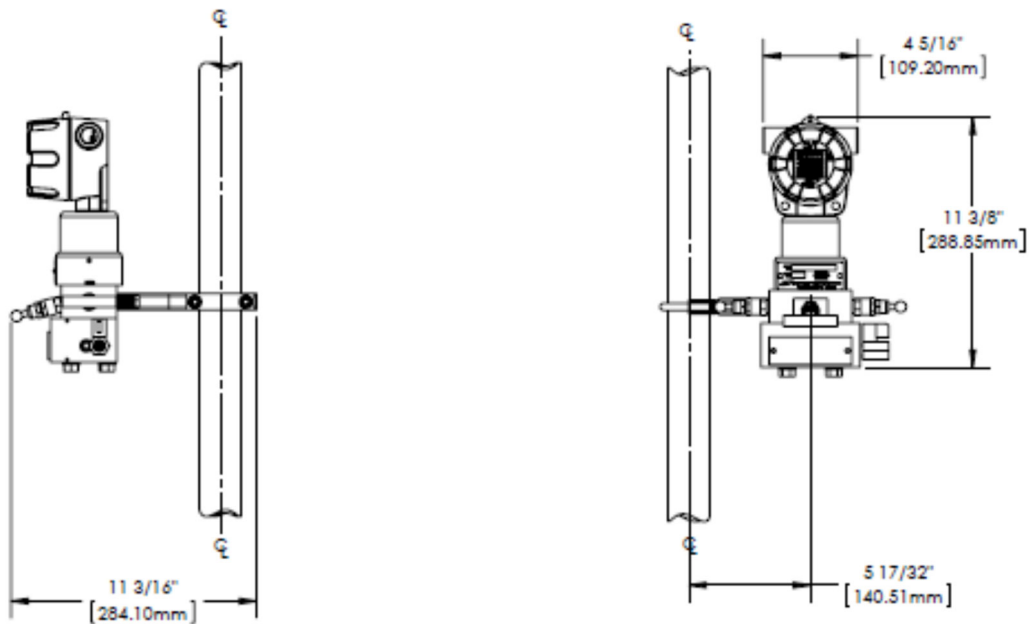
Vertical Pipe Mount - Transmitter and 3-Way Valve Manifold



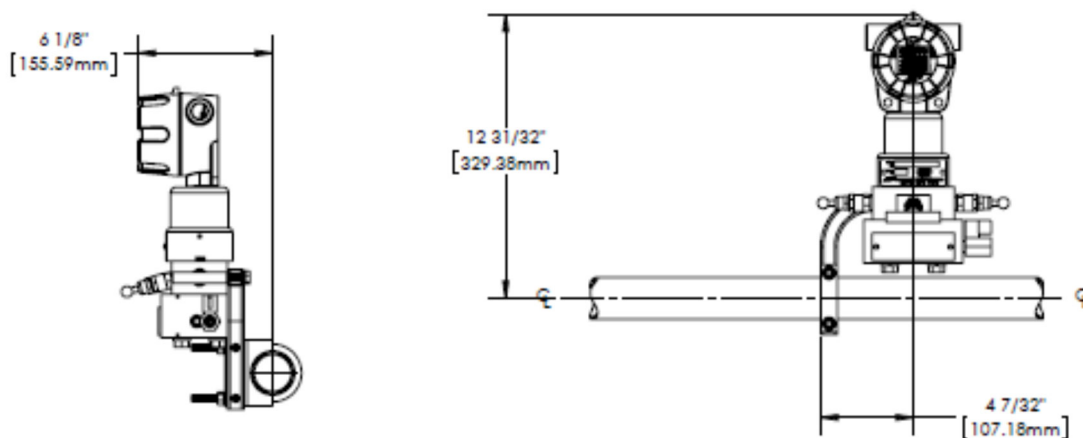
Horizontal Pipe Mount - Transmitter and 3-Way Valve Manifold



Vertical Pipe Mount - Transmitter, 3-Way Valve Manifold and Purge System



Horizontal Pipe Mount - Transmitter, 3-Way Valve Manifold and Purge System



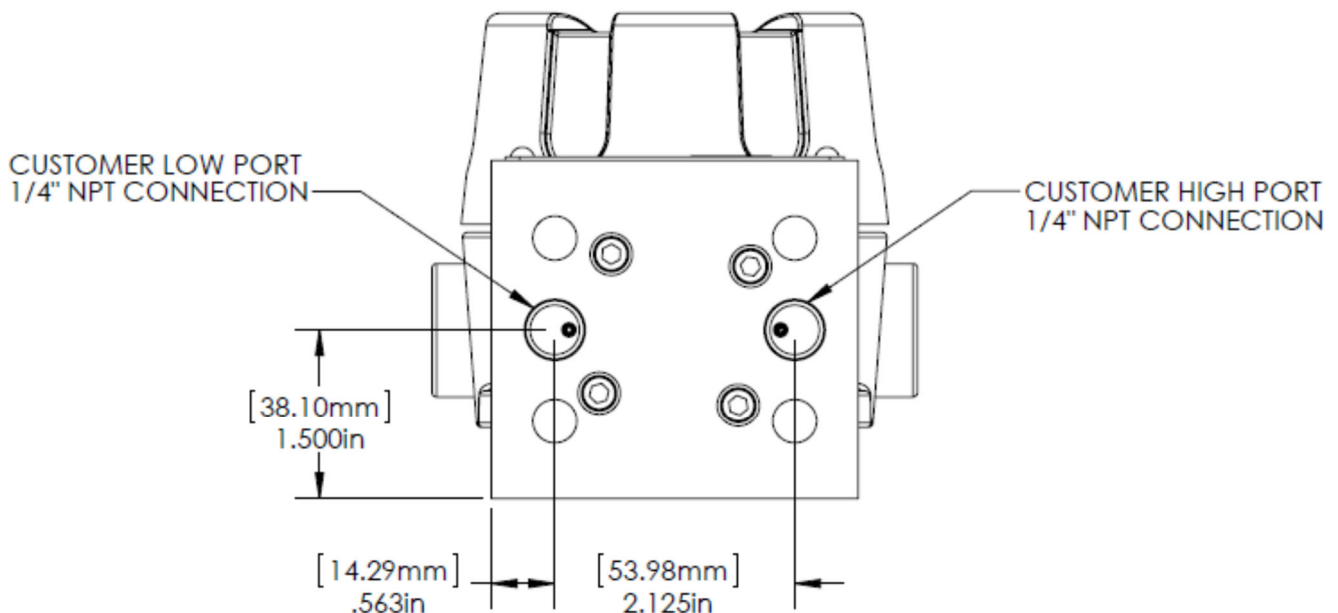
TUBING THE QVT

Process Connections are made to the bottom of the QVT via 1/4" NPT female connections on 2 1/8" Centers. Please note that if the optional 3-Way Valve or the Purge System were purchased, the Process Connections will vary. These connections can be modified to accept manifolds on 2", 2 1/8" and 2 1/4" centers by using an optional adapter flange.

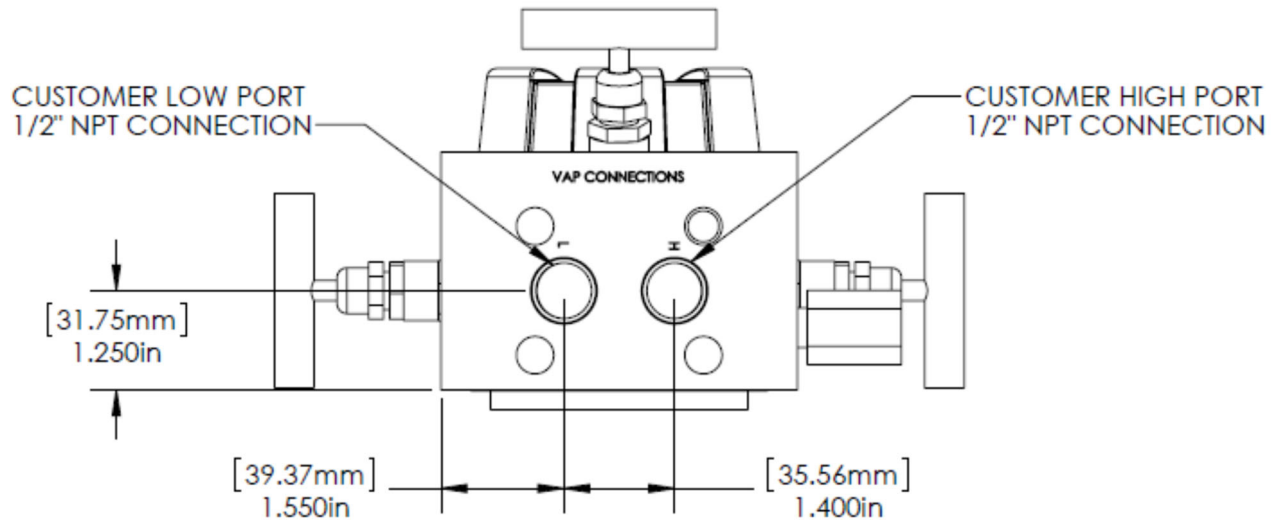
It is recommended that the tubing used to connect the QVT to your flow element be at least 3/8" hard walled Stainless Steel or Copper Pipe if using the optional Purge System. Please see the accompanying table in the "Purge System" section of this manual for specifics on the recommended diameter of tubing versus the run length of the pipe.

Please note that the connections will differ depending on whether you are connecting directly to the QVT, via a 3-way valve or via the TMP transmitter purge. The connections for each of these three scenarios are illustrated below.

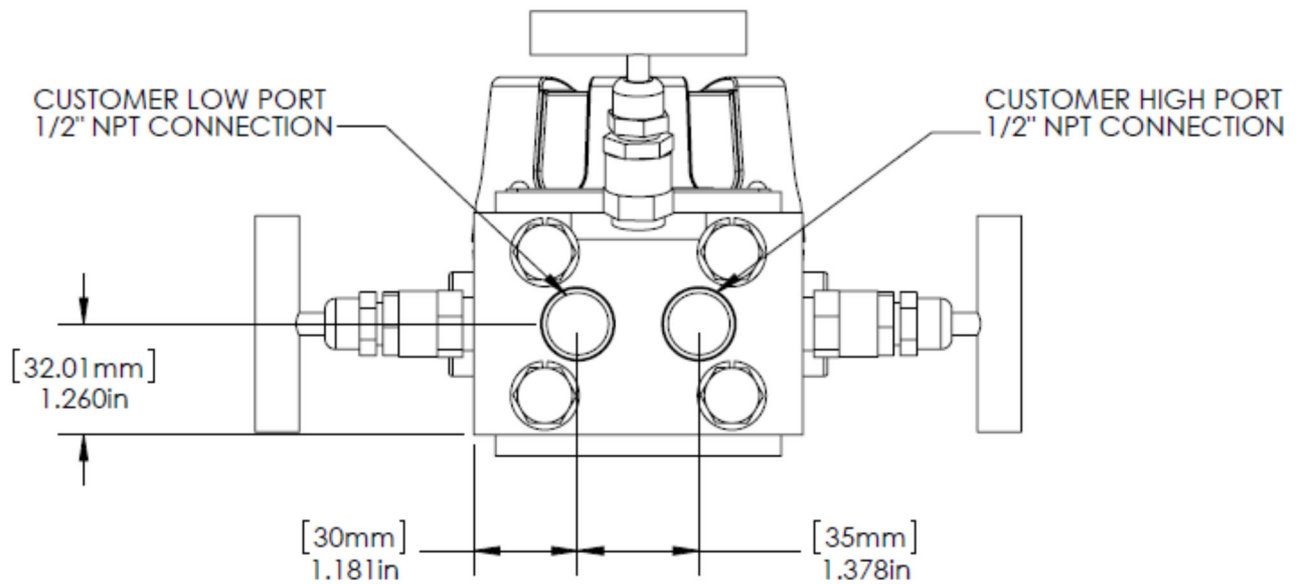
QVT Transmitter Process Connections



QVT Transmitter with 3-Way Valve Process Connections



QVT Transmitter with 3-Way Valve and TMP Purge System Process Connections



ELECTRICAL INSTALLATION

ACCESSING THE WIRING CONNECTORS OF THE QVT

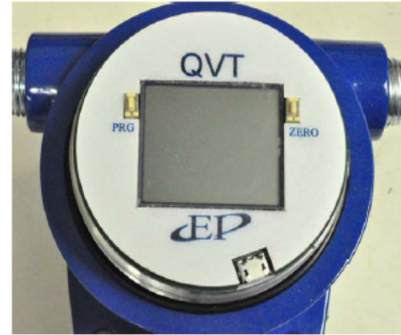
NOTE: POWER MUST BE OFF BEFORE REMOVING THE COVER OF THE QVT!

REMOVING THE LCD BOARD

1. Once power has been turned off to the transmitter, remove the cover to expose the Processor Board or LCD Circuit Board. Once the cover has been removed, your QVT should look similar to the picture #1 on the right.
2. Remove the Processor Board or LCD Circuit Board. To remove the board, press on the bottom and pull out at the top behind the circuit board as seen in picture #2. DO NOT PULL ON THE OVERLAY AS IT COULD BE DAMAGED.
3. Carefully remove the board as shown in picture #3.

REPLACING THE LCD BOARD

1. Align the Board Snap Mounts with the Snap Mounting Holes on the LCD Board
2. With fingers over the snap mounts press the board into place as in picture #4. The Board Snap Mounts should snap into the Snap Mounting Holes.
3. Please note that the Board has four holes and there are only two Board Snap Mounts. This enables the board to be rotated to any of four positions depending on the desired orientation of the LCD screen. Please see picture #5 for reference.
4. Check the wiring to ensure that the internal wiring clears prior to snapping the board into place.
5. Replace the cover of the QVT.



#1



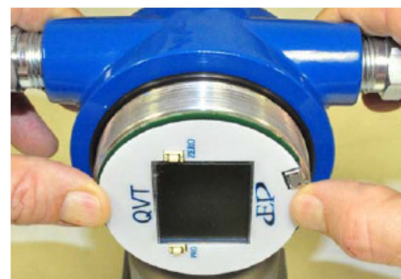
#2



#3

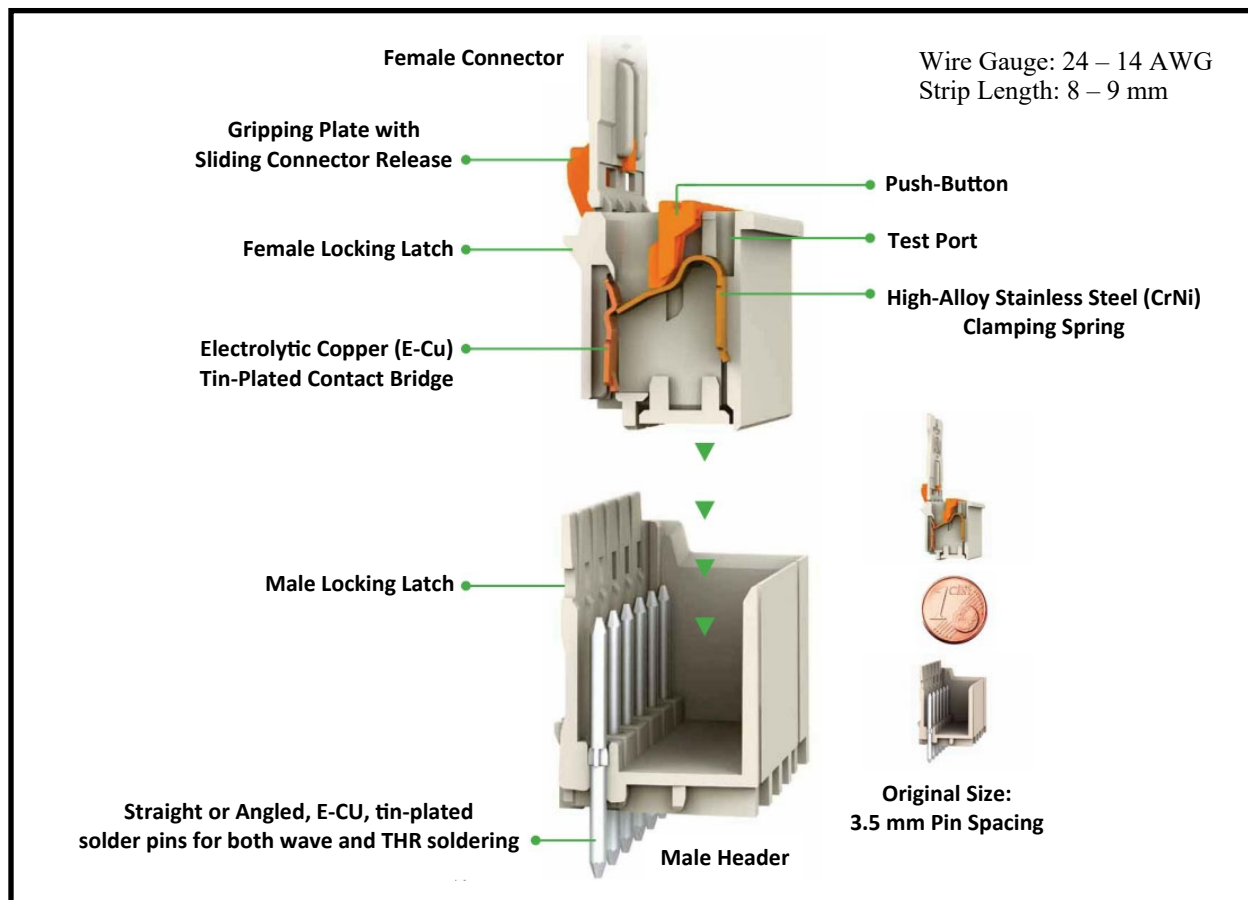


#4

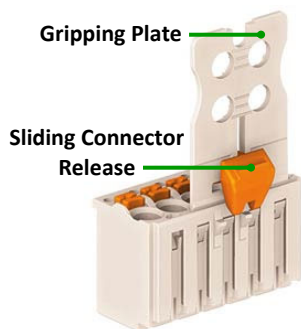


#5

USING THE WIRING CONNECTORS



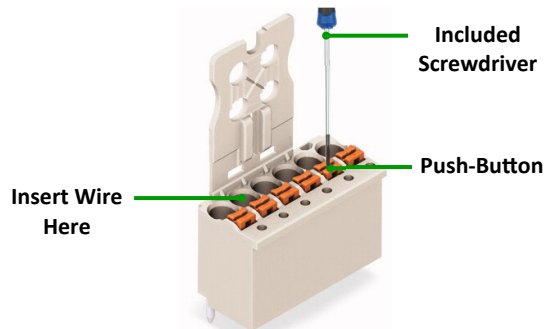
Connecting/Disconnecting Male Header and Female Connector



To Disconnect: Press down on the Sliding Connector Release (towards the Male Header) and pull on the Gripping Plate to release Female Connector from Male Header.

To Connect: Push the Female Connector into the Male Header until you hear a click.

Inserting and Removing Conductors from Connector



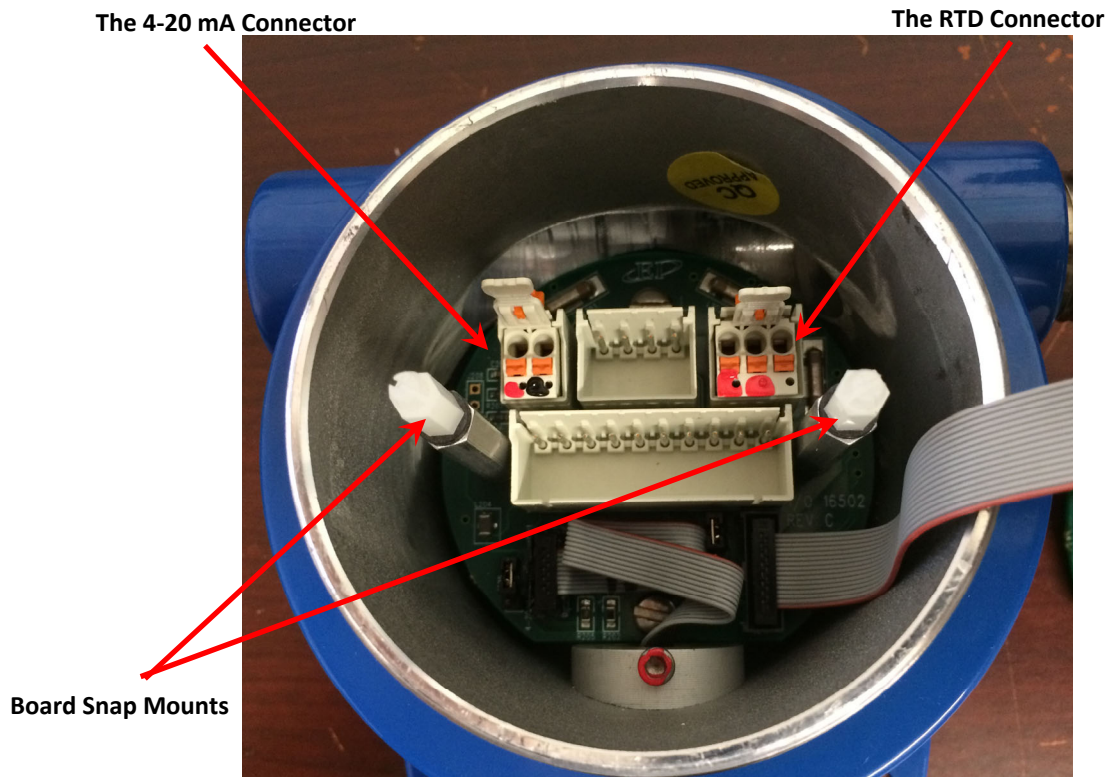
To Insert: Using the supplied screwdriver, press down on the Push Button and insert the wire into the terminal.

To Remove: Press the Push Button and pull upwards on the wire to remove the wire from the Female Connector.

WIRING THE QVT

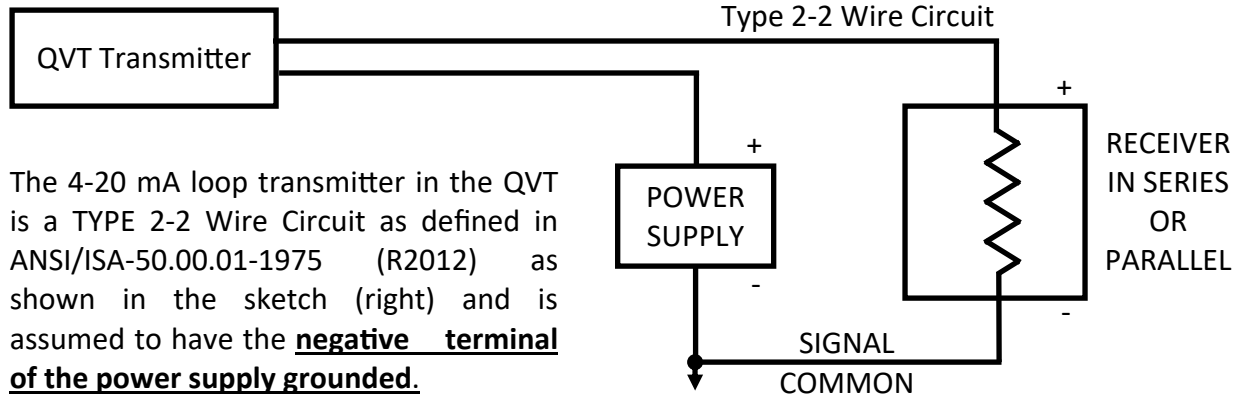
There are two parts to wiring the QVT. For all versions of the QVT, 4-20 mA loop power must be supplied. For multivariable transmitters in which Process Temperature will be measured, an RTD must also be wired to the QVT. The wiring connections for both the 4-20 mA loop power and the RTD inputs are located behind the LCD circuit board inside the head of the transmitter. Once the LCD Board has been removed, the connectors for both the 4-20 mA loop power and the RTD can be wired. You can wire the connectors by either removing the female connector from the board, adding the wire externally and replacing the female connector into the male header already wired, or you can leave the female connector seated in the male header and wire it in place or internally.

NOTE: ALWAYS REMOVE POWER TO THE QVT BEFORE REMOVING THE LCD BOARD AND ONLY RESTORE POWER AFTER THE LCD BOARD HAS BEEN RETURNED TO ITS PLACE!

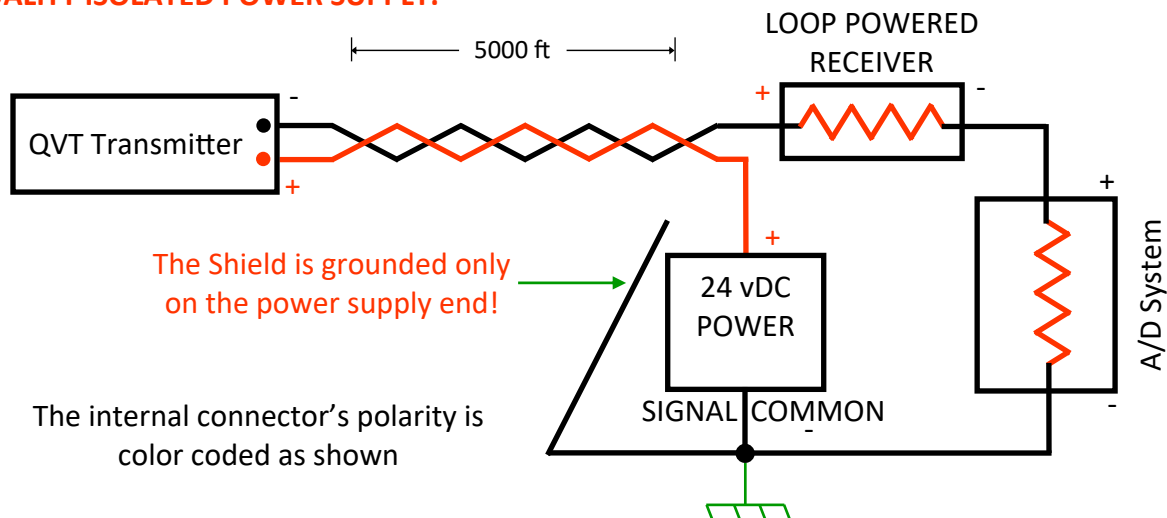


Please note the color indicators at the bottom of the customer connection wiring terminals for both the 4-20 mA Connector and the RTD Connector. The following pages offer a more detailed description of the proper wiring for each of these connections.

4-20 MA LOOP POWER:



An example of loop wiring is shown below. We have assumed that we used 5000 feet of Belden 88760 twisted, 18 AWG shielded pair, 7.5 ohm/1000 ft conductor. The Receiver and A/D data logger both have a 250 Ω resistor. The power supply is assumed to be a +/-10%, 24 vDC source, with the negative terminal grounded, which is shared with other loops. The minimum voltage expected is the $24 \times 0.9 = 21.6$ v DC. **NOTE: POWER SUPPLY SHOULD BE A GOOD QUALITY ISOLATED POWER SUPPLY.**



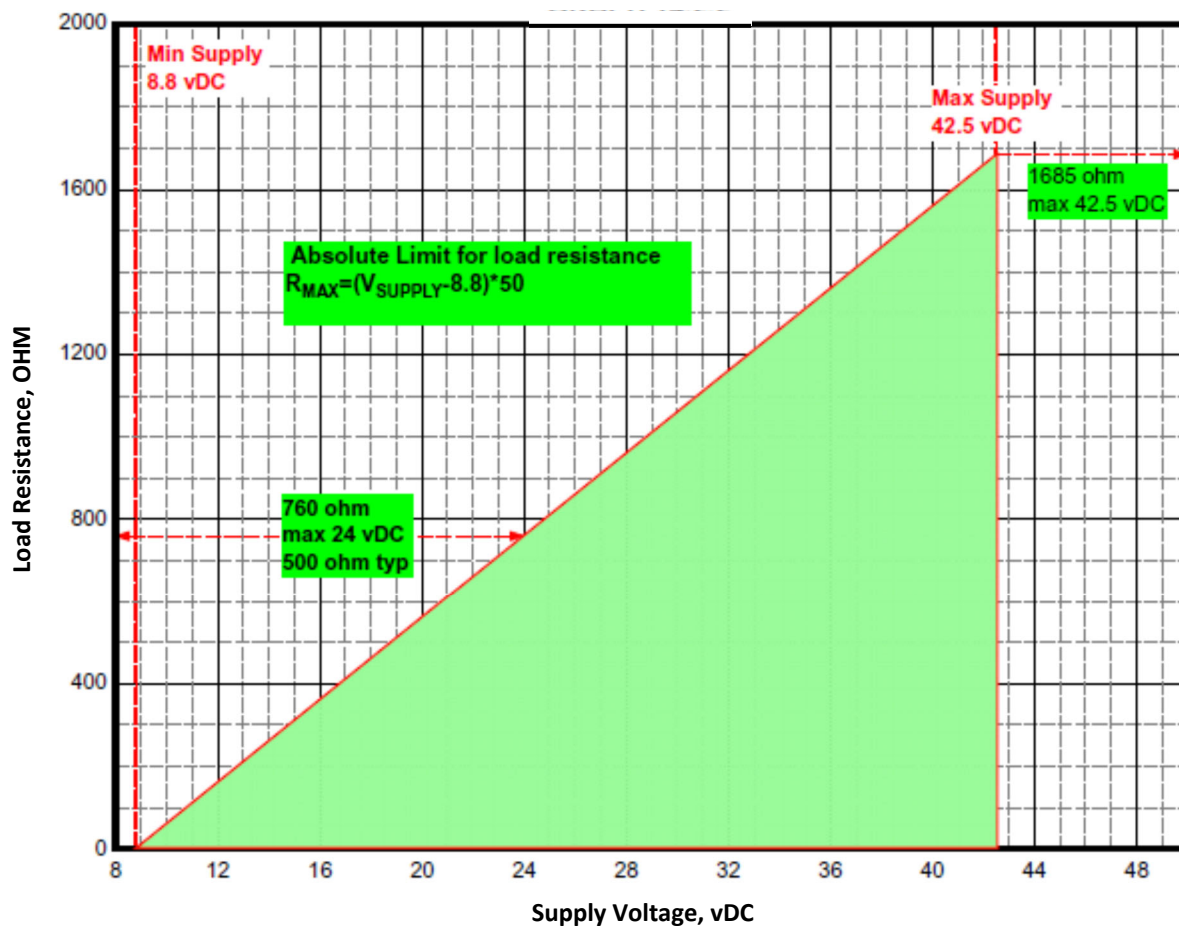
Typical Calculation Based on 5,000 feet of Cable

Description	Length (ft)	Ω /ft	Ω	mA FS	Volt Drop
Transmitter Minimum Drop					8.8
Positive Cond.	5000	0.0075	37.5	20	0.75
Negative Cond.	5000	0.0075	37.5	20	0.75
Loop Powered Receiver			250	20	5
A/D Data Logger			250	20	5
Total			575		20.3

Be sure to check your load resistance in the output current loop as too high a load resistance will cause malfunction or incorrect operation of the QVT transmitter. Below are two methods of determining whether the load resistance exceeds the allowable operational limit.

Voltage Drop: The minimum transmitter voltage as seen in the chart below, is 8.8 V. The resistance values of the conductive elements are multiplied by the current to give the voltage drop of each element. Sum the voltage drops for all conductive elements along with the minimum transmitter voltage and compare that value with the minimum power supply voltage. If the total is less than the minimum power supply voltage, the load is OK.

Summing Resistances: Sum the resistances of all circuit elements. Find where the total, summed resistance total intersects the supply voltage in the below graph. Compare the value for supply voltage that you found on the graph with your minimum power supply voltage. If the value from the chart is lower than the minimum power supply voltage, the load is OK.



RTD TEMPERATURE SENSOR INPUT:

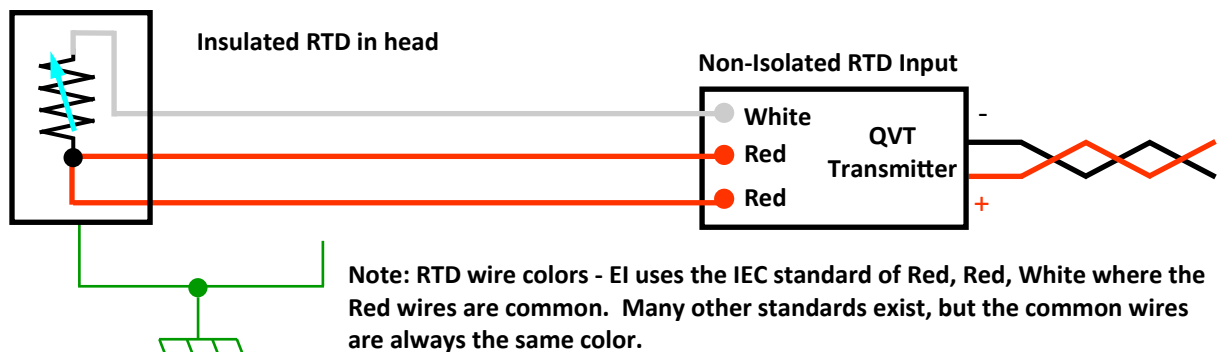
If the QVT is purchased as a multivariable transmitter with Temperature measurement, an RTD sensor must be wired to the QVT. The QVT temperature input requires an insulated Platinum Pt100 RTD sensor which will typically be Class A, 3 wire model (although 2 and 4 wire models can also be used).

Typically, RTD's have an insulation resistance of at least 100 mega ohms - a lower insulation resistance can lead to inaccuracies.

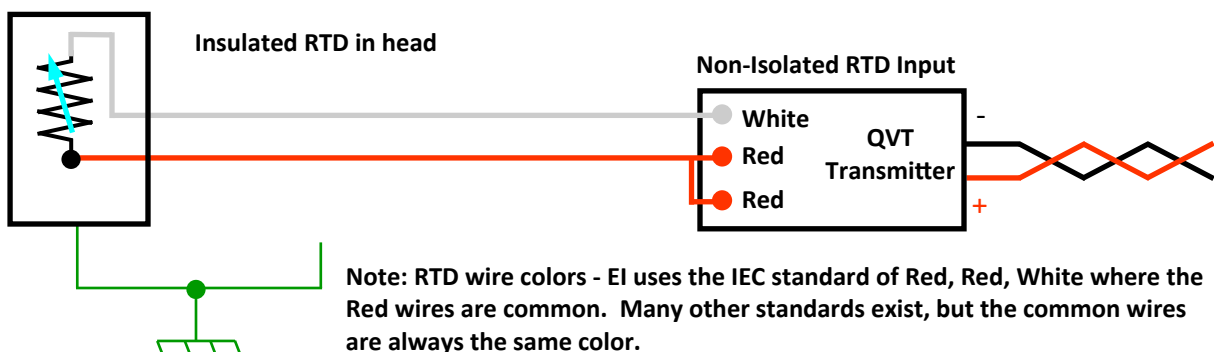
When extension wire is required for the connection between the sensor head and transmitter, 22 or 24 AWG RTD extension wire is recommended. Use of the Shield is optional, but recommended. If used, the Shield must be grounded to the housing or head of the RTD, which in turn, must be grounded. **DO NOT GROUND THE SHIELD TO THE QVT TRANSMITTER!**

Although the QVT RTD input cancels lead resistance, it is best to use the minimum lead resistance in case they are unequal. It is highly recommended to connect to ground the Shield of longer cables, typically greater than 10 feet in length.

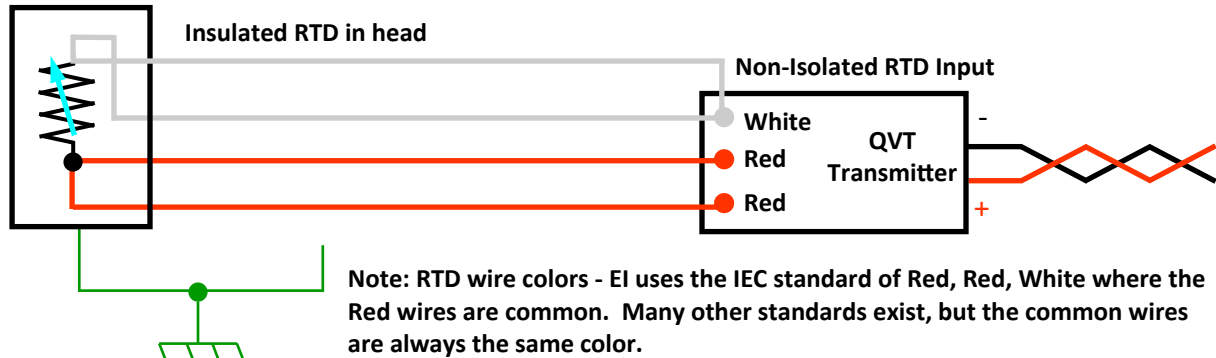
TYPICAL 3-WIRE RTD INSTALLATION DIAGRAM



TYPICAL 2-WIRE RTD INSTALLATION DIAGRAM



TYPICAL 4-WIRE RTD INSTALLATION DIAGRAM



NOTE ON TEMPERATURE READINGS: When the external RTD input temperature reading is out of range (not between -355°F [-215°C] and +1589°F [865°C]), due to a break, short or some other condition, then the QVT will revert to its static "Entered" value for Temperature for use in its mass flow calculation.

When this occurrence happens, the temperature display will alternate between the RTD's "fault" display (Image #1) and the "Entered" Temperature value that will be used to calculate the mass flow for the 4-20 mA output (Image #2). When the RTD has faulted and the "Entered" Temperature value is being used, the Temperature Icon "T" will flash when displaying the "Entered" value. This is an indication that the "Entered" value is being used to calculate mass flow rather than the RTD's measured value.

Even after the fault has been corrected and the RTD is reading the Temperature correctly again, the QVT will continue using the "Entered" value for Temperature until the QVT has been rebooted (power removed and then restored). Once power has been cycled, the QVT will begin using the RTD's measured Temperature for its mass flow calculation and 4-20 mA output.

As an indication, the display will stop alternating between the measured Temperature and the stored or "Entered" value and the Temperature Icon "T" will stop flashing.

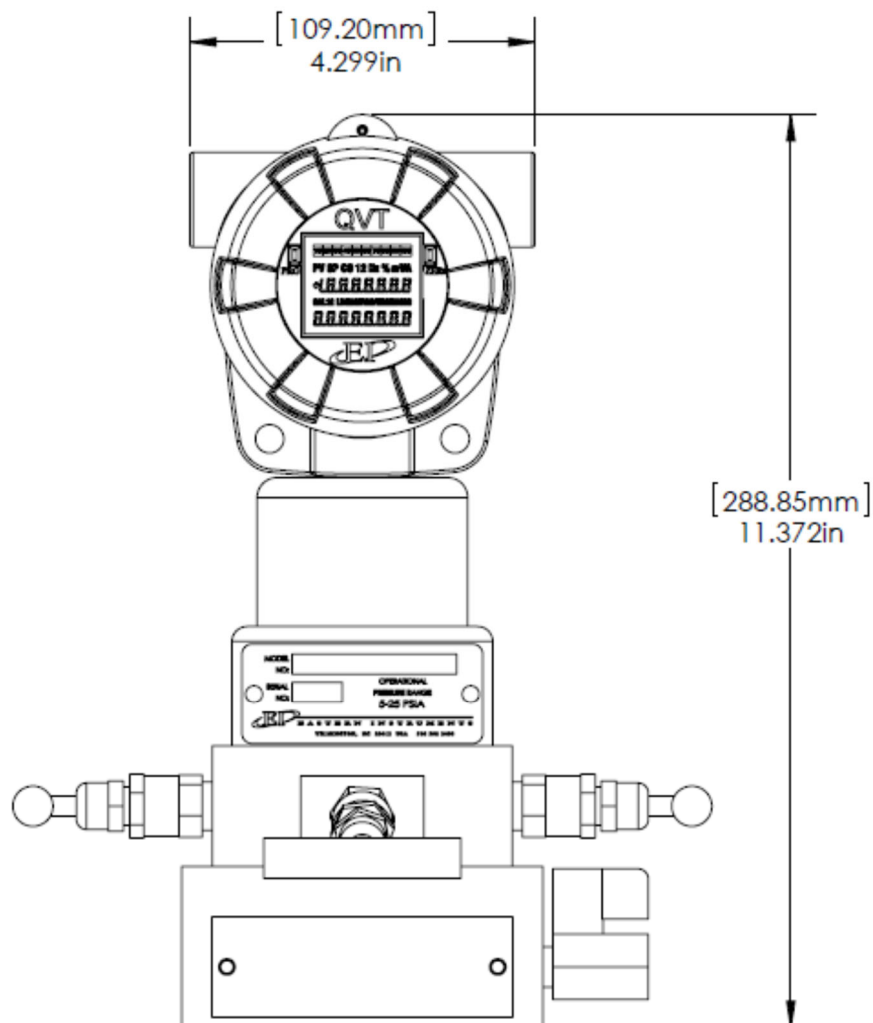


PURGE SYSTEM (OPTIONAL)

Theory of Operation

The TMP is a continuous purge system which is an optional adder to the QVT Transmitter. The TMP is designed to supply a continuous balanced flow of air through the impulse lines. The unit consists of an anodized aluminum purge block and capillary/internal filter set with ports tapped to receive NPT fittings. When dry instrument air is used for the purge, freeze protection is afforded to the impulse lines down to the dew point of the instrument air. The purge flow is based on the impulse line length and diameter between the pitots and the transmitter (see Table 2 below). Also, this type of purge can prevent hazardous or corrosive gasses from migrating from the measured gas to the external impulse lines. When ordered with the QVT, the TMP will be pre-mounted to the bottom of the QVT. Please note that if the purge is included, the QVT will also be mounted with a 3-Way Valve as shown below.

QVT with Optional TMP Purge System and 3-Way Valve



Connecting the Impulse Lines for the TMP Purge System

Impulse lines used to connect to the TMP are recommended to be no smaller than 3/8" hard walled Stainless Steel or Copper Pipe. The following is a list of steps to be taken to install the LMP. Use this as a guide during installation.

- If the optional mounting bracket for the QVT/TMP was purchased, use this to mount the transmitter with purge to its mounting location. (If the Transmitter has not been installed, then do this first.)
- Next connect the impulse lines from the flow element within the process (VAP³® probe array for example) to the bottom of the TMP labeled "CUSTOMER CONNECTIONS". Be sure to connect the "High" impulse line to the "High" connection port and the "Low" impulse line to the "Low" connection port of the TMP. These are 1/2" FNPT connections and require swage type compression fittings and the appropriate thread sealant.
- Now is a good time to leak check all connections. All connections must be free from leaks and bubble-tight to ensure proper function of the TMP and the impulse lines.
- Supply air can now be connected to the LMP. Recommended 75—150 psi dry plant air.

Please note that the ball valve located on the side of the purge must be open in order for the purge to function properly. To open, the handle of the ball valve must be in line with the fitting itself.

Maximum Allowable Run Lengths for Given Tubing Sizes with TMP Transmitter Purging Configuration				
Transmitter Span- in WC	Purge Flow Per Leg EI Flow Element-scfh	3/8" OD tub- ing, feet	1/2" OD tubing, feet	3/4" OD tubing, feet
10.0	4	40	250	500
5.0	4	20	100	500
2.0	2	20	100	500
1.0	2	10	50	500
0.50	1	10	50	500
0.25	1	4	25	225
0.10	0.5	4	20	175

USING THE 3-WAY VALVE

PROPER SETUP

If your QVT transmitter was purchased with a 3-way block valve, the valve should come mounted to the transmitter from the factory. One of the isolation valves will be connected to the High Port on the transmitter and one of the isolation valves will be connected to the Low Port. Each of the isolation valves will be connected to the High and Low Ports (High to High/Low to Low) of the flow element within the process. **FIGURE #1**

DURING TRANSMITTER INSTALLATION

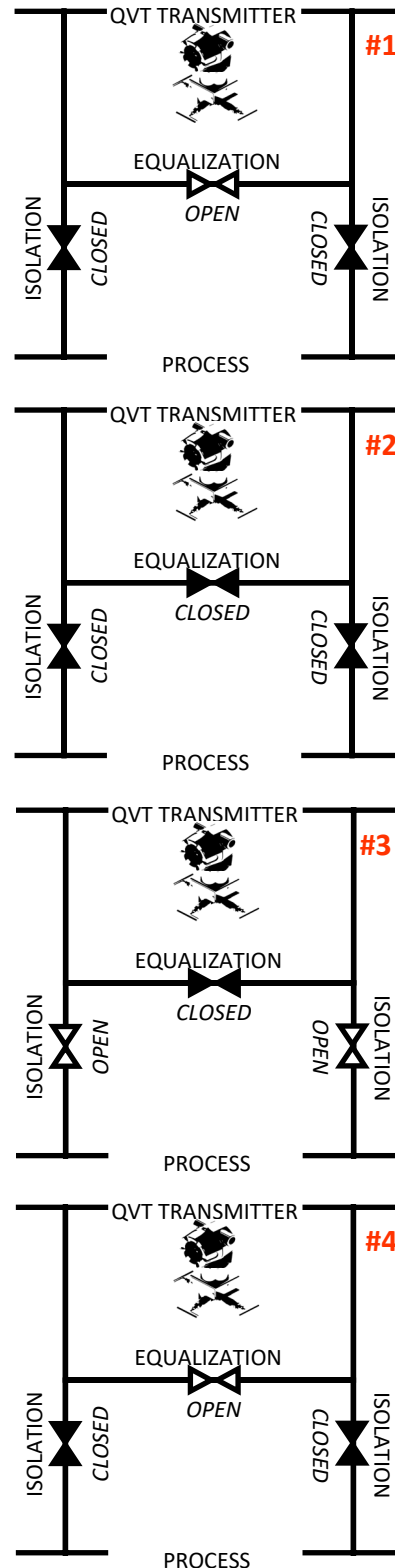
Prior to Installation, ensure that all three valves are closed as in the diagram (#2). Open the Equalization Valve to ensure the same pressure will be applied to both sides of the transmitter. Slowly open the High Pressure Isolation Valve and check for leakage as the High Pressure Isolation Valve opens. Close the Equalization Valve ensuring that the High and Low sides are separated. Finally, open the Low Pressure Isolation Block to establish the working Differential Pressure. **FIGURE #2**

NORMAL OPERATION

Under normal operation, the three way valve will be oriented so that the two isolation valves will be open and the Equalization Valve will be closed. This will ensure that the High Pressure Isolation Valve and the Low Pressure Isolation Valve will not be equalized and will allow the transmitter to see the Differential Pressure that is created as air flows across your flow element. **FIGURE #3**

REMOVING TRANSMITTER FROM SERVICE

To remove the transmitter from service, close the Low Pressure Block Valve and open the Equalization Valve. Finally, close the High Pressure Block Valve. The transmitter is now out of service. **Figure #4**





E A S T E R N I N S T R U M E N T S

GETTING TO KNOW THE LCD SCREEN

The LCD screen has a dual push button design that allows for navigation through the process variables as well as some basic programming capabilities. The two buttons are labeled “PRG” or the Program Button and “Zero” or the Zero Button. If powered up (with no button pushes) the QVT screen will cycle through the various process variable display screens. The screen displays are listed below:

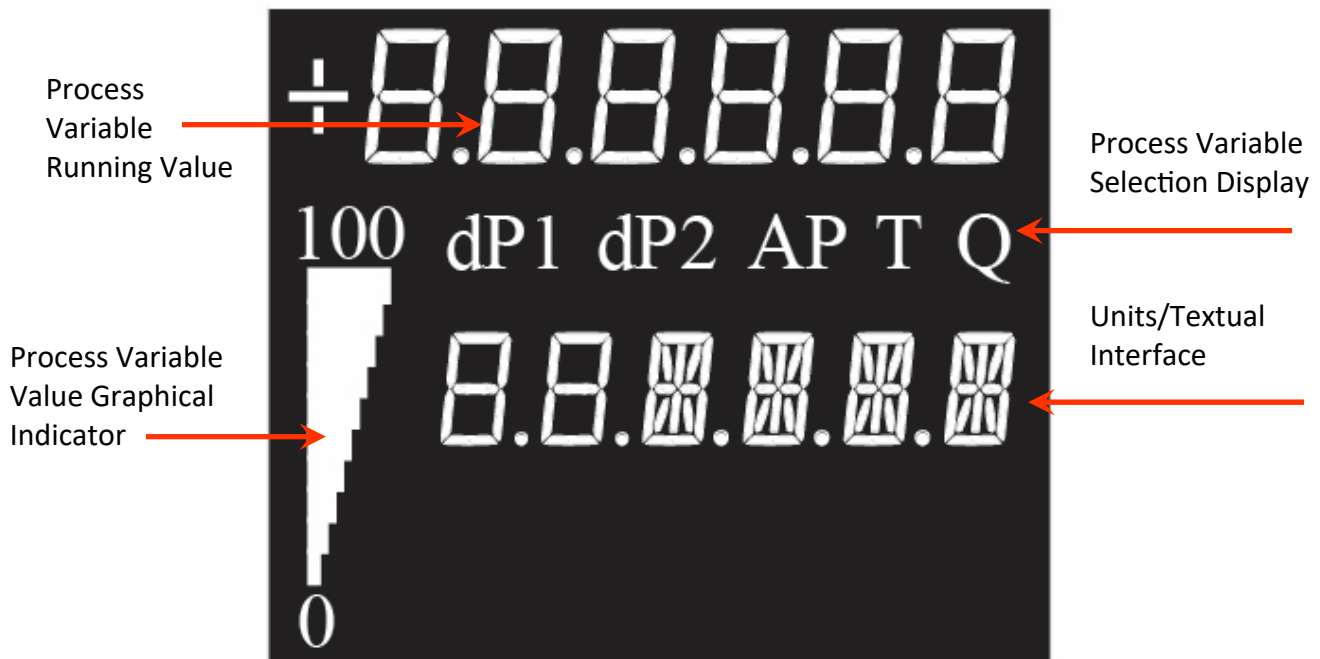
DP1: Differential Pressure (example: in WC)
AP: Absolute Pressure (example: in WC)
T: Process Temperature (example: Deg F)
Q: Process Flow (example: lb/hr)
EFS: Electronics Full Scale (example: lb/hr)

NOTE: Pressing the Program Button will allow you to manually cycle through the different screens above.

NOTE: The screen which currently displays the Process Variable Graphical Indicator is the Process Variable which is currently being transmitted via the 4-20 mA output. (DP1 or Q)



LCD Screen Layout



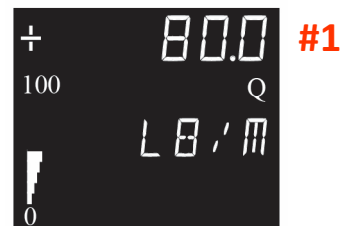


PROCEDURES

CHANGING THE Ae NUMBER

This is a procedure for changing the Ae number within your QVT. The Ae number is a constant that reflects the Effective Area of the duct. The Ae number comprises the duct area, the flow sensor and the calibration factor/constant. Changing the Ae number will allow you to adjust the output.

1. **Press the Program Button until the Q or Process Flow screen is displayed.** The screen should look like screen #1.
2. **Press and hold the Zero Button for 5 seconds.** This will open up the Ae number edit screen. The Ae edit screen will look like screen #2.
3. **Press the Program/Zero Button until the desired value for the Ae number is displayed.** Pressing the Program Button will decrease the Ae number while Pressing the Zero Button will increase the Ae number. Pressing and holding either button will increase the rate at which the numbers increase/decrease.
4. **Once the correct value is displayed, wait 10 seconds.** Waiting for this duration signals to the QVT that a selection has been made and it will automatically transition to the next step in the process.
5. After 10 seconds, the confirmation screen will be displayed. Please see screen #3.
6. **Press Zero Button to Confirm/Program Button to Disregard.** The Program Button will disregard the changes and will revert your Ae number to the previously selected value. The Zero Button will confirm your new Ae number selection and will implement your changes. No selection after 15 seconds will revert you back to Step 1 of this procedure.



Please note that the selection will not be reflected in your 4-20 mA output until you have confirmed the selection in Step 6.

Please note that if your Ae number is over 100, then there is a two step process to entering this Ae number. First, change the decimal location. The default decimal location is 2 digits before the decimal and 4 digits after it (xx.xxxx). To change to 3 digits before the decimal (xxx.xxx), the decimal location needed for Ae numbers over 100, you must first enter an Ae number between 90 and 90.9999. Once you have changed the Ae number to a number between 90 and 90.9999, the next time you go to change the Ae number, the decimal place will have moved to the (xxx.xxx) position. You can now enter an Ae number over 100.

CHANGING THE EFS (Electronic Full Scale)

This is a procedure for changing the EFS or Electronics Full Scale of the QVT. Changing the EFS allows you to change the scale of the 4-20 mA output. Please note that the units for the EFS value are the same units as the currently selected 4-20 mA output. For example, if the DP1 or Differential Pressure Output is selected as the 4-20 mA output, the units would be the same as DP1.

1. **Press the Program Button until the EFS Flow screen is displayed.** The screen should look like screen #1.
2. **Press and hold the Zero Button for 5 seconds.** This will open up the EFS number edit screen. The EFS edit screen will look like screen #2 and the screen will be blinking on and off.
3. **Press the Program/Zero Button until the desired value for the EFS number is displayed.** Pressing the Program Button will decrease the EFS number while Pressing the Zero Button will increase the EFS number. Pressing and holding either button will increase the rate at which the numbers increase/decrease.
4. **Once the correct value is displayed, wait 10 seconds.** Waiting for this duration signals to the QVT that a selection has been made and it will automatically transition to the next step in the process.
5. After 10 seconds, the confirmation screen will be displayed. Please see screen #3.
6. **Press Zero Button to Confirm/Program Button to Disregard.** The Program Button will disregard the changes and will revert your EFS number to the previously selected value. The Zero Button will confirm your new EFS number selection and will implement your changes. No selection after 15 seconds will revert you back to Step 1 of this procedure.



#1



#2



#3

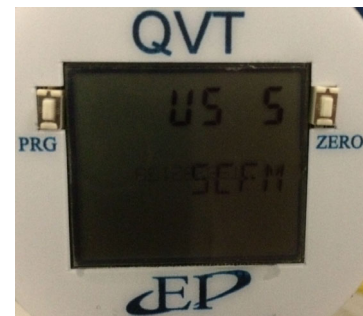
Please note that the selection will not be reflected in your 4-20 mA output until you have confirmed the selection. In Step 6.

CHANGING THE UNITS OF MEASURE

This is a procedure for changing the units of your QVT. Please note that changing the units will not automatically change either the Full Scale or the Ae Number (in the case of Flow Outputs). The full scale should be adjusted to reflect the new units. Special attention should be given to the Ae Number especially if changing between metric and imperial units.

Also, the QVT has a 10 second time limit and so you must wait 10 seconds since the last button push before attempting to change the units.

1. **Press the Program Button twice (x2)**
2. **Press the Zero Button twice (x2)**
3. **Press the Program Button twice again (x2)**
4. **Press the Zero Button twice again (x2).**
You should now see your unit selection flashing on the screen. (example to the right).
5. **You can now select your units. Cycle through your choices (listed below) using the Program Button.**



UNIT GROUPINGS (Metric)

	SI1	SI2	SI3	SI4	SI5	SI6
Ae Units	M ²	M ²	M ²	M ²	M ²	M ²
Absolute Pressure Units	BAR	BAR	BAR	BAR	BAR	BAR
Temperature Units	°C	°C	°C	°C	°C	°C
DP Units	MMWC	MMWC	MMWC	MMWC	MMWC	MMWC
Flow Units	Kg/s	Kg/min	Kg/hr	mTon/hr	NCMH	CMH

UNIT GROUPINGS (Imperial)

	US1	US2	US3	US4	US5	US6
Ae Units	ft ²	ft ²	ft ²	ft ²	ft ²	ft ²
Absolute Pressure Units	PSIA	PSIA	PSIA	PSIA	PSIA	PSIA
Temperature Units	°F	°F	°F	°F	°F	°F
DP Units	INWC	INWC	INWC	INWC	INWC	INWC
Flow Units	Lb/min	Klb/hr	Lb/hr	KCFM*	SCFM	ACFM

Please note that KCFM is a prefix indicating 1000 CFM - example - a reading of 10 KCFM would be 10,000 ACFM

6. Once you have selected your units, press the Zero Button to Save your units. You will be asked if the selected units are OK. Press the Zero Button again to confirm your selection.

ZERO DP1 DIFFERENTIAL PRESSURE MEASUREMENT

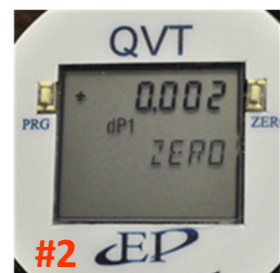
This is a procedure for zeroing the Differential Pressure which is displayed under the screen DP1. The first step is to ensure that the sensor does not see any flow by equalizing the pressure between the high and low port, typically performed by using a 3-way or 5-way valve. The second step is to actually zero the value using the Buttons/LCD Screen. **NOTE: DO NOT ASSUME DUCT FLOW IS ZERO. BE SURE TO PERFORM THE EQUALIZATION BETWEEN THE HIGH AND LOW PORTS OR YOU CAN INTRODUCE ERROR INTO YOUR MEASUREMENT.**

Equalizing Pressure Between High/Low Ports Using a 3-Way Valve

1. During typical operation, the Equalization Valve is closed and the Isolation Valves are both open. To equalize pressure between the High and Low ports, first close the High Port Valve. Then open the Equalization Valve and finally, close the Low Port Valve. The pressure between the ports should now be equalized and the Differential Pressure between them should be 0. Please note when returning to typical operation, you must first open the Low Port Valve, then close the Equalization Valve and finally, reopen the High Port Valve to ensure no damage to the QVT.

Performing a Zero for DP1

1. **Press the Program Button until the DP1 Differential Pressure screen is displayed.** The screen should look like screen #1.
2. **Press and hold the Zero Button for 5 seconds.** This will open up the DP1 Zero screen. The DP1 Zero screen will look like screen #2. The screen will flash on and off.
3. **Press the Zero Button to perform the Zero.** Please note that waiting more than 15 seconds to press the Zero Button will make the Zero function automatically time out and you will be automatically moved back to Step 1. Once the button has been pushed, the display should look like screen #3.
4. **Press Zero Button to Confirm/Program Button to Disregard.** The Program Button will disregard the changes and will revert your Zero to the previous value. The Zero Button will confirm your new Zero change. Only now will the zero be reflected in the 4-20 mA output.



The zero for the Differential Pressure sensor will not be changed in regards to the QVT's output until the Zero Procedure has been completed.

ZERO FAILURE: The Differential Pressure can not be zeroed if the pressure is outside of the designated Zero range (+/- 0.01 in WC or 0.25 mmWC). If the Differential Pressure is outside this range and the Zero Procedure is attempted, the Procedure will Fail and this failure will be signified by flashing between the Failure Screen (Screen #1) and the Greater than 0.01 inWC Screen (Screen #2). The original zero value will be retained.



#1

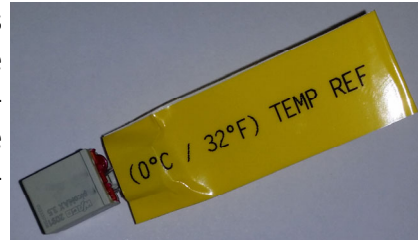


#2

PLEASE NOTE: Typically, the transmitter will not need to be zeroed unless the zero error exceeds 1 part in 1000 of the full scale of the transmitter. If the full range of the transmitter is used, for example, then $8.00 \text{ inwc} / 1000 = 0.008 \text{ in WC}$. The transmitter would only need to be zeroed, then, if the zero error is greater than 0.008 inWC.

ZERO PROCESS TEMPERATURE

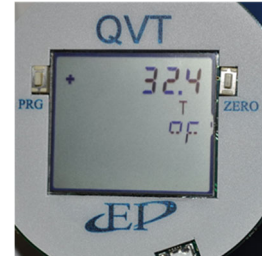
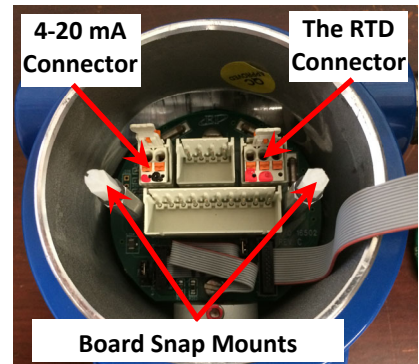
This is a procedure for zeroing the Process Temperature which is displayed under the screen T. The first step is to ensure that the sensor is registering 0 deg C by utilizing a 0 deg C (32 deg F) Temperature Simulator (provided). A picture of the Temperature Simulator can be seen to the right. The second step is to actually zero the value using the Buttons/LCD Screen.



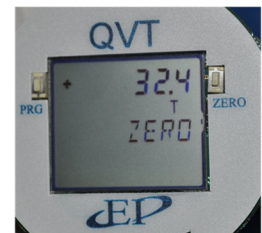
NOTE: DO NOT ZERO WITHOUT SIMULATING 0 DEG C OR ENSURING YOUR PROCESS TEMPERATURE IS 0 DEG C. IF THE TRANSMITTER IS ZEROED WHEN THE TEMPERATURE IS NOT 0, YOU WILL INTRODUCE ERROR INTO YOUR MEASUREMENT.

Using the 0 deg C Temperature Simulator

1. **Remove power from the QVT.** Wiring the QVT while the QVT has power turned on can result in damage to the LCD Board and can cause failure of the QVT.
2. **Remove the QVT Cover.**
3. **Remove the LCD Board.** A detailed description of this procedure can be found in the Electrical Installation section of this manual.
4. Looking at the RTD Connector, **remove the Female Connector from the Male Header** so that the RTD is no longer connected to the QVT.
5. The Temperature Simulator contains a duplicate Female Connector. **Place the Female Connector of the Temperature Simulator into the RTD Connector's Male Header and push until you hear it click.**
6. **Replace the LCD Board**
7. **Return power to the QVT.**



#1



#2



#3

Performing a Zero for Temperature

1. Once a Zero, using the Temperature Simulator has been performed (as outlined above) **Press the Program Button until the T Process Temperature screen is displayed (Screen #1).**
2. **Press and hold the Zero Button for 5 seconds.** This will open up the Temperature Zero screen. The Temperature Zero screen will look like screen #2. The screen will flash on and off.

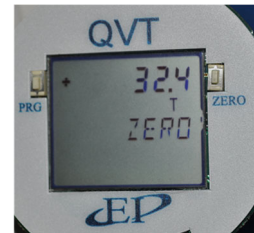
3. **Press the Zero Button to perform the Zero.** Please note that waiting more than 15 seconds to press the Zero Button will make the Zero function automatically time out and you will be automatically moved back to step 1. Once the button has been pushed, the display should look like screen #3.
4. **Press Zero Button to Confirm/Program Button to Disregard.** The Program Button will disregard the changes and will revert your Zero to the previous value. The Zero Button will confirm your new Zero change.
5. **Power off the QVT.**
6. **Remove the LCD Board.** A detailed description of this procedure can be found in the Electrical Installation section of this manual.
7. Looking at the RTD Connector, **remove the Temperature Simulator from the Male Header.**
8. Replace the **Female Connector of the RTD (live process)** into the RTD Connector's Male Header.
9. **Replace the LCD Board and QVT Cover.**
10. **Return power to the QVT.**

The zero will not be changed in regards to the QVT's output until the Zero Procedure has been completed.

Please Note: The Temperature can not be zeroed if the temperature is outside of the designated Zero range (+/- 5.5 degrees C and 10 degrees F). If the temperature is outside this range and the Zero Procedure is attempted, the Procedure will Fail and this failure to zero the temperature will be signified by flashing between the Failure Screen (Screen #4) and the Greater than 10 degrees Screen (Screen #5). The original zero value will be retained.



#1



#2



#3



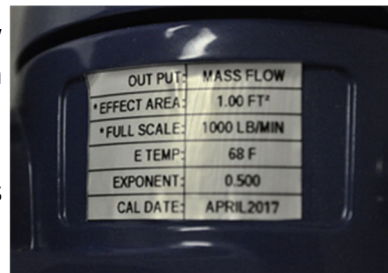
#4



#5

REVERT TO FACTORY SETTINGS (FACTORY RESTORE)

If you would like to revert to the factory settings please follow the below procedure. These factory settings are displayed on the QVT Placard that was originally shipped with the unit and can be found on the side of the transmitter (Image #1). Reverting to Factory Settings is accomplished through a series of button pushes outlined below:



Press PGM Button (x1 times)

Press Zero Button (x3 time)

Press PGM Button (x1 times)

Press Zero Button (x3 time)

PLEASE NOTE: If incorrectly entered, the button push function will time out at which point you will need to wait 10 seconds before retrying the button sequence.

4-20 Output



Ae Number



Molecular Weight



Mass Flow Exponent



Density



"Entered" Temperature



Electronic Full Scale



Filter



Factory



Pressing the above buttons at one second increments will initiate a series of display screens that will show each of the factory settings. These screens will rotate at three second intervals until the final screen is displayed. The final screen displaying "Fact" for factory settings, will be flashing. In order to initiate the change to factory settings, press the "Zero" Button while this screen is displaying. To exit without changing, press the "PGM" Button. The factory restore will revert all of the above values to factory settings and will revert the Zero for both DP1 and Temperature to original Zero values.



EASTERN INSTRUMENTS

QVT SPECIFICATIONS

MEASURED VARIABLE SENSOR PERFORMANCE

Differential Pressure Sensor

SENSOR ACCURACY OVER VARIOUS TEMPERATURE RANGES

SENSOR RANGE	AMBIENT TEMP	HIGH ACCURACY MODEL	EXTREME ACCURACY MODEL
BU	25° C	± 0.05% Reading and ± 0.005% URL at Operating Temp. of 25°C	
	0° to 50° C	± 0.2% Reading and ± 0.2% URL at Operating Temp. of 0° to 50°C	± 0.05% Reading and ± 0.005% URL at Operating Temp. of 0° to 50°C
	-20° to 70° C		± 0.05% Reading and ± 0.005% URL at Operating Temp. of -20° to 70°C

- Static Pressure Effect: Less than 0.00375% URL over specified operating range (5 - 25 PSI)
- Typical Operating Range: 10000:1 (0.0009 in WC to 9.0 in WC) at -40° to 70° C (-40 to 160° F)
- Minimum Resolution: (1 ct) 0.0001 in WC
- Position Effect: Less than 0.00375% URL in any plane
- Rangeability: 160:1 (0 - 0.05 to 0 - 8.0 in WC) - [4-20 mA Full Scale Range]
- Ambient Temperature Effect: 0-50° C Accuracy does not degrade (Extreme Accuracy Only)
- Update Rate: 10 times/s without strobing
- Long Term Stability: 0.125% URL/year
- Maximum Common Mode Pressure: ±10 PSI
- Maximum Differential Pressure: 4 PSI

Temperature Sensor

SENSOR ACCURACY

TEMP. RANGE	ACCURACY
SU	± 0.05% Reading (abs) and ±0.005% of URL (abs)

- Transmitter is compatible with any Class A DIN 100 ohm 385 Platinum RTD Sensor (3 Wire)
- Update Rate: 5 times/s without strobing
- Minimum Resolution: 0.024° C



Absolute Pressure Sensor

SENSOR ACCURACY OVER VARIOUS TEMPERATURE RANGES

SENSOR RANGE	AMBIENT TEMP	HIGH ACCURACY MODEL	EXTREME ACCURACY MODEL
JU	25° C	$\pm 0.05\%$ Reading $\pm 0.005\%$ URL at Operating Temp. of 25°C	
	0 - 50° C	$\pm 0.2\%$ Reading $\pm 0.2\%$ URL at Operating Temp. of 0° to 50°C	$\pm 0.05\%$ Reading $\pm 0.005\%$ URL at Operating Temp. of 0° to 50°C
	-20° to 70° C		$\pm 0.05\%$ Reading and $\pm 0.005\%$ URL at Operating Temp. of -20° to 70°C

- Operating Temperature Range: -40° to 70° C (-40 to 160° F)
- Minimum Resolution: (1 ct) 0.001 PSI
- Position Effect: Less than 0.00375% URL in any plane
- Ambient Temperature Effect: 0-50° C Accuracy does not degrade (Extreme Accuracy Only)
- Update Rate: 5 times/s without strobing
- Long Term Stability: 0.05% URL/year

MEASURED VARIABLE SENSOR PERFORMANCE

Density Computation

TRANSMITTER ACCURACY OVER VARIOUS TEMPERATURE RANGES

SENSOR RANGE	AMBIENT TEMP	HIGH ACCURACY MODEL	EXTREME ACCURACY MODEL
BU	25° C	$\pm 0.25\%$ Reading over full range of AP and Process Temperature	
	0 - 50° C		$\pm 0.25\%$ Reading over full range of AP and Process Temperature
	-20° to 70° C		$\pm 0.25\%$ Reading over full range of AP and Process Temperature

- Absolute Pressure Range: 5 - 25 PSIA; Process Temperature Range: -328° to 1562° F
- Accuracy calculation does not include RTD probe accuracy
- Update Rate: 5 times/s without strobing
- Density is computed using live/measured values or entered values for Absolute Pressure and Temp.



Mass Flow Computation

TRANSMITTER ACCURACY OVER VARIOUS TEMPERATURE RANGES

SENSOR RANGE	AMBIENT TEMP	HIGH ACCURACY MODEL	EXTREME ACCURACY MODEL
BU	25° C	±0.50% Reading 100:1 dP (10:1 flow) ±1.0% of Reading 225:1 dP (15:1 flow)	
	0 - 50° C		±0.50% Reading 100:1 dP (10:1 flow) ±1.0% of Reading 225:1 dP (15:1 flow)
	-20° to 70° C		±0.50% Reading 100:1 dP (10:1 flow) ±1.0% of Reading 225:1 dP (15:1 flow)

- Update Rate: 10 times/s without strobing
- Operating Range: 100:1

SENSOR LIMITS

Sensor Range Limits

SENSOR	LOWER LIMIT(LRL)	UPPER LIMIT (URL)
BU	0 in WC	8 in WC
BB	-8 in WC	8 in WC
JU	5 PSIA	25 PSIA
SU	-328° F	1562° F

Sensor Span Limits

SENSOR	MIN SPAN	MAX SPAN
BU	0.05 in WC	8 in WC
BB	0.05 in WC	16 in WC
JU	0.15 PSIA	20 PSIA
SU	20° F	1890° F

4-20 mA OUTPUT

Zero and Span Adjustment

Zero and Span can be set anywhere within the range of the sensors listed. The 2-wire 4-20 mA output is user-selectable for either a standard square root output (0.5 power) or for Eastern Instruments' modified power output (0.455 power).

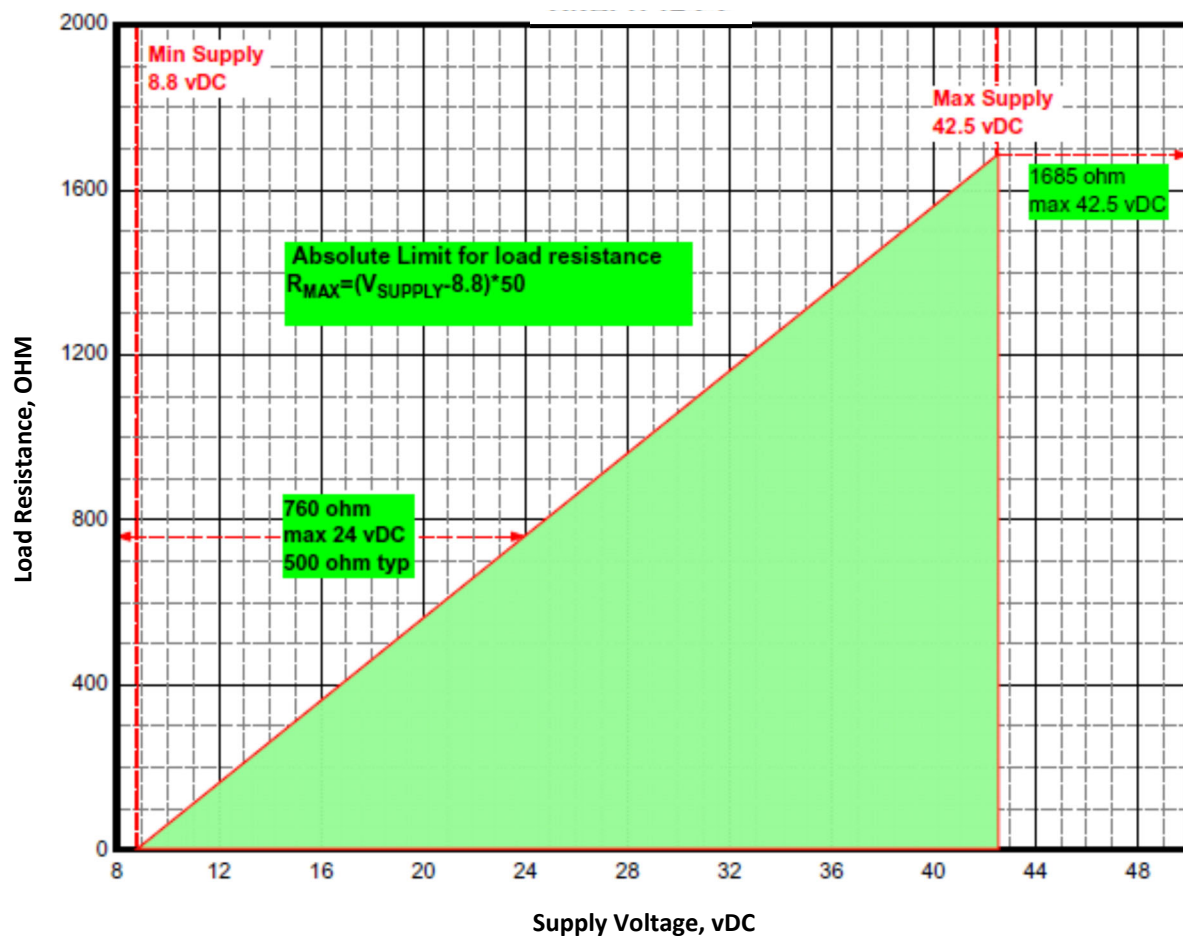
Accuracy: +/-0.05% Full Scale (-40° to 70° C)

Power Supply: Loop Power Required

Supply Voltage Range: 8.8 to 42.5 Vdc

Power Supply Effect: Negligible

Maximum load resistance is determined by the voltage level of the external power supply as described in the graph (right):

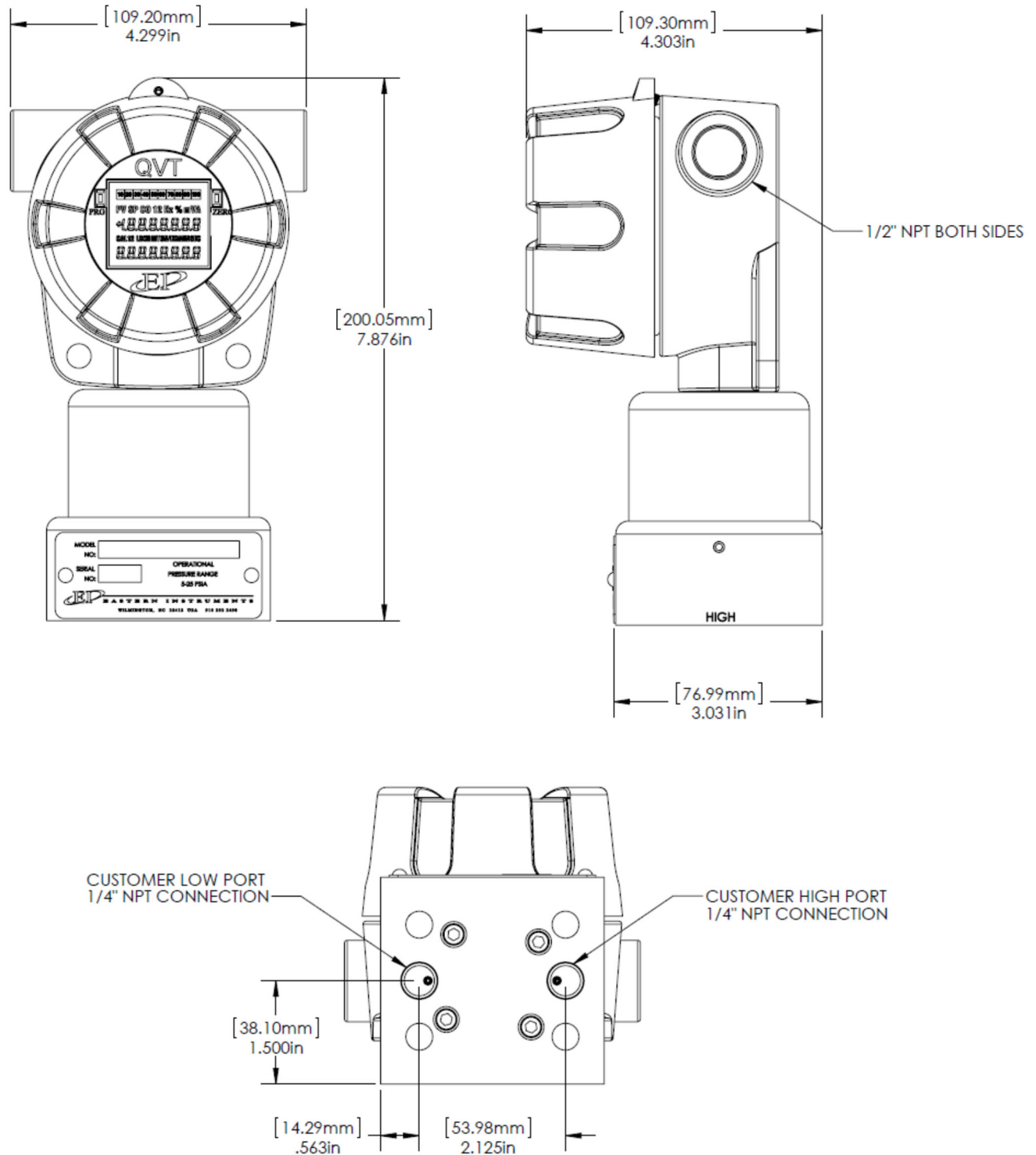




EASTERN INSTRUMENTS

DIMENSIONAL DRAWINGS

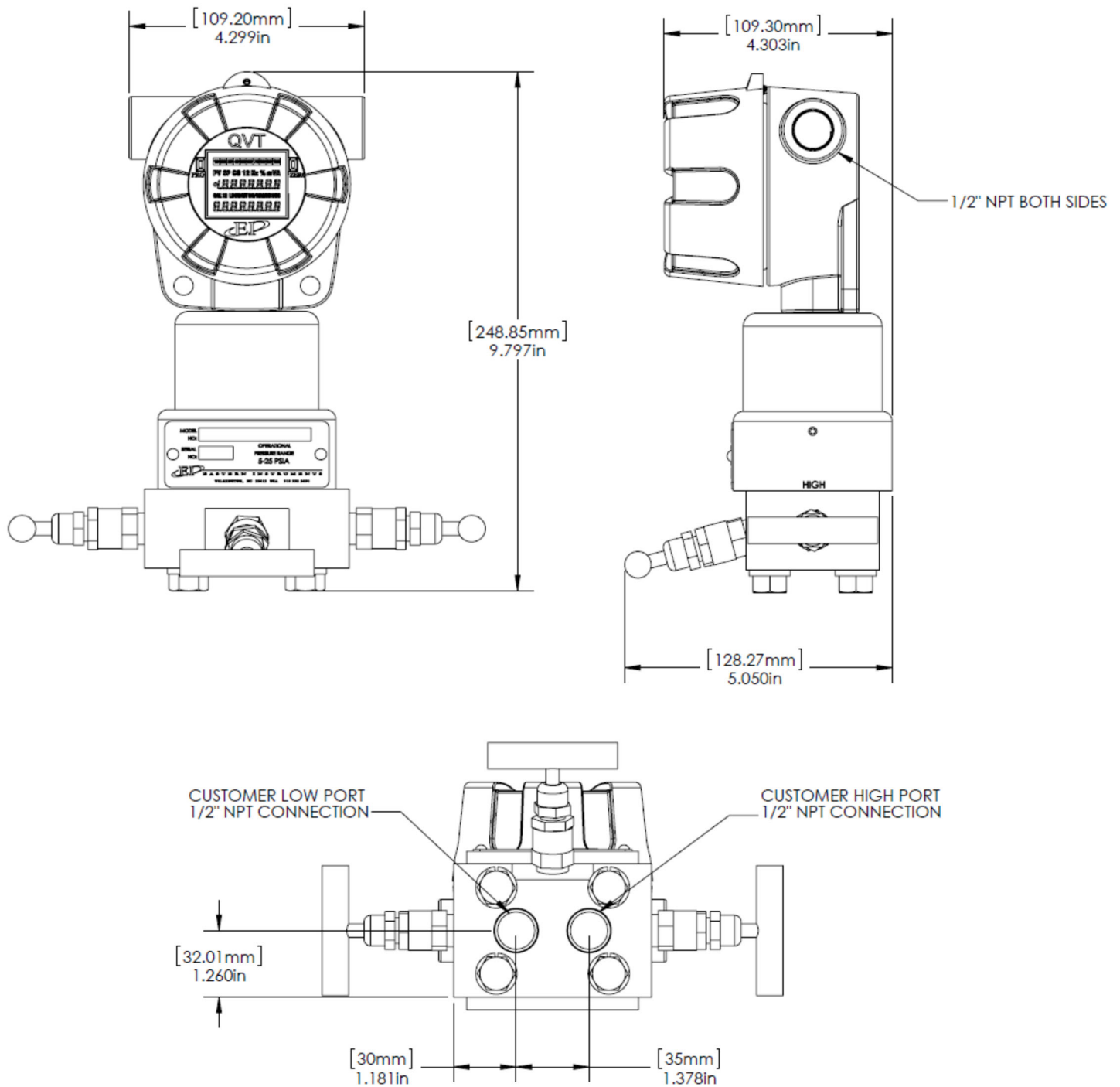
QVT TRANSMITTER





E A S T E R N I N S T R U M E N T S

QVT TRANSMITTER WITH 3-WAY VALVE





E A S T E R N I N S T R U M E N T S

QVT TRANSMITTER WITH 3-WAY VALVE AND PURGE

