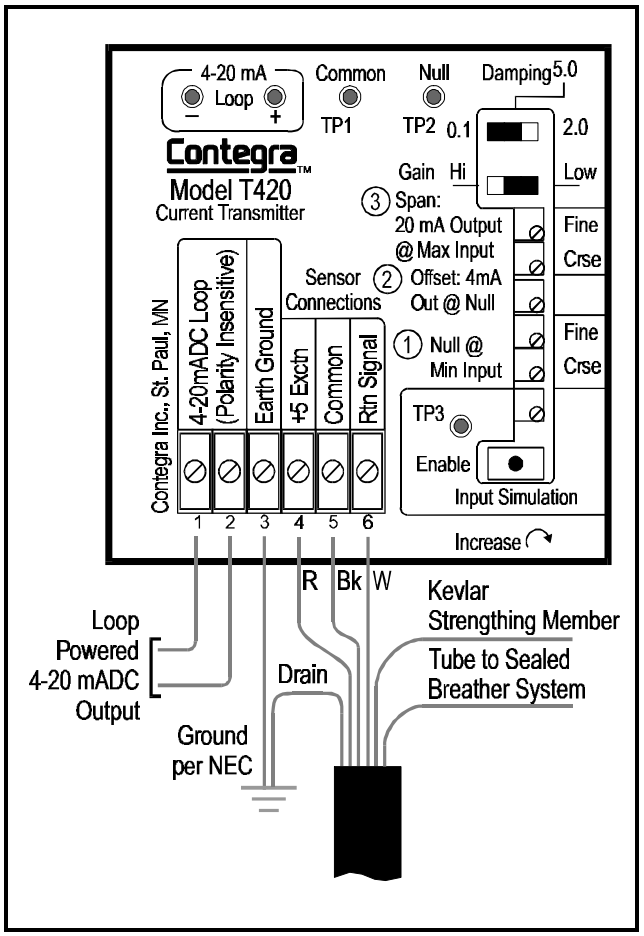
Model T420 4-20 mADC Transmitter Calibration

Connections

Reference the figure at right.

1. Terminal 3 (EARTH GROUND) must be grounded per the National Electric Code (NEC). Failure to properly ground the T420 voids the warranty.
2. A twisted-pair cable (20 AWG min.) is required for best performance. Use metal conduits to isolate signal wiring from electrically noisy environments.
3. The 4-20 mADC loop must be powered by a UL approved Class 2 supply.
4. The T420 (terminals 1 & 2) requires a minimum of 12 VDC (the lift-off voltage) and accepts a maximum of 40 VDC. The Class 2 power supply must be sized to accommodate the sum of the loop resistance and the in-circuit resistance of all connected controllers.
   - The Min voltage = 12 VDC + (resistance X 0.02)
   - The Max voltage = 40 VDC + (resistance X 0.02)
   - The Max load = (supply voltage - 12) X 50

   The maximum load includes loop resistance and the resistance of all connected equipment.



Benchtop Cal

(w/Cal Stand)

1. Apply the "zero scale" pressure to the sensor (i.e. the pressure at which 4 mA is to be transmitted).
2. Measure the voltage from TP1 (common) to TP2 (Null).
3. Adjust the potentiometers labeled "**Null @ Min Input**" (course and fine) until zero volts is measured between TP1 and TP2.
4. Monitor the 4-20 mADC loop current[1]. (Placing the DVM's probes in the T420's 4-20 mADC test points found in the upper left corner of the transmitter.)
5. Adjust the potentiometer labeled "**Offset: 4 mA Out @ Null**" until 4 mA is measured.
6. Apply full-scale pressure to the sensor.
7. Adjust the potentiometers labeled "**Span: 20 mA Output @ Max Input**" (course and fine) until 20 mA is measured. (If a small excursion is being measured, the "gain" jumper may need to be moved to the "Hi" setting to achieve the required 20 mA output.)
8. Finally, choose the desired Damping time constant. Three time constants are available: 0.1 (jumper @ left), 2.0 (jumper @ right) and 5.0 (jumper removed) seconds.

Simulated Calibration

The T420 contains on-board input simulation circuitry. The simulation feature allows the installing technician to perform a simulated calibration prior to installation. The simulated calibration is preformed as follows:

1 Connect the transducer to the T420, leaving the sensor unpressurized (i.e. out of the sensed media) and in a vertical orientation. In this condition the transducer is generating its 'zero-pressure' output.

2. Measure the voltage from TP1 (common) to TP2 (Null).
3. Adjust the potentiometers labeled "Null @ Min Input" (course and fine) until zero volts is measured.

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T420 Calibration

4. Typically the transducer is subjected to only a percentage of its full pressure rating. The installing technician must calculate the maximum percentage or "Max %". The equation is shown below:

$$\text{Max\%} = \left[\frac{\text{Max Sensed Height}}{\text{Sensor's Max Output}}\right] \quad \textit{Equation 1}$$

(Sensor's Max Output = Sensor's PSI * 2.31^2)

e.g. for a 10' wet well using a 5 psi sensor, Max% is:

$$\text{Max\%} = 10/(5*2.31^2) = 0.8670$$

5. Calculate the Full Scale Output (FSO) as follows:

$$FSO = (4 * \text{Max\%}) + .5$$

Equation 2

e.g. continuing the above example of a 10' wet well using a 5 PSI sensor, the 0.8670 is inserted into the formula.

$$FSO = (4 * 0.8670) + .5 = 3.968 \text{ VDC}^3$$

Using this information:

6. Connect a voltmeter to TP1 (common) and TP3 (Input Simulation Level).
7. While pressing the Input Simulation pushbutton, adjust the Input Simulation potentiometer until the calculated full-scale simulation voltage (FSO as calculated above) is measured. Release the pushbutton.
8. Monitor the 4-20 mADC loop current by placing the DVM's probes in the T420's test points - located in the upper left corner.
9. Adjust the potentiometer labeled "**Offset: 4 mA Output @ Null**" until 4 mA is measured.
10. Press the Input Simulation pushbutton and thus apply the simulated full-scale signal. Adjust the potentiometers labeled "**Span: 20 mA Output @ Max Input**" (Course & Fine) until the DVM measures 20 mA.
11 Finally, choose the desired Damping time constant. Three time constants are available: 0.1 (jumper @ left), 2.0 (jumper @ right) and 5.0 (jumper removed) seconds.

Example 1

A 5 PSI sensor has a maximum range of 11.53 feet (5 PSI * 2.31^2 Ft./PSI). If the maximum level to be measured is 8 feet, the percentage is a portion of that range calculated by dividing 8 by the full scale range of 11.53 (e.g. 8/11.53 = 69.38% = Max%.) In this case the sensor's 'full scale' output, based upon the above information and Equation 2 is calculated as follows:

FSO = (4 * 0.6938) + 0.5

or

FSO = 2.28 VDC at 8 ft.

Example 2

A 15 PSI sensor has a maximum range of 34.6 feet (15 PSI * 2.31^2 Ft./PSI). If the maximum level to be measured is 17 feet, the Max% is 49.13 % (17 ft / 34.6 ft.) In this case the sensor's 'full scale' output is calculated as follows:

FSO = (4 * 0.4913) + 0.5

or

FSO = 2.47 VDC at 17 ft.

NOTES:

1) When using the T420's 4-20 mADC test points, best accuracy is achieved by using DVM's with a burden voltage less than 5.0 mV/mA (i.e 5 ohm sense resistance). If using a DVM with a higher sense resistance the installing technician should calibrate by intercepting the 4-20 mADC current loop.
2) There are 2.3067 feet per PSI. Use this number (2.3067) in your equations.
3) The sensor has a 4 VDC span and a 0.5 VDC offset. The Max% is used to calculate the percentage of the 4 VDC span the sensor will output. This "reduced span" is added to the sensor's offset for the FSO (Full Scale Output).