InnovaMass® 240/241 HART

Instruction Manual

HART Device Specification for Models:
240-V, -VT, -VTP, -LP & 241-V, -VT, -VTP, -LP
Multivariable Mass Vortex Flow Meters

Part Number: IM240/241 Modbus, Rev. V1
May 2013
GLOBAL SUPPORT LOCATIONS: WE ARE HERE TO HELP!

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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 determining if this mass flow meter is appropriate for your oxygen application. You are responsible for cleaning the mass flow meter to the degree required for your oxygen flow application.

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Warnings and Cautions

Warning! Agency approval for hazardous location installations varies between flow meter models. Consult the flow meter nameplate for specific flow meter approvals before any hazardous location installation.

Warning! 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.

Warning! All wiring procedures must be performed with the power off.

Warning! To avoid potential electric shock, follow National Electric Code safety practices or your local code when wiring this unit to a power source and to peripheral devices. Failure to do so could result in injury or death. All AC power connections must be in accordance with published CE directives.

Warning! Do not power the flow meter with the sensor remote (if applicable) wires disconnected. This could cause over-heating of the sensors and/or damage to the electronics.

Warning! Before attempting any flow meter repair, verify that the line is de-pressurized.

Warning! Always remove main power before disassembling any part of the mass flow meter.

Caution! Before making adjustments to the device, verify the flow meter is not actively monitoring or reporting to any master control system. Adjustments to the electronics will cause direct changes to flow control settings.

Caution! All flow meter connections, isolation valves and fittings for hot tapping must have the same or higher pressure rating as the main pipeline.

Caution! Changing the length of cables or interchanging sensors or sensor wiring will affect the accuracy of the flow meter. You cannot add or subtract wire length without returning the meter to the factory for re-calibration.

Caution! 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 meter.

Caution! The AC wire insulation temperature rating must meet or exceed 80°C (176°F).

Caution! Printed circuit boards are sensitive to electrostatic discharge. To avoid damaging the board, follow these precautions to minimize the risk of damage:

- before handling the assembly, discharge your body by touching a grounded, metal object
- handle all cards by their edges unless otherwise required
- when possible, use grounded electrostatic discharge wrist straps when handling sensitive components
Note and Safety Information

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

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 and performance. Read and follow all cautions that apply to your application.

Receipt of System Components

When receiving a Sierra mass 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 240/241 Series Product Instruction Manual.

If the problem persists after following the troubleshooting procedures outlined in the 640S or 780S product manuals, contact Sierra Instruments by fax or by E-mail (see inside front cover). For urgent phone support you may call (800) 866-0200 or (831) 373-0200 between 8:00 a.m. and 5:00 p.m. PST. In Europe, contact Sierra Instruments Europe at +31 20 6145810. In the Asia-Pacific region, contact Sierra Instruments Asia at +86-21-58798521. 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 problem you are encountering and any corrective action taken
- Application information (gas, pressure, temperature and piping configuration)
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Chapter 1: HART Communications

The HART Communications Protocol (Highway Addressable Remote Transducer Protocol) is a bidirectional digital serial communications protocol. The HART signal is based on the Bell 202 standard and is superimposed on 4-20 mA Output 1. Burst mode is not supported.

**Wiring**

The diagrams below detail the proper connections required for HART communications:
Loop Powered Meter Wiring, HART Point-to-Point, Shown Below

DC Powered Meter Wiring, Shown Below
AC Powered Meter Wiring, HART Point-to-Point, Shown Below

Multi-Point Meter Wiring (digital only) Loop Power, Shown Below

Note: To activate Multi-drop mode, put a device ID of 1 to 15 in the “Dev id” menu (0 is point to point mode). This fixes the 4-20 mA output to 4 mA. Typically DC power for the loop is provided by an external power supply (isolated power on AC and DC models). Consult your HART modem manufacturer's documentation for specific wiring requirements.
# Chapter 2: HART Commands with the InnovaMass DD Menu

Available on HARTcomm.org under INNOVAMASS

## Online Menu

<table>
<thead>
<tr>
<th>Device Setup</th>
<th>Display Unit</th>
<th>Analog Output</th>
<th>External Loop</th>
<th>Meter Display</th>
<th>Alarm Setup</th>
<th>Totalizer</th>
<th>Fluid Menu</th>
<th>Energy Setup</th>
<th>Device Menu</th>
<th>Diagnostics</th>
<th>Sensor Cal</th>
<th>Review</th>
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<td>2 Vol unit</td>
<td>3 Temp unit</td>
<td>4 Energy flo unit</td>
<td>5 Line press unit</td>
<td>6 Dens unit</td>
<td>7 Totalizer units</td>
<td>8 Std &amp; Norm Cond</td>
<td>1 Norm Temp</td>
<td>2 Norm Press</td>
<td>3 Std Temp</td>
<td>4 Std Press</td>
<td></td>
</tr>
<tr>
<td>2 Analog Output</td>
<td>To Analog Output Menu</td>
<td>1 External Input</td>
<td>2 Set Ext. 4 mA</td>
<td>3 Set Ext. 20 mA</td>
<td>1 Alarm Status</td>
<td>2 Alarm 1 Setup</td>
<td>3 Alarm 2 Setup</td>
<td>4 Alarm 3 Setup</td>
<td>5 Records in Log</td>
<td>6 Read Alarm Log</td>
<td>7 Alarm Log Clear</td>
<td>1 Alarm 1 var</td>
<td>2 Alarm 1 typ</td>
</tr>
<tr>
<td>3 External Loop</td>
<td>Inactive Temp 1</td>
<td>Temp 2 Pressure</td>
<td>4 Dis_alarm</td>
<td>5 Dis_alarm</td>
<td>1 Alarm 1 var</td>
<td>2 Alarm 1 typ</td>
<td>3 Alarm 1 set pt</td>
<td>4 Alarm 2 var</td>
<td>2 Alarm 2 typ</td>
<td>3 Alarm 2 set pt</td>
<td>1 Alarm 3 var</td>
<td>2 Alarm 3 typ</td>
<td>3 Alarm 3 set pt</td>
</tr>
<tr>
<td>4 Meter Display</td>
<td>1 Disp Cycle</td>
<td>2 Disp Digits</td>
<td>3 Disp Damping</td>
<td>4 Int Displ</td>
<td>5 Disp ShowHide</td>
<td>6 PV % range</td>
<td>7 Alrm Status</td>
<td>1 Alarm Status</td>
<td>2 Alarm 1 Setup</td>
<td>3 Alarm 2 Setup</td>
<td>4 Alarm 3 Setup</td>
<td>5 Records in Log</td>
<td>6 Read Alarm Log</td>
</tr>
<tr>
<td>5 Alarm Setup</td>
<td>6 Totalize</td>
<td>7 Alrm Status</td>
<td>1 Alarm Status</td>
<td>2 Alarm 1 Setup</td>
<td>3 Alarm 2 Setup</td>
<td>4 Alarm 3 Setup</td>
<td>5 Records in Log</td>
<td>6 Read Alarm Log</td>
<td>7 Alarm Log Clear</td>
<td>1 Alarm 1 var</td>
<td>2 Alarm 1 typ</td>
<td>3 Alarm 1 set pt</td>
<td>4 Alarm 2 var</td>
</tr>
<tr>
<td>6 Totalizer</td>
<td>8 Fluid Menu</td>
<td>To Fluid Menu</td>
<td>1 Total</td>
<td>2 Totalize</td>
<td>3 Alrm Status</td>
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<td>6 Clear Totalize</td>
<td>7 Alrm Status</td>
<td>1 Alarm Status</td>
<td>2 Alarm 1 Setup</td>
<td>3 Alarm 2 Setup</td>
<td>4 Alarm 3 Setup</td>
</tr>
<tr>
<td>7 Fluid Menu</td>
<td>To Fluid Menu</td>
<td>1 Meter Location</td>
<td>2 Heating or Cooling</td>
<td>3 % Return</td>
<td>8 Energy Menu</td>
<td>1 Total</td>
<td>2 Totalize</td>
<td>3 Alrm Status</td>
<td>4 Total 1</td>
<td>5 Totalize 2</td>
<td>6 Clear Totalize</td>
<td>7 Alrm Status</td>
<td>1 Alarm Status</td>
</tr>
</tbody>
</table>

---

From Diagnostics Menu, Calibration Review
Analog Output Menu

From Online Menu

1 Fix Analog Output
2 Trim Analog Output
3 Configure AO1
4 PV is
5 PV AO1 Out
6 PV % rnte
7 Configure AO2
8 SV is
9 SV AO2 Out
SV % rnte
Configure AO3
TV is
TV AO
TV % rnte
Configure AO4
QV is
QV AO
QV % rnte

1 PV is
2 PV AO1 Out
3 PV
4 PV % rnte
5 Apply values
6 PV Rnte unit
7 PV LRV
8 PV URV
9 PV AO1 Lr end pt
PV AO1 Hi end pt
PV AO1 Added damp

1 SV is
2 SV AO2 Out
3 SV
4 SV % rnte
5 Apply values
6 SV Rnte unit
7 SV LRV
8 SV URV
9 SV AO2 Lo end pt
SV AO2 Hi end pt
SV AO2 Added damp

1 TV is
2 TV AO
3 TV
4 TV % rnte
5 Apply values
6 TV Rnte unit
7 TV LRV
8 TV URV
9 TV AO3 Lo end pt
TV AO3 Hi end pt
TV AO3 Added damp

1 QV is
2 QV AO
3 QV
4 QV % rnte
5 Apply values
6 QV Rnte unit
7 QV LRV
8 QV URV
9 QV AO1 Lo end pt
QV AO1 Hi end pt
QV AO1 Added damp

From Online Menu

Analog Output Menu
Sensor Cal Menu

From Online Menu
   Calibration Review
   1 Vol snsr unit
   2 USL
   3 LSL
   4 Min Span
   5 Damp
   6 Snsr s
   7 Sim Vtx
   8 Max Vel
   9 Vortex Diag

   1 K Factor
   2 CK Value
   3 Lo Flo cutoff

   1 Flow 1
   2 Deviation 1
   3 Flow 2
   4 Deviation 2
   5 Flow 3
   6 Deviation 3
   7 Flow 4
   8 Deviation 4
   9 Flow 5
   10 Deviation 5

   1 Temp unit
   2 USL
   3 LSL
   4 Min span
   5 Damp
   6 Snsr s
   7 Sim Temp
   8 Maximum
   9 Temp Diag

   1 RTD1 Ro
   2 RTD1 alpha
   3 RTD1 beta
   4 RTD2 Ro
   5 RTD2 alpha
   6 RTD2 beta

   1 Temp unit
   2 USL
   3 LSL
   4 Min span
   5 Damp
   6 Snsr s
   7 Sim Temp 2
   8 Maximum
   9 Temp Diag

   1 PCal B00
   2 PCal B01
   3 PCal B02
   4 PCal B10
   5 PCal B11
   6 PCal B12
   7 PCal B20
   8 PCal B21
   9 PCal B22
   Ref Resistance
   Internal Temp. Cal
   Cal Current

   1 Temp
   2 Sim Temp
   3 RTD1
   4 RTD1 AtoD
   5 Max Temp
   6 Temp 2
   7 Sim Temp 2
   8 RTD2
   9 RTD2 AtoD
   Max temp 2

   1 Press snsr unit
   2 USL
   3 LSL
   4 Min span
   5 Damp
   6 Snsr s
   7 Sim Press
   8 Maximum
   9 Press Diag

   1 Press
   2 Sim Press
   3 Excite
   4 Excite AtoD
   5 Sense
   6 Sense AtoD
   7 Max Press

   1 Vortex Sensor
   2 Vortex Cal
   3 Press Sensor
   4 Press Cal
   5 Temp Sensor
   6 Temp 1 & 2 Cal
   7 Temp 2 Sensor
   8 Cal. Correction

   Figure 1 Sensor Cal Menu
HART Commands with Generic DD Menu

Online Menu
1 Device Setup
2 PV
3 PV AO

1 Process Variables
1 Snsr
2 AI % Rnge
3 AO1

2 Diag/Service
1 Test Device
2 Loop Test
3 Calibration
4 D/A Trim

3 Basic Setup
1 Tag
2 PV unit
3 Range Values
4 Device Information
5 PV Xfer fnctn
6 PV Damp

4 Detailed Setup
5 Review

1 Sensors
2 PV Sensor Unit
3 Sensor information

2 Signal Condition
1 Snsr Damp
2 URV
3 AI LRV
4 Xfer Fnch
5 AI % rnge

3 Output Condition
1 Analog Output
2 HART Output

4 Device Information
1 PV LRV
2 PV URV

PV LSL, PV USL, PV Min span

Figure 2 Online Menu - use Password 16363.
## Fast Key Sequence

Use password 16363.

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Description</th>
<th>Access</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,1,1</td>
<td>Snsr</td>
<td>View</td>
<td>Primary variable value</td>
</tr>
<tr>
<td>1,1,2</td>
<td>AI % Rnge</td>
<td>View</td>
<td>Analog output % range</td>
</tr>
<tr>
<td>1,1,3</td>
<td>AOT</td>
<td>View</td>
<td>Analog output, mA</td>
</tr>
<tr>
<td>1,2,1</td>
<td>Test Device</td>
<td>N/A</td>
<td>Not used</td>
</tr>
<tr>
<td>1,2,2,1</td>
<td>4 mA</td>
<td>View</td>
<td>Loop test, fix analog output at 4 mA</td>
</tr>
<tr>
<td>1,2,2,2</td>
<td>20 mA</td>
<td>View</td>
<td>Loop test, fix analog output at 20 mA</td>
</tr>
<tr>
<td>1,2,2,3</td>
<td>Other</td>
<td>Edit</td>
<td>Loop test, fix analog output at mA value entered</td>
</tr>
<tr>
<td>1,2,2,4</td>
<td>End</td>
<td>Exit</td>
<td>Exit loop test</td>
</tr>
<tr>
<td>1,2,3,1,1</td>
<td>4 mA</td>
<td>N/A</td>
<td>Not used, apply values</td>
</tr>
<tr>
<td>1,2,3,1,2</td>
<td>20 mA</td>
<td>N/A</td>
<td>Not used, apply values</td>
</tr>
<tr>
<td>1,2,3,1,3</td>
<td>Exit</td>
<td>Exit</td>
<td>Exit apply values</td>
</tr>
<tr>
<td>1,2,3,2,1</td>
<td>PV LRV</td>
<td>Edit</td>
<td>Primary variable lower range value</td>
</tr>
<tr>
<td>1,2,3,2,2</td>
<td>PV URV</td>
<td>Edit</td>
<td>Primary variable upper range value</td>
</tr>
<tr>
<td>1,2,3,2,3</td>
<td>PV USL</td>
<td>View</td>
<td>Primary variable upper sensor limit</td>
</tr>
<tr>
<td>1,2,3,2,4</td>
<td>PV LSL</td>
<td>View</td>
<td>Primary variable lower sensor limit</td>
</tr>
<tr>
<td>1,1,1,2,1</td>
<td>D/A Trim</td>
<td>Edit</td>
<td>Calibrate electronics 4mA and 20mA values</td>
</tr>
<tr>
<td>1,3,1</td>
<td>Tag</td>
<td>Edit</td>
<td>Tag</td>
</tr>
<tr>
<td>1,3,2</td>
<td>PV unit</td>
<td>Edit</td>
<td>Primary variable units</td>
</tr>
<tr>
<td>1,3,3,1</td>
<td>PV LRV</td>
<td>Edit</td>
<td>Primary variable lower range value</td>
</tr>
<tr>
<td>1,3,3,2</td>
<td>PV URV</td>
<td>Edit</td>
<td>Primary variable upper range value</td>
</tr>
<tr>
<td>1,3,3,3</td>
<td>PV LSL</td>
<td>View</td>
<td>Primary variable upper sensor limit</td>
</tr>
<tr>
<td>1,3,3,4</td>
<td>PV USL</td>
<td>View</td>
<td>Primary variable lower sensor limit</td>
</tr>
<tr>
<td>1,3,4,1</td>
<td>Distributor</td>
<td>N/A</td>
<td>Not used</td>
</tr>
<tr>
<td>1,3,4,2</td>
<td>Model</td>
<td>N/A</td>
<td>Not used</td>
</tr>
<tr>
<td>1,3,4,3</td>
<td>Dev id</td>
<td>View</td>
<td>Device identification</td>
</tr>
<tr>
<td>1,3,4,4</td>
<td>Tag</td>
<td>Edit</td>
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<tr>
<td>1,3,4,5</td>
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<td>Edit</td>
<td>Date</td>
</tr>
<tr>
<td>1,3,4,6</td>
<td>Write Protect</td>
<td>View</td>
<td>Write protect</td>
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<td>1,3,4,7</td>
<td>Descriptor</td>
<td>Edit</td>
<td>Vortex flowmeter</td>
</tr>
<tr>
<td>1,3,4,8</td>
<td>Message</td>
<td>Edit</td>
<td>32 character alphanumeric message</td>
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<tr>
<td>1,3,4,9</td>
<td>PV snsr s/n</td>
<td>View</td>
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</tr>
<tr>
<td>1,3,4,men</td>
<td>Final assy #</td>
<td>Edit</td>
<td>Final assembly number</td>
</tr>
<tr>
<td>1,3,4,men</td>
<td>Universal Rev</td>
<td>View</td>
<td>Universal revision</td>
</tr>
<tr>
<td>1,3,4,men</td>
<td>Fld dev Rev</td>
<td>View</td>
<td>Field device revision</td>
</tr>
<tr>
<td>1,3,4,men</td>
<td>Software Rev</td>
<td>View</td>
<td>Software revision</td>
</tr>
<tr>
<td>1,3,5</td>
<td>PV Xfer fnctn</td>
<td>View</td>
<td>Linear</td>
</tr>
<tr>
<td>1,3,6</td>
<td>PV Damp</td>
<td>Edit</td>
<td>Primary variable damping (time constant) in seconds</td>
</tr>
<tr>
<td>1,4,1,1</td>
<td>PV</td>
<td>View</td>
<td>Primary variable value</td>
</tr>
<tr>
<td>1,4,1,2</td>
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<td>1,4,1,3</td>
<td>Sensor Information</td>
<td>View</td>
<td>PV LSL, PV USL, PV Min span</td>
</tr>
<tr>
<td>1,4,2,1</td>
<td>Snsr Damp</td>
<td>Edit</td>
<td>Primary variable damping (time constant) in seconds</td>
</tr>
<tr>
<td>1,4,2,2,1</td>
<td>PV LRV</td>
<td>Edit</td>
<td>Primary variable low range value</td>
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<tr>
<td>1,4,2,2,2</td>
<td>PV URV</td>
<td>Edit</td>
<td>Primary variable upper range value</td>
</tr>
<tr>
<td>1,4,2,3,1</td>
<td>PV LRV</td>
<td>Edit</td>
<td>Primary variable low range value</td>
</tr>
<tr>
<td>1,4,2,3,2</td>
<td>PV URV</td>
<td>Edit</td>
<td>Primary variable upper range value</td>
</tr>
<tr>
<td>1,4,2,4</td>
<td>Xfer Fnctn</td>
<td>View</td>
<td>Linear</td>
</tr>
<tr>
<td>1,4,2,5</td>
<td>AI % rnge</td>
<td>View</td>
<td>Analog output % range</td>
</tr>
<tr>
<td>1,4,3,1,1</td>
<td>AO1</td>
<td>View</td>
<td>Analog output, mA</td>
</tr>
<tr>
<td>1,4,3,1,2</td>
<td>AO alarm typ</td>
<td>N/A</td>
<td>Not used</td>
</tr>
<tr>
<td>Sequence</td>
<td>Description</td>
<td>Access</td>
<td>Notes</td>
</tr>
<tr>
<td>------------</td>
<td>----------------------</td>
<td>--------</td>
<td>------------------------------------------------</td>
</tr>
<tr>
<td>1,4,3,1,3,1</td>
<td>4 mA</td>
<td>View</td>
<td>Loop test, fix analog output at 4 mA</td>
</tr>
<tr>
<td>1,4,3,1,3,2</td>
<td>20 mA</td>
<td>View</td>
<td>Loop test, fix analog output at 20 mA</td>
</tr>
<tr>
<td>1,4,3,1,3,3</td>
<td>Other</td>
<td>Edit</td>
<td>Loop test, fix analog output at mA value entered</td>
</tr>
<tr>
<td>1,4,3,1,3,4</td>
<td>End</td>
<td></td>
<td>Exit loop test</td>
</tr>
<tr>
<td>1,4,3,1,4</td>
<td>D/A trim</td>
<td>Edit</td>
<td>Calibrate electronics 4mA and 20mA values</td>
</tr>
<tr>
<td>1,4,3,1,5</td>
<td>Scaled D/A trim</td>
<td>N/A</td>
<td>Not used</td>
</tr>
<tr>
<td>1,4,3,2,1</td>
<td>Poll addr</td>
<td>Edit</td>
<td>Poll address</td>
</tr>
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