SmartTrak® 50 Series

Economical/OEM Digital Gas Mass Flow Control up to 200 slpm (nlpm)

Instruction Manual

IM-50, Rev. O 8/23

SIERRA®

GLOBAL SUPPORT LOCATIONS: WE ARE HERE TO HELP!

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IMPORTANT CUSTOMER NOTICE: 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 or controllers for oxygen gas. You are responsible for determining if this mass flow meter or controller is appropriate for your oxygen application. You are responsible for cleaning the mass flow meter or controller to the degree required for your oxygen flow application.

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TRADEMARKS

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Table of Contents

Chapter 1: Introduction

This instruction manual is your guide to the SmartTrak® 50 Series. Visit the Sierra Instruments website **www.sierrainstruments.com/products/50series.html** for more information about this product.

Using This Manual

This manual is organized into five chapters:

- **Chapter 1:** Introduction and Theory of Operation.
- **Chapter 2:** Installation, Plumbing & Wiring instructions.
- **Chapter 3**: Digital Operation
- **Chapter 4**: Analog Operation
- **Chapter 5**: Technical Support and Service.

There are also 4 Appendices:

- **Appendix A:** Conversion Formula and Gas Tables.
- **Appendix B1:** Low Flow Product Specifications
- **Appendix B2:** Medium Flow Product Specifications
- **Appendix C:** Warranty Policy

Throughout this manual, we use the word *instrument* as a generic term to represent the **SmartTrak® 50 Series** mass flow meters and controllers.

Safety Information!

Caution and warning statements are used 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! OR IMPORTANT NOTE

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 Your Instrument

When receiving the instrument, carefully check the outside packing carton for damage that may have occurred during 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 and match your specifications. 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 one of Sierra's Technical Support Centers:

USA (Headquarters) Customer Service:
TOLL FREE: 800-866-0200
PHONE: +1-831-373-0200
FAX: +1-831-373-4402
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FAX: +8621 5879 8586
EMAIL: www.sierra-asia.com

Definitions Used In This Manual

The following terms are used frequently in this manual. They are presented here with their definitions for your information.

Setpoint—The command or control signal supplied to a flow controller is called the setpoint. The controller will maintain the flow at this value.

Full scale—The highest flow that an instrument will measure within its specified accuracy. It is often possible for an instrument to measure a flow beyond its full scale (FS) value, but the accuracy of this measurement may be outside of published specifications.

LFE—Laminar Flow Element (LFE) or bypass generates pressure drop forcing a small fraction of the total flow to pass through the sensor capillary tube.

The SmartTrak® 50 Series Flow Sensing Principle

The operating principle of the SmartTrak® 50 Series instruments is based upon heat transfer and the first law of thermodynamics. During operation process gas enters the instrument's flow body and divides into two flow paths, one through the sensor tube and the other through the laminar flow bypass. The laminar flow bypass (often called LFE for "laminar flow element") generates a pressure drop, P_1–P_2, forcing a small fraction of the total flow to pass through the sensor tube (m_1).

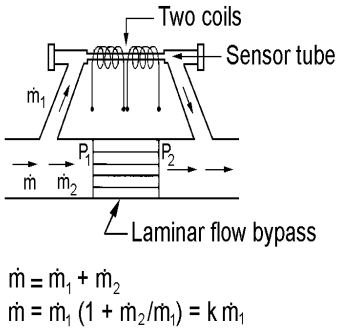


Figure 1-1. Flow Paths through the Instrument

Two resistance temperature detector (RTD) coils around the sensor tube direct a constant amount of heat (H) into the gas stream. During operation, the gas mass flow carries heat from the upstream coil to the downstream coil. The resulting temperature difference (ΔT) is measured by the SmartTrak® 50 Series microprocessor. From this, SmartTrak® 50 Series calculates the output signal. Since the molecules of the gas carry away the heat, the output signal is linearly proportional to gas mass flow.

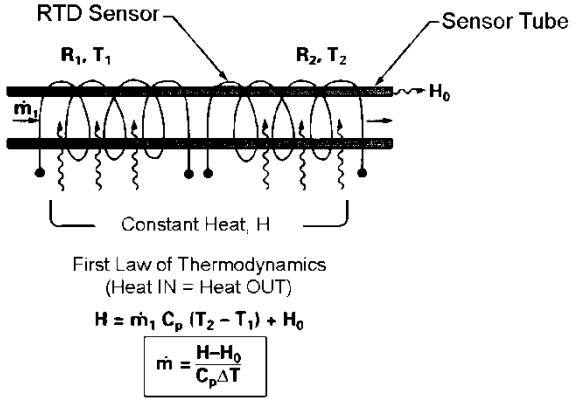


Figure 1-2. Flow Measuring Principle

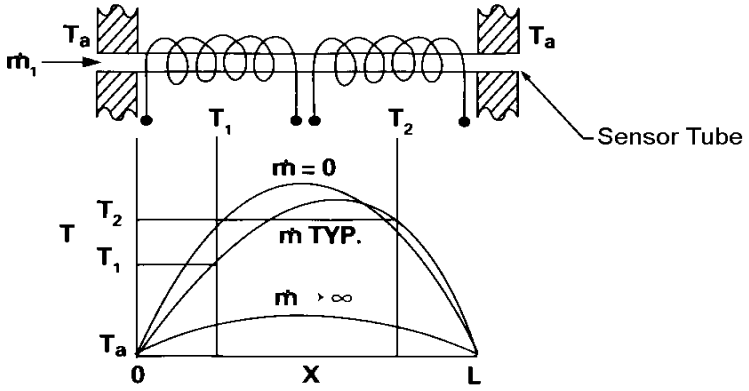


Figure 1-3. Sensor Temperature Distribution

Figures 1-2 and 1-3 show the mass flow through the sensor tube as inversely proportional to the temperature difference of the coils. The coils are legs of a bridge circuit with an output voltage in direct proportion to the difference in the coils' resistance; the result is the temperature difference (ΔT). Two other parameters, heat input (H) and coefficient of specific heat (Cp) are both constant. Through careful design and attention to these parameters, this output signal is made linear over the transducer's normal operating range (Figure 1-4). As a result, the measured flow through the sensor tube is directly proportional to the gas flow in the main body.

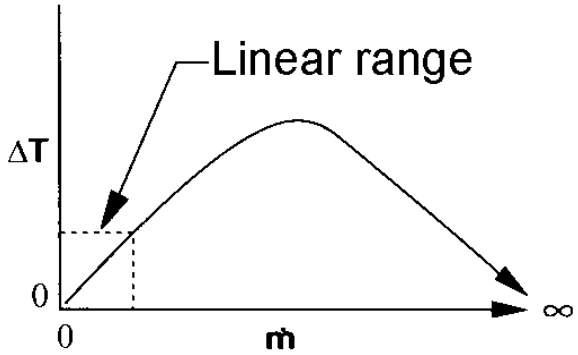


Figure 1-4. Linear Range of the Transducer's Output Signal

In SmartTrak® 50 Series mass flow *controllers*, the gas which flows through the monitoring section is precisely regulated by the built-in electromagnetic valve. The normally closed valve is similar to an on/off solenoid valve, except that the current to the valve coil, and hence the magnetic field, is modulated so that the ferromagnetic valve armature, or valve plug, assumes the exact height above the valve's orifice required to maintain the valve's command flow (set point). The result is excellent resolution.

View an animated tutorial on the concepts discussed in this section at:
http://sierratechsupport.com/video/flow_control.html

Chapter 2: Installation

Before You Begin Installation

Warning!
Injury can result if line pressure exceeds the maximum rating of 145 psig (10 barg).

Before installing the instrument, ensure that the installation site conforms to the specific operating parameters recorded on the instrument's Data Label. The Data Label is located on the back of the instrument electronics enclosure. This is critical because each instrument is configured for a specific application range. Please review the gas, the mounting orientation, the maximum flow range, the inlet and outlet pressure and the operating temperature. The line pressure should not exceed 145 psig (10 barg). The temperature should not exceed 122°F (50°C). The minimum operating temperature is 32°F (0°C) and ambient temperature is 0-50°C. If your application exceeds any of these parameters, contact your Sierra Sales Agent before installation. You may also contact one of Sierra's Technical Support Centers listed on Page 5 of this manual.

Installation Check List

1. **Double-check to be sure that the O-ring material used in your instrument is compatible with the gas to be measured.** The O-ring material used in your SmartTrak® 50 Series is Viton. See Appendix A for a table of elastomer compatibility with a wide variety of gases.

2. **Sierra strongly recommends you install an in-line filter upstream of the instrument.** Recommended filter size: 10 micron. A 10 micron filter will eliminate the possibility of sensor tube clogs, maximizing the life of the unit and accuracy of the calibration. A 10 micron filter is available from Sierra as an accessory. See Appendix B or contact your local Sierra distributor.

3. **Do not place the instrument in areas subject to sudden temperature changes, excessive moisture or near equipment radiating significant amounts of heat.** Be sure to allow adequate space for cable connectors and wiring.

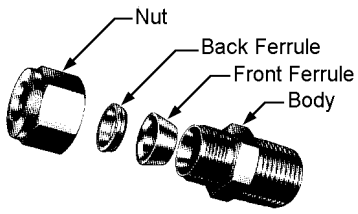
4. **For controllers, use a properly sized pressure regulator.** Make sure the pressure regulator is not too small or too big. There can be no restrictions (such as valves, tubing or pipe internal diameters, reducers, etc.) upstream or downstream of the controller with a dimension that is less than the valve orifice diameter. To determine orifice diameter, consult the factory for further information. If restricted, controller will not reach full scale.

5. **Output Signals:** The 50 Series has RS-232 communications as the standard configuration, with optional RS-485, 0-5 VDC or 4-20 mA. The output signals specified at time of order will be indicated on the data label.

6. **The instrument has specific power supply requirements.** See the table later in this chapter for a complete listing of power requirements.

Installing the Instrument—Plumbing

SmartTrak® 50 Series instruments are supplied with compression, VCO®, VCR®, Festo®-type push-in or female NPT process connections. To ensure a successful installation, inlet and outlet tubing should be clean prior to plumbing the instrument into the system. The shipping caps covering the inlet/outlet fittings should not be removed until immediately before installation.



Follow the installation instructions that are applicable to your instrument's process connection. Ensure that the tubing is free from burrs or sharp rims that may result from cutting.

CAUTION! Before use, all plumbing should be checked carefully for leaks, especially at the connecting fittings. All instruments are leak-tested prior to shipping. It is not a requirement to leak test your instrument. Do not use liquid leak detectors such as Snoop® to search for leaks inside or outside the SmartTrak® 50 Series. Instead, monitor pressure decay.

Compression Fittings

1. Position the instrument with the flow direction arrow pointing in the direction of flow.
2. Verify the position of the front and back ferrule. Insert the tubing into the fitting. Be sure that the tubing rests firmly on the shoulder of the fitting and that the nut is finger-tight. Scribe the nut at the six o'clock position.
3. While holding the fitting body steady with a backup wrench, tighten the nut 1-1/4 turns, watching the scribe mark make one complete revolution and continue to the nine o'clock position. For 1/8-inch fittings, tighten only 3/4 turns from finger-tight. **DO NOT OVER-TIGHTEN!**
4. If you use flexible tubing (Example: Polyflow) use an "Insert" (see www.swagelok.com)
5. Check the system's entire flow path thoroughly for leaks. **Do not use liquid leak detectors on or near the unit.** Exposing the instrument to leak detector fluid may cause damage.

VCO Fittings

1. Position the instrument with the flow direction arrow pointing in the direction of flow.
2. Tighten the nut finger-tight, and then 1/8 turn tighter with a wrench. **Do not over-tighten!**
3. Check the system's entire flow path thoroughly for leaks. **Do not use liquid leak detectors on or near the unit.** Exposing the instrument to leak detector fluid may cause damage.

VCR Fittings

1. Position the instrument with the flow direction arrow pointing the direction of flow.
2. Install new gaskets that are compatible with the gas to be used.
3. Tighten the nut finger-tight, and then 1/8 turn tighter with a wrench. **Do not over-tighten!**
4. Check the system's entire flow path thoroughly for leaks. **Do not use liquid leak detectors on or near the unit.** Exposing the instrument to leak detector fluid may cause damage.

1/4 Inch Female NPT

1. Position the instrument with the flow direction arrow pointing the direction of flow.
2. Apply high quality Teflon tape to the male NPT fitting. Alternatively, use a high quality paste pipe thread sealant suitable for the application and gas, and apply this compound to the inlet and outlet fittings. Avoid getting the tape or the thread sealant onto the first two threads to keep it out of your process gas.
3. Tighten each fitting by hand. Then, tighten no more than one (1) turn. **Do not over-tighten.**
4. Check the system's entire flow path thoroughly for leaks. **Do not use liquid leak detectors on or near the unit.** Exposing the instrument to leak detector fluid may cause damage.

Installing Your Instrument—Mechanical Mounting

Mounting Your Instrument

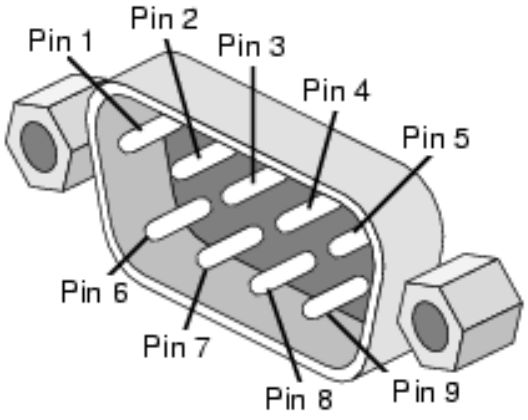
The base plate or bottom of the instrument has four mounting holes. Two are SAE thread and two are metric thread. For location and dimensions, please see Appendix B.

Installing Your Instrument—Electrical Connections

All electrical connections for your SmartTrak® 50 Series instrument can be made on either side panel. See Figure 2-2 for the pinout

50 Series DB9	Description	Wire Color in Cable
1	4-20 mA / 0-5 VDC Output	White
2	4-20 mA / 0-5 VDC Output Return	Brown
3	4-20 mA / 0-5 VDC Setpoint in	Blue
4	4-20 mA / 0-5 VDC Setpoint Return	Orange
5	+24 VDC in/Power Input (+)	Red
6	Power Return (-)/RS 232 Ground	Green
7	N/C (RS-485 Bus Isolated Ground)	Yellow
8	RS-232 Tx (RS-485 Bus B, +, D1)	Purple
9	RS-232 Rx (RS-485 Bus A, -, D0)	Gray
Shield/Case	Earth Ground	Shield/Drain Wire

Figure 2-2: SmartTrak® 50 Series Connections



DB9 Pin-out locations on instrument. There are two DB9 connectors, one on each side of the enclosure. Assure block off plate covers unused DB9...

Instrument Power:

The SmartTrak® 50 Series requires a **24 VDC power supply** (meter can use 15 VDC). Connect power to the 9-pin connector on the side of the instrument (pins 5 and 6). If you are supplying your own power source, it must regulate 24 VDC, and supply at least 315 mA (445mA for RS-485 controller) (meter can use 15 VDC, 85 mA) (215mA for RS-485 Meter). The instrument is polarity sensitive. If you reverse this wiring, the instrument will not be damaged, but it will not function.

Instrument Grounding:

The SmartTrak® 50 Series has very high levels of RFI and EMI shielding built into the metal electronics cover (meets or exceeds the CE Standard EN 61326-1; 2006). To maintain the integrity of this CE rating, it is critical that a path be provided for any residual internal noise to exit the instrument or it may register on the outputs. Grounding provides this path.

To properly ground your instrument, secure the chassis to solid earth ground using the mounting holes on the bottom of the flow body. If the instrument will be used without permanent mounting (on a laboratory bench, for instance) then connect the shield wire (no insulation) to earth ground in your facility. If you purchased a Sierra power supply, a ground wire is provided for your convenience.

CAUTION! This instrument is not a loop-powered device! Do NOT apply power to the 4-20 mA / 0-5 VDC output or setpoint connections.

Analog Signals:

- **Output Signal:** Measure the current or voltage output signal, 4-20 mA / 0-5 VDC, across pin 1 (positive) and 2 (negative). The minimum load is 50 Ohms, the maximum load is 500 Ohms.

- **Setpoint:** To transmit an analog setpoint, supply the current signal across pins 3 (positive) and 4 (negative).

For Digital Communication:

You can communicate with your instrument using the SmartTrak® 50 Series User Software package and your PC running the Windows operating system. See the pinout on the previous page regarding the necessary RS connections pending RS-232 vs. RS-485. After consulting the pinout diagram, plug the DB9 connector into an appropriate serial port on your PC for RS-232. For an RS-485 instrument you must go through an appropriate RS-232 or USB converter. If you

do not have a serial port, use a serial to USB convertor (available at most consumer electronics stores or from Sierra).

To minimize the potential for RF interference, it is recommended to shield these wires. If you are making your own cabling, Sierra recommends you use wire that comes shielded. Solder one end of the shield wire/casing to the DB-9 connector at one end of the wire, so as to allow the collected interference to dump to earth ground.

Digital RS-232 Communication Connections To DB9 PC Serial Port

50 Series DB9 Pin Connections	PC Serial Port DB9 Pin Connections
RS-232 Transmit, Pin 8, Purple	DB-9 Pin#2
RS-232 Receive, Pin 9, Gray	DB-9 Pin#3
RS-232 Ground, Pin 6, Green	DB-9 Pin#5

NOTE: Transmit and Receive may need to be reversed, depending in which type of device or cable is connected. No damage will result, attempt communication after reversal.

Chapter 3: Digital Operation

Mass Flow Meter

After your instrument is installed and the system has undergone a complete leak check as discussed in detail in Chapter 2, follow these steps:

The Smart-Trak ® 50 Series is not a loop-powered device. Do not apply power to the 4-20 mA outputs.

1. **Power Up Your Instrument:** Apply power to your instrument. See Chapter 2, Figure 2-2: SmartTrak® 50 Series Connections. After a few seconds of warm up, the display (optional) will turn on.

2. **Open the gas supply:** SmartTrak® 50 Series MFM is now ready to monitor the gas mass flow rate. Let the instrument warm up for at least 15 minutes for optimal performance accuracy.

Your SmartTrak® 50 Series Mass Flow Meter is now ready for use!

Mass Flow Controller

After your instrument is installed and the system has undergone a complete leak check as discussed in detail in Chapter 2, follow these steps:

1. **The valve will remain closed until power is supplied and a setpoint is given.** The unit was shipped to you without a setpoint. However, we recommend that you confirm this yourself, for safety sake. See Chapter 2 for wiring instructions.

CAUTION! Remember that the valve in the SmartTrak® 50 Series is NOT a guaranteed positive shut-off device. For dangerous applications, Sierra recommends use of an external shut-off safety valve. DO NOT LEAVE A SETPOINT APPLIED FOR AN EXTENDED PERIOD OF TIME TO A CONTROLLER WHEN THE GAS SUPPLY IS SHUT OFF OR BLOCKED. Damage may result and the instrument will become hot to the touch.

WARNING! If you do not know the setpoint or the valve state of the Mass Flow Controller before it was shut down, you must assume that the valve will open when power is applied. *TAKE NECESSARY PRECAUTIONS.*

2. **Power Up Your Instrument:** Apply power to your instrument using Sierra's power supply or your own input power source. See Chapter 2, Figure 2-2: After a few seconds of warm up the display (Optional) will turn on.

3. **Open the gas supply:** SmartTrak® 50 Series MFC is now ready to monitor and control the gas mass flow rate. Let the instrument warm up for at least 15 minutes for optimal performance accuracy.

Your SmartTrak® 50 Series Mass Flow Controller is now ready for use!

Loading the SmartTrak® 50 Series Software

If you are using your SmartTrak® 50 Series instrument or your computer for the first time, it is necessary to install the SmartTrak® 50 Series Software into your computer. If this software is already installed, skip this section.

Each SmartTrak® 50 Series order is shipped with a CD-ROM containing the SmartTrak® 50 Series Software. Locate this disk. At this point, **EXIT OUT OF ANY OPEN APPLICATIONS BEING RUN ON YOUR COMPUTER.**

PROCEDURE:

1. Insert the SmartTrak® 50 Series Software CD into your CD-ROM
2. Open "My Computer" on your desktop
3. Open the CD Named: "SmartTrak® 50 Series" on your D-drive
4. Run "setup.exe"
5. Follow the instructions on screen

CAUTION! It is recommended that you do not change the default installation directory for this software. The default directory is: Program Files. Changing the installation directory may lead to malfunctions in the software.

Connecting SmartTrak® 50 Series to Your Computer

We suggest you use the Sierra Instruments RS-232 communication cable (part number C9RS232). This pre-manufactured cable has the correct DB9 connection to mate with all computer DB9 serial ports, and a DB9 to connect to the instrument.

1. Plug the DB9 connector into an appropriate serial port on your computer (if you do not have a serial port, use an off-the-shelf USB-to-serial converter available from most consumer electronics stores or from Sierra).
2. Note the serial port channel number. You can look this up in the 'System Properties' window of your PC. This can be accomplished by right-clicking on 'My Computer,' left-click 'Properties,' or in the 'Control Panel' under 'System.'
3. Under the 'Hardware' tab, click the button 'Device Manager.' Once 'Device Manager' is open, expand the collapsible menu item 'Ports.' All available ports on your computer should be listed. Find which one is the native serial port on your computer (generally COM1 or COM2), or the USB/serial converter COM port.

NOTE: *If you cannot find the USB/serial converter you installed listed, or it has a yellow exclamation mark on it, you may have incorrectly installed the driver software. Please refer to the manufacturer's instructions on driver installation before proceeding.*

If you plan to control more than one SmartTrak® 50 Series from your computer…

If you wish to operate more than one 50 Series at a time, you will need a dedicated COM port for each, be it native serial or a USB/serial converter. After looking up and recording which ports are which in 'Device Manager' (see last paragraph for review), open up an instance of the user software for each unit (Example: If you have 5 units, you need to have 5 instances of the program running at once). Setup communications for each instance to match the communication type (RS-232 vs. RS-485) for each unit, the port it is on, and the device address (if necessary).

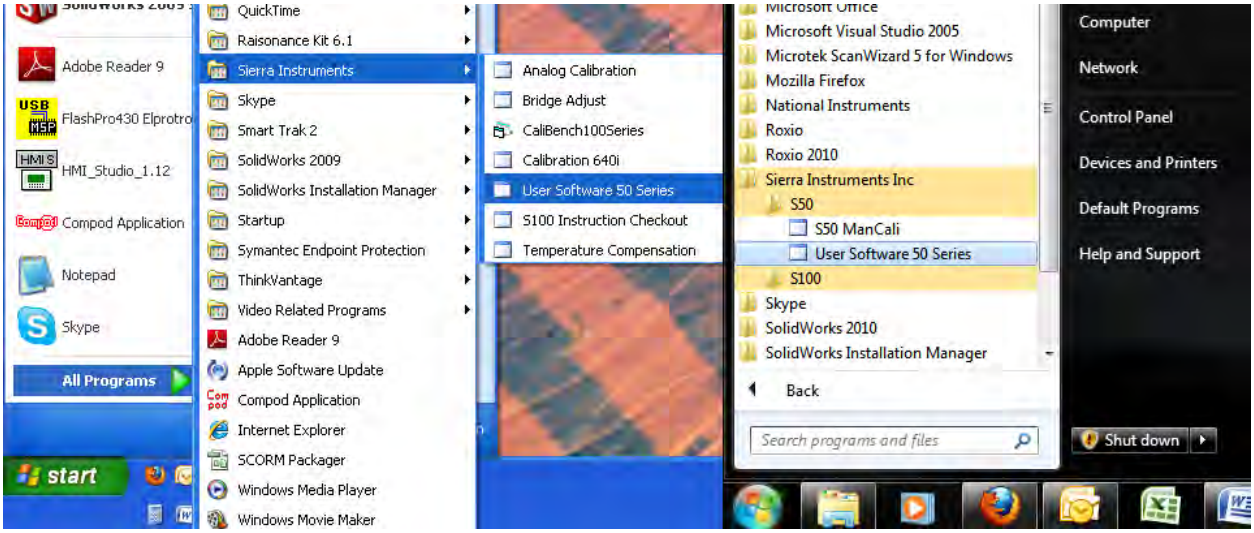
Once communications are established for each unit individually, you can switch between instances with mouse clicks to take readings and change settings on multiple units using a single PC.

NOTE: Computers have limited capacity and computational ability, as well as streaming speeds; the more instances you run, the slower the response. Please remain patient with the system, or consider upgrading your PC to handle the load.

If connecting your computer to the SmartTrak® 50 Series creates any confusion, please contact Sierra Instruments or your IT person for assistance.

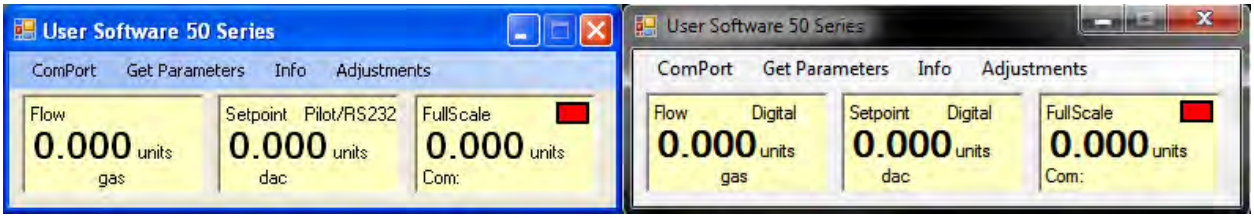
Running the SmartTrak® 50 Series User Software

1. Locate the program named "50 Series User Software" and open it.



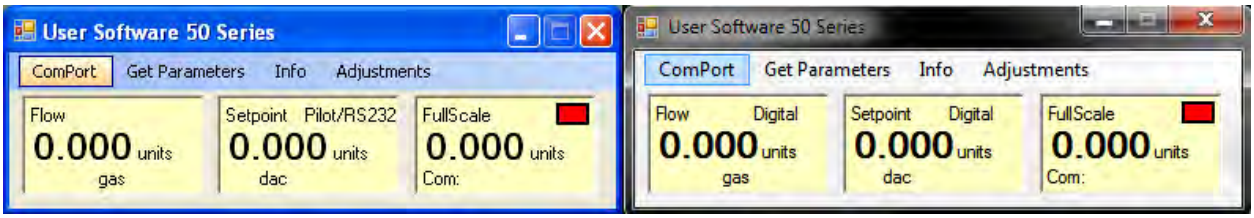
WINDOWS XP **WINDOWS 7**

You will see the following main screen:

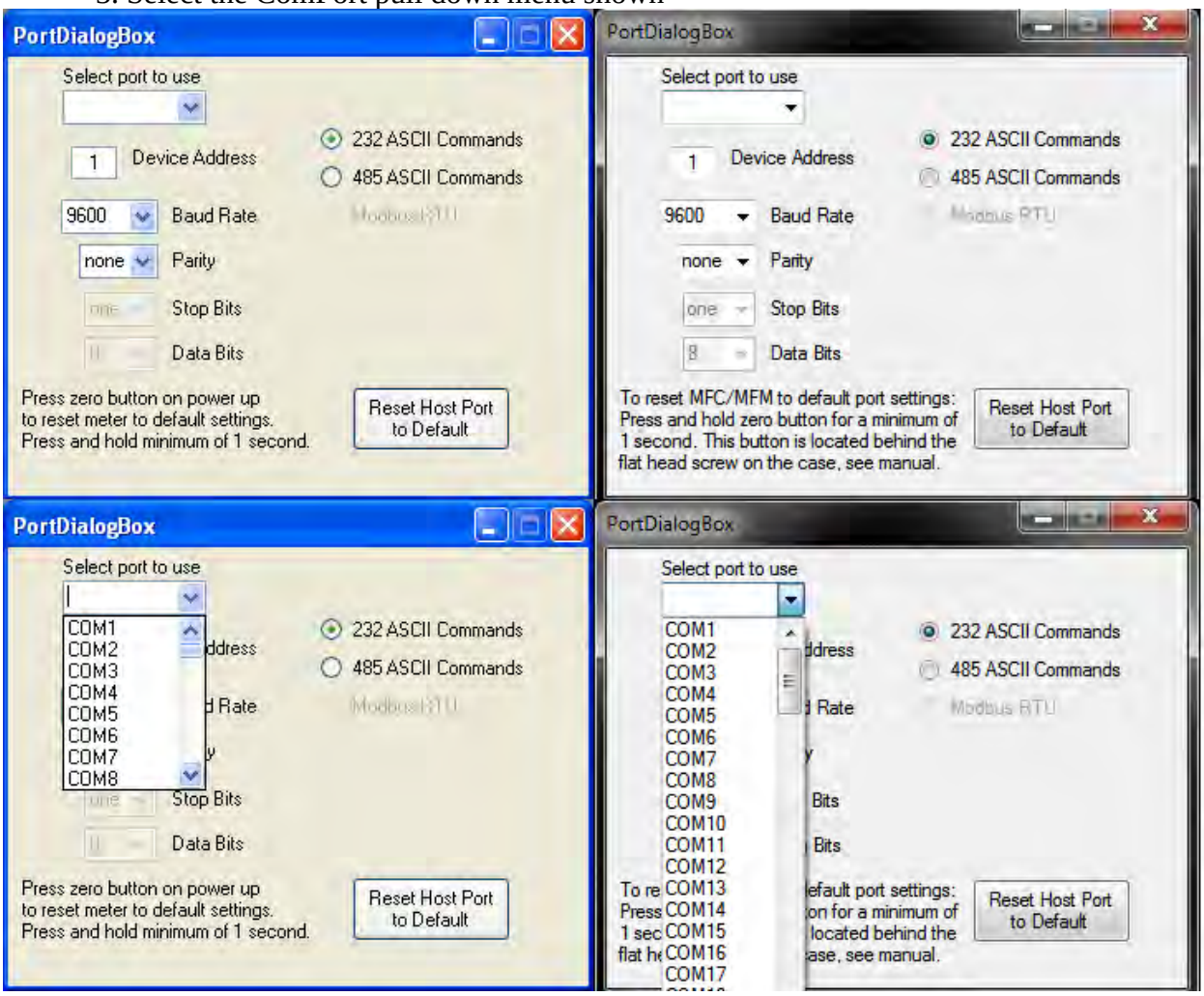


NOTE: Hovering the mouse pointer over any of the input fields and buttons will give you a description of its purpose.

2. Select ComPort in the menu to set up the ComPort. (See below)

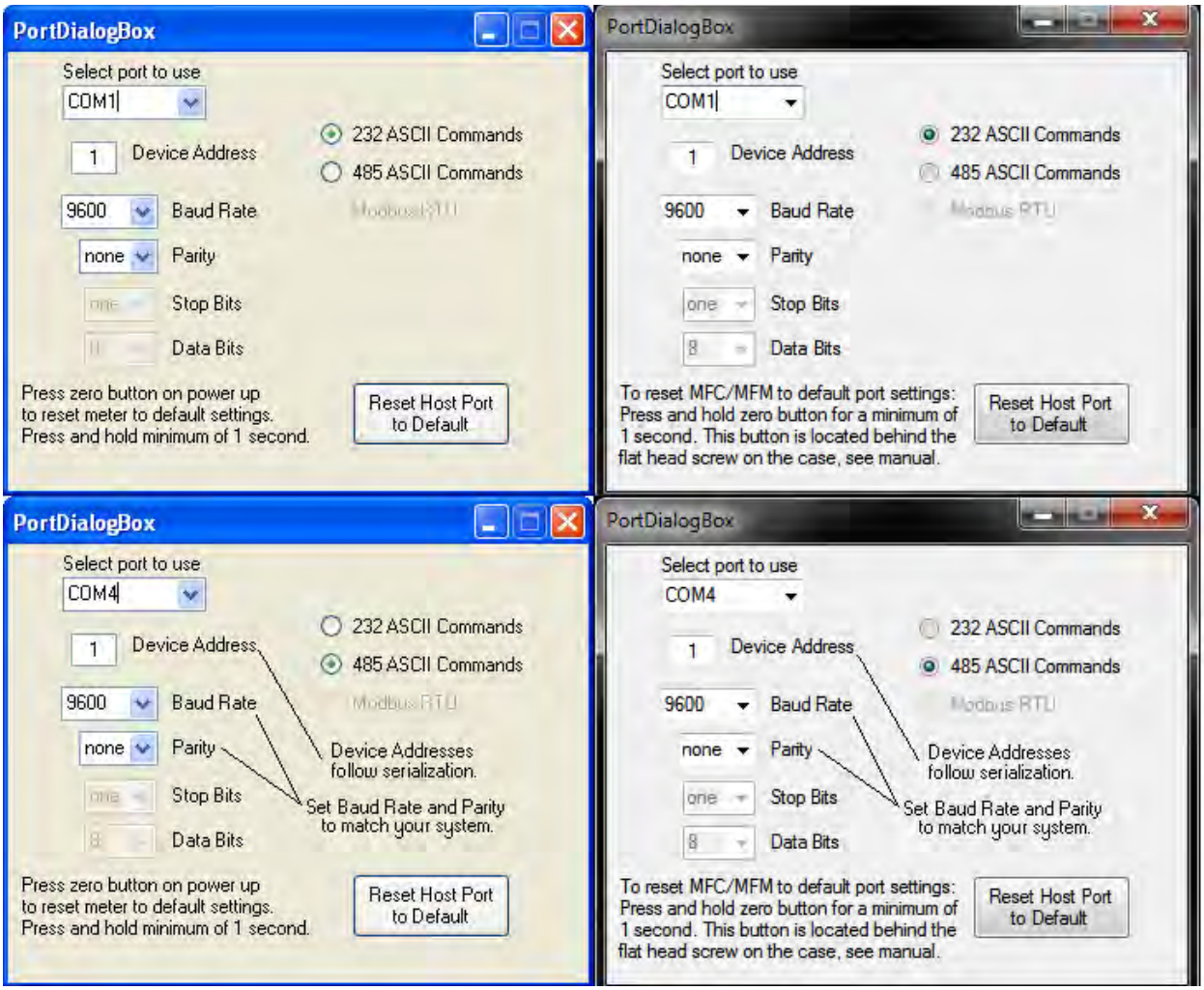


3. Select the ComPort pull down menu shown

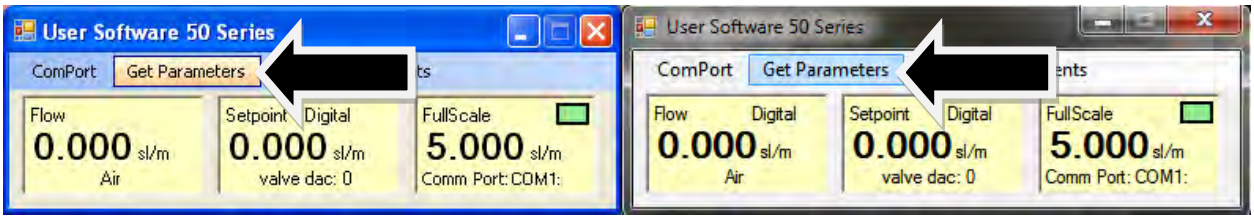


As shown above, use the pull-down menu to choose the port number that corresponds to the serial port channel your 50 Series is connected to. Depending on whether the unit is RS-232 or RS-485, you'll need to select the proper "ASCII Commands" setting to match as shown above right.

If your unit is RS-485, you'll want to match the Device Address, Baud Rate and Parity to that of your instrument (default settings are shown below). Once you have established communication, you can change the Device Address, Baud Rate, and Parity to set up the instrument for use on your RS-485 Bus system.



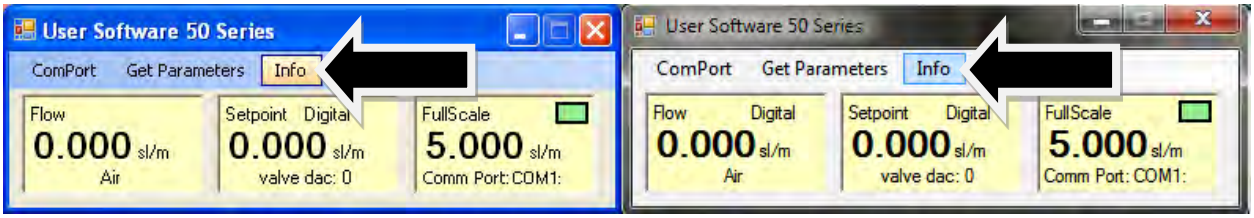
4. Close the window using the X button in the upper right corner of the dialog box. The communications are set up, and the unit should be communicating with the computer, as evident by the changing numbers right of the COM1: port in the picture below. If the numbers are not changing, click 'Get Parameters.'

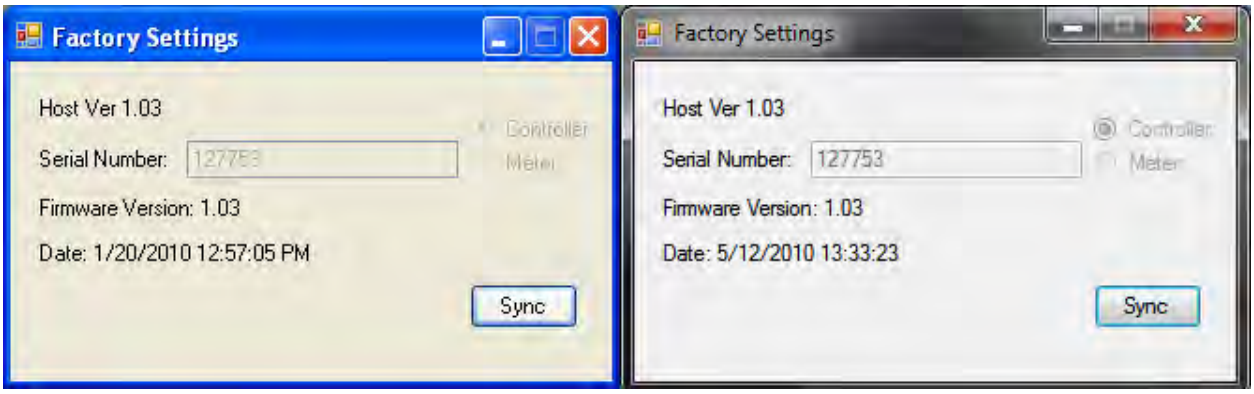


RESET NOTE: If you are not able to establish communication with your instrument be sure you have the proper ComPort selected to match your PC port then hit the "Reset Host Port To Default" button in the Port Dialog Box and power down your instrument. Next, power up the instrument again and hold the zero pushbutton (located inside your instruments side plate behind the silver socket head cap screw) for a minimum of one second after powering up your instrument. This will reset both the host software and your instrument to the default settings. Click on the 'Get Parameters' button and communication should be established.

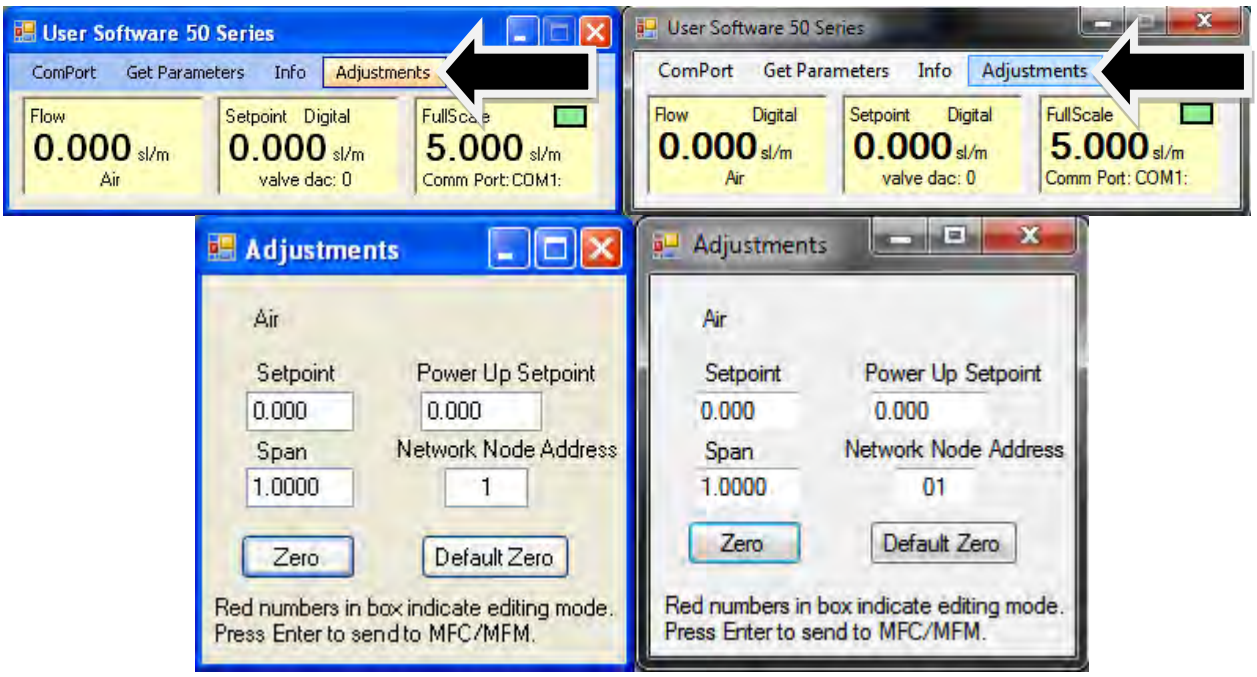
Important Features of the SmartTrak® 50 Series User Software

You can learn more about your unit, including the Serial Number, Firmware Version, etc., by clicking on the 'Info' button.

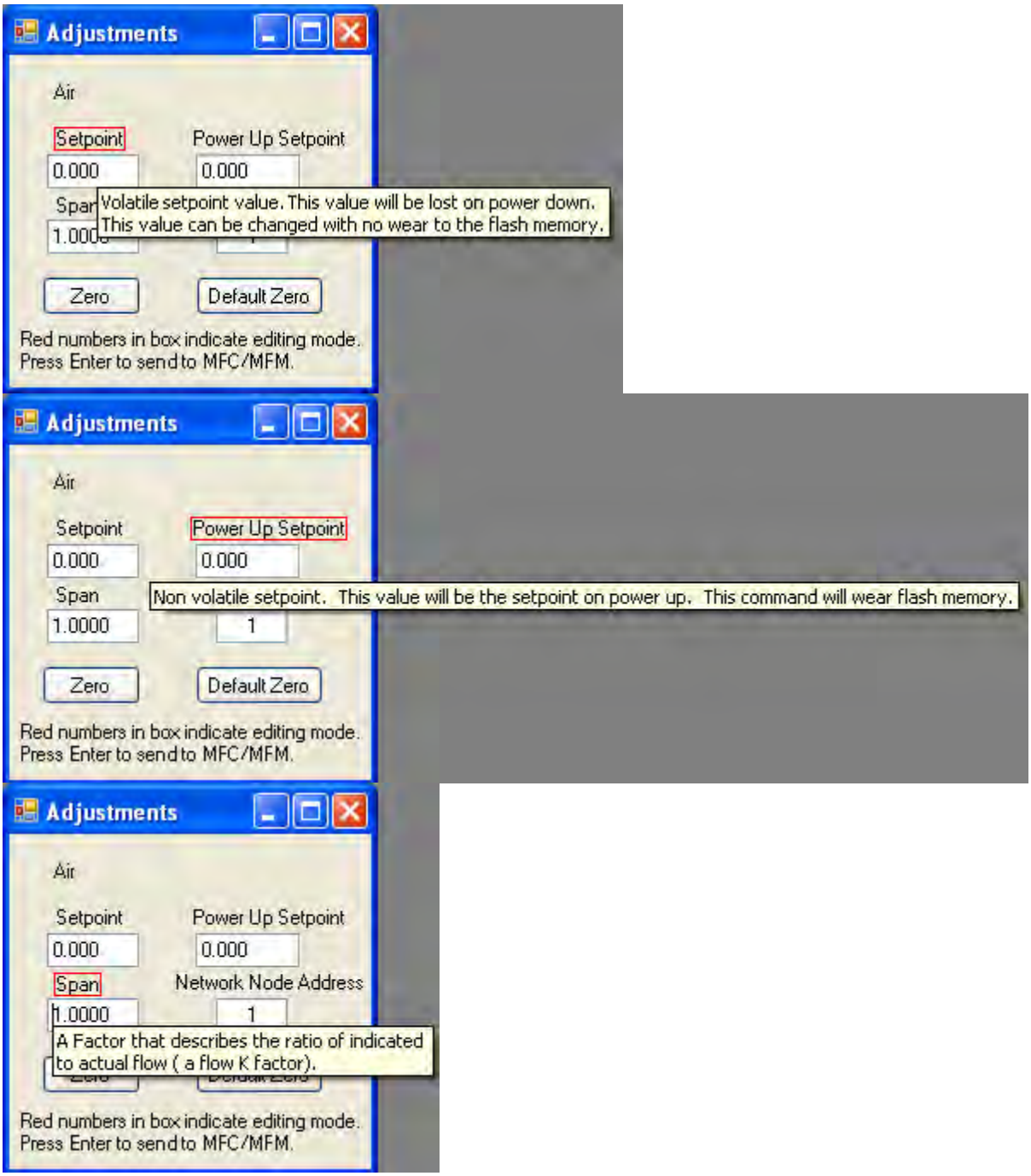


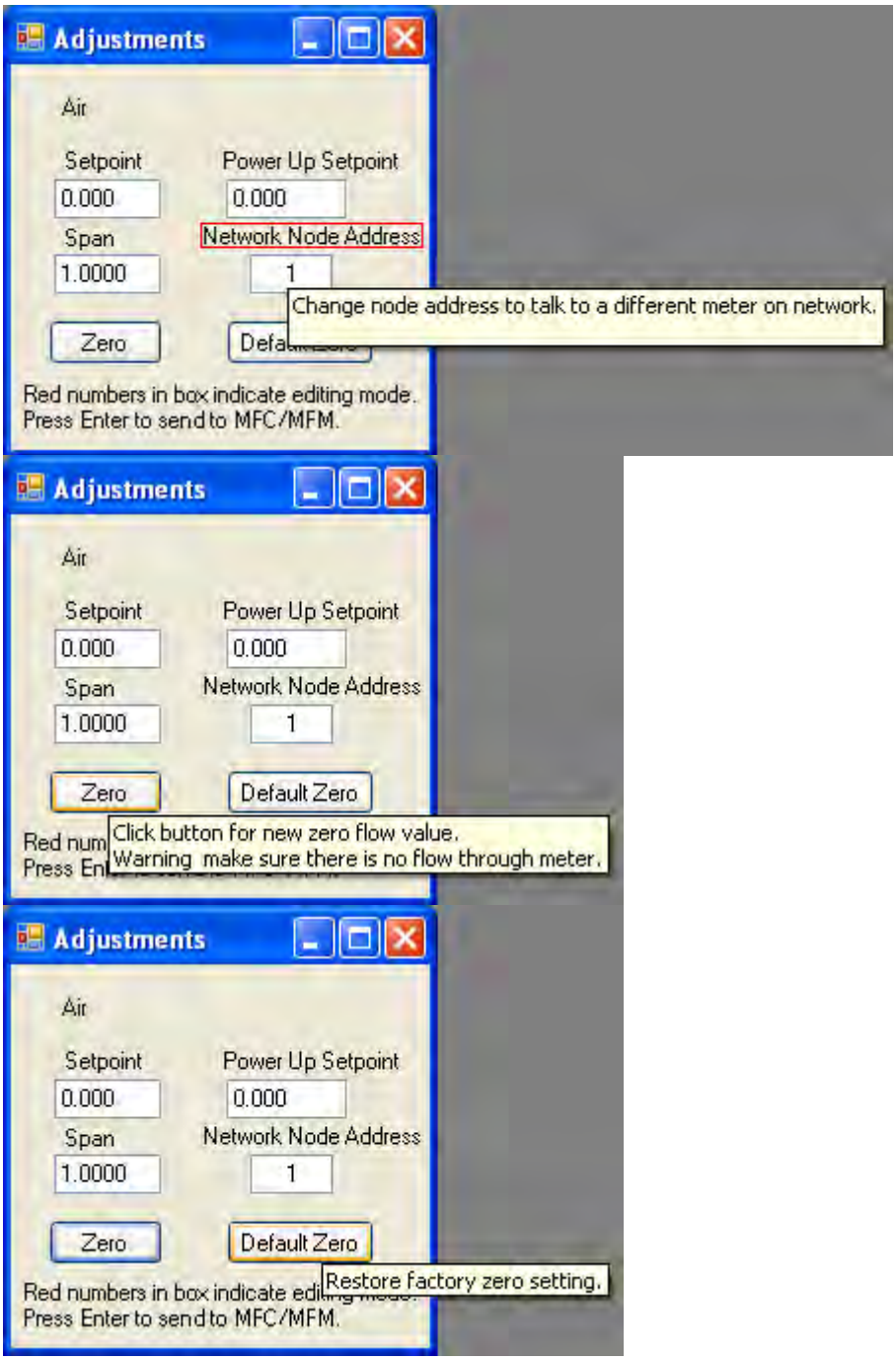


The final window below will provide control of the system. Click the 'Adjustments' button.

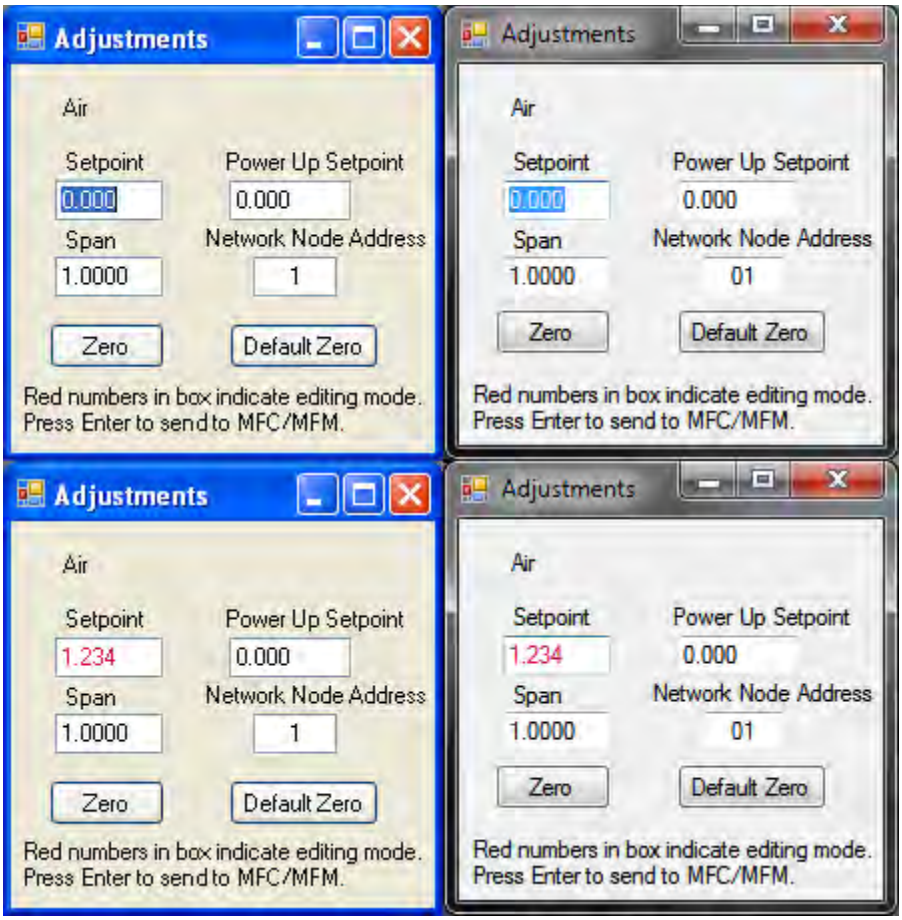


Hovering the mouse pointer over the input fields and buttons listed above will give you a description of its purpose. For your reference, this is shown below.

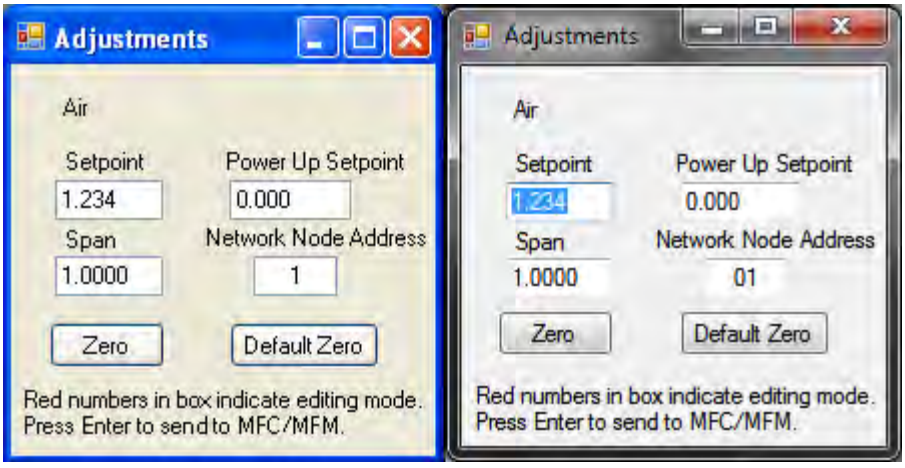




Change the value in any input field by selecting the data and inputting a desired value. Below left, for example, we have selected Setpoint. Below right, we have entered 1.234



Select ‘Enter’ on your computer keyboard to confirm. The value will change from RED to BLACK.

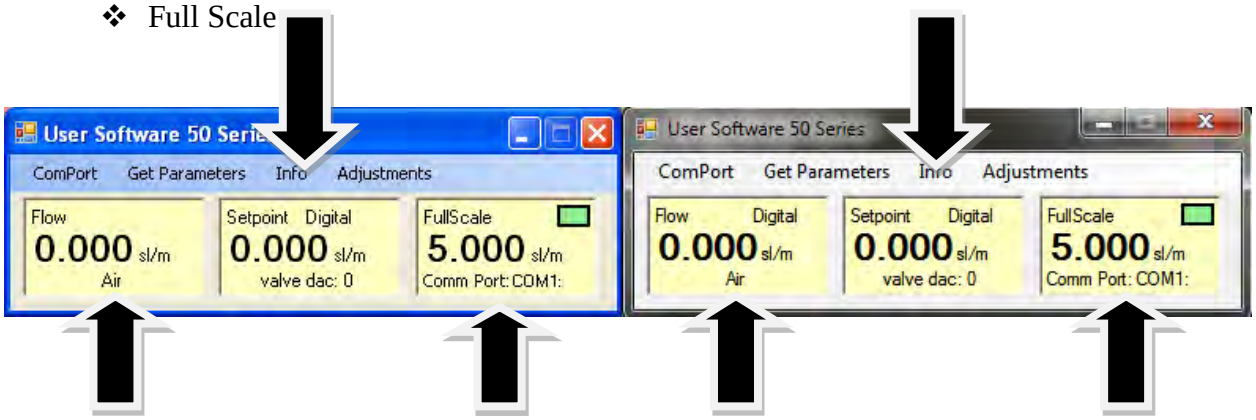


Using the 50 Series Software

A. Software Window

Across the upper half of the 50 Series User Software window, you will see three yellow boxes. These are titled:

- Flow
- Setpoint (flow controllers only, meters will have numbers grayed out)
- Full Scale



These boxes display the current operating conditions of your 50 Series instrument. The features of these boxes are described below.

Flow

The box displays the mass flow rate, the engineering units, and the gas type listed.

Setpoint

The Setpoint box displays the current setpoint given to the flow controller in the 'Adjustments' window, the engineering units, the source of the setpoint signal, the dac values for the valve (for Sierra troubleshooting only).

Full Scale

The box displays the full scale flow rate, the engineering units, the Com Port selected, and communications count.

Chapter 4: Analog Operation

Your SmartTrak® 50 Series instrument has an optional analog mode

This chapter will discuss Analog Operation. The analog output option is a 4-20 mA or 0- 5 VDC output signal corresponding to 0% to 100% of the mass flow full scale range.

For mass flow controllers, one analog setpoint signal and one analog output signal of either 4-20 mA or 0-5 VDC may be chosen to set the mass flow rate to any desired value within the range of the device, or to read mass flow value as an outputted analog value. This input signal must be a direct linear representation of 0% to 100% of the desired gas mass flow full scale value. Your unit was programmed for either 4-20 mA or 0-5 VDC, not both; please refer to the data label or calibration certificate for this information
2-2.

Analog Operation, Mass Flow Meter

After your instrument is installed and the system has undergone a complete leak check as discussed in detail in Chapter 2, you are ready to supply power.

Power Your Instrument: Provide adequate power per Figure 2-2. Apply power using Sierra's power supply or your own power source. Hook up the analog output per Figure 2-2 if desired, or use the RS communications or display (optional) to read mass flow value. Let the instrument warm up for at least 15 minutes for optimal performance.

Analog Operation, Mass Flow Controller

After your instrument is installed and the system has undergone a complete leak check as discussed in detail in Chapter 2, follow these steps:

1. **The valve will remain closed until power is supplied.** See Chapter 2 for wiring instructions. Remember that the valve in the SmartTrak® 50 Series is not a positive shut-off device. When power is applied, the flow control valve will operate per any instructions it receives. When the SmartTrak® 50 Series is delivered, the valve will be closed. However, upon subsequent power-ups, the valve will return to the state it was in the last time the instrument was operated.

CAUTION! If you do not know the value of the setpoint or the valve state given to the SmartTrak® 50 Series when it was last operated, you must assume that the valve will open when power is applied. TAKE NECESSARY PRECAUTIONS. You may use the SmartTrak® 50 Series Software to check the setpoint or the valve state currently on your instrument. See Chapter 4 or Chapter 5 for information on Setpoint and Valve State.

2. **Power Your Instrument:** Provide adequate power per Figure 2-2. Apply power using Sierra's power supply or your own power source. **Let the instrument warm up for at least 15 minutes for optimal performance.**

3. **Adjust the controller setpoint to the desired flow rate by supplying an appropriate signal (mA, voltage or digital).** The effective control range of the unit is 5% to 100% of the calibrated full scale flow range. Automatic shut-off occurs at 4.9% of the factory full scale calibrated range unless specifically modified at time of order. (This 5-100% flow is taken directly from the functional specs and the data sheet) SmartTrak® 50 Series will immediately begin accurately monitoring and controlling the gas mass flow rate. **Let the instrument warm up for at least 15 minutes for optimal performance.**

50 Series Features

Setpoint Adjustment

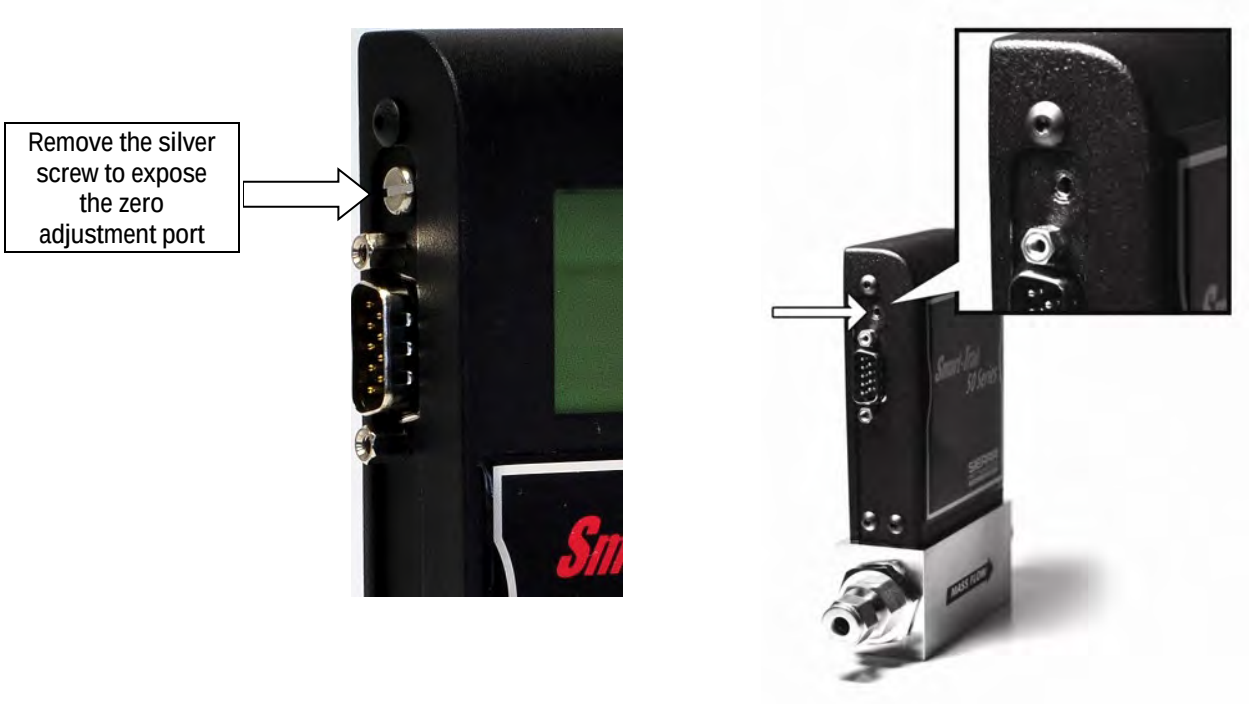
The setpoint (command) input signal you supply to the 50 Series must be a direct linear representation of 0% to 100% of the mass flow full scale value. Apply the setpoint signal per Chapter 2. A setpoint value of 0 VDC or 4 mA will regulate the flow to 0% and a setpoint value of 5 VDC or 20 mA will adjust the flow to 100% of the instrument's full scale range.

When the setpoint (command) signal is applied, the flow controller will reach the setpoint value within two seconds to within ±2% of the selected flow rate.

CAUTION! *DO NOT LEAVE A SETPOINT APPLIED FOR AN EXTENDED PERIOD OF TIME TO A CONTROLLER WHEN THE GAS SUPPLY IS SHUT OFF OR BLOCKED.*
Damage may result and the instrument will become hot to the touch.

Zero Adjustment

If you believe your instrument requires a zero adjustment, allow the instrument to warm up for at least 15 minutes at your operating conditions (Orientation, Temperature, and Pressure), be sure there is ZERO flow through the instrument. Remove the silver screw to expose the zero adjustment port to expose the zero adjustment button. Using a small screwdriver or ball point pen, press the zero button, momentarily. The display should flash and then read zero. If the display "freezes" at another value, or if computer communication is lost, remove power and allow the device to re-initialize.



CAUTION! Zero-button needs only a light touch to activate. Pay attention for a physical click feeling and/ or a very quiet, but audible *click* noise. DO NOT push hard! There is no reason to hold the button down, either. If you push too hard the plastic button may become stuck under the edge of the metal shroud that holds it. In the event that the zero button does get stuck in the depressed position from pushing too hard and rocking it sideways and will not release it is very easy to get it unstuck. Using the same tool, you can get it unstuck by pushing in on the other side of the button that is not stuck under the edge or by pushing in and rocking it back and forth. This should release the button and it will come right out to its normal, non-depressed position. Returns for this issue will NOT be covered by warranty, as it is considered device abuse.

Over-Range Condition

If the mass flow rate exceeds the full scale range listed on the SmartTrak® 50 Series data label the output signal will measure above full-scale. However, the device has not been calibrated for flows in excess of the calibrated full scale value and the value will be both non-linear and inaccurate if an over-range condition exists. Please be aware that the analog outputs can exceed full scale by as much as 20%, or more.

Once the over-range condition has been removed, it may take up to 30 seconds for the 50 Series to recover and resume normal operation. An over-range condition will not harm the instrument.

IMPORTANT NOTES ABOUT PURGING

Purging Non-Reactive Gases:

Purge your 50 Series with clean, dry nitrogen for a minimum of two hours. To purge an MFC apply a full scale setpoint.

Purging Reactive Gases:

One of the following methods may be used:

- Cycle purge. This is done by alternately evacuating and purging the instrument for 2 to 4 hours with clean, dry nitrogen.
- Purge the instrument with clean, dry nitrogen for 18 to 24 hours.
- Evacuate the instrument for 18 to 24 hours.

Important Safety Notes About Purging

WARNING! When toxic or corrosive gases are used, purge unit thoroughly with inert dry gas before disconnecting from the gas line to prevent personnel from being injured when coming in contact with the instrument. Above discusses how to purge your instrument. Always neutralize any toxic gas trapped inside the instrument before removing it from the gas line. If an instrument used with a toxic or corrosive gas is returned to the factory a Material Safety Data Sheet (MSDS) must be enclosed & attached to the outside of the box to alert Sierra personnel of the potential hazard. Also make sure the inlet & outlet are securely sealed.

Chapter 5: Technical Support & Service

Technical Support

If you encounter any problem with your instrument, review the configuration information for each step of the installation, operation, and set up procedures as explained in this manual. Verify that your settings and adjustments are consistent with factory recommendations.

If the problem persists, Sierra is eager to help you. You may contact us at any of the following Technical Support Centers listed below. It may also help to call your Sierra Sales Agent, who is also well trained in the operation of the product.

IMPORTANT: When contacting Technical Support, make sure you have included the following information*:*

- The flow range, serial number, Sierra order number and model number (all marked on the instrument data label).
- The problem you are encountering and any corrective action taken.
- Application information (gas, pressure, temperature, pipe and fitting configuration).

Customer Service and Support Information

Email Technical Support: service@sierrainstruments.com
Email Sales: sales@sierrainstruments.com

FACTORY USA
TOLL FREE: 800-866-0200
PHONE: +1-831-373-0200
FAX: +1-831-373-4402
EMAIL: service@sierrainstruments.com

European Sales & Service Center:
PHONE: +31 72 5071400
FAX: +31 72 5071401
EMAIL: service@sierra-instruments.nl

Asia Sales & Service Center:
PHONE: + 8221 5879 8521
FAX: +8621 5879 8586
EMAIL: www.sierra-asia.com

Returning Equipment to the Factory

Factory Calibration—All Models

Sierra Instruments maintains a fully-equipped calibration laboratory. All measuring and test equipment used in the calibration of Sierra transducers are traceable to NIST Standards. Sierra is ISO-9001 registered and conforms to the requirements of ANSI/NCSL-Z540 and ISO/IEC Guide 25.

Instructions for Returning Your Instrument for Service

The following information will help you return your instrument to Sierra Instruments' Factory Service Center and will ensure that your order is processed promptly. Prices may vary depending on the flow range, type of gas and operating pressure of your unit. To request detailed pricing, contact your local Sierra Instruments distributor or contact one of our offices directly.

Please follow these easy steps to return your instrument for factory service:

1. To obtain a Return Materials Authorization (RMA) number from the Sierra Instruments to **http://www.sierrainstruments.com/rma/new.php** to create a Sierra Account.
2. Once you have created an account, click on the *Submit New RMA* tab and fill in the RMA form and follow the instructions. You will receive an email confirmation once you have submitted your RMA.
3. Print a copy of the RMA (that now includes RMA #) and send a copy of the RMA form along with your meter back to the factory.

If you require service beyond calibration, but do not know which service(s) will be required, describe the symptoms as accurately as possible on the RMA form.

Pack your instrument carefully. Use the original packaging and foam or bubble wrap (packing peanuts NOT recommended) and include a copy of the RMA form (complete with Sierra supplied RMA number) with the unit(s).

Ship the unit(s) to the following address:

Sierra Instruments, Inc.
Attention: Factory Service Center
5 Harris Court, Building L
Monterey, CA 93940 USA
RE: RMA# (your number)
RE: RMA# (your number)

Appendix A: Gas Tables & K-Factor Calculations

K-Factor Calculations-- Using SmartTrak® 50 Series with Other Gases

If you will be using SmartTrak® 50 Series with a gas other than as calibrated, you may use the tables below. They provide K-factors and thermodynamic properties of gases commonly used with mass flow meters and controllers. This is particularly useful if the actual gas is not a common gas or if it is toxic, flammable, corrosive, etc. The tables can also be used to interpret the reading of a flow meter or flow controller that has been calibrated with a gas other than the actual gas.

Before applying the tables, set the instrument for Air. Then, the following fundamental relationship may be used:

$$Q_1/Q_N = K_1/K_N$$

Where:

Q = The volumetric flow rate of the gas referenced to normal conditions of 0°C and 760 mm Hg (sccm or slm),

K = The K-factor from the following tables, referenced to Air

$( )_1$ = Refers to the "actual" gas, and

$( )_N$ = Refers to the "reference" gas, Air in this case.

Gas Tables and K-factors

Actual Gas	Chemical Symbol	K-factor Relative to Air	Cp (Cal/g)	Density (g/l) @ 70°F	Density (g/l) @ 0°C	Elastomers* O-ring	Elastomers* Valve Seat
Acetylene	C_2H_2	.581	.4036	1.079	1.162		
Air		1.000	.240	1.200	1.293		
Allene (Propadiene)	C_3H_4	.431	.352	1.659	1.787		KR
Ammonia	NH_3	.732	.492	.706	.760	NEO	KR/NEO
Argon	Ar	1.398	.1244	1.655	1.782		
Arsine	AsH_3	.671	.1167	3.229	3.478		KR
Boron Trichloride	BCl_3	.411	.1279	4.852	5.227	800 Series Recommended	
Boron Trifluoride	BF_3	.511	.1778	2.808	3.025		KR
Boron Tribromide	Br_3	.381	.0647	10.378	11.18		KR
Bromine	Br_2	.812	.0539	6.619	7.130		
Bromine Pentafluoride	BrF_5	.261	.1369	7.244	7.803		KR
Bromine Trifluoride	BrF_3	.381	.1161	5.670	6.108		KR
Bromotrifloromethane (Freon-13 B1)	$CBrF_3$	.371	.1113	6.168	6.644		
1,3-Butadiene	C_4H_6	.321	.3514	2.240	2.413		
Butane	C_4H_{10}	.261	.4007	2.407	2.593	NEO	KR
1-Butane	C_4H_8	.301	.3648	2.324	2.503	NEO	KR
2-Butane	C_4H_8 CIS	.325	.336	2.324	2.503	NEO	KR
2-Butane	C_4H_8 TRANS	.292	.374	2.324	2.503		
Carbon Dioxide	CO_2	.737	.2016	1.835	1.964		
Carbon Disulfide	CS_2	.601	.1428	3.153	3.397		
Carbon Monoxide	CO	1.002	.2488	1.160	1.250		
Carbon Tetrachloride	CCl_4	.311	.1655	6.368	6.860		KR
Carbon Tetrafluoride (Freon-14)	CF_4	.421	.1654	3.645	3.926		KR
Carbonyl Fluoride	COF_2	.541	.1710	2.734	2.945		
Carbonyl Sulfide	COS	.661	.1651	2.488	2.680		
Chlorine	CL_2	.862	.114	2.936	3.163	800 Series Recommended	
Chlorine Trifluoride	CIF_3	.401	.1650	3.829	4.125		KR
Chlorodifluoromethane (Freon-22)	$CHClF_2$	.461	.1544	3.581	3.858		KR
Chloroform	$CHCl_3$	.391	.1309	4.944	5.326		KR
Chloropentafluoroethane (Freon-115)	C_2ClF_5	.241	.164	6.398	6.892		KR
Chlorotrifluromethane (Freon-13)	$CCIF_3$	.381	.153	4.326	4.660		KR
Cyanogen	C_2N_2	.611	.2613	2.156	2.322		KR
Cyanogen Chloride	CICN	.611	.1739	2.545	2.742		
Cychlopropane	C_3H_5	.461	.3177	1.742	1.877		KR
Deuterium	D_2	1.002	.1722	1.670	1.799		
Diborane	B_2H_6	.441	.508	1.147	1.235		KR
Dibromodifluoromethane	CBr_2F_2	.190	.15	8.691	9.362		KR
Dibromethane		.471	.075	7.204	7.76		KR
Dichlorodifluoromethane (Freon-12)	CCl_2F_2	.351	.1432	5.008	5.395		KR
Dichlorofluoromethane (Freon-21)	$CHCl_2F$	.421	.140	4.597	4.952		KR

- If no O-ring material is specified then O-ring to be used is Viton. NEO is neoprene or equivalent. KR is DuPont Kalrez or equivalent. Valve Seat applies only to controllers.

Actual Gas	Chemical Symbol	K-factor Relative Air	Cp (Cal/g)	Density (g/l) @ 70°F	Density (g/l) @ 0°C	Elastomers* O-ring	Valve Seat
Dichloromethylsilane	$(CH_3)_2SiCl_2$	.251	.1882	5.345	5.758		KR
Dichlorosilane	SiH_2Cl_2	.401	.150	4.183	4.506		KR
Dichlorotetrafluoroethane (Freon-114)	$C_2Cl_2F_4$	.220	.1604	7.079	7.626		KR
1,1-Difluoroethylene (Freon-1132A)	$C_2H_2F_2$	.185	.224	2.652	2.857		KR
Dimethylamine	$(CH_3)_2NH$	.371	.366	1.867	2.011		KR
Dimethyl Ether	$(CH_3)_2O$	.391	.3414	1.908	2.055		KR
2,2-Dimethylpropane	C_3H_{12}	.220	.3914	2.988	3.219		KR
Ethane	C_2H_6	.501	.4097	1.246	1.342		
Ethanol	C_2H_6O	.391	.3395	1.908	2.055		KR
EthylAcetylene	C_4H_6	.321	.3513	2.240	2.413		KR
Ethyl Chloride	C_2H_5Cl	.391	.244	2.673	2.879		KR
Ethylene	C_2H_4	.601	.358	1.161	1.251		
Ethylene Oxide	C_2H_4O	.521	.268	1.824	1.965		KR
Fluorine	F_2	.982	.1873	1.574	1.695	800 Series Recommended	
Fluoroform (Freon-23)	CHF_3	.501	.176	2.903	3.127		KR
Freon-11	CCl_3F	.331	.1357	5.690	6.129		KR
Freon-12	CCl_2F_2	.351	.1432	5.008	5.395		KR
Freon-13	$CClF_3$	.381	.153	4.326	4.660		KR
Freon-13	B1 $CFrF_3$	.371	.1113	6.168	6.644		KR
Freon-14	CF_4	.421	.1654	3.645	3.926		
Freon-21	$CHCl_2F$	.421	.140	4.597	4.952		KR
Freon-22	$CHClF_2$	.461	.1544	3.581	3.858		KR
Freon-113	CCl_2FCClF_2	.200	.161	7.761	8.360		KR
Freon-114	$C_2Cl_2F_4$	.220	.160	7.079	7.626		KR
Freon-115	C_2ClF_5	.241	.164	6398	6.892		KR
Freon-C318	C_4F_6	.170	.185	7.795	8.397		KR
Germane	GeH_4	.571	.1404	3.173	3.418		
Germanium Tetrachloride	$GeCL_4$	.271	.1071	8.879	9.565		KR
Helium	He	1.399	1.241	.164	.1786		
Hexafluoroethane (Freon-116)	C_2F_6	.241	.1834	5.716	6.157		KR
Hexane	C_6H_{14}	.180	.3968	3.569	3.845		KR
Hydrogen	H_2	1.001	3.419	.083	.0899		
Hydrogen Bromide	HBr	1.002	.0861	3.351	3.610		KR
Hydrogen Chloride	HCl	1.002	.1912	1.510	1.627	800 Series Recommended	
Hydrogen Cyanide	HCN	1.072	.3171	1.120	1.206		KR
Hydrogen Fluoride	HF	1.002	.3479	.829	.893	800 Series Recommended	
Hydrogen Iodide	HI	1.002	.0545	5.298	5.707		KR
Hydrogen Selenide	H_2Se	.792	.1025	3.354	3.613		KR
Hydrogen Sulfide	H_2S	.802	.2397	1.411	1.520	NEO	KR
Iodine Pentafluoride	IF_5	.251	.1108	9.190	9.90		KR
Isobutane	$CH(CH_3)_3$	.271	.3872	3.335	2.593		KR
Isobutylene	C_4H_8	.291	.3701	2.324	2.503		KR
Krypton	Kr	1.456	.0593	3.471	3.739		
Methane	CH_4	.754	.5328	.665	.715		
Methanol	CH_3OH	.581	.3274	1.327	1.429		
Methyl Acetylene	C_3H_4	.431	.3547	1.659	1.787		KR
Methyl Bromide	CH_3Br	.581	.1106	3.932	4.236		
Methyl Chloride	CH_3Cl	.193	2.253	2.092			KR
Methyl Fluoride	CH_3F	.681	.3221	1.409	1.518		KR

- If no O-ring material is specified then O-ring to be used is Viton. NEO is neoprene or equivalent. KR is DuPont Kalrez or equivalent. Valve Seat applies only to controllers.

Actual Gas	Chemical Symbol	K-factor Relative Air	Cp (Cal/g)	Density (g/l) @ 70°F	Density (g/l) @ 0°C	Elastomers* O-ring	Valve Seat
Methyl Mercaptan	CH_3SH	.521	.2459	1.992	2.146		KR
Methyl Trichlorosilane	$(CH_3)\ SiCl_3$	.251	.164	6.191	6.669		KR
Molybdenum Hexafluoride	MoF_6	.210	.1373	8.695	9.366		KR
Monoethylamine	$C_2H_5NH_2$	.351	.387	1.867	2.011		KR
Monomethylamine	CH_3NH_2	.511	.4343	1.287	1.386		KR
Neon	NE	1.463	.245	.836	.900		
Nitric Oxide	NO	.992	.2328	1.243	1.339		
Nitrogen	N_2	1.002	.2485	1.161	1.25		
Nitrogen Dioxide	NO_2	.742	.1933	1.905	2.052	800 Series Recommended	
Nitrogen Trifluoride	NF_3	.481	.1797	2.941	3.168		KR
Nitrosyl Chloride	NOCl	.611	.1632	2.711	2.920		KR
Nitrous Oxide	N_2O	.716	.2088	1.836	1.964		
Octafluorocyclobutane (Freon-C318)	C_4F_6	.170	.185	7.795	8.397		KR
Oxygen Difluoride	OF_2	.631	.1917	2.234	2.406		
Oxygen	O_2	.998	.2193	1.326	1.427		
Ozone	O_3	.447	.3	1.990	2.144		
Pentaborane	B_5H_9	.261	.38	2.614	2.816		KR
Pentane	C_5HI_2	.210	.398	2.988	3.219		KR
Perchloryl Fluoride	ClO_3F	.391	.1514	4.243	4.571		KR
Perfluoropropane	C_3F_8	.174	.197	7.787	8.388		KR
Phosgene	$COCl_2$	.441	.1394	4.101	4.418		KR
Phosphine	PH_3	.762	.2374	1.408	1.517		KR
Phosphorous Oxychloride	$POCl_3$	.361	.1324	6.352	6.843		KR
Phosphorous Pentafluoride	PH_5	.301	.1610	5.217	5.620		KR
Phosphorous Trichloride	PCl_5	.301	.1250	5.688	6.127		KR
Propane	C_3H_8	.335	.3885	1.826	1.967		
Propylene	C_3H_6	.411	.3541	1.742	1.877		
Silane	SiH_4	.601	.3189	1.330	1.433		KR
Silicon Tetrachloride	$SiCl_4$	.281	.1270	7.037	7.580		KR
Silicon Tetrafluoride	SiF_4	.351	.1691	4.310	4.643		KR
Sulfur Hexafluoride	SF_6	.261	.1592	6.049	6.516		KR
Sulfuryl Fluoride	SO_2F_2	.391	.1543	4.235	4.562		KR
Teos		.090				800 Series Recommended	
Tetrafluorahydrazine	N_2F_4	.321	.182	4.307	4.64		KR
Trichlorofluormethane (Freon-11)	CCl_3F	.331	.1357	5.690	6.129		KR
Trichlorisilane	$SiHCl_3$	.331	.1380	5.610	6.043		KR
1,1,2-Trichloro-1,2,2 Trifluorethane (Freon-113)	CCl_2FCClF_2	.200	.161	7.761	8.360		KR
Trisobutyl Aluminum	$(C_4H_9)Al$	.061	.508	8.214	8.848		KR
Titanium Tetrachloride	$TiCl_4$	.271	.120	7.858	8.465		KR
Trichloro Ethylene	C_2HCl_3	.321	.163	5.523	5.95		KR
Trimethylamine	$(CH_3)_3N$	.281	.3710	2.450	2.639		KR
Tungsten Hexasfuoride	WF_6	.251	.0810	12.328	13.28	800 Series Recommended	
Uranium Hexafluoride	UF_6	.200	.0888	14.574	15.70		KR
Vinyl Bromide	CH_2CHBr	.461	.1241	4.430	4.772		KR
Vinyl Chloride	CH_2CHCl	.481	.12054	2.588	2.788		KR
Xenon	Xe	1.443	.0378	5.438	5.858		

- If no O-ring material is specified then O-ring to be used is Viton. NEO is neoprene or equivalent. KR is DuPont Kalrez or equivalent. Valve Seat applies only to controllers.

Appendix B1: 50 Low Flow (to 50 slpm) Product Specifications

2

SPECIFICATIONS

PERFORMANCE SPECIFICATIONS

Accuracy
+/- 1.0% of full scale including linearity under calibration conditions over 32° to 122°F (0° to 50°C) and 5 to 145 psig (0.3 to 10 barg).

Repeatability
+/- 0.25% of full scale

Temperature Coefficient
0.025% of full scale per °F (0. 05% of full scale per °C), or better

Pressure Coefficient
0.01% of full scale per psi (0.15% of full scale per bar), or better

Response Time
300 ms time constant; two seconds (typical) to within +/- 2% of final value including setting time. May be tuned to be faster or slower (consult factory)

OPERATION SPECIFICATIONS

Gases
All neutral, non-contaminated dry and clean gases compatible with wetted materials aluminum, stainless steel and Viton®

Mass Flow Rates
The 50 Series can be calibrated for any gas compatible with viton, aluminum and stainless steel, using any units, to either normal or standard conditions, for flow rates up to 50 slpm air equivalent. Standard calibrations are available for ranges (slpm air equivalent) from 20 sccm/nccm to 50 slpm/nlpm. Above 50 slpm, please consider the SmartTrak® 100 Series

Gas Pressure:
145 psig (10 barg) maximum, burst tested to 225 psig (15 barg)

Differential Pressure Requirement
15 to 20 psi (1.0 to 1.3 bar) see table

Gas and Ambient Temperature
32°F to 122°F (0 to 50°C)

Leak Integrity
5 X 10-9 atm cc/sec of helium maximum

Power Requirements
Meter: 24 VDC (+/- 10%) 85 mA regulated
Controller: 24 VDC (+/-10%), 315 mA, regulated, RS-485 option adds 130 mA

Control Range
5 to 100% of full scale flow (20:1) at published accuracy. Automatic shut-off off at 4.9% of full scale
Output and Command (Setpoint) Signal
• RS-232

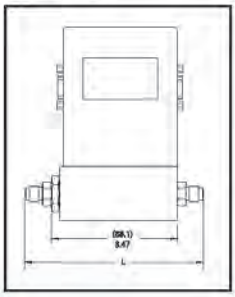
Optional:
- Linear 4-20 mA, 500 ohms maximum load resistance.
- Linear 0-5 VDC
- RS-485 Addressable (no analog outputs)
- Zero, span, and setpoint are field adjustable via supplied user software and RS-232 communications cable

Display
Flow rate, units, full scale, and setpoint. Display may be mounted on the front or back of the unit.

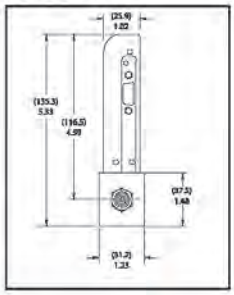
PHYSICAL SPECIFICATIONS & DIMENSIONS

Wetted Material
Anodized aluminum or 316 stainless steel flow body; 316L stainless steel sensor tubes; Viton® O-rings and valve seats.

50 Series - Front View

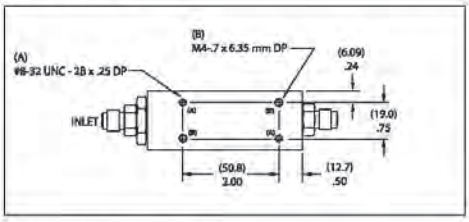


50 Series - Side View



Fittings	Dimension L
1/8-inch SS compression	5.31 (134.8)
1/4-inch SS compression	5.49 (139.4)
1/4-inch VCO	5.03 (127.7)
1/4-inch VCR	5.35 (135.8)
6 mm compression	5.51 (139.9)
1/4-inch NPT	5.32 (135.1)
1/8-inch brass compression	5.31 (134.8)
1/4-inch brass compression	5.49 (139.4)

50 Series - Bottom View



Note: Units in inches (mm in parenthesis)

Pressure Drop

3

slpm	Pressure Drop psid (mbar) Meter	Minimum Delta psid (mbar) Controller	Pressure Drop psid (mbar) Meter	Minimum Delta psid (mbar) Controller
	1/4-inch Standard Fitting	**1/4-inch Standard Fitting**	**3/8- inch Standard Fitting**	**3/8-inch Standard Fitting**
0.02	.45 (31.0)	1 (68.95)	N/A	N/A
.200	.45 (31.0)	1.5 (103.4)	N/A	N/A
1.00	0.46 (31.7)	1.88 (129.6)	N/A	N/A
5.00	0.54 (37.2)	4.70 (324.1)	N/A	N/A
10.00	0.58 (40.0)	7.5 (517.1)	0.51 (35.2)	4.75 (327.5)
20.00	0.83 (57.2)	15 (1034.3)	0.59 (40.7)	8.25 (568.8)
50.00	2.72 (187.5)	50 (3448)	1.25 (86.2)	18.75 (1292.8)

Software Screenshots

User Program Interface

4

Ordering the 50 Series

Features Option

50	-		-		-		-		-		-		-	
Parent		1		2		3		4		5		1	2	3

Instructions: To order a 50 please fill in each number block by selecting the codes from the corresponding features below and following pages.

Parent Number	
M50L-AL	Flow meter aluminum (Note: Flow meter is only available in aluminum) to 50 slpm
C50L-AI	Flow controller aluminum to 50 slpm
C50L-SS	Flow controller 316 stainless steel to 50 slpm

Feature 1: Display	
NR	No display (standard)
DD	Digital display
DDB	Digital display (back mounted); not available on C50M

Feature 2: Inlet/Outlet Fittings Low Flow	
0	customer supplies fittings
1	1/8-inch stainless steel compression (maximum 5 slpm)
2	1/4-inch stainless steel compressione
3	3/8-inch compression (Standard for 30 to 200 slpm). For low and medium bodies. (maximum 200 slpm)
4	1/2-inch stainless steel compression
5	1/4-inch stainless steel VCO
6	1/2-inch stainless steel VCO
8	1/4-inch stainless steel VCR
9	1/2-inch stainless steel VCR
10	6 mm stainless steel compression
13	1/4-FNPT adapter bushing (maximum 200 slpm). For low and med flow bodies only.
14	3/8-inch stainless steel female NPT

Feature 3: Input Power	
PV2	24 VDC for all instruments

Feature 4: Output Signal/Setpoint	
V0	RS-232 (no analog out)
V1	0-5 VDC linear output signal (and setpoint if controller); includes RS-232
V4	4-20 mA linear output signal (and setpoint if controller); includes RS-232
V6	RS-485 (no analog out or RS-232)

Feature 5: Low Flow Option	
LF	Flow calibration for C50L and M50L required for 0-20 sccm full scale calibration or less.

Option 1: Certificates	
MC	Material certificates--US mill certs on all wetted parts
CC	Certificate of conformance
LT	Leak test certificate
PT	Pressure test certificate
OC2	O2 cleaning. Includes certification. Product cleaned for O2 service. Inspected with ultra-violet light and double bagged prior to shipment. O2 cleaning only available for stainless steel bodies.
5POINTCAL	5-point calibration certificate (ISO 17025 compliant)
CO	Stamped Certificate of Origin

Option 2: Electrical Connections			
50-C9(0)	9-pin mating connector with no cable	50-C9RS232 (10)	10-foot (3 m) digital/analog communication cable with D9 mating connector, D9 serial computer connector, and fly leads.
50-C9(1)	1-foot (304.8 mm) 50-analog cable. 9 conductor cable with D-connector on one end, fly leads on the other.	50-C9RS232 (25)	25-foot (7.62 m) digital/analog communication cable with D9 mating connector, D9 serial computer connector, and fly leads.
50-C9(3)	3-foot (1 m) 50-analog cable. 9 conductor cable with D-connector on one end, fly leads on the other.	50-C9RS232 (50)	50-foot (15.24 m) digital/analog communication cable with D9 mating connector, D9 serial computer connector, and fly leads.
50-C9(10)	10-foot (3 m) 50-analog cable. 9 conductor cable with D-connector on one end, fly leads on the other.	50-SerialUSB	USB to serial RS-232 converter. Needed for use with CRN. Many users elect to supply their own USB.
50-C9(25)	25-foot (8 m) 50-analog cable. 9 conductor cable with D-connector on one end, fly leads on the other.	50-CRN	6-foot (2 m) digital only cable with D9 mating connector and D9 computer connector.

Note: CE and ISO certificates are available for download from www.sierrainstruments.com/downloads

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Appendix B2: 50 Medium Flow (to 200 slpm) Product Specifications

2

PERFORMANCE SPECIFICATIONS

Accuracy
+/- 1.0% of full scale including linearity under calibration conditions over 32° to 122°F (0° to 50°C) and 5 to 145 psig (0.3 to 10 barg) for common gases: Air, Ar, CO2, CO, CH4, He, H2, O2, N2.

Repeatability
+/- 0.25% of full scale

Temperature Coefficient
0.025% of full scale per °F (0. 05% of full scale per °C), or better

Pressure Coefficient
0.01% of full scale per psi (0.15% of full scale per bar), or better

Response Time
Two seconds (typical) to within +/- 2% of final value including setting time. 50 Series may be tuned to be faster or slower (consult factory)

OPERATION SPECIFICATIONS

Gases
All neutral, non-contaminated dry and clean gases compatible with wetted materials aluminum, stainless steel and Viton®

Mass Flow Rates
The 50 Series can be calibrated for any gas compatible with Viton®, aluminum and stainless steel, using any units, to either normal or standard conditions, for flow rates up to 200 slpm air equivalent.

Gas Pressure
Max 145 psig (10 barg) maximum, burst tested to 225 psig (15 barg)

Minimum Differential Pressure Requirement
See Table

Gas and Ambient Temperature
32°F to 122°F (0° to 50°C)

Leak Integrity
5 X 10-9 atm cc/sec of helium maximum

Power Requirements
24 VDC (+/-10%), 850 mA, regulated, RS-485 option adds 130 mA

Control Range
5 to 100% of full scale flow (20:1) at published accuracy
Automatic valve shut-off with setpoints below 4.9% of full scale.
Output and Command (Setpoint) Signal
- RS-232

Optional:
- Linear 4-20 mA, 500 ohms maximum load resistance
- Linear 0-5 VDC
- RS-485 Addressable (no analog outputs)
- Zero, span, and setpoint are field adjustable via supplied user software and optional RS-232 communications cable

Display
Flow rate, units, full scale, and setpoint

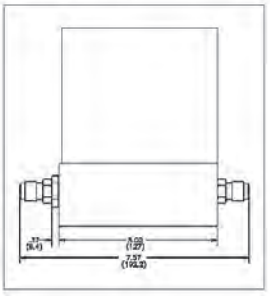
PRESSURE DROP

Minimum Pressure Drop for Air, Mass Flow Controller	
Flow Rate (slpm)	Medium Flow 3/8 or 1/2 inch fittings Pressure Drop in PSI (mbar)
20	1 (68)
30	1.2 (82)
40	1.6 (110)
50	2 (136)
100	5 (340)
150	10 (680)
200	15 (1020)

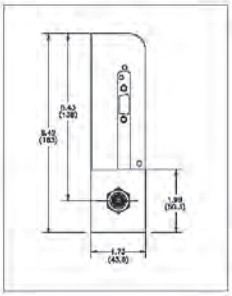
PHYSICAL SPECIFICATIONS & DIMENSIONS

Wetted Material
Anodized aluminum or 316 stainless steel flow body. 316L stainless steel sensor tubes; Viton® O-rings and valve seats.
Note: All dimensions are in inches with mm in brackets.
Certified drawings are available upon request.

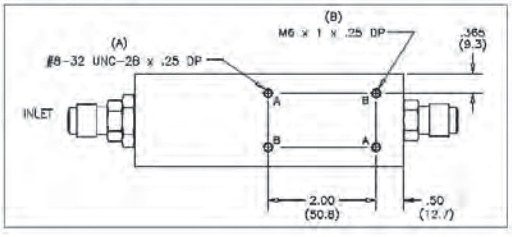
50 Series - Front View



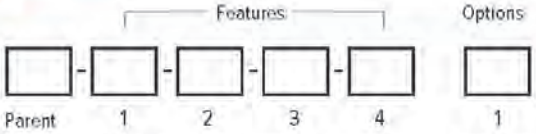
50 Series - Side View



50 Series - Bottom View



ORDERING THE 50 SERIES



Instructions: To order the 50M please fill in each number block by selecting the codes from the corresponding features below and following pages.

Parent Number	
C50M-AL (Med Flow)	SmartTrak® 50 OEM mass flow controller aluminum to 200 slpm
C50M-SS (Med Flow)	SmartTrak® 50 OEM mass flow controller stainless steel to 200 slpm

Feature 1: Display	
NR	No display (standard)
DD	Digital display
DDB	Digital display (back mounted); not available on C50M

Feature 2: Inlet/Outlet Fittings Medium Flow	
3	3/8-inch stainless steel compression
4	1/2-inch stainless steel compression
6	1/2-inch stainless steel VCO
9	1/2-inch stainless steel VCR
11	10 mm stainless steel compression
12	12 mm stainless steel compression
13	1/4-FNPT adapter bushing (maximum 200 slpm). For low and med flow bodies only.
14	3/8-inch stainless steel female NPT

Feature 3: Input Power	
PV2	24 VDC for all instruments

Feature 4: Output Signal/Setpoint	
V0	RS-232 (no analog out)
V1	0-5 VDC linear output signal (and setpoint if controller); includes RS-232
V4	4-20 mA linear output signal (and setpoint if controller); includes RS-232
V6	RS-485 (no analog out or RS-232)

Note: For digital communications protocols, see 100 Series price tab.

Option 1: Certificates	
MC	Material certificates- US mill certs on all wetted parts
CC	Certificate of conformance
LT	Leak test certificate
PT	Pressure test certificate
O2C	O2 cleaning. Includes certification. Product cleaned for O2 service. Inspected with ultra-violet light and double bagged prior to shipment. O2 cleaning only available for stainless steel bodies.
5PC	5-point calibration certificate (ISO 17025 compliant)
CO	CO Stamped Certificate of Origin

Appendix C: Warranty Policy

LIMITED WARRANTY POLICY- REGISTER ONLINE

All Sierra products are warranted to be free from defects in material and workmanship and will be repaired or replaced at no charge to Buyer, provided return or rejection of product is made within a reasonable period but no longer than one (1) year for calibration and non-calibration defects, from date of delivery. To assure warranty service, customers must register their products online on Sierra's website. Online registration of all of your Sierra products is required for our warranty process. Register now at www.sierrainstruments.com/register. Learn more about Sierra's warranty policy at www.sierrainstruments.com/warranty.