Impeller
Data Industrial®

Transmitters

Model 310 Programmable Analog

Badger Meter

XMT-UM-01653-EN-07 (July 2015)

User Manual

CONTENTS

DESCRIPTION

Model 310 from Badger Meter is a loop-powered, programmable 4-20mA transmitter designed to accept relatively fast, unscaled raw pulses from devices like flow sensors, and then transmit a linear analog signal of desired scaling and units of measure. In addition to our standard flow sensors, the Model 310 can also accept a sine wave, making it a versatile transmitter for numerous applications.

SCOPE AND PURPOSE

This manual provides instructions for installing and programming the Model 310 transmitter.

MECHANICAL INSTALLATION

The Model 310 can be surface mounted onto a panel, attached to DIN rails using adapter clips or wall mounted using two optional enclosures.

Location

Although the Model 310 is encapsulated, all wiring connections are made to exposed terminals. The unit should be protected from weather and moisture in accordance with electrical codes and standard trade practices.

In any mounting arrangement, the primary concerns are ease of wiring and attachment of the programming cable. The unit generates very little heat so no consideration need be given to cooling or ventilation.

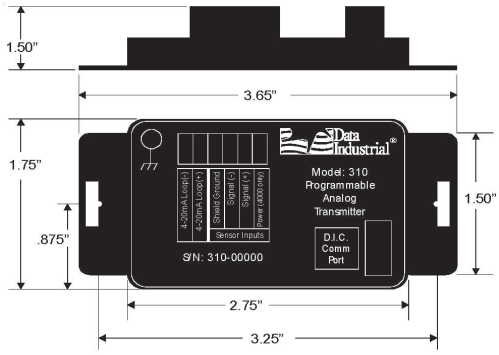

Figure 1: Model 310 transmitter board dimensions

Surface Mount Installation

The Model 310 can be mounted to the surface of any panel using double-sided adhesive tape or by attaching fasteners through the holes in the mounting flanges of the unit.

DIN Rail Mounting

Optional clips snap onto the mounting flanges allowing the Model 310 to be attached to DIN 15, 32, 35 mm DIN rail systems.

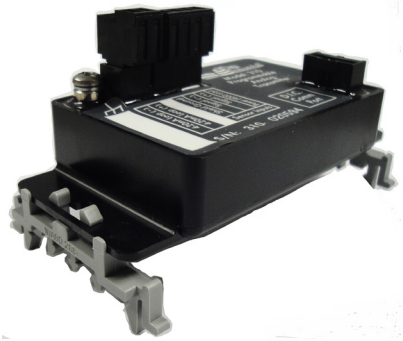

Figure 2: DIN rail mounting

Wall Mounting

For locations requiring additional protection, three wall mount options are available.

310-01 NEMA 4x Plastic Enclosure

The 310-01 NEMA 4x plastic enclosure is usually used in industrial or commercial locations requiring this rating. This version is shipped with the Model 310 secured to the cover with double-sided adhesive tape.

Length = 4.72" (120 mm) Width = 3.15" (80 mm) Height = 2.17" (55 mm)

The enclosure is secured to the wall by screws inserted through the rear corners, outside the o-ring seal area.

Watertight conduit connectors must be used if the NEMA 4x rating is to be maintained.

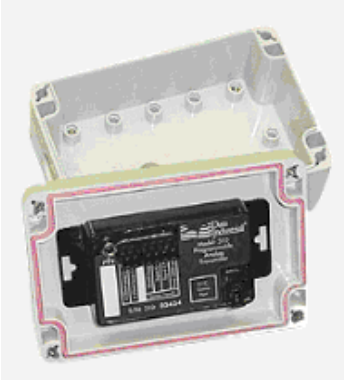

Figure 3: 310-01 NEMA 4x plastic enclosure

310-02 Metal Enclosure

The 310-02 metal enclosure is weather tight and made for installations needing additional impact protection. It is shipped with the Model 310 mounted in an inverted position secured by the cover screws.

Double-sided adhesive tape is included should the installer prefer this method to secure the cover. The box is secured to the wall with a screw through the rear, or can be supported by conduit

Figure 4: 310-02 metal enclosure

310-03 Plastic Enclosure

The 310-03 plastic enclosure is weather tight and good for outdoor locations. It is shipped with the Model 310 secured to the cover with double-sided adhesive tape.

Length = 4.50" (114.3 mm) Width = 2.8" (71.12 mm) Height = 2.0" (50.8 mm)

The enclosure is secured to the wall by screws inserted through side tabs as shown in *Figure 5*.

Figure 5: 310-03 plastic enclosure

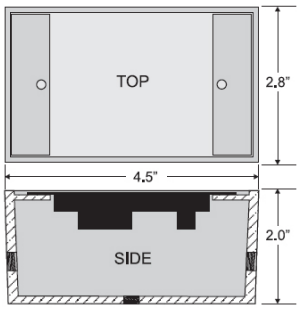

Figure 6: Optional enclosure dimensions (310-02 and 310-03)

ELECTRICAL INSTALLATION

⚠WARNING

According to standard wiring practices, loop power must be off before making any wire connections.

The Model 310 is a non-isolated, loop-powered transmitter. The sensor connections must be electrically floating – with no path to loop power. Any path from the sensor to the loop power supply would result in ground faults that would affect calibration and potentially damage the Model 310 or any devices connected. For this reason the Model 310 cannot share a sensor signal with another device and cannot be used with intrinsic safety barriers without the use of an optic isolator.

The terminal strips have removable plug-in connectors to make wiring easier.

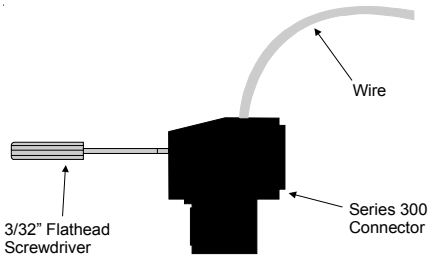

Figure 7: Side View – Typical 300 series removable connector wiring

The Model 310 is shipped with a two-pin Analog Output connector, and a four-pin Sensor Input connector. The programming kit is required to configure the Model 310 and is sold separately. The kit includes a programming cable with a DB9 connector on one end and a connector that plugs into the Model 310 port labeled **D.I.C. Comm Port** on the other (*Figure 8*). If a computer serial port is not available, a USB to COM port adapter can be purchased locally.

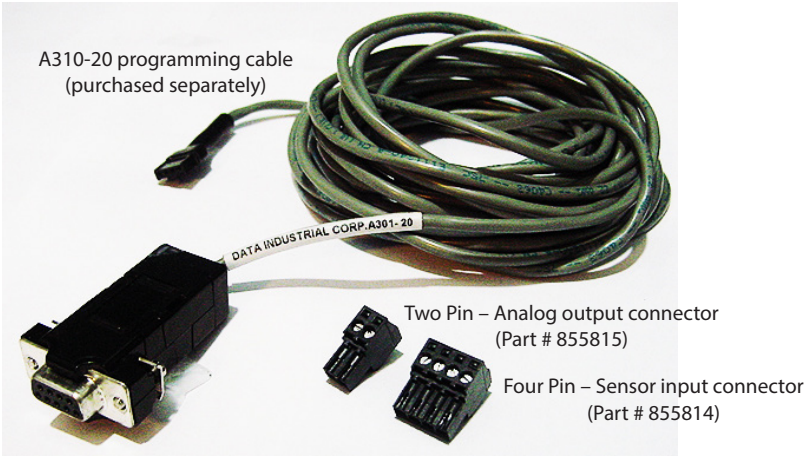

Figure 8: Model 310 connectors

1. As shown in *Figure 9*, connect the loop power supply positive (+) to the Model 310 terminal marked **4-20mA loop (+)**.

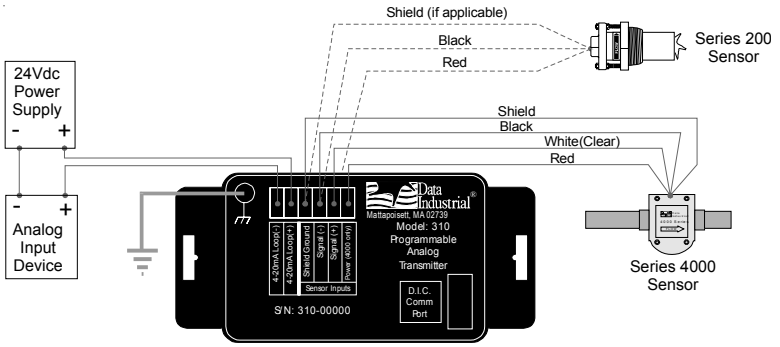

Figure 9: Model 310 wiring to Analog loop and Series 200 or 4000

2. Connect the Model 310 terminal marked **4-20mA loop (–)** to the positive (+) analog terminal of the input device (Chart Recorder, PLC, etc.).
3. Connect the negative (**–**) analog terminal of the input device to the negative (**–**) terminal of the loop power supply.
4. If wiring a **200** sensor, connect the red wire (signal) to the Signal (+) terminal, black wire (common) to the Signal (–) terminal and the shield to the Shield Ground terminal (disregard shield for the IR sensors).

   If wiring a **4000** sensor, connect the clear wire (signal) to the Signal (+) terminal, black wire (common) to the Signal (–) terminal, shield wire to the Shield Ground terminal and red wire (power) to the Power (4000 only) terminal.

   If wiring to a **sine wave output** sensor, consult the factory.
5. For maximum EMI protection, connect the Model 310 ground lug to panel ground.

   NOTE: Included with every Model 310 is a 310-IK (installation kit) containing a screw, a lock washer and a ground lead to connect the Model 310 to earth ground. This will help prevent electrical shock interference from affecting the normal operation of the 310.
6. Make sure all connections are tight. Then plug the connector into the header.

Communications Cable Wiring

Field configuration requires a Badger Meter programming kit (consisting of a custom cable and software, sold separately) and a computer (PC) running Windows® 7, XP or Vista. To connect, the Model 310 must be powered with a minimum of 9V DC across the +/– loop terminals and have at least 4mA of current flowing.

The A301 cable must be connected to the Model 310 "Comm" port connector and an available 9-pin serial port on the PC. A USB to COM port adapter can be used if the DB9 port is not available.

NOTE: Badger Meter provides free programming software updates via the Internet for all 300 devices. Go to *www.badgermeter.com*. Software updates can be found at **Flow Instrumentation/Impeller Products/Transmitters**.

SOFTWARE INSTALLATION

CD Installation

Place the software disk from the programming kit (sold separately) in the computer drive and follow the on screen instructions.

Web Installation

Go to **Flow Instrumentation/Impeller Products/Transmitters** at *www.badgermeter.com* to access the installation software:

PROGRAMMING

Connecting Via D.I.C. Comm Port

Programming the Model 310 is accomplished by installing the programming software on a computer (PC) and entering data on templates of the Windows-based program.

The Model 310 is normally shipped from the factory with the default setting of K=1.0, Offset = 0.0, 4 mA = 0, and 20 mA = 10,000. These settings were chosen to allow the 310 to operate but in such a way that the output cannot be confused with actual operational settings. As a result, the **4-20 mA** output will be 4 mA with no flow input signal, and less than 6mA even with a high flow input signal. The 310 must be configured in the field before it will transmit a useful signal.

1. Load the software on the PC.
2. Connect the Model 310 to a powered 4-20 mA loop. If setting up in the office, a 9-24V DC power source can be used to simulate the loop.

   NOTE: The 310 will not communicate if there is not at least a minimum of 4 mA, 9V DC across the loop+ and loop terminals.
3. Connect the computer to the Model 310 transmitter socket labeled "**D.I.C. Comm Port"** using the A-301 communications cable, taking care to properly align the tab on the plug and socket to maintain polarity.
4. Connect the DB9 connector of the A301 communications cable to a port on the PC that has the software installed. If a DB9 port is not available on the PC, a USB to COM port adapter can be purchased locally.
5. Open the program and from the **Device** option in the menu bar, select **310** as shown in *Figure 10*.

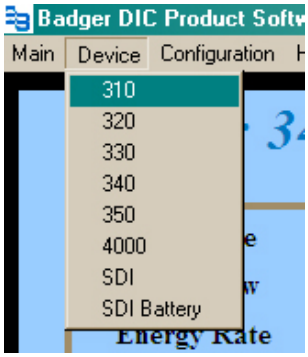

Figure 10: Select 310

6. From the **Configuration** option in the menu bar, select **Set Comm Port**. The Comm Settings window opens (*Figure 12*).

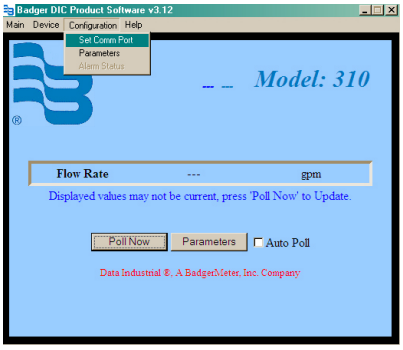

Figure 11: Set Comm Port

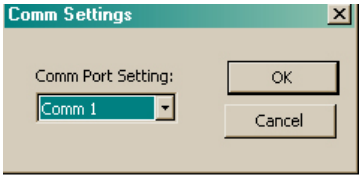

Figure 12: Select "Comm" port

7. Select the "Comm**"** port and then click **OK**. If the Comm port and Device type have been properly selected, the dashes "---" on the screen will be replaced with values. See *Figure 14*.

   If this does not occur, communication has not been established and you cannot continue to the next step. To establish communication, click the **Poll Now** button.

   If communication still does not occur and you are using a DB9 to Comm 1 or Comm 2, use a USB to COM adapter. The USB to COM adapter will create a new port that was not previously listed. The **Ports (COM & LPT)** file in Windows **Device Manager** can be helpful in determining the actual ports that are available.

   To access **Device Manager**, click the **Start/Windows icon** in the lower left corner on the main task bar of the PC. Then go to **Control Panel > Device Manager** and click the small arrow next to **Ports (COM & LPT)** to expand the file. See the example in *Figure 13*.

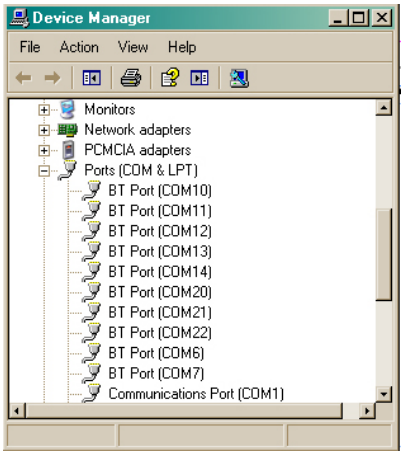

Figure 13: Ports (COM & LPT) in Device Manager

   Select the new port created by the adapter. The screen should show the dashes "---" replaced with values, which confirms communications are properly established as in *Figure 14*.

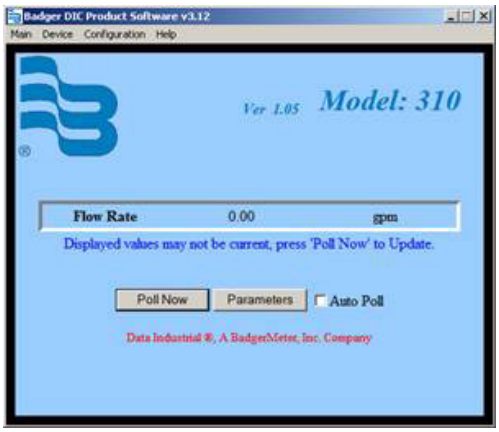

Figure 14: Communications established - value filled

8. When communication has been confirmed, click the **Parameters** button to display the Parameters screen. See the example in *Figure 15*.

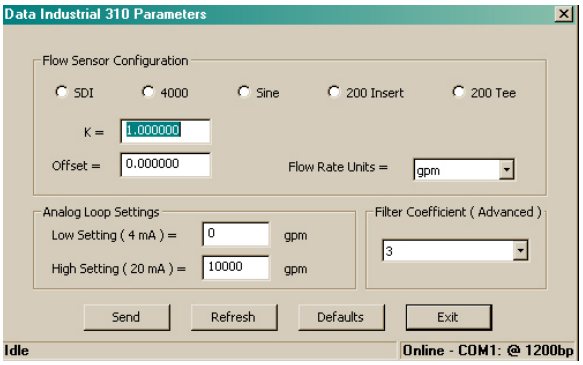

Figure 15: Parameters screen

Programming Parameters

1. From the Parameters screen, program the following:
    - **Flow Sensor Configuration** and **Flow Rate Units**
    - **Filter Coefficient** (flow and energy averaging for reading stability)
    - **Analog Loop Settings**
2. Select the **Sensor** type and enter the **K** and **Offset** values.

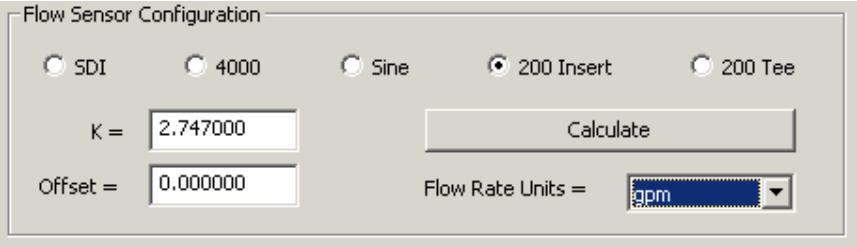

Figure 16: Flow sensor configuration

- **SDI**: If the **SDI** sensor is selected, the required **K** and **Offset** values can be found in the SDI owner's manual.
- **4000**: If the **4000** sensor is selected, select the sensor from the drop-down menu that appears.
- **Sine**: Provided for connection to sensors which have a sine wave output. Consult the sensor manufacturer for the calibration settings.
- **200**: If the **200 Insert** is selected, the **Calculate** button appears. Enter the required **K** and **Offset** values found in the 200 owners manual. Or click the **Calculate** button and enter an inside pipe diameter and the **K** and **Offset** values will automatically be entered in.

Figure 17: Calculate button for 200 Insert sensor

- **200 Tee**: If the **200 Tee** sensor is selected, select the sensor from the drop-down menu that appears.

3. Select **Flow Rate Units** from the drop-down menu.

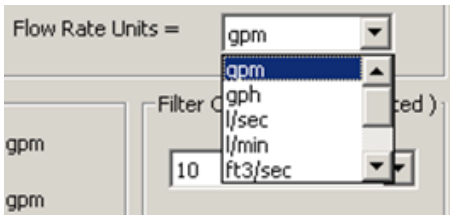

Figure 18: Flow Rate Units menu

4. Enter the **Analog Loop Settings**: 4 mA rate and 20 mA rate.

   The 4-20 mA output is a linear representation of flow rate. Except under very unusual circumstances, 4 mA is set to represent 0.00 flow.

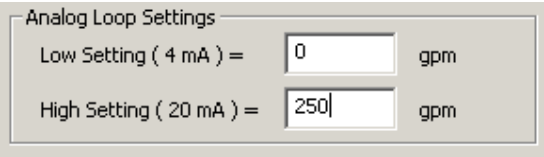

Figure 19: Analog loop settings

   20 mA should be selected to represent a flow greater than ever expected to occur. This will prevent the analog output from running out of range and locking on 20 mA at times of high flow. However, 20 mA should not be set at such a high value that even at times of high flow the output does not exceed 60-80% of full scale. Doing so will waste the range of the meter and affect the system's signal-to-noise ratio. It is also very important that the range of the device receiving the 4-20 mA as an input be scaled in exactly the same way as the Model 310.

5. The **Filter Coefficients** are a weighted, moving average used to smooth out any instability in the incoming flow signal. The instability is usually the result of a disturbed flow profile due to inadequate straight pipe, fittings or other variables. Set the value from 0…20, with **3** as the factory default. For most applications leave the default setting of **3** if the flow rate or energy rates are, for some reason, unstable (from a disturbed flow profile, for example). Increase the values as needed.
6. To save any changes, click **Send** before leaving the screen.

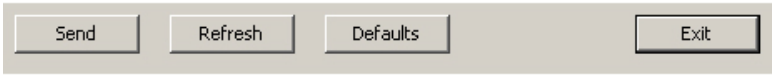

Figure 20: Click Send to save changes

Other options are:
Refresh – rereads the unit and refreshes the screen with the current 310 settings.

Defaults – restores all factory settings.

Exit – returns to the Main screen.

SPECIFICATIONS

Power Requirements	Loop input voltage 9…35V DC
Input Frequency	0.4…10 kHz
Load Resistance	Max 750 Ω @ 24V DC
Output Response Time	Varies with filter
Temperature (operating)	–29…70°C
	–20…158°F
Temperature (storage)	–40…85°C
	–40…185°F
Accuracy	±0.04% of reading over entire span
Linearity	0.1% of full scale

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