



InnovaMass 240i / 241i

InnovaMass[®] iSeries Models 240i & 241i

Vortex Volumetric Flow &
Multivariable Mass Vortex Flow Meters

Instruction Manual

Smart Interface Portal (SIP)



Part Number: 24i-IM-SIP
Version 1.1, December 2015



SIERRA[®]

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<http://www.sierrainstruments.com/facilities.html>

CORPORATE HEADQUARTERS

5 Harris Court, Building L Monterey, CA 93940
Phone (831) 373-0200 (800) 866-0200 Fax (831) 373-4402
info@sierrainstruments.com
www.sierrainstruments.com

EUROPE HEADQUARTERS

Bijlmansweid 2 1934RE Egmond aan den Hoef
The Netherlands
Phone +31 72 5071400 Fax +31 72 5071401
sales@sierrainstruments.nl

ASIA HEADQUARTERS

Second Floor Building 5, Senpu Industrial Park
25 Hangdu Road Hangtuo Town
Pu Dong New District, Shanghai, P.R. China
Postal Code 201316
Phone: + 8621 5879 8521 Fax: +8621 5879 8586

IMPORTANT CUSTOMER NOTICE- OXYGEN SERVICE

Unless you have specifically ordered Sierra's optional O₂ cleaning, this flow meter may not be fit for oxygen service. Sierra Instruments, Inc., is not liable for any damage or personal injury, whatsoever, resulting from the use of Sierra Instruments standard mass flow meters for oxygen gas. You are responsible for cleaning the mass flow meter to the degree required for your oxygen flow application. However, some models can only be properly cleaned during the manufacturing process.

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Warnings and Cautions

We use caution and warning statements throughout this manual to draw your attention to important information.

| Symbol Key | | |
|---|----------------|---|
| Symbol | Symbol Meaning | Description |
|  | Warning | This statement appears with information that is important to protect people and equipment from damage. Pay very close attention to all warnings that apply to your application. |
|  | Caution | This statement appears with information that is important for protecting your equipment's performance. Read and follow all cautions that apply to your application. |

General Safety Information



Warning!

- Consult the flow meter nameplate for specific flow meter approvals before any hazardous location installation.
- For insertion flow meter installations, an insertion tool must be used for any installation where a flow meter is inserted under pressure greater than 50 psig.
- Hot tapping must be performed by a trained professional. U.S. regulations often require a hot tap permit. The manufacturer of the hot tap equipment and/or the contractor performing the hot tap is responsible for providing proof of such a permit.
- All flow meter connections, isolation valves and fittings for cold/hot tapping must have the same or higher pressure rating as the main pipeline.
- To avoid serious injury, DO NOT loosen a compression fitting under pressure.
- To avoid potential electric shock, follow National Electric Code or your local code when wiring this unit to a power source. Failure to do so could result in injury or death. All AC power connections must be in accordance with published CE directives. All wiring procedures must be performed with the power off.
- Before attempting any flow meter repair, verify that the line is not pressurized. Always remove main power before disassembling any part of the mass flow meter.
- When using toxic or corrosive gases, purge the line with inert gas for a minimum of four hours at full gas flow before installing the flow meter.



Caution!

- If required, Calibration must be performed by qualified personnel. Sierra strongly recommends that you return your flow meter to the factory for calibration.
- In order to achieve accurate and repeatable performance, the flow meter must be installed with the specified minimum length of straight pipe upstream and downstream of the flow meter's sensor head.
- For insertion flow meter installations, the sensor alignment pointer must point downstream in the direction of flow.
- The AC wire insulation temperature rating must meet or exceed 85°C (185°F)

Receipt of System Components

When receiving a Sierra flow meter, carefully check the outside packing carton for damage incurred in shipment. If the carton is damaged, notify the local carrier and submit a report to the factory or distributor. Remove the packing slip and check that all ordered components are present. Make sure any spare parts or accessories are not discarded with the packing material. Do not return any equipment to the factory without first contacting Sierra Customer Service.

Technical Assistance

If you encounter a problem with your flow meter, review the configuration information for each step of the installation, operation, and setup procedures. Verify that your settings and adjustments are consistent with factory recommendations. Installation and troubleshooting information can be found in the InnovaMass 240i/241i Instruction Manual, Chapter 2 (Installation) and Chapter 4 (Troubleshooting).

If the problem persists after following the troubleshooting procedures outlined in the InnovaMass 240i/241i Instruction Manual, Chapter 4, contact Sierra Instruments by fax or by e-mail (see inside front cover for contact information). For urgent phone support, you may call (800) 866-0200 or (831) 373-0200 between 8:00 a.m. and 5:00 p.m. In Europe, contact Sierra Instruments Europe at +31 72 5071400. In the Asia-Pacific region, contact Sierra Instruments Asia at +8621 5879 8521.

When contacting Technical Support, make sure to include this information:

- The flow range, serial number, and Sierra order number (all marked on the meter nameplate)
- The software version (visible at start up)
- The firmware version display (displayed at meter start up)
- The problem you are encountering and any corrective action taken
- Application information (fluid, pressure, temperature and piping configuration)

Additional Resources

Visit Sierrainstruments.com for additional resources. Note: the most current versions of the iSeries documents can be found at www.sierrainstruments.com/download/iSeries.

Chapter 1 | Smart Interface Portal (SIP) Set Up & Installation

This manual provides information needed to install, setup, and operate the Smart Interface Portal (SIP) for the 240i Inline and 241i Insertion InnovaMass vortex flow meters. For your reference, below is the SIP main screen with key functionality. Please note that the data displayed on the graphic below is for illustrating use only. Your data will differ.



Watch Video Tutorial – a video tutorial for this function is available on the USB flash drive provided in the product shipment.

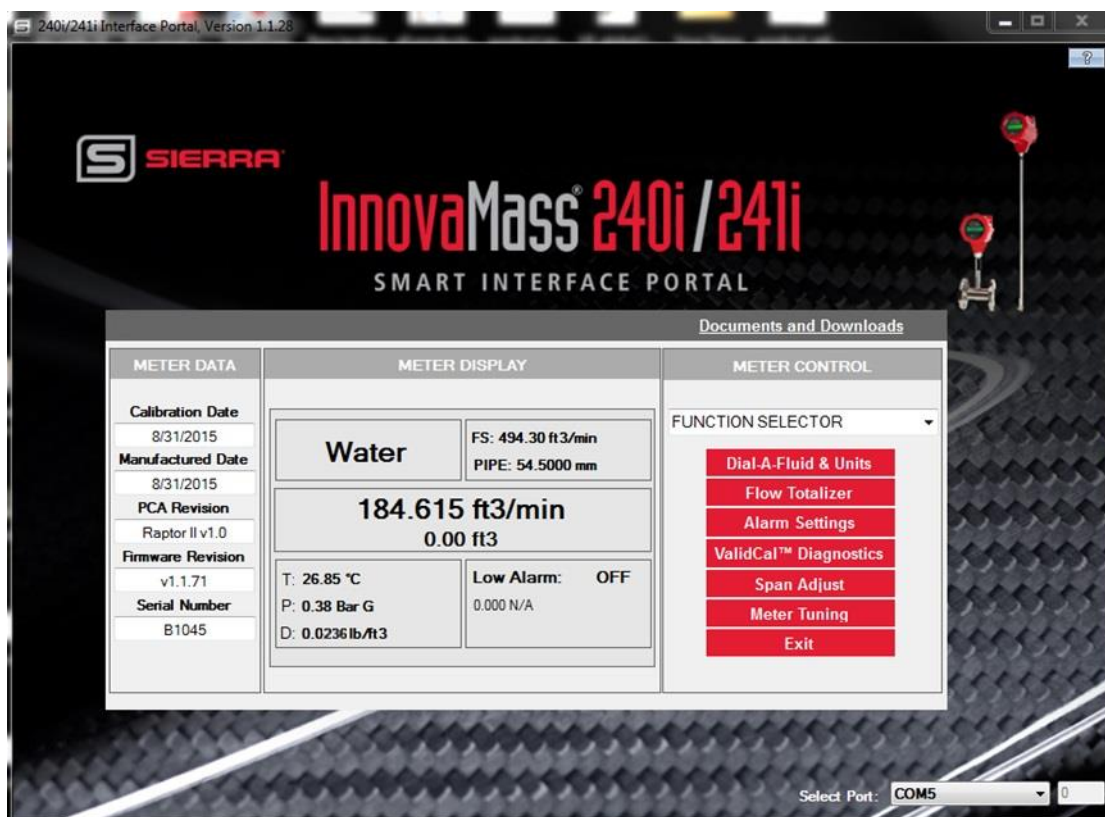


Figure 1. InnovaMass Smart Interface Portal Home Screen

Installing Your Smart Interface Software (SIP)

System Requirements

Operating System: Windows Vista/7/8/10



InnovaMass 240i and 241i Sierra Interface Portal is Windows Compatible

Software & Firmware Updates

If your meter is connected to a computer with internet connection, notifications about SIP software or meter firmware updates will appear when you start your SIP. The notification will inform you if there is a software update to SIP itself or if newer firmware for the meter is available. You will have the option to install or ignore.

If you do not have internet capabilities, we recommend you periodically check this page (<http://www.sierrainstruments.com/products/sip/sip-innovamass.html>) for updates.

SIP Installation Steps:

| | |
|---|--|
|  | <p>You must have internet in order to install the Smart Interface Program (SIP). If you do not have internet capabilities the meter will notify you it tried to connect, but wasn't able to. Sierra recommends you periodically check this page (http://www.sierrainstruments.com/products/sip/sip-innovamass.html) for updates.</p> |
|  | <p>Watch Video Tutorial – a video tutorial for this function is available on the USB flash drive provided in the product shipment.</p> |

Connect your flow meter to your computer using the provided USB male to USB male cable (See Figure 3). Use the provided plug to install power to the meter. You may also use an RS-232 to serial port connection. Please note that this is a special USB cable (B+B) that is provided with your meter.

In the event you want to connect to the RS-232 terminal strip, you will need to wire your RS-232 connections to the terminal strip connectors numbers 13, 14 and 15 (See Figure 2).

- The "TX" (send) connection from the computer must be connected to terminal slot number 13 "RxIn/Buss-".
- The "RX" (receive) connection from the computer must be connected to terminal slot number 14 "TxOut/Buss+".
- The "common" RS-232 ground connection must be connected with terminal slot number 15 "CommGround."

From a RS-232 DB9 point of view, the wiring

- DB9 pin #2 (RX) to terminal pin #14 (TxOut/Buss+)
- DB9 pin #3 (TX) to terminal pin #13 (RxIn/Buss+)
- DB9 pin #5 (ground) to terminal pin #14 (Comm/Ground)

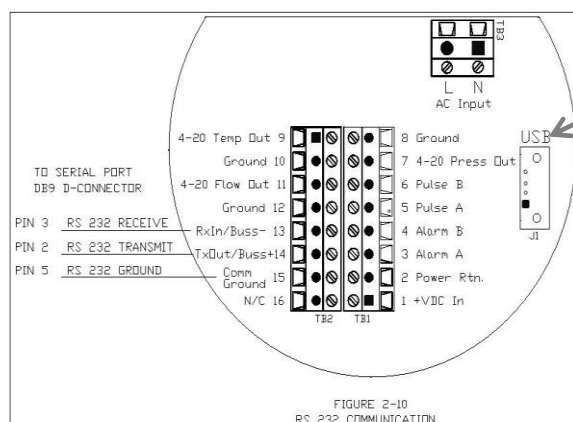


Figure 2. InnovaMass 240i/241i USB Connection



Figure 3. InnovaMass 240i/241i USB male to USB male cable

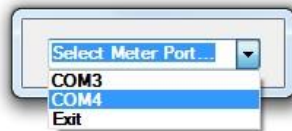
- 1) Go to <http://www.sierrainstruments.com/products/sip/sip-innovamass.html> to download the InnovaMass 240i and 241i Smart Interface Portal (SIP) “InnovaMass_SIP.exe” file. The SIP software is also on the USB stick shipped with your meter.
- 2) Click on “InnovaMass_SIP.exe” to begin download and let the program install the 240i and 241i Smart Interface Portal (SIP). The file is self-extracting.
- 3) Follow instructions for installing the files.
<http://www.sierrainstruments.com/products/sip/sip-innovamass.html>
- 4) The SIP installation process takes about 1-10 minutes, depending on the speed of your computer.

If you have any questions about downloading the files please contact Sierra at:
techsupport@sierrainstruments.com.

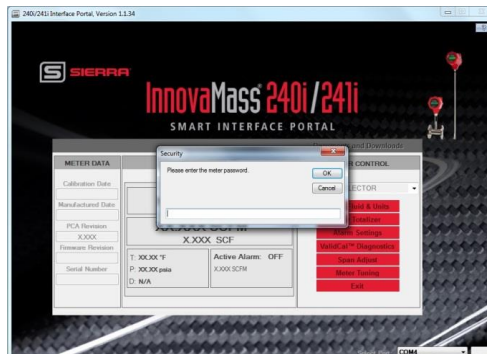
SIP Start-Up & Configuration

The Smart Interface Portal allows the user to configure the unit and view all unit parameters.

- 1) Power up the meter and use a USB or RS-232 to connect to the computer with the installed SIP (See Figure 2 & 3 for meter USB connection).
- 2) Click on the 240i/241i Sierra “S” SIP Icon on your computer to start the program.
- 3) Use the drop down menu to select the appropriate Communications Port.



- 4) Once the port is selected, the meter data is read into the SIP software. It may take several seconds for all data fields to become populated. If you get an error, make sure you are connected to the correct Com port.
- 5) For security, upon initial startup, the meter will require a password. The factory default is 0000. This can be reset in the “Meter Information” section on the function selector drop down menu (See Figure 1).



Chapter 2 | Overview of InnovaMass Smart Interface Portal (SIP)

Once you have submitted your password, you will see the SIP Main menu. The data fields on the top page are read only. All meter updates and adjustments are performed via the “Function Selector” or Quick Key buttons. These functions are discussed in later sections. See Main Menu overview Figure 4.

Watch Video Tutorial – a video tutorial for this function is available on the USB flash drive provided in the product shipment.

The screenshot shows the SIP Main Menu interface with the following callout boxes:

- ! Indicates Meter fault click to run Validcal Diagnostics**: Points to a red exclamation mark icon in the top left corner.
- Meter Data Section Provides Cal Date, Firmware Version, and Serial Number**: Points to the 'METER DATA' table.
- Meter Display Section Gives Fluid, Flow Rate and Units, & Totalized Flow**: Points to the 'METER DISPLAY' section showing 'Water', '19.011 ft3/min', and '5962.00 ft3'.
- Use Function Selector to Get a Dropdown Menu of all Features**: Points to the 'FUNCTION SELECTOR' dropdown menu.
- Get all Document and Downloads**: Points to the 'Documents and Downloads' link in the top right.
- Use Quick Keys to Configure Unit**: Points to the 'ValidCal™ Diagnostics' button in the function selector list.

| METER DATA | METER DISPLAY | METER CONTROL |
|--|---|---|
| Calibration Date 8/31/2015 Manufactured Date 8/31/2015 PCA Revision Raptor II v1.0 Firmware Revision v1.1.83 Serial Number B1045 | Water FS: 494.30 ft3/min PIPE: 54.5000 mm <div style="text-align: center; font-size: 1.2em;"> 19.011 ft3/min 5962.00 ft3 </div> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> T: 26.85 °C P: 0.32 Bar G D: 0.0236 lb/ft3 </div> <div style="width: 45%;"> Window Alarm: ON 0.00 / 5.00 ft3/min </div> </div> | FUNCTION SELECTOR Dial-A-Pipe Dial-A-Fluid & Units Flow Totalizer Alarm Settings ValidCal™ Diagnostics Span Adjust Meter Tuning Exit |

Figure 4. Overview of Innovamass Smart Interface Portal (SIP) Main Menu

Main Menu: Meter Data Section

The “Meter Data” section on the main menu displays the basic identifying information of the meter: manufacture date, most recent calibration date, PCA and Firmware versions, and the meter’s serial number. See Figure 5.

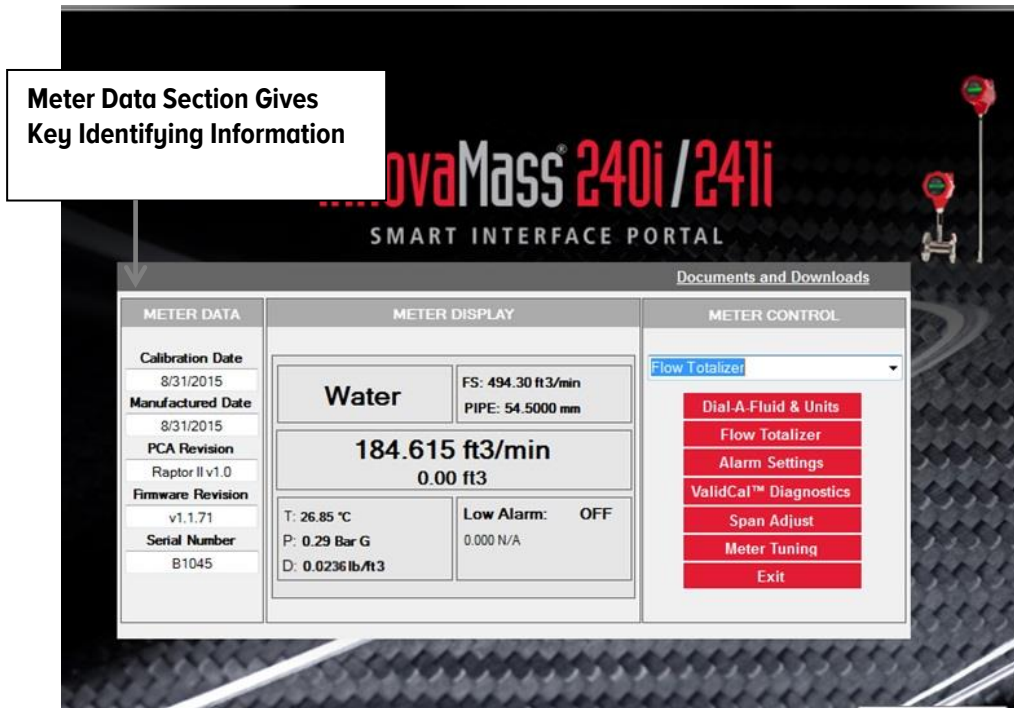


Figure 5. Explanation of Meter Data Section

Main Menu: Meter Display Section

The “Meter Display” section contains the primary meter output variables. Fluid type, flow rate, totalized flow, temperature, pressure, and density can all be viewed at a glance. Application full scale and pipe size are also displayed along with current meter alarm status. See Figure 6

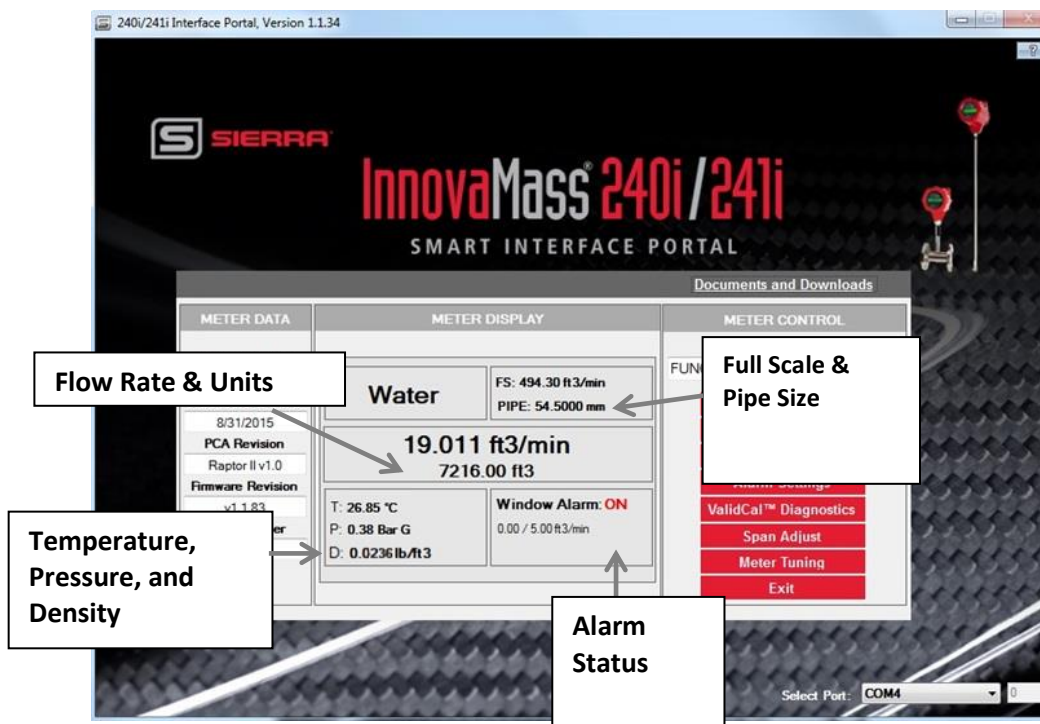


Figure 6. Main Menu-Meter Display

In this example (See Figure 6):

- The fluid being measured is water
- The calibrated full scale (FS) is 494.30 ft³/min
- The inside diameter of the pipe is 54.5000 mm
- The meter flow rate is 19.011 ft³/min
- The meter has totalized Flow of 7216.00 ft³
- The temperature is 26.85°C
- The pressure is 0.38 Bar G
- The low alarm is set to warn if flow drops below 5.00 ft³/min
- Since flow is 7216.00 ft³/min, the alarm is ON

Main Menu: Meter Control Section

The “Meter Control” section enables direct configuration of the meter. The function selector dropdown menu gives access to all of the available meter function screens. There are also a series of quick key buttons, like “Dial-A-Pipe”, “Dial-A-Fluid & Units”, “Flow Totalizer”, “ValidCal”, “Meter Tune”, and “Meter Settings” to allow for rapid adjustment of application conditions and meter. See Figure 7.

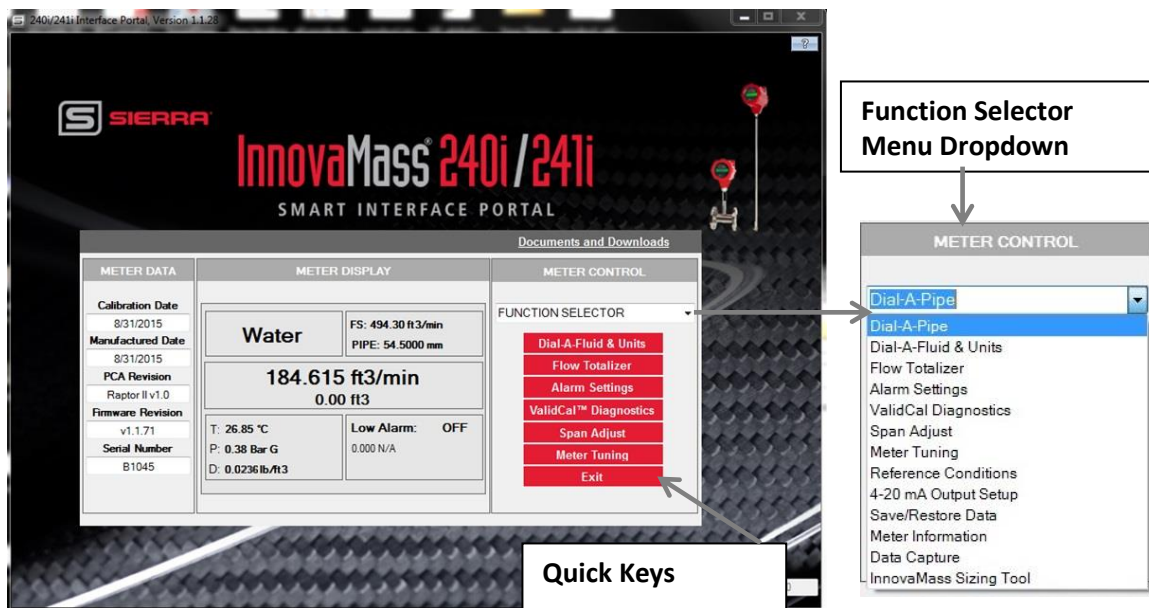


Figure 7. Main Menu-Meter Control Section

Quick Key Functions in the Meter Control Section- Dial-A-Pipe (241i Insertion Meters Only)

Quick Keys on the main menu in the “Meter Control” section (see Figure 7) allow for fast configuration of your unit. The first quick key, “Dial-A-Pipe”, makes in-the-field pipe reconfiguration very convenient (241i Insertion meters only). You only need to know the type of pipe and either the pipe schedule or the inside diameter to make adjustments.



The Dial-A-Pipe quick key is only present on the main menu for 241i insertion meters.

To use Dial-A-Pipe (See Figure 8):

- 1) Click the Dial-A-Pipe Quick Key in the “Meter Control” Section.
- 2) Select either English or Metric units.
- 3) If the “Inside Diameter” is known, type this value in the “Inside Diameter” field.
- 4) If the “Pipe Schedule” is known, select it from the pipe schedule pull down menu. The inside diameter will then be auto-populated with the correct value.
- 5) Use the pipe type pull down menu to select the type.
- 6) Pipe insertion depth is automatically set to the pipe centerline unless adjusted here. (For some large pipes where centerline placement is not possible. An insertion depth of 5 inches is suggested.)
- 7) Save new pipe configuration.

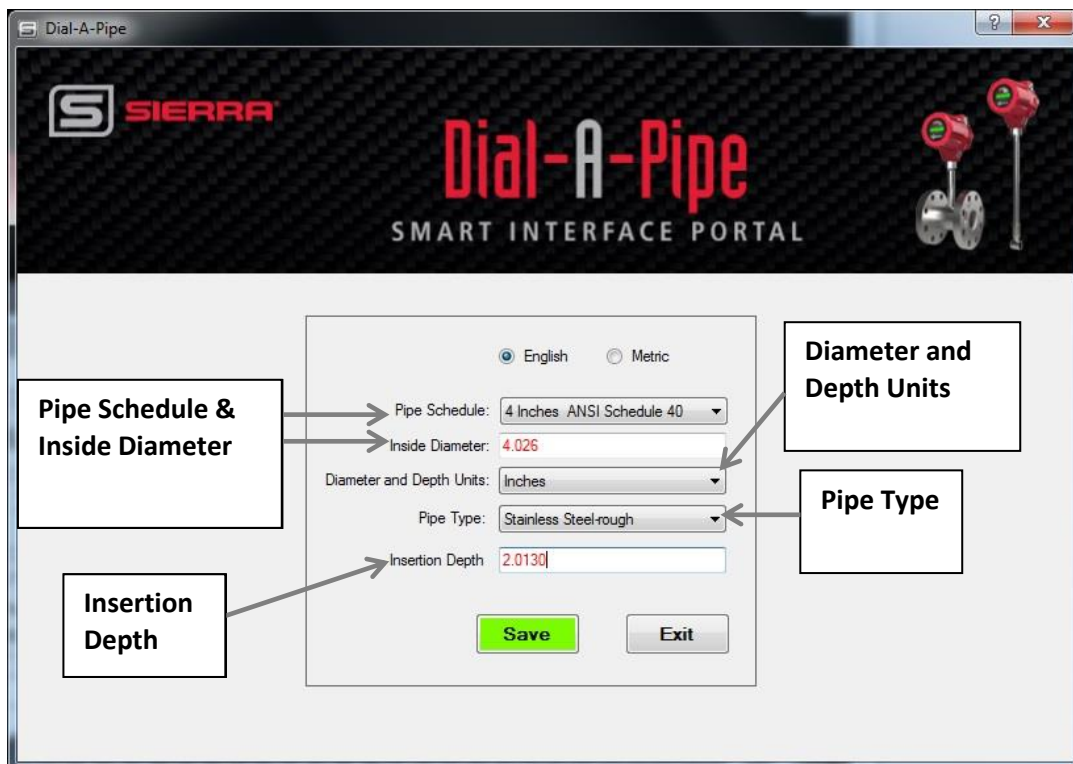


Figure 8. Dial-A-Pipe Main Screen

In this example (See Figure 8):

- English units are displayed
- Pipe schedule is set to 4-inch ANSI Schedule 40
- Inside diameter is set to 4.0260 inches
- Pipe type is set to “Stainless Steel-rough”

- Insertion depth is set to 2.013 inches (centerline)

The meter automatically adjusts for the new pipe specifications.

Quick Key Function: Dial-A-Fluid & Units

“Dial-A-Fluid”, found in the “Meter Control” section allows you to change your fluid and units in the field.

To Use Dial-A-Fluid (See Figure 9):

1. Click the “Dial-A-Fluid” quick key in the “Meter Control” section. See Figure 7.
2. Select the fluid to be measured from the dropdown menu. Properties of gases and liquids that are stored on-board the meter and are available for selection.
3. Select the appropriate “Flow Units.”
4. Select “Temperature Units.”
5. Select “Pressure Units.”
6. Save new configuration.

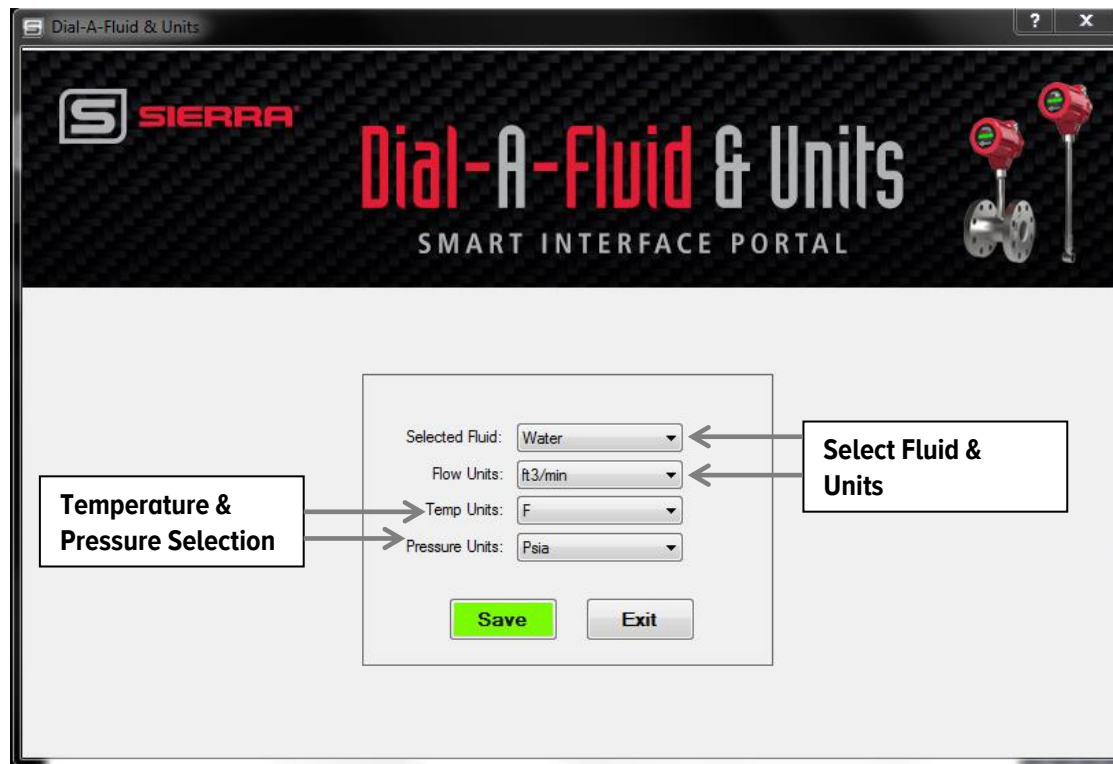


Figure 9. Dial-A-Fluid & Units Overview

In this example (See Figure 9):

- Selected fluid is water
- Flow is measured in ft³/min
- Temperature measured in °F
- Pressure measured in psia

The meter automatically adjusts for those new fluid and measurement properties.

Quick Key Function: Flow Totalizer

The “Flow Totalizer” allows for measurement of accumulated flow. Using the “Flow Totalizer” menu, you can edit the configuration of the “Totalizer” and test it.

To Use the Flow Totalizer (See Figure 10):

- 1) Click the “Flow Totalizer” quick key in the “Meter Control” section. See Figure 10.
- 2) Accumulated “Flow Total” is displayed with flow units.
- 3) Reset flow total using “Reset Totalizer” button (This function is disabled on meters requiring non-resettable totalizers).
- 4) Turn “Flow Totalizer” on or off with the “Totalizer Status” drop down menu. “Flow Totalizer” will only accumulate flow if it is turned **on**.
- 5) Use “Force Totalizer Relay Pulse” to test pulse relay.
- 6) The number of flow units per pulse determines the amount of flow accumulated with each relay pulse.
- 7) The duration of the pulse can be set by entering numbers 1 to 1000 in the Pulse Width field.

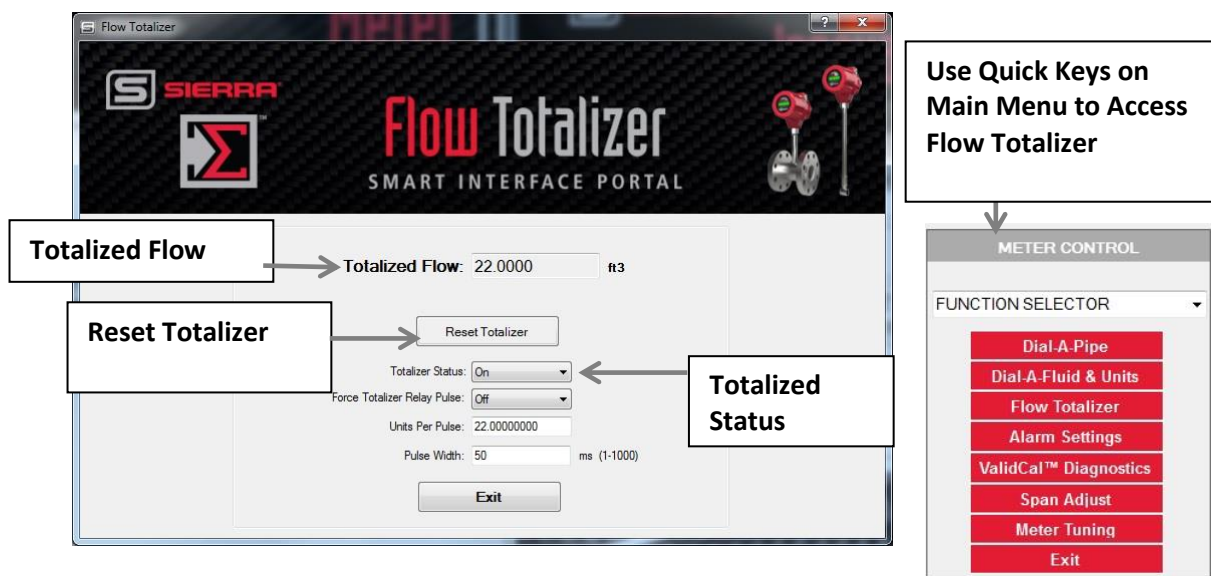



Figure 10. Flow Totalizer Main Screen



The totalizer menu is only available when using volumetric or mass flow units.

The totalizer operates at a maximum frequency of 1HZ (1 pulse per second). This limits the maximum units per pulse. The totalizer will not roll over until 1 billion billion is reached.

- For example, if you have a flow of 60 scfm with a units per pulse set to 1 scf. This means 1 pulse per second or 1 Hz. This is within the ability of the totalizer.
- Reducing the flow to 30 scfm means the totalizer will pulse once every two seconds. Again this is acceptable.
- Increasing the flow to 120 scfm means the totalizer would pulse once every 0.5 seconds, but this is too fast. In this case, it will count but will buffer the output to match the 1Hz rule. So in your example, if you stop flow after 1 minute, the totalizer will continue to count until all 120 overflows are processed.
- This puts a limit on the resolution of the totalizer at higher flows. You must convert the flow to units per second and ensure this number is equal to or bigger than one. If you make changes in SIP that could affect the UPP (units Per Pulse), SIP will auto update the UPP value to honor the 1Hz rule.

In this example (See Figure 10):

- Total accumulated flow is 22.0000 ft³
- Totalizer is ON
- Units Per Pulse is 22.0 ft³
- Pulse Width is 50 ms

Quick Key Function: Alarm Settings

The “Alarm Settings” menu allows for configuration of alarms for “Flow Rate,” “Temperature,” “Pressure,” or “Totalized Flow.”

To use the Alarm Settings (See Figure 11):

- 1) Click the “Alarm Settings” quick key in the “Meter Control” section. See Figure 7.
- 2) Use the “Active” dropdown menu to select the active alarm or turn off the alarm function entirely. Only **one** alarm can be active at any time.
- 3) Use the “Mode” drop down menu to select when the meter should activate alarm low, high or to set an window alarm. A window alarm will turn on once the parameter drops below the low alarm or exceeds the high alarm, so it serves as a combination of low and high alarm (the alarm is off when the active parameter is within the “window”).
- 4) You can now set the alarm low and high values for “Flow,” “Temperature,” “Pressure,” and the “Totalizer.”
- 5) To edit a value, click on the field and type in the desired numeric value.
- 6) Click the “Save” button and all edited values will be written into memory (See Figure 11).

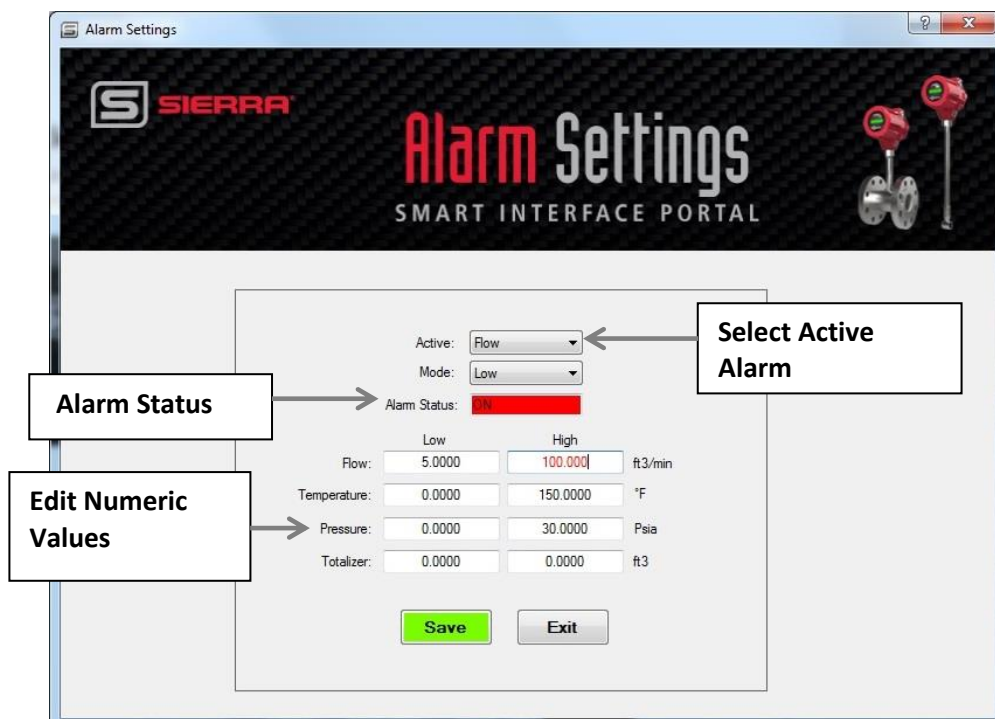



Figure 11. Alarm Settings Main Menu

In this example (See Figure 11):

- Flow is selected as the Active alarm
- Alarm in Low Mode
- Alarm will activate when Flow is below 5 ft³/min
- Alarm is **ON**

Chapter 3: ValidCal Diagnostics: Hardware Validation

Once your meter is powered on, the meter will report any hardware faults by displaying an “!” on the Smart Interface Program (SIP) top left (See Figure 4). When you click the “!”, you will be taken to the ValidCal Diagnostic screen and the diagnostic test will automatically run.

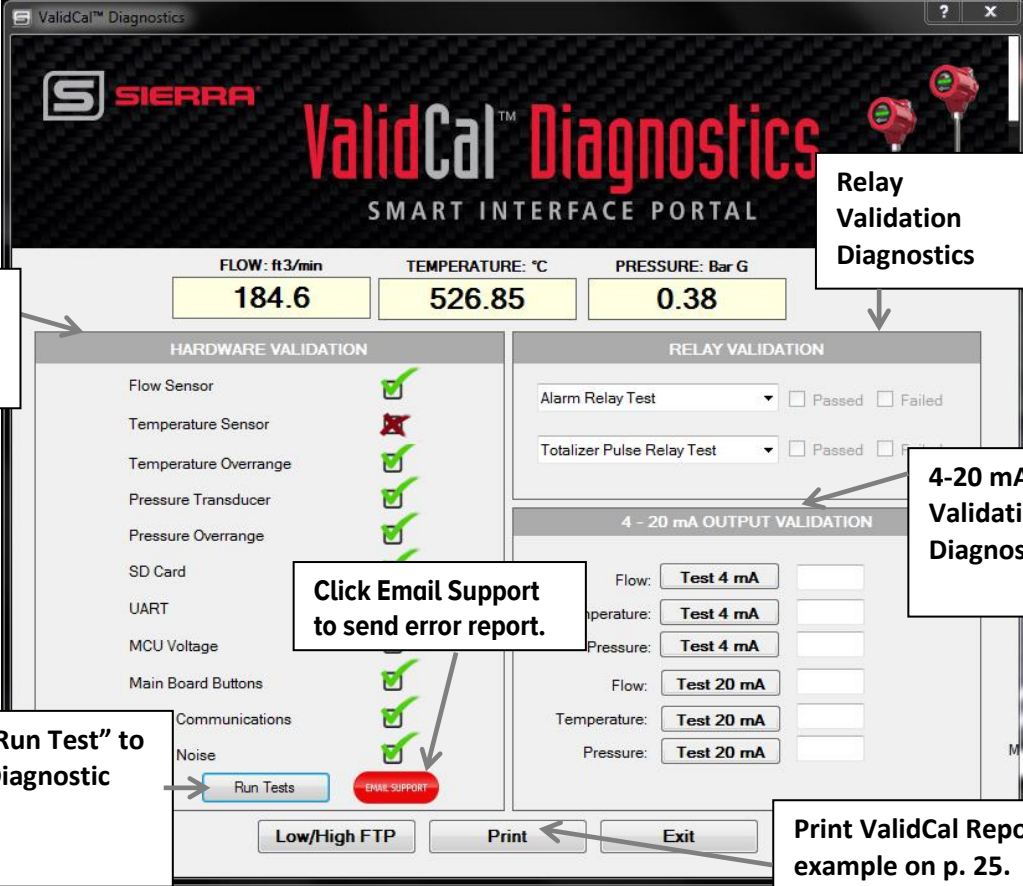


Watch Video Tutorial – a video tutorial for this function is available on the USB flash drive provided in the product shipment.

To use ValidCal Diagnostics quick key, you can click the “ValidCal Diagnostic” button on the main menu (See Figure 4) which will take you to the ValidCal Diagnostic screen.

To run the hardware ValidCal Diagnostics test (See Figure 12):

1. Click the “Run Tests” button.
2. When tests are conducted the passed/failed status is indicated with the green checks and red x above. If any tests fail, there is an option to send an error report to Sierra by clicking the “Email Support” button.
3. If you want to run the test again, press “Run Tests” again.



The screenshot shows the ValidCal Diagnostics main screen. At the top, it displays the Sierra logo and the title "ValidCal™ Diagnostics SMART INTERFACE PORTAL". Below this, three data fields are shown: FLOW: ft³/min (184.6), TEMPERATURE: °C (526.85), and PRESSURE: Bar G (0.38). The screen is divided into three main sections: HARDWARE VALIDATION, RELAY VALIDATION, and 4-20 mA OUTPUT VALIDATION. The HARDWARE VALIDATION section lists various components with their status: Flow Sensor (checked), Temperature Sensor (failed), Temperature Overrange (checked), Pressure Transducer (checked), Pressure Overrange (checked), SD Card (checked), UART (checked), MCU Voltage (checked), and Main Board Buttons (checked). The RELAY VALIDATION section has two tests: Alarm Relay Test and Totalizer Pulse Relay Test, both with "Passed" checkboxes. The 4-20 mA OUTPUT VALIDATION section has three tests: Flow (Test 4 mA), Temperature (Test 4 mA), and Pressure (Test 4 mA), each with a "Test" button and a "Passed" checkbox. Below these sections are buttons for "Run Tests", "EMAIL SUPPORT", "Low/High FTP", "Print", and "Exit". Callouts point to various elements: "Hardware Validation Diagnostics" points to the hardware section; "Relay Validation Diagnostics" points to the relay section; "4-20 mA Output Validation Diagnostic" points to the output section; "Click Email Support to send error report." points to the EMAIL SUPPORT button; "Click 'Run Test' to Start Diagnostic Tests" points to the Run Tests button; and "Print ValidCal Report. See example on p. 25." points to the Print button.

Figure 12. Overview of ValidCal Diagnostics Main Screen

Hardware Diagnostic: Trouble Shooting /Solutions

The hardware diagnostic test results give you valuable information to trouble shoot possible solutions to the reported errors. See example test results in Figure 12. Below are the possible hardware errors and suggestions for trouble shooting or solutions to the problem.

Flow Sensor Error

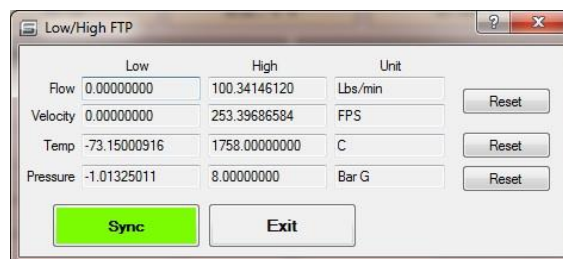
Possible Causes of Error Code

1. **The flow sensor may have been damaged.**

This can be caused by water hammer or excessive velocity but not limited to just these two.

Solution

- Go to the **Low/High FTP** to see the highest velocity recorded (See Figure 13).



- The maximum velocity specification is 30 fps for a liquid; 300 fps for a gas. If these velocities have been exceeded, the sensor may have been damaged.
- Pull the meter and check for visible damage.

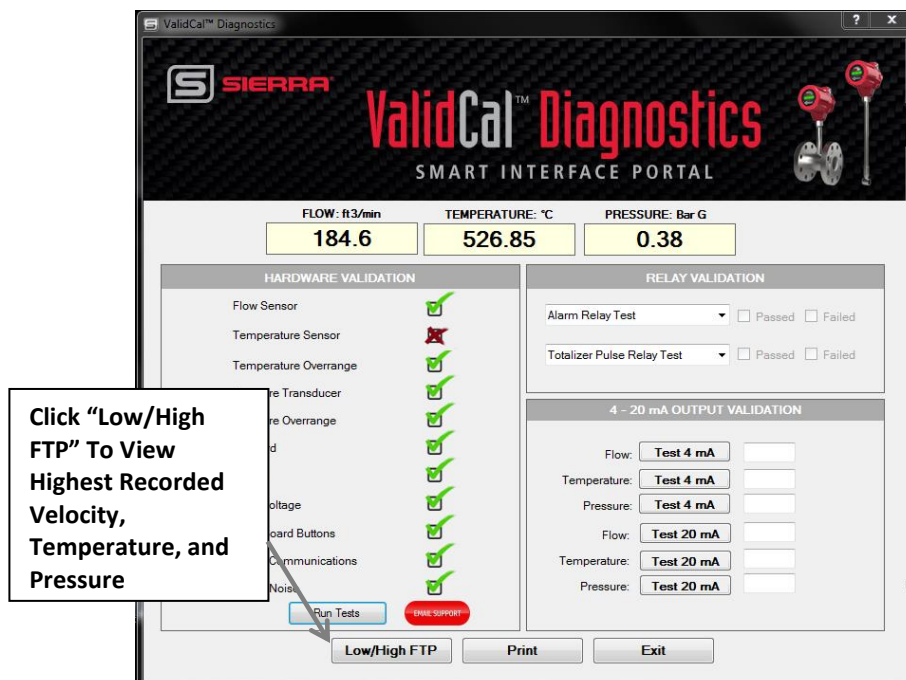


Figure 13. "Low/High FTP" to View Highest Recorded Velocity, Temperature, Pressure

2. The set-up or installation may be incorrect.

Solution

- Verify the installation:
 - For 240i, make sure nothing is clogging the flow body or building up around the flow sensor.
 - Along with the above test, also do the following for 241i, verify insertion depth and meter orientation are correct.
- Verify the cabling
 - There should be no power wires in the same conduit as the signal wires. This can couple noise into the line, especially if powered by AC.
 - There should be no cable splices. If additional cable is added to the meter, this can lead to an attenuated vortex signal which is of insufficient strength for the meter electronics to process.
- Verify meter is properly earth grounded.

Temperature Sensor Error

Since mass flow is determined by calculating density from Temperature and Pressure, this may cause errors in the flow readings as well.

240i/241i VT and VTP meters have one 1000 ohm PRTD for measuring process temperature.
Temperature ranges: Standard: -40°F to +392°F (-40°C to +200°C)

Possible Causes of Error Code

1. Temperature calibration is incorrect/ corrupted.

Solution

- Contact Sierra for remote troubleshooting techsupport@sierrainstruments.com.
- If this is not immediately possible, temperature may be simulated in the Meter Tuning Screen (See page 31, Figure 18).
- Also do a factory restore to “fix” bad data for temperature.

2. Temperature sensor has failed (often evidenced by a very high temperature reading on the display).

Solution

- Check the Low/High FTP to see if the meter’s temperature limits have been exceeded (Figure 13).
- The meter may need to be returned to the factory. To return your meters, create an RMA at <http://www.sierrainstruments.com/rma/login.php>. If this is not immediately possible, temperature may be simulated in the Fluid Properties section of the Meter Tune screen (See page 31, Figure 18).

3. Remote wiring is incorrect.

- Check that remote wiring is as shown in Figure 19 in the InnovaMass 240i/241i product instruction manual.

Temperature Overrange Error

Since mass flow is determined by calculating density from temperature and pressure, this may cause errors in the flow reading. 240i/241i VT and VTP meters have one 1000 ohm PRTD for measuring the process temperature.

Temperature ranges: Standard: -40°F to +392°F (-40°C to +200°C)

Possible Causes of Error Code

1. Process temperature exceeded temperature sensor limits.

Solution

- Adjust process conditions to remain within temperature sensor range.
- Remove meter from process until temperature is within sensor range.

2. Temperature calibration is incorrect/ corrupted.

Solution

- Contact Sierra for remote troubleshooting techsupport@sierrainstruments.com
- If this is not immediately possible, temperature may be simulated in the Meter Tuning screen (See page 31, Figure 18).

3. Temperature sensor has failed (often evidenced by a very HIGH or VERY LOW (i.e. -99.67) temperature reading on the display).

Solution

- Check the Low/High FTP (See Figure 13) to see if the meter's temperature limits have been exceeded. See Figure above to get number.
- The meter may need to be returned to the factory. If this is not immediately possible, temperature may be simulated in the Meter Tuning screen (See page 31, Figure 18).

Pressure XDCR Error

Since mass flow is determined by calculating density from temperature and pressure this may cause errors in the flow readings as well. 240i/241i VTP meters have one transducer for measuring process pressure.

Pressure Ranges for Model Codes:

MP0: No pressure input (incompressible liquids)

MP1: 30 psia (2.068 Bara A)

MP2: 100 psia (6.895 Bara A)

MP3: 300 psia (20.684 Bara A)

MP4: 500 psia (34.474 Bara A)

Possible Causes of Error Code

2) The pressure calibration is incorrect/ corrupted.

Solution

- Contact Sierra for remote troubleshooting techsupport@sierrainstruments.com
- If this is not immediately possible, pressure may be simulated in the Fluid Properties sub-menu section of the Meter Tuning Screen (See page 31, Figure 18).
- Also, do a factory restore to "fix" bad data for pressure XDCR.

3) The sensor has failed.

Solution

- Check Low/High FTP to see if the meter's pressure limits have been exceeded (Figure 13).
- The meter may need to be returned to the factory. To return meter, create an RMA at <http://www.sierrainstruments.com/rma/login.php>. If this is not immediately possible, pressure may be simulated in the Meter Tuning screen (See page 31, Figure 18).

4) Remote wiring is incorrect

Solution

- Check that remote wiring is as shown in InnovaMass Product Instruction Manual, Chapter 2, Figure 19 of the InnovaMass 240i/241i product instruction manual.

Pressure XDCR Overrange

Since mass flow is determined by calculating density from temperature and pressure this may cause errors in the flow readings as well.

240i/241i VTP meters have one transducer for measuring process pressure.

Pressure Ranges for Model Codes:

MP0: No pressure input (incompressible liquids)

MP1: 30 psia (2.068 Bara A)

MP2: 100 psia (6.895 Bara A)

MP3: 300 psia (20.684 Bara A)

MP4: 500 psia (34.474 Bara A)

Possible Causes of Error Code

1. Process pressure exceeded pressure sensor limits.

Solution

- Adjust process conditions to remain within pressure sensor range.
- Remove meter from process until pressure is within sensor range.

2. The pressure calibration is incorrect/ corrupted.

Solution

- Contact Sierra for remote troubleshooting techsupport@sierrainstruments.com
- If this is not immediately possible, pressure may be simulated in the Meter Tuning screen (See page 31, Figure 18).
- In addition, do a factory restore to fix bad data for pressure XDCR overrange.

3. The sensor has failed.

Solution

- Check Low/High FTP to see if the meter's pressure limits have been exceeded (Figure 13).
- The meter may need to be returned to the factory. To return meter, create an RMA at <http://www.sierrainstruments.com/rma/login.php>. If this is not immediately possible, pressure may be simulated in the Meter Tuning screen (See page 31, Figure 18).

SD Card Issues

240i/241i meters have one SD card for storing meter data.

Possible Causes of Error Code

1. The SD card is missing.

Solution

- Replace the SD Card.

- Contact Sierra for replacement SD card at techsupport@sierrainstruments.com. Original card must be returned to Sierra.

2. The SD card is damaged.

Solution

- Contact Sierra for replacement SD card at techsupport@sierrainstruments.com

UART Issues

240i/241i meters have multiple Universal Asynchronous Receiver/Transmitters (UART) for communications (eg. USB).

Possible Causes of Error Code

1. UART is malfunctioning.

Solution

- Adjust the “Frame Delay” in hardware configuration screen.
- Make sure the sending baud rate (38400) and receiving Baud are the same.
- Contact Sierra for remote troubleshooting techsupport@sierrainstruments.com
- The meter may need to be returned to the factory. To return meter, create an RMA at <http://www.sierrainstruments.com/rma/login.php>.
- In addition, do a “factory restore” to fix bad data for UART.

2. UART is damaged

Solution

- Pressing button on main board for 5 (five) seconds also resets UART factory of value.
- The meter may need to be returned to the factory. To return meter, create an RMA at <http://www.sierrainstruments.com/rma/login.php>.

MCU Voltage Issues

240i/241i meters have a Microcontroller (MCU) with a nominal voltage range.

Possible Causes of Error Code

1. MCU is malfunctioning.

Solution

- Contact Sierra for remote troubleshooting techsupport@sierrainstruments.com
- The meter may need to be returned to the factory. To return meter, create an RMA at <http://www.sierrainstruments.com/rma/login.php>.

2. MCU has failed.

Solution:

- The meter may need to be returned to the factory. To return create an RMA at <http://www.sierrainstruments.com/rma/login.php>.

Main Board Button Stuck

240i/241i meters have display buttons for navigation and data entry.

Possible Causes of Error Code

1. Main board button stuck down.

Solution:

- Attempt to unstick button manually.
- Contact Sierra for remote troubleshooting techsupport@sierrainstruments.com.
- The meter may need to be returned to the factory. To return meter, create an RMA at <http://www.sierrainstruments.com/rma/login.php>.

Digital Communications Failure

240i/241i meters can be ordered with Digital Communications (Hart, Profibus, Foundation Fieldbus).

Possible Causes of Error Code

1. Digital Communications malfunction.

Solution:

- Contact Sierra for remote troubleshooting techsupport@sierrainstruments.com.
- The meter may need to be returned to the factory. To return meter, create an RMA at <http://www.sierrainstruments.com/rma/login.php>.
If this is not immediately possible, output via 4-20 mA, RS232, or USB is available.

Signal Noise

240i/241i meters are sensitive to background noise or vibration in the application environment (60 Hz/50 Hz from power lines).

Possible Causes of Error Code

1. Meter Settings may need to be adjusted.

Solution:

- Go to Meter Tuning (See page 31, Figure 18) and check Ck and Minimum Noise Level. Reset these values if necessary.
- In addition, do a factory restore to fix any “bad” values.
- Contact Sierra for remote troubleshooting techsupport@sierrainstruments.com.

2. Meter Earth Ground is faulty.

Solution:

- Verify meter is properly earth grounded.

3. Flow sensor may be damaged/miswired.

Solution:




- Contact Sierra for remote troubleshooting techsupport@sierrainstruments.com.
- The meter may need to be returned to the factory. To return create an RMA at <http://www.sierrainstruments.com/rma/login.php>

Low/High FTP

Pressing the “Low/High FTP” button, located at the bottom left of the main “ValidCal” screen (See Figure 13), brings up the menu below.

| | Low | High | Unit | |
|----------|--------------|---------------|---------|-------|
| Flow | 0.00000000 | 100.34146120 | Lbs/min | Reset |
| Velocity | 0.00000000 | 253.39686584 | FPS | |
| Temp | -73.15000916 | 1758.00000000 | C | Reset |
| Pressure | -1.01325011 | 8.00000000 | Bar G | Reset |
| Sync | | Exit | | |

- This menu displays the lowest and highest flow, velocity, temperature and pressure the meter has experienced since the last High/Low reset.
- This information is valuable in documenting events that might have caused meter damage, such as blowing out the pressure transducer or severely overheating the sensor.
- Use the “Reset” button to reset the High/Low values.
- Use the “Sync” button to reread the High and Low values in case a new value has been set since the menu was initially loaded.

| | |
|---|--|
|  | For all meters, the maximum velocities are: liquids 30 fps (9.1 mps) and gases 300 fps (91.4 mps). Exceeding these velocities may damage the temperature and velocity sensors, as well as other meter internals exposed to the process flow. |
|  | For VT or VTP meters, the minimum and maximum temperature limits are -40°F to +392°F (-40°C to +200°C). Operating outside of these limits could damage the velocity sensor. |
|  | For VTP meters, the maximum pressure is the rating of the pressure transducer. Exceeding the maximum pressure rating of the pressure transducer may damage the transducer. |

Once ValidCal diagnostics has been completed, users may print a report or exit to the main screen (See Figure 14).

SIERRA

InnovaMass 240i/241i

ValidCal Certificate

5 Harris Court, Building L • Monterey, California • (800) 866-0200 • (831) 373-0200 • Fax (831) 373-4402 • www.sierrainstruments.com

Meter Information:

| | |
|-----------------------|----------------|
| Serial Number: | B1045 |
| Tag: | N/A |
| Manufacturer Date: | 8/31/2015 |
| Up Time: | 541 |
| Firmware Version: | v1.1.83 |
| Firmware Date: | Sep 30 2015 |
| Firmware Time: | 12:51:03 |
| Calibration Date: | 8/31/2015 |
| Calibration Due Date: | 8/31/2016 |
| PCA Revision: | Raptor II v1.0 |

Meter Configuration:

Dial-A-Fluid

| Fluids | Units | Full Scale |
|--------|---------|------------|
| Water | ft3/min | 494.30 |

Dial-A-Pipe

| Type | Pipe I.D. |
|----------|-----------|
| ss-rough | 54.5 mm |

Meter Validation:

Hardware Validation

| | |
|------------------------|--------|
| Flow Sensor | Passed |
| Temperature Sensor | Failed |
| Temperature Overrange | Passed |
| Pressure Sensor | Passed |
| Pressure Overrange | Passed |
| SD Card | Passed |
| UART | Passed |
| MCU Voltage | Passed |
| Main Board Buttons | Passed |
| Digital Communications | Passed |
| Signal Noise | Passed |

4-20mA Analog Output Validation

| | 4 mA | Output | DAC | 20 mA | Output | DAC |
|------------------|------|-----------|-----|--------|------------|------|
| Flow (Lbs/min) | 4.02 | 0.0 | 724 | 20.005 | 130.358 | 3612 |
| Temperature (C) | 4.11 | 0.000000 | 724 | 19.976 | 100.000000 | 3612 |
| Pressure (Bar G) | 3.88 | -1.013250 | 724 | 20.01 | -0.713250 | 3612 |

| | | | |
|-------------|--------|-----------------|--------|
| Alarm Relay | Passed | Totalizer Relay | Passed |
|-------------|--------|-----------------|--------|

Figure 14. ValidCal Certificate

Chapter 4 | Validation Diagnostics: Relay 4-20 mA & Output Validation

Relay Validation

The ValidCal diagnostics “Relay Validation” section runs validation tests on the alarm and totalizer pulse relays.

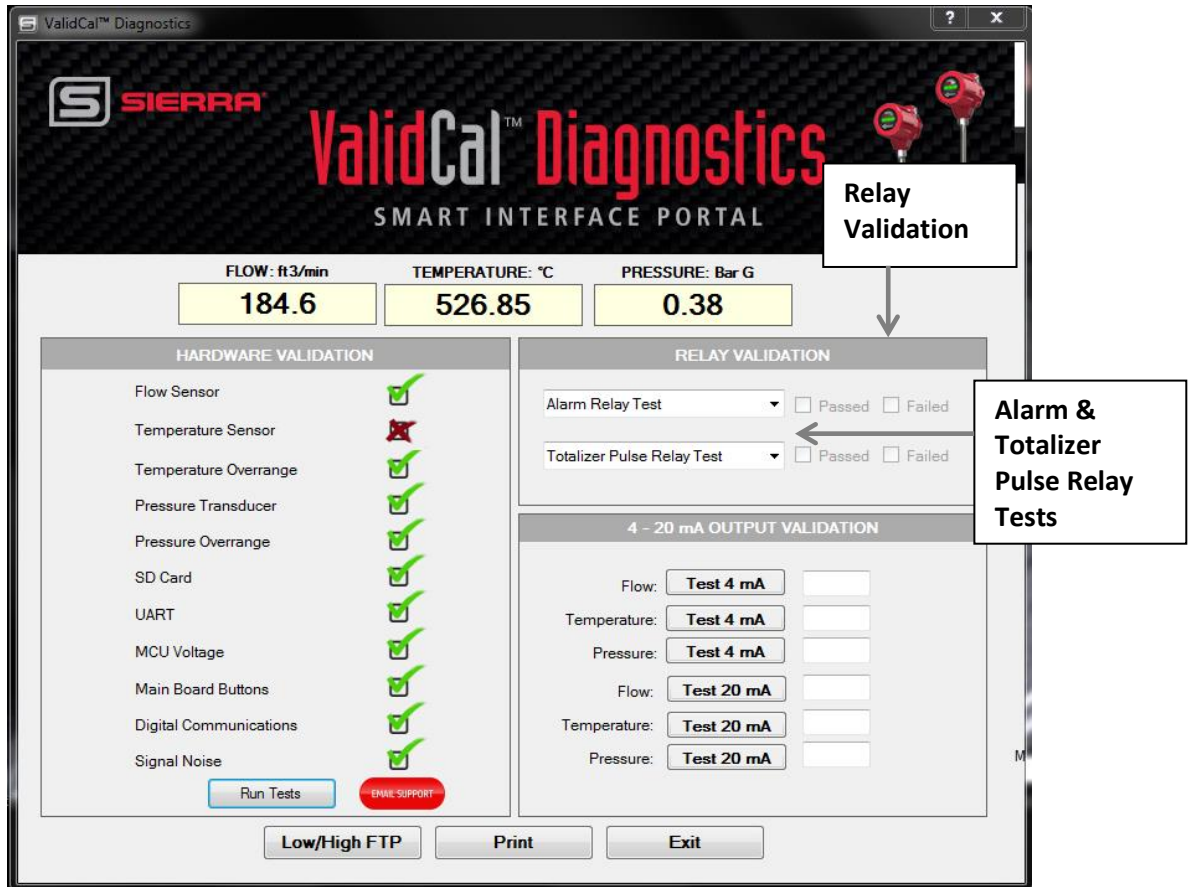
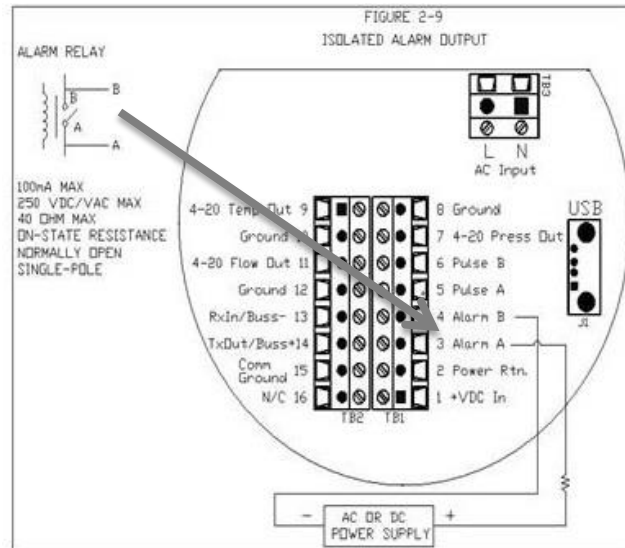


Figure 15. Span Adjust Quick Key To Fine Tune your Meter

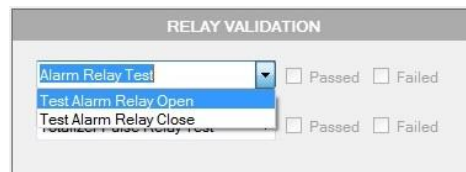
Alarm Relay Test

To test the alarm relay:

- 1) Connect the voltmeter as shown:



- 2) Use the “Alarm Relay Test” dropdown menu to open and close the relay. Check the pass/fail box per voltmeter reading.

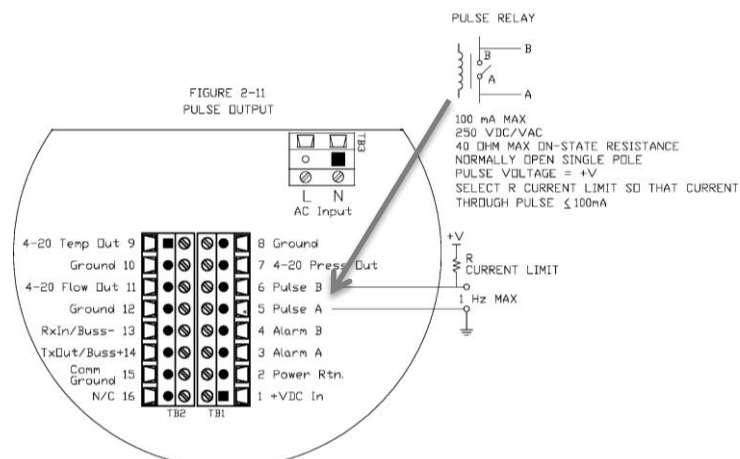


- 3) Check the relay with the voltmeter. Check the pass/fail box per voltmeter reading
- 4) If the relay has failed, the PCA must be replaced. Contact Sierra techsupport@sierrainstruments.com for assistance.

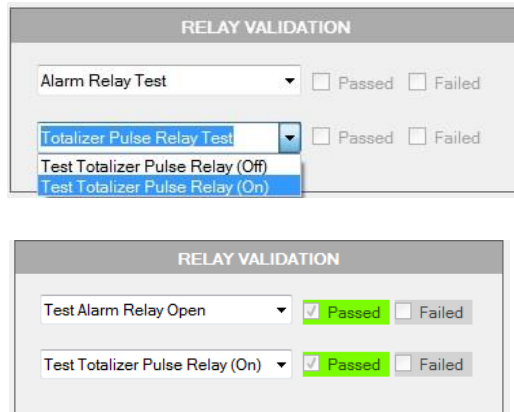
Totalizer Pulse Relay Test

To test the totalizer pulse relay:

- 1) Connect voltmeter as shown:



- 2) Use the "Totalizer Pulse Relay Test" dropdown menu to open and close the relay. The test will indicate pass or fail.



- 3) Check the relay with the voltmeter. Check the pass/fail box per voltmeter reading
- 4) If relay has failed, the PCA must be replaced. Contact Sierra Technical Support at techsupport@sierrainstruments.com.

4-20 mA Output Validations

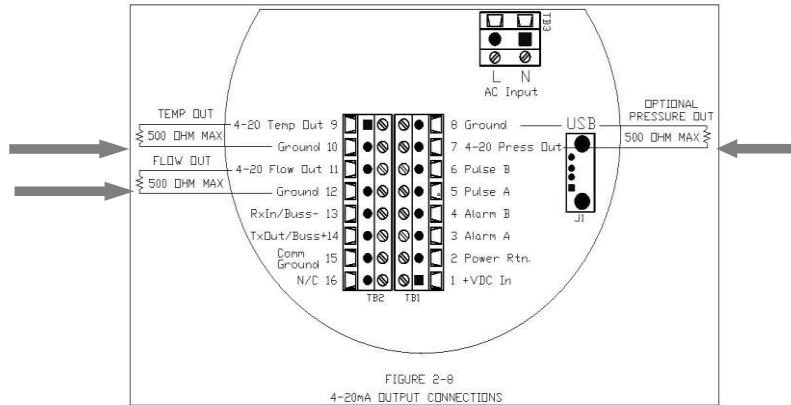
The "4-20 mA Output Validation" allows users to force a 4 or 20 mA output on all three analog outputs.



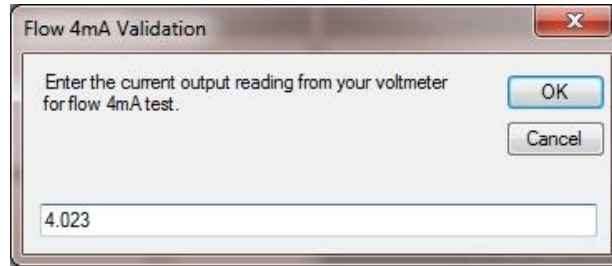
Figure 16. 4-20 Output Validations

To use the 4-20 mA Validation:

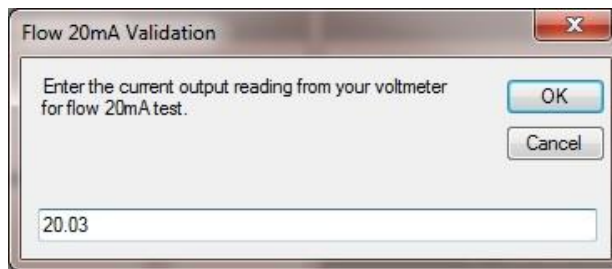
- 1) Set voltmeter to “DC Current” and connect to the +/- terminals of the output you are validating:



- 2) Press the “Flow Test 4 mA” button and enter the value from your voltmeter (should be around 4.000 mA). The test will show as passed if the reading is within tolerance.



- 3) Press the “Flow Test 20 mA” button and enter the value from your voltmeter (should be around 20.000 mA). The test will show as passed if the reading is within tolerance.



- 4) Repeat process for the temperature and pressure 4 mA and 20 mA Outputs.
- 5) If any tests fail, please contact customer support for assistance.



The most common failure is that the 4-20 mA wires are loose or that the voltmeter is set up incorrectly (the meter must be set up for measuring direct DC current in the mA range).

Chapter 5 | Quick Keys: Span Adjust & Meter Tuning

Quick Keys: Span Adjust

The “Span Adjust” menu allows you to fine tune your meter reading to match other devices or expectations. Click the “Span Adjust” quick key on the main menu or under the “Function Selector.”

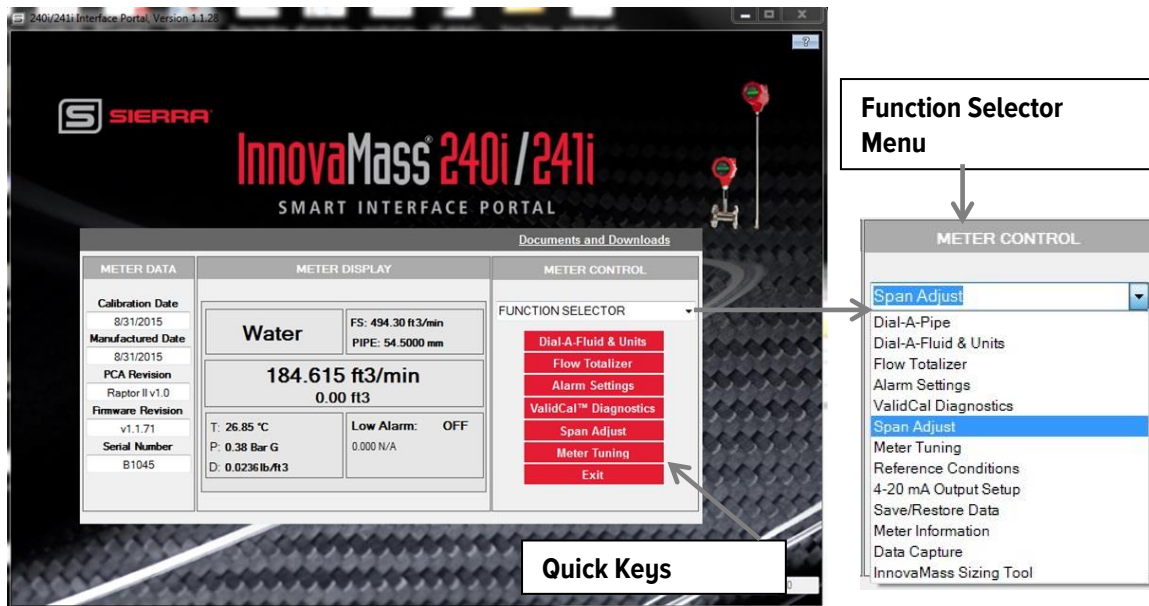


Figure 17. Span Adjust Quick Keys


To use “Span Adjust”:

Simply enter the “desired flow” reading from the other device and the meter span will be auto adjusted to make the InnoMass readings the same. Click “Save” to save your data.

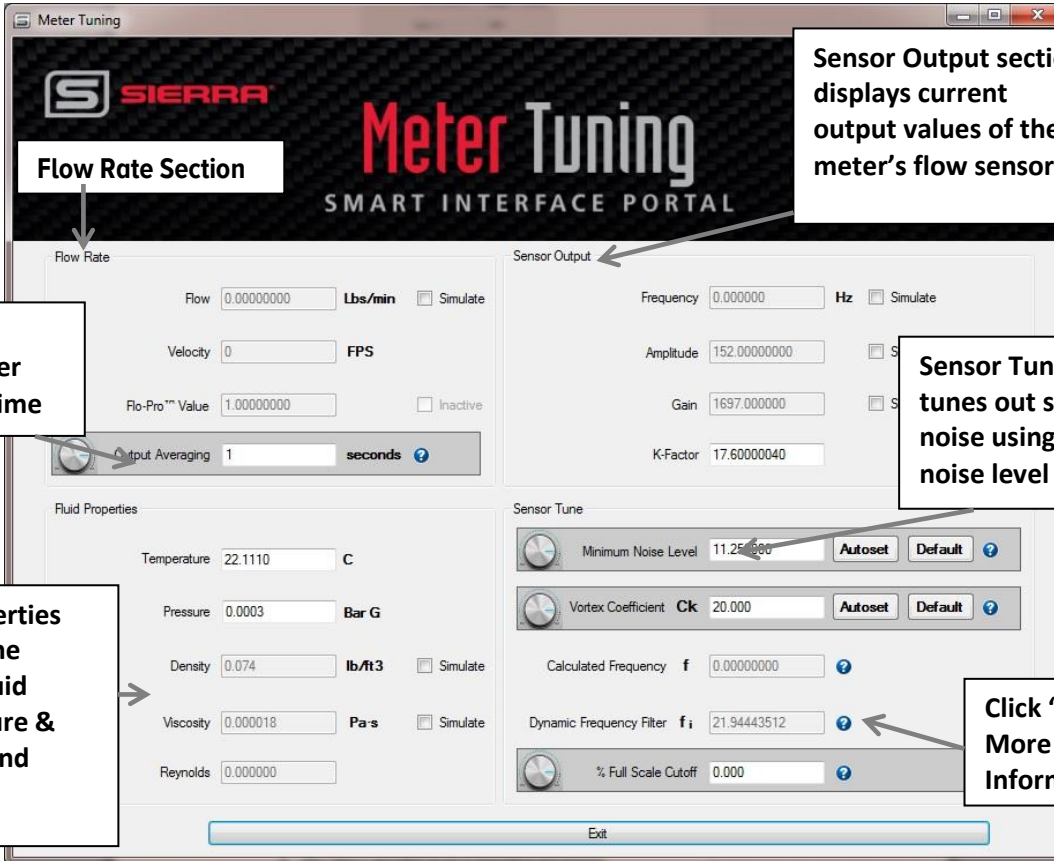
The screenshot shows the 'Span Adjust' configuration screen. At the top, it displays 'METER FLOW: ft³/min' with a value of 5.622. Below this, there are two input fields: 'Desired Flow:' with a value of 5.6 and 'MeterTune (Span Adjust):' with a value of 1.000. At the bottom, there are three buttons: 'Save' (highlighted in green), 'Span Default', and 'Exit'.

Quick Keys: Meter Tuning

The “Meter Tuning” menu provides the ability to adjust and monitor all of the most important meter constants, inputs and outputs. This interface can be used to quickly ascertain meter health and provides a very powerful tool for troubleshooting the meter if any issues are encountered in the field.

| | |
|---|---|
|  | <p>Watch Video Tutorial – a video tutorial for this function is available on the USB flash drive provided in the product shipment.</p> |
|---|---|



Click the “Meter Tuning” quick key on the main menu (See Figure 4) to go to the “Meter Tuning” main screen. Once on the Meter Tuning screen, there are four main sections: “Flow Rate”, “Fluid Properties”, “Sensor Outputs”, and “Sensor Tune” (See Figure 18). For more information about each section, click the “?” icon.



The screenshot shows the Sierra Meter Tuning interface with the following callouts:

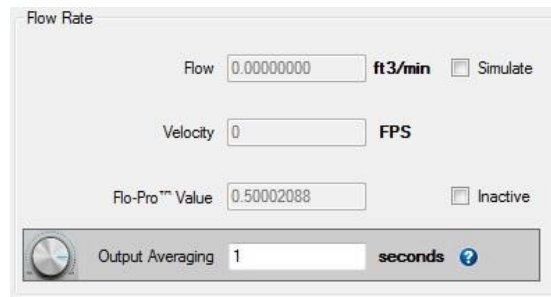
- Flow Rate Section:** Points to the Flow Rate section containing fields for Flow (0.00000000 Lbs/min), Velocity (0 FPS), Flo-Pro™ Value (1.00000000), and Output Averaging (1 seconds).
- Sensor Output section:** Points to the Sensor Output section containing fields for Frequency (0.000000 Hz), Amplitude (152.00000000), Gain (1697.000000), and K-Factor (17.60000040).
- Sensor Tune Section:** Points to the Sensor Tune section containing a Minimum Noise Level dial (11.25), Vortex Coefficient Ck (20.000), Calculated Frequency f (0.00000000), Dynamic Frequency Filter fi (21.94443512), and % Full Scale Cutoff (0.000).
- Fluid Properties:** Points to the Fluid Properties section containing fields for Temperature (22.1110 C), Pressure (0.0003 Bar G), Density (0.074 lb/ft³), Viscosity (0.000018 Pa·s), and Reynolds (0.000000).
- Adjust Output Average to filter outputs over time:** Points to the Output Averaging dial.
- Click “?” for More Information:** Points to the question mark icons next to the Frequency, fi, and % Full Scale Cutoff fields.

Figure 18. Meter Tuning Main Screen

| | | |
|---|--|---|
|  | <p>The “Min/Max Dial” image indicates parameters of % Full Scale, Cut Off, Minimum Noise Level, and Ck that can be adjusted and tuned.</p> |  |
|---|--|---|

Flow Rate

The “Flow Rate” section (See Figure 18) displays current flow measurement and associated values.



The image shows a software interface for the 'Flow Rate' section. It contains four rows of controls: 1) 'Flow' with a text box containing '0.0000000', units 'ft3/min', and a 'Simulate' checkbox. 2) 'Velocity' with a text box containing '0', units 'FPS'. 3) 'Flo-Pro™ Value' with a text box containing '0.50002088' and an 'Inactive' checkbox. 4) 'Output Averaging' with a text box containing '1', units 'seconds', and a help icon.



Simulating the flow value will **always** use that value regardless of flow units. Entering “1000” will remain “1000” even if you change units.

- 1) The “Flow” text box displays the current flow rate and current “Units.”
 - This value may be simulated by clicking the checkbox and entering the value.
- 2) The “Velocity” text box displays the current flow velocity in FPS flow units.
 - This value allows for quick determination of whether flow is within the specified meter range.
- 3) The “Flo-Pro™ Value” text box displays the flow profile calculated using the Flo-Pro™ math algorithms for 241i Insertion Meters. 240i Inline Meters use a value of 1.
- 4) The “Output Averaging” text box allows for filtering output over time by specifying the number of seconds for the rolling average. This is adjustable from 1 to 200 seconds. To adjust, type your desired value in the text box. By increasing this value, you will “soften” the flow response.



Output Averaging can also be set in the Diagnostics menu.

Fluid Properties

The “Fluid Properties” (See Figure 18 of Meter Tuning) section displays the current fluid temperature and pressure with associated properties.



The image shows a software interface for the 'Fluid Conditions' section. It contains five rows of controls: 1) 'Temperature' with a text box containing '21.11111069', units 'C', and a 'Simulate' checkbox. 2) 'Pressure' with a text box containing '14.70015432', units 'Paia', and a 'Simulate' checkbox. 3) 'Density' with a text box containing '62.515', units 'lb/ft3', and a 'Simulate' checkbox. 4) 'Viscosity' with a text box containing '0.000998', units 'Pa s', and a 'Simulate' checkbox. 5) 'Reynolds' with a text box containing '5260.326171'.

- 1) The “Temperature” text box displays the current fluid temperature and current “Units”.
 - This value may be simulated by clicking checkbox and editing the value.
 - If there is no temperature sensor enabled, then this value represents the process temperature.
- 2) The “Pressure” text box displays the current fluid pressure and current “Units”.
 - This value may be simulated by clicking the checkbox and editing the value.
 - If there is no pressure transducer enabled, then this value represents the process pressure.
- 3) The “Density” text box displays the current fluid mass density and current “Units”.
 - This value is calculated based on temperature and pressure.
 - To simulate “Density”, click the simulate box and add the value you would like to simulate.
- 4) The “Viscosity” text box displays the current fluid dynamic viscosity and Pa’s “Units”.
 - This value is calculated based on temperature and pressure.
 - To simulate “Viscosity”, click the simulate box and add the value you would like to simulate.
- 5) The “Reynolds” text box displays the current fluid Reynolds Number.
 - This value is calculated based on fluid conditions and flow rate.

Sensor Output

The “Sensor Output” section of Meter Tuning (See Figure 18) shows the current output values of the meter flow sensor.

The screenshot shows a window titled "Sensor Output" with the following parameters:

| Parameter | Value | Units | Simulate |
|-----------|--------------|-------|--------------------------|
| Frequency | 0.000000 | Hz | <input type="checkbox"/> |
| Amplitude | 152.00000000 | | <input type="checkbox"/> |
| Gain | 1697.000000 | | <input type="checkbox"/> |
| K-Factor | 17.60000040 | | |

- 1) The “Frequency” text box displays the real-time frequency output of the vortex sensor in Hertz.
 - The higher the flow, the higher the frequency
 - The frequency may be simulated by clicking the check box and editing the value.
 - In simulate mode, the displayed flow is based on the *simulated* frequency.
 - To simulate, click the “Simulate” box, and add the simulated value.
- 2) The “Amplitude” text box displays the current sensor amplitude.
 - The strength of the flow signal is dependent on the density and velocity of the fluid.
- 3) The “Gain” text box displays the current gain stage.
 - Gain is the ratio of the output to the input.
 - There are eight gain stages from no gain to full gain (1.0, 3.33, 10.0, 33.33, 100.0, 333.33, 511.0, 1697.0).
 - At low flow rates, the signal is weak and requires amplification to be detected. In this case, the amplitude is low and the gain value is high.
 - As flow rate increases, the amplitude will build until it reaches a maximum, then the gain will drop to the next lower level (from 333.33 to 100 to 33.3). If flow rate continues to increase, the amplitude will build again, and the gain stage will drop.
 - So, a very strong flow signal will result in amplitude of 2000- 4000 and a gain of 1.0.
- 4) The “K-Factor” text box displays the current value for meter calibration K-Factor.

- The K-Factor value is determined during meter calibration based on frequency and flow rate and cannot be changed.

Sensor Tune

The “Sensor Tune” section (See Figure 15) displays the current settings for tuning out signal noise using minimum noise level and Ck and applying %full scale cutoff.

- 1) The “Minimum Noise Level” text box displays a value used for noise cutoff at zero flow.
 - Electrical noise that the sensor detects from the surrounding application environment (e.g. 60 Hz from power lines) can result in flow output when there is no actual flow.
 - In general, the minimum noise level should be a value slightly higher than the value of the amplitude divided by the gain detected by the sensor at zero flow.
 - For example, if Amp = 900 and Gain = 100 at zero flow, then Amp/Gain = 9. A Minimum Flow Level > 9 will cut off unwanted flow output.
 - To “tune” your meter for your application, click the “Autoset” button and your minimum noise level will adjust. Click the “default” button to return to your original setting.
- 2) The “Vortex Coefficient Ck” text box displays the current value set for Ck.
 - Ck is used in the placement of a low pass noise filter which helps to avoid false frequency readings.
 - Ck is calculated based on frequency, amplitude, and gain along with the density of the fluid under flow.
 - In general, the Ck should result in a dynamic frequency filter that is 20-25% higher than the actual Sensor Frequency.
 - To “tune” your meter for your application, click the “Autoset” button and your Ck will adjust. Click the “default” button to return to your original setting.



As the Ck value increases, the window for detecting frequency widens and can eventually allow in anomalous higher frequencies. Reduce the Ck value if the Dynamic Frequency Filter value is more than 25% greater than the Sensor Frequency.


- 3) The “Calculated Frequency f” text box displays the expected sensor frequency based on current flow rate and K-Factor.
 - Calculated frequency should always be very close to the measured sensor frequency.
 - This reference allows for a valuable real-time check that all flow and signal strength inputs are correct.

- 4) The “Dynamic Frequency Filter f_i ” text box displays the frequency at which a low pass filter is applied.
- This value is calculated using the current sensor amplitude and gain along with the set value for Vortex Coefficient C_k .
 - In general, this value should be approximately 20-25% above the actual sensor frequency.
- 5) The “% FS Cutoff” text box displays the current value of the percent of Full Scale cutoff.
- For any flow rate lower than this percentage of full scale, the meter is forced to show no flow.
 - This is useful if there is persistent noise or vibration in the pipe that is causing erroneous readings at low flow rates.
 - For example, if the full scale is 100 Kg/hr, then setting the % FS cutoff to 5% of full scale will not allow the meter to show flow less than 5 kg/hr
 - To adjust the % FS Cutoff, type desired value in the text box.



Chapter 6 | Troubleshooting Meter Settings

The functionality in the Meter Tuning section give you powerful tools to both adjust key parameters for your application and assess meter problem and troubleshoot solutions. Below are some common scenarios and possible solutions.

| | |
|---|--|
|  | Watch Video Tutorial – a video tutorial for this function is available on the USB flash drive provided in the product shipment. |
|---|--|

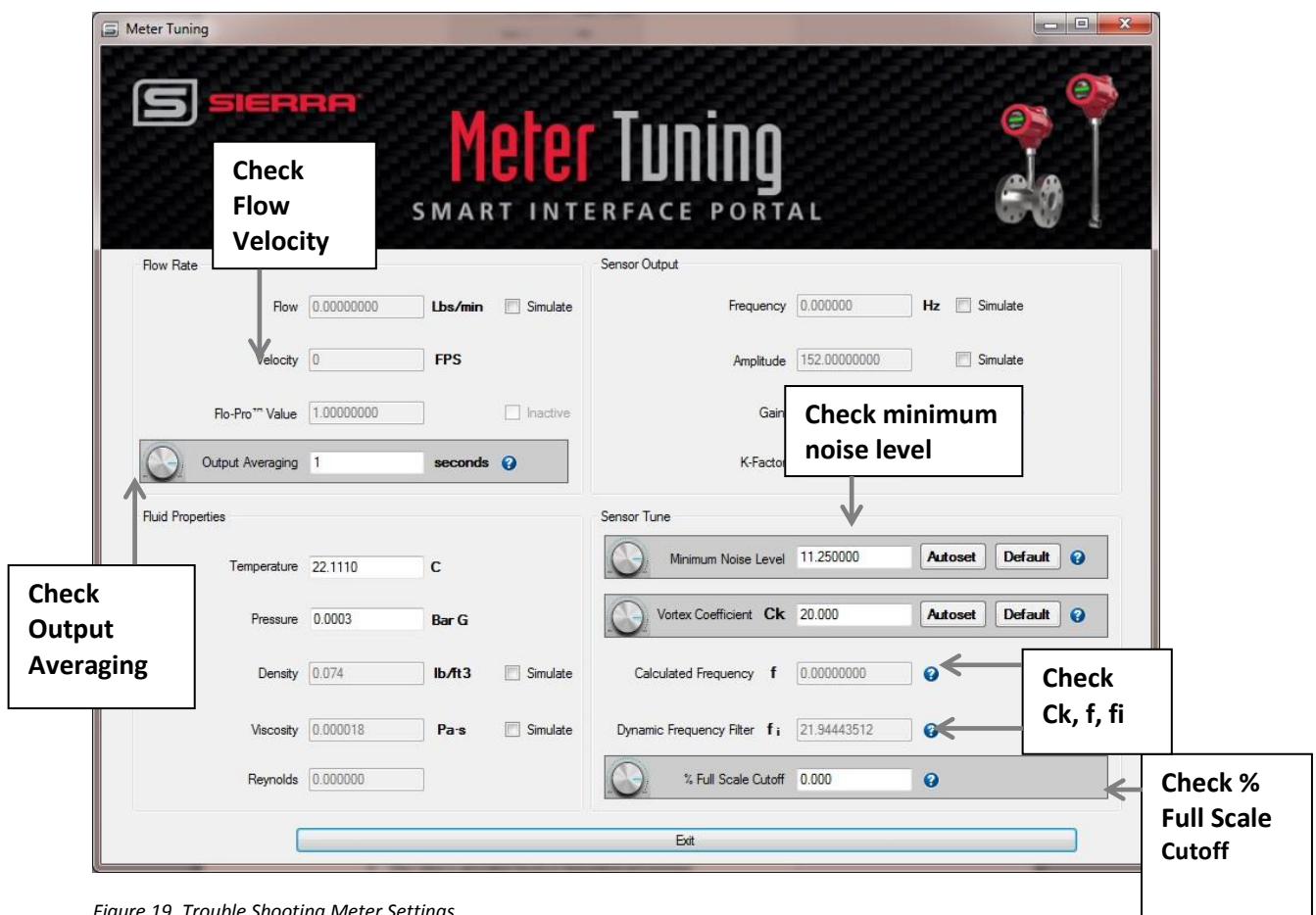


Figure 19. Trouble Shooting Meter Settings

Case I: Meter erroneously shows no flow when you know there is flow

Solution 1: Check the flow velocity (See Figure 19).

- The flow velocity is too low. The Vortex meter has minimum velocity requirements-shown in the InnovaMass 240i/241i Instruction manual, page 10 Figure D. If the velocity is below this, the meter generally cannot measure this flow. No vortex meter can measure down to zero flow as the velocity must be enough to form the vortices that the meter uses to make its flow measurement.
- In some cases (very low noise and vibration) the meter may be able to measure lower than the minimum.



The turn knob image indicates tunable parameters of Cut Off, Minimum Noise Level, Ck, % Full Scale



Solution 2: Check the % FS Cutoff (See Figure 19).

- The % FS Cutoff is set as a percent of full scale and the meter will not be allowed to read below the % FS Cutoff setting. Perhaps you have set it too high? If you discover you do have the setting too high, adjust using the % FS Cutoff menu. You can adjust the % FS Cutoff from 1% to 50% of full scale flow.



Case II: Meter shows flow when you know there is zero flow

Solution 1: Check the Minimum Noise Level (See Figure 19).

- The Minimum Noise Level may be set too low. This will allow false flow signals caused by noise or vibration to be seen. The Minimum Noise Level must be set above the level of this noise/vibration to cut it out. To do this, **Autoset** the value. With NO FLOW in the pipe, perform an Autoset and the meter will sense the noise and vibration present, and set the Minimum Noise Level just above this. See Figure 20.



For a very noisy environment, the Minimum Noise Level setting can result in cutting off low flow rates.

Case III: Meter shows erratic flow output

Solution 1: Check the measured velocity (See Figure 19).

- The flow rate may be too low, just at the cutoff of the meter range, and the flow cycles above and below the cutoff making an erratic output.

Solution 2: Check the installation.

- Mechanical installation may be incorrect. Verify the straight run is adequate as described in InnovaMass Instruction Manual, Chapter 2. For in-line meters, make sure the meter is not installed backwards and there are no gaskets protruding into the flow stream. For insertion meters, verify the insertion depth and flow direction.

Solution 3: Check the Minimum Noise Level (See Figure 19).

- Check the Minimum Noise Level. It may be possible to lower the value to increase the meter range. See case above. Again, lowering the Minimum Noise Level will allow more noise/vibration into the meter and the meter will eventually lose the true flow signal in this noise.



Solution 4: Check the Output Averaging setting (See Figure 19).

- Check the Output Averaging setting. The meter may be reacting to actual changes in the flow stream. The output can be smoothed using averaging. The meter samples the flow every 1 second (1 Hz). This value



is fixed. The output will compute a rolling average of each reading over the requested time span. For example 5 seconds will average the last 5 readings together.

Solution 5: Check f, fi, and Ck settings (See Figure 19).

- Check f, fi and Ck. The vortex coefficient Ck may be incorrectly set. The Ck is a value in the equation used to determine if a frequency represents a valid vortex signal given the fluid density and signal amplitude. In practice, the Ck value controls the adaptive filter (fi) setting.



During flow, view the f and fi values. The fi value should be approximately 10-20 % higher than the f value. This is a low pass filter, so all frequencies below fi can be seen by the Vortex meter. You may need to adjust Ck to filter out noise that has a higher frequency than the flow signal. See Ck Adjust

Function Selector

The “Function Selector” provides access to all available meter functions found in the quick keys (See page 30, Figure 17). The function selector also has 4 additional features: “Reference Conditions”, “4-20 mA Output”, “Save” and “Restore.” To operate the selector, simply select the desired function from the dropdown menu.

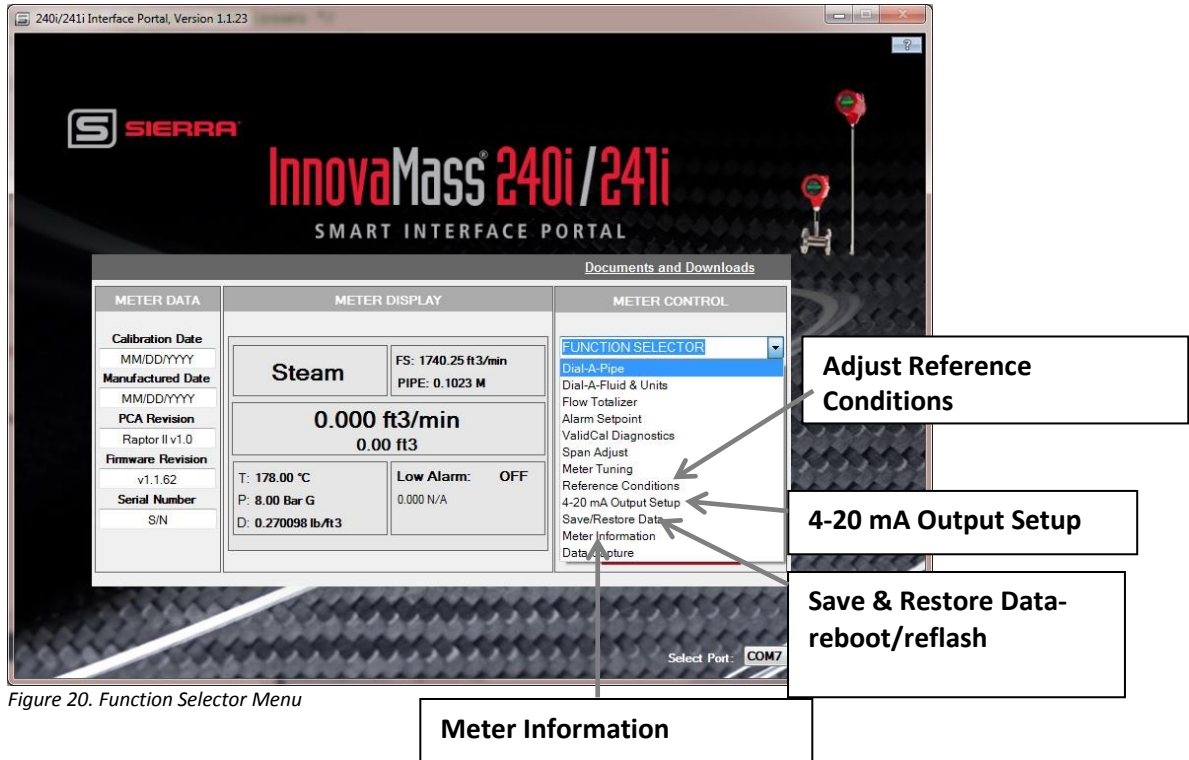
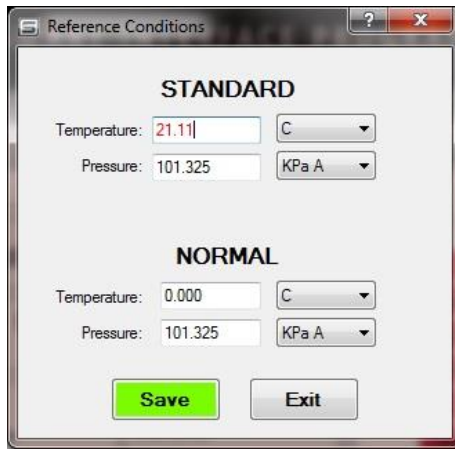


Figure 20. Function Selector Menu

Function Selector Functions

Reference Conditions

This function allows the user to enter the normal and standard temperatures and pressures to which gas mass flows are referenced. Typically this is 70°F and 1 atmosphere in the USA (standard conditions as used in scfm: standard cubic feet per minute) or 0°C and 1 atmosphere in Europe (normal conditions as used in nlpm: normal liters per minute).

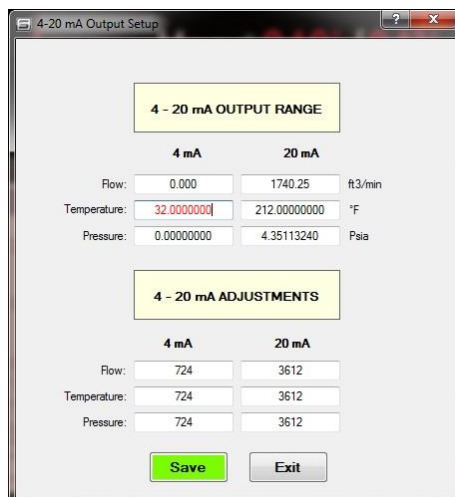


4 – 20 mA Output Setup

This function allows you to set up the analog outputs. The 240i and 241i comes standard with linear 4-20 mA analog outputs for flow, temperature, and pressure. For flow, “4 mA” is always = 0 flow. The user may select “20 mA” to equal any value up to the meter’s theoretical maximum (as calculated by the [sizing program](#)).



The meter will still read digital flow values up to the calibrated full scale, but analog outputs will be scaled per the user settings.



“Pressure” and “Temperature” may be scaled as the user desires.

All units are as set in the units menu. The 4 mA and 20 mA analog outputs can be adjusted by adjusting the DAC counts until 4 mA or 20 mA is observed. For example if the flow 4 mA output is actually reading 3.98 mA, adjust the DAC counts up from 724 and press test and repeat until the readings has increased to 4.00 mA.

Save & Restore Data: Reboot Meter & Reflash Firmware



Watch Video Tutorial – a video tutorial for this function is available on the USB flash drive provided in the product shipment.

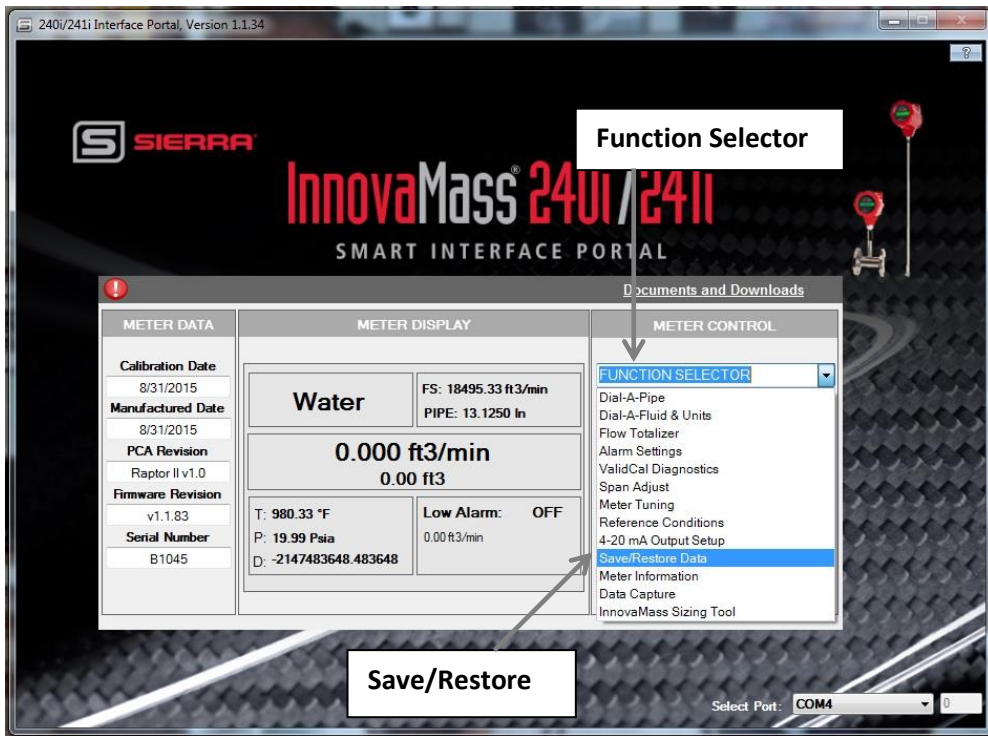


This screen allows users to:

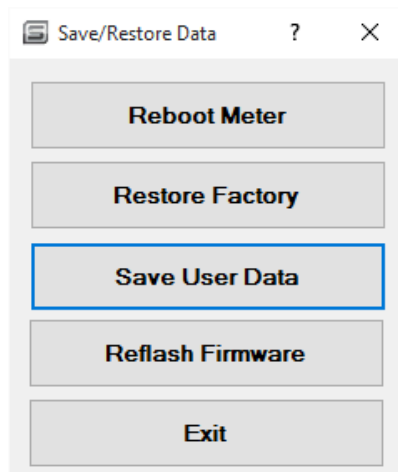
- Reboot (restart) the meter
- Restore the meter to factory default (undoing any customer changes)
- Reflash Meter Firmware
 - The meter can be flashed to latest firmware version without losing any data.
 - This allows for any improvements or fixes to be applied in the field with no application interruption. Process takes approximately 5 minutes to fully upgrade meter, making it “offline” until it’s done.
 - The firmware file is required. Latest available firmware is available at <http://www.sierrainstruments.com/products/sip/sip-innovamass.html> . The firmware is part of SIP.
- Exit menu

Upgrading Firmware

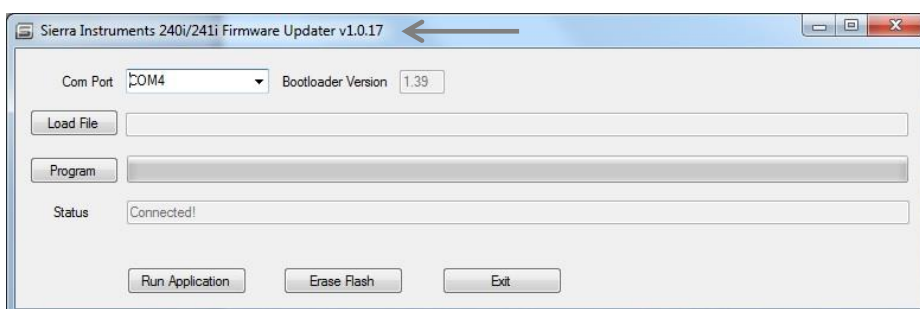
The InnovaMass 240i/241i product line supports the ability for the user to upgrade their meter using the provided “Bootloader” tool. This tool is accessible through the “Function Selector” menu under the “Save/Restore Data” menu selection option.



Once the user selects the “Save/Restore Data” selection, the user will be promoted with a secondary dialog box with additional selections.

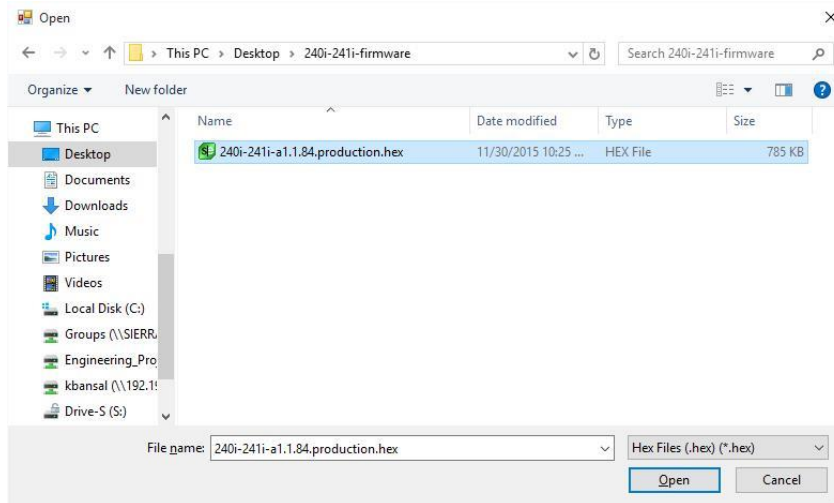


1. To start the firmware upgrade process, select the “Reflash Firmware” button. If the system successfully connects to the meter, you will see a “Bootloader Version” number (1.39 shown in image below). The meter is ready to install the new firmware file at this point.

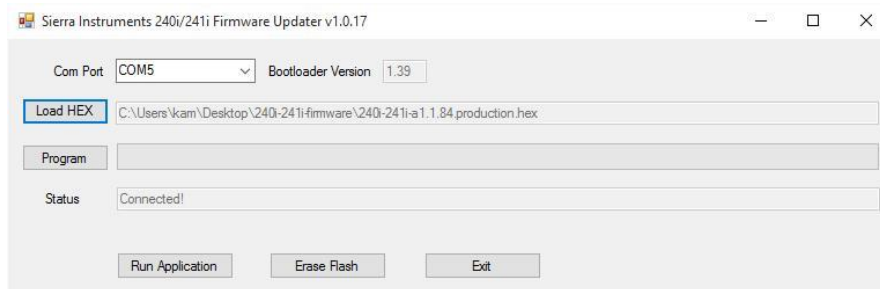


2. Next, select “Load HEX” file and point to the latest HEX file. The meter will automatically

“point” to the latest file.

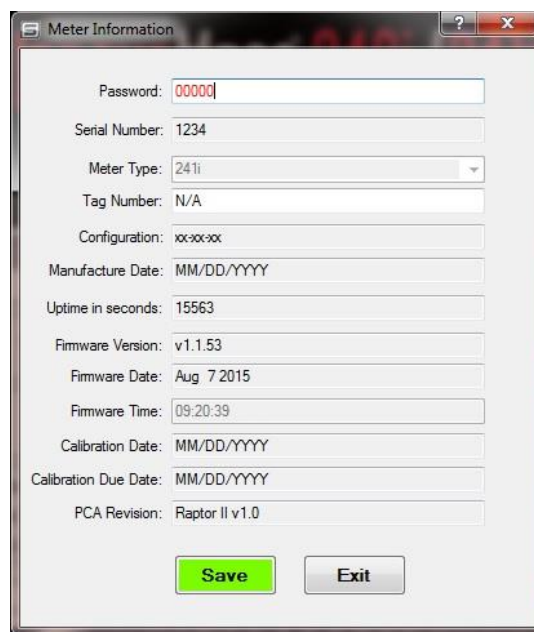


3. Now select “Open” and then select “Program.” At this point, the meter will now start the upgrade process. Upgrade process can take up to five minutes to complete.



Meter Information

“Meter Information” allows you to view meter identification data and to customize some aspects of it. Example: You can change the meter’s password and create your own “Tag Number.”



Data Capture

“The “Data Capture” menu allows you to log all the most important meter inputs and outputs and store in a .CSV file for reference.

1. Simply enter the Target Flow Rate and click the “Acquire Data” button to log a data point.
2. If you would like to specify a polling interval for logging data, just click the “Poll” checkbox and choose the time interval from the dropdown menu.
3. Click the “Acquire Data” button to begin polling, and the “Stop Data Acquire” button when finished.
4. All data will be stored in a .CSV file located at
C:\SierraInstruments\240i\Data\{SerialNumber}.csv”

| TimeStamp | Target Flow | Meas. Flow | Profile | Temp | Press | Density | Frequency | Amplitude | Gain | Filter | K-Factor | Ck |
|---------------|-------------|-------------|------------|-------------|-------------|--------------|--------------|--------------|--------------|------------|--------------|---------------|
| 10/5/2015 ... | 0.000000000 | 0.000000000 | 1.00000... | 22.11100... | 0.000290... | 0.0740000... | 0.0000000... | 148.00000... | 1697.0000... | 21.0000... | 17.600000... | 20.0000000... |
| 10/5/2015 ... | 0.000000000 | 0.000000000 | 1.00000... | 22.11100... | 0.000290... | 0.0740000... | 0.0000000... | 150.00000... | 1697.0000... | 21.0000... | 17.600000... | 20.0000000... |

Appendix A | Hardware Diagnostic Trouble Shooting Chart

| | |
|--|---|
| <p>Flow Sensor Issues</p> | <p>The flow Sensor may have been damaged. This can be caused by water hammer or excessive</p> <ul style="list-style-type: none"> • Go to the High/Low FTP button, and check the highest velocity recorded. • The max velocity spec is 30 fps for a liquid; 300 fps for a gas. If these velocities have been exceeded, the sensor may have been damaged. • Pull the probe and check for visible damage. |
| <p>Temperature Issues or Over-range</p> | <p>Temperature ranges: ST: -40°F to +392F (-40°C to +200°C)</p> <ul style="list-style-type: none"> • Check the Low/High sub-menu to see if the meter’s temperature limits have been exceeded. • The meter may need to be returned to the factory. If this is not immediately possible, temperature may be simulated in the simulate submenu. |
| <p>Pressure XDCR Issues or Over-range</p> | <p>Pressure Ranges: No pressure input (incompressible liquids); MP1: 30 psia; MP2: 100 psia; MP3: 300 psia; MP4: 500 psia</p> <ul style="list-style-type: none"> • Check the Low/High sub-menu (page 58) to see if the meter’s pressure limits have been exceeded. • The meter may need to be returned to the factory. If this is not immediately possible, pressure may be simulated in the simulate submenu. |
| <p>SD Card Issues</p> | <p>240i/241i meters have one SD Card for storing meter data</p> <ul style="list-style-type: none"> • The SD Card is missing or damaged. • Contact Sierra for a replacement SD Card. |
| <p>UART Issues</p> | <p>240i/241i meters have multiple Universal Asynchronous Receiver/Transmitters (UART) for communications (ex. USB).</p> <ul style="list-style-type: none"> • UART is malfunctioning, damaged or disconnected. • Contact Sierra for remote troubleshooting. The meter may need to be returned. |
| <p>MCU Voltage Issues</p> | <p>240i/241i meters have a Microcontroller (MCU) with a nominal voltage range.</p> <ul style="list-style-type: none"> • MCU is malfunctioning. Contact Sierra for remote troubleshooting. • The meter may need to be returned to the factory. |
| <p>Main Board Button Stuck</p> | <p>240i/241i meters have display button for navigation and data entry.</p> <ul style="list-style-type: none"> • Attempt to unstick button manually. • Contact Sierra for remote troubleshooting. • The meter may need to be returned to the factory. |
| <p>Digital Communications Failure</p> | <ul style="list-style-type: none"> ▪ 240i/241i meters can be ordered with Digital Communications (Hart, Profibus DP, Foundation Fieldbus, etc.). ▪ Digital Communications malfunction. Contact Sierra for remote troubleshooting. ▪ The meter may need to be returned to the factory. If this is not immediately possible, output via 4-20 mA, RS232, or USB is available. ▪ |
| <p>Signal Noise</p> | <p>240i/241i meters are sensitive to background noise in the application environment (60 Hz/50 Hz from power lines for example).</p> <ul style="list-style-type: none"> ▪ Go to Diagnostics, then Sensor Tune menu and check Ck and Minimum Noise Level. Reset these values if necessary. ▪ Meter Earth Ground may be faulty. Verify meter is properly earth grounded. |