

Smart-Trak® 50 Series

Economical OEM Digital Mass Flow Meters & Controllers

Instruction Manual



IM-50 Series
Rev. B, July 2011



GLOBAL SUPPORT LOCATIONS: WE ARE HERE TO HELP!

CORPORATE HEADQUARTERS

5 Harris Court, Building L Monterey, CA 93940

Phone (831) 373-0200 (800) 866-0200 Fax (831) 373-4402

www.sierrainstruments.com

EUROPE HEADQUARTERS

Bijlmansweid 2 1934RE Egmond aan den Hoef

The Netherlands

Phone +31 72 5071400 Fax +31 72 5071401

ASIA HEADQUARTERS

Rm. 618, Tomson Centre, Bldg A, 188 Zhang Yang Road

Pu Dong New District, Shanghai, P.R. China

Phone: + 8621 5879 8521 Fax: +8621 5879 8586

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.

© COPYRIGHT SIERRA INSTRUMENTS 2010

No part of this publication may be copied or distributed, transmitted, transcribed, stored in a retrieval system, or translated into any human or computer language, in any form or by any means, electronic, mechanical, manual, or otherwise, or disclosed to third parties without the express written permission of Sierra Instruments. The information contained in this manual is subject to change without notice.

TRADEMARKS

Smart-Trak[®] 50 Series is a Registered Trademark of Sierra Instruments, Inc. Other product and company names listed in this manual are trademarks or trade names of their respective manufacturers.

Table of Contents

Chapter 1: Introduction	4
Using This Manual	4
Safety Information!	4
Receipt of Your Instrument	5
The Smart-Trak® 50 Series Flow Sensing Principle	7
Chapter 2: Installation	90
Installation Check List	9
Installing the Instrument—Plumbing	10
Compression Fittings	10
VCO Fittings	11
VCR Fittings	11
1/4 Inch Female NPT	11
Installing Your Instrument—Mechanical Mounting	12
Installing Your Instrument—Electrical Connections	12
Instrument Power:	13
Chapter 3: Digital Operation	15
Loading the Smart-Trak® 50 Series Software	16
Connecting Smart-Trak® 50 Series to Your Computer	16
If you plan to control more than one Smart-Trak® 50 Series from your computer	17
Running the Smart-Trak® 50 Series User Software	17
Chapter 4: Analog Operation	26
Setpoint Adjustment	28
Zero Adjustment	28
Over-Range Condition	29
Chapter 5: Technical Support & Service	30
Appendix A: Gas Tables & K-Factor Calculations	32
Appendix B1: 50 Low Flow (to 50 slpm) Product Specifications	36
Appendix B2: 50 Medium Flow (to 200 slpm) Product Specifications	39
Appendix C: Quick Start Guide	42

Chapter 1: Introduction

This instruction manual is your guide to the Smart-Trak® 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 B:** Product Specifications
- **Appendix C:** Quick Start Guide

Throughout this manual, we use the word *instrument* as a generic term to represent the **Smart-Trak® 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

EMAIL: service@sierrainstruments.com**European Customer Service:**

PHONE: +31 72 5071400

FAX: +31 72 5071401

EMAIL: service@sierra-instruments.nl**Asia Customer Service:**

PHONE: + 8621 5879 8521

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 Smart-Trak® 50 Series Flow Sensing Principle

The operating principle of the Smart-Trak® 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 ($\dot{m}_1$).

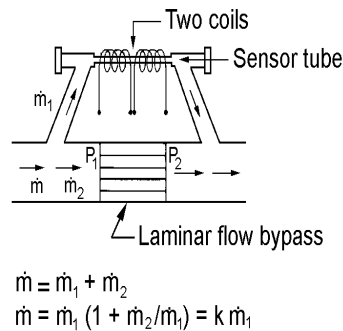


Figure 1-1. Flow Paths through the Instrument

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 Smart-Trak® 50 Series microprocessor. From this, Smart-Trak® 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.

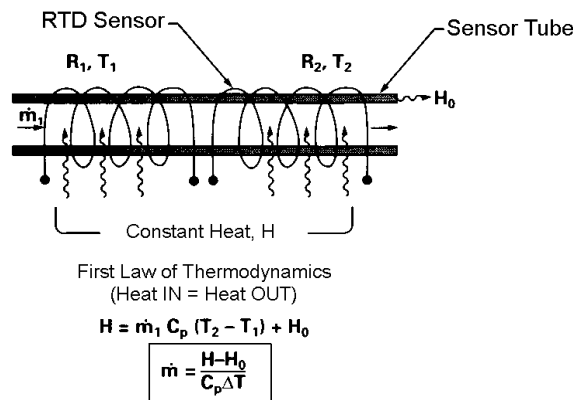


Figure 1-2. Flow Measuring Principle

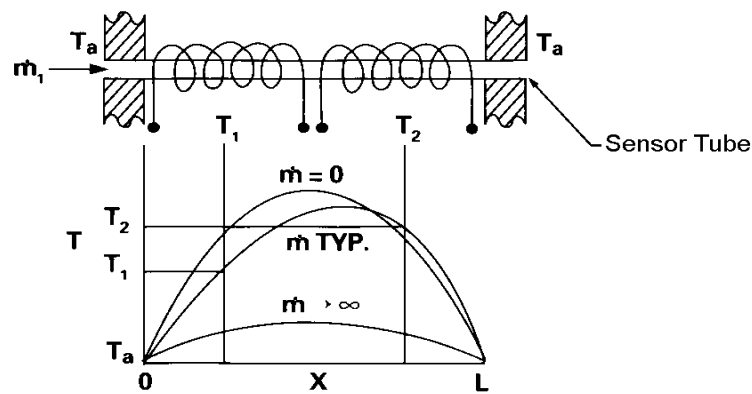


Figure 1-3. Sensor Temperature Distribution

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 (C_p) 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.

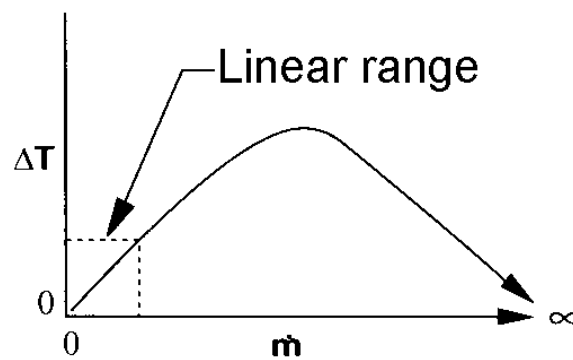


Figure 1-4. Linear Range of the Transducer's Output Signal

In Smart-Trak® 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.

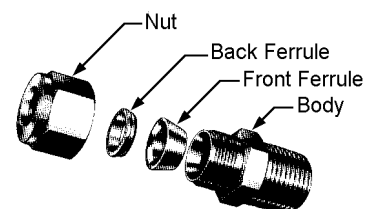
Installation Check List

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 Smart-Trak® 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

Smart-Trak® 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 Smart-Trak® 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

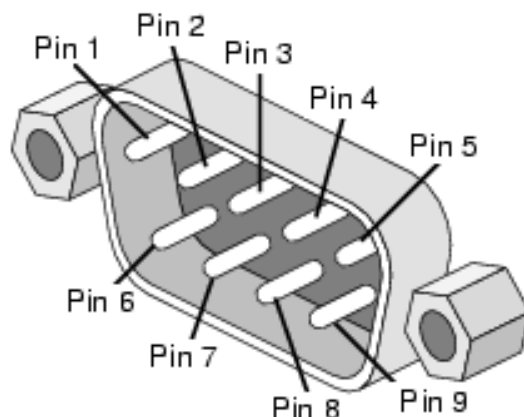
The base plate or bottom of the instrument has four mounting holes. Two are SAE thread and two are metric thread. For location and dimensions, please see Appendix B.

Installing Your Instrument—Electrical Connections

All electrical connections for your Smart-Trak® 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: Smart-Trak® 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 Smart-Trak® 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 Smart-Trak® 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 Smart-Trak® 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: Smart-Trak® 50 Series Connections. After a few seconds of warm up, the display (optional) will turn on.
2. **Open the gas supply:** Smart-Trak® 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 Smart-Trak® 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 Smart-Trak® 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:** Smart-Trak® 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 Smart-Trak® 50 Series Mass Flow Controller is now ready for use!

Loading the Smart-Trak® 50 Series Software

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

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

PROCEDURE:

1. Insert the Smart-Trak® 50 Series Software CD into your CD-ROM
2. Open “My Computer” on your desktop
3. Open the CD Named: “Smart-Trak® 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 Smart-Trak® 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 Smart-Trak® 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.

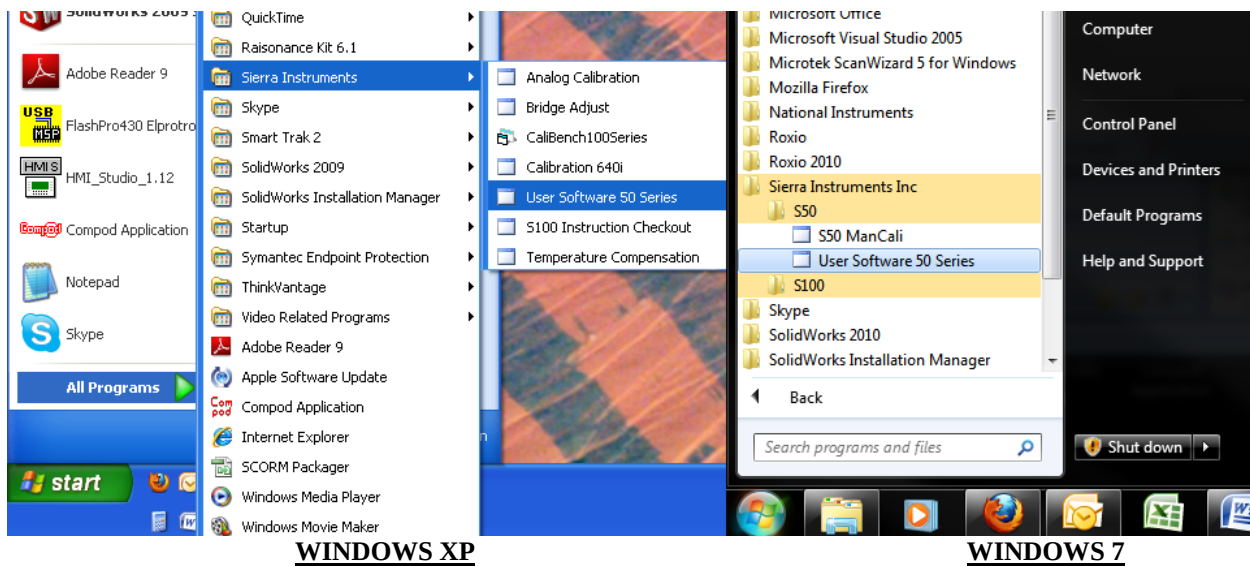


NOTE: Computers have limited capacity and computational ability, as well as streaming speeds; the more instances you run, the slower the response. Please remain patient with the system, or consider upgrading your PC to handle the load.

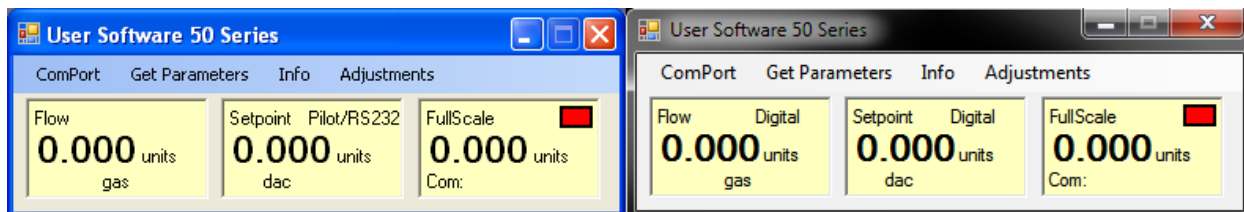
If connecting your computer to the Smart-Trak® 50 Series creates any confusion, please contact Sierra Instruments or your IT person for assistance.

Running the Smart-Trak® 50 Series User Software

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

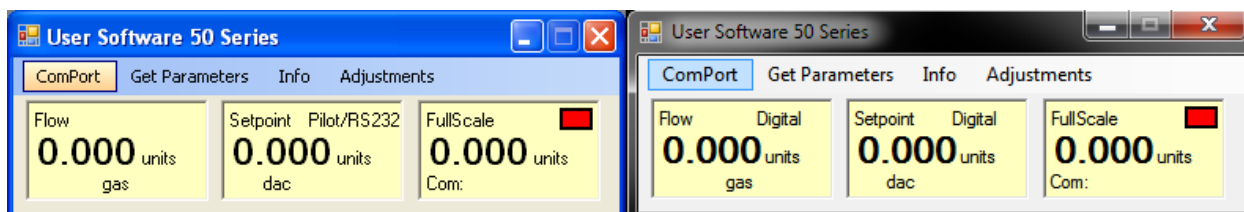


You will see the following main screen:

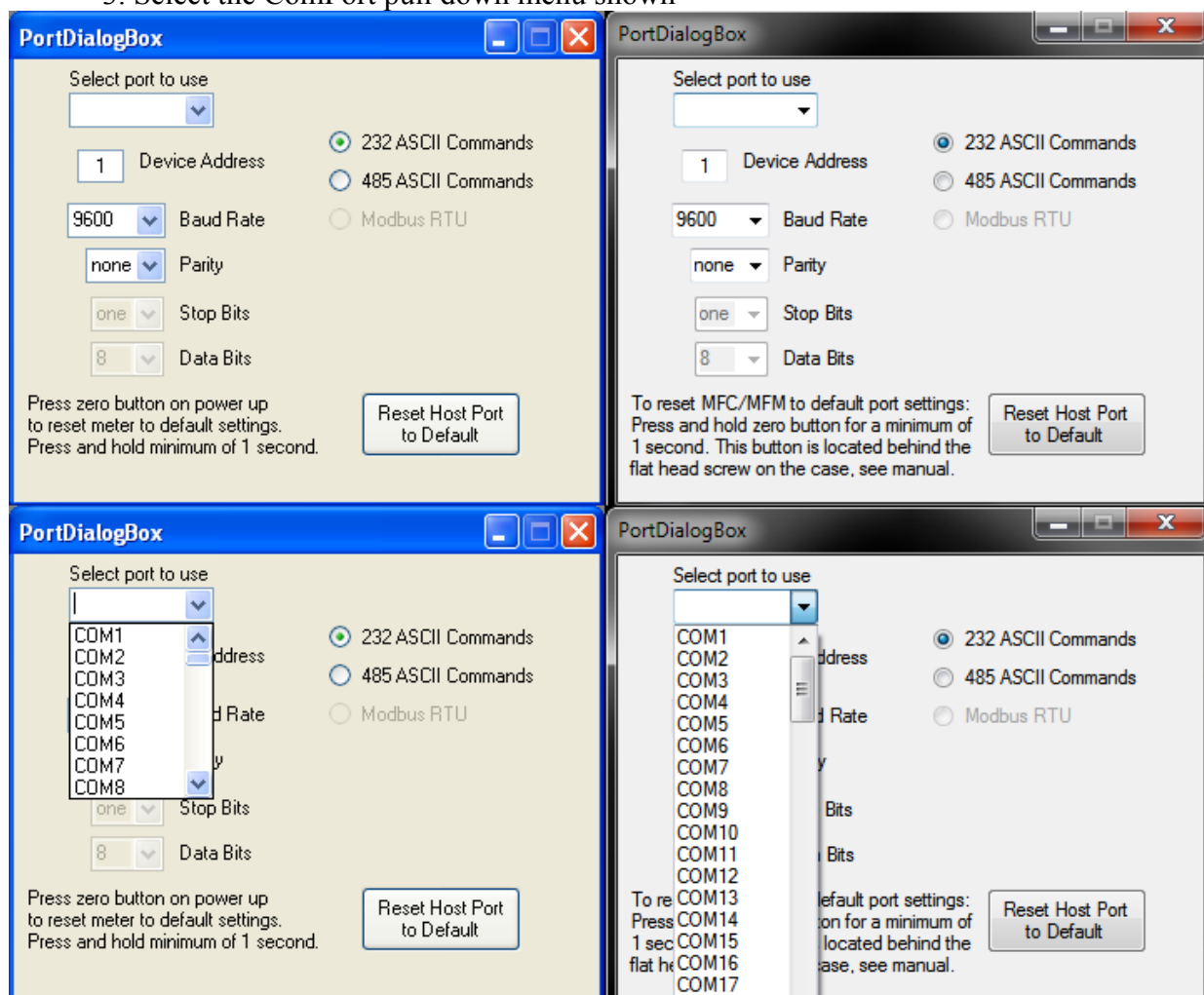


NOTE: Hovering the mouse pointer over any of the input fields and buttons will give you a description of its purpose.

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

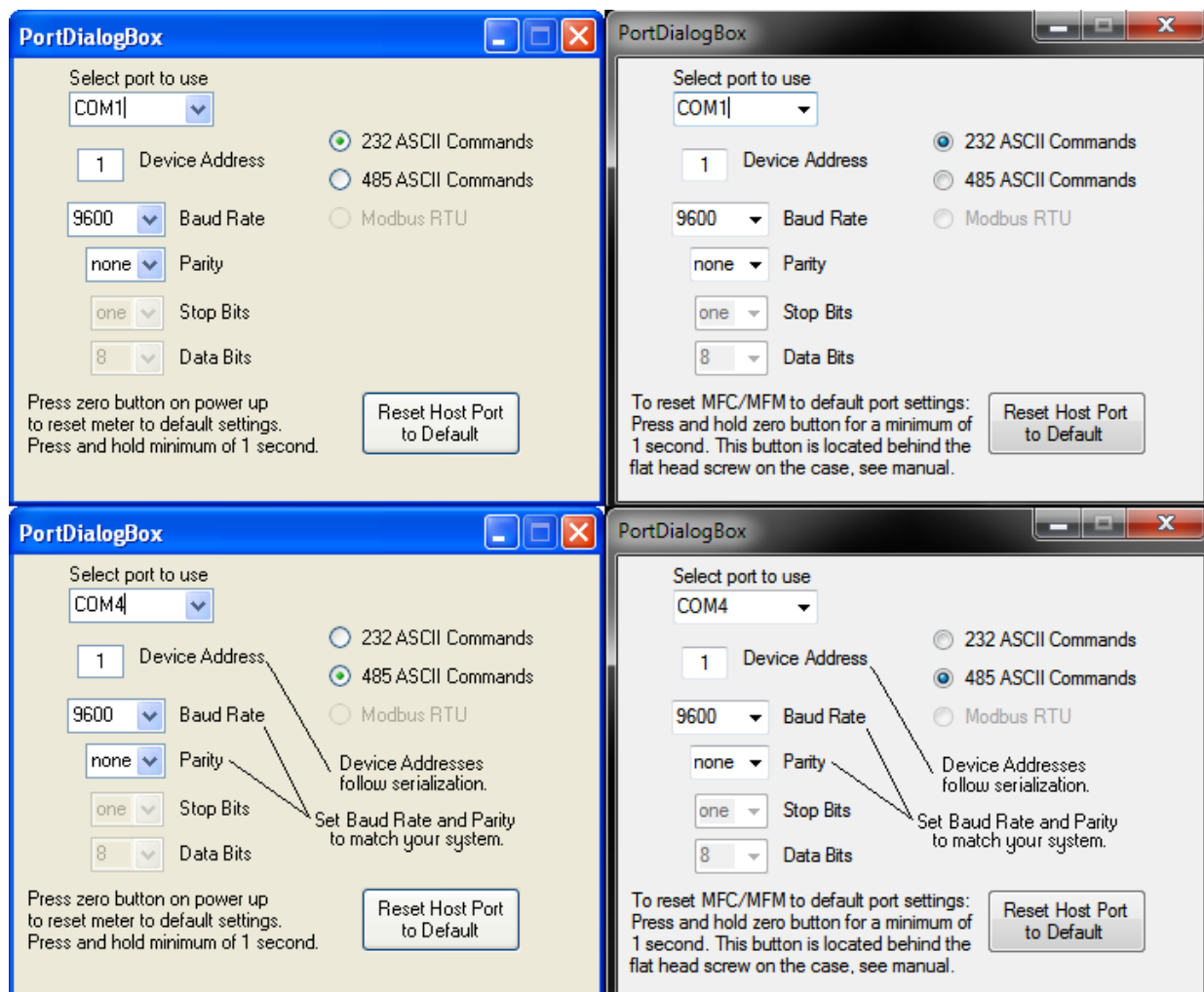


3. Select the ComPort pull down menu shown

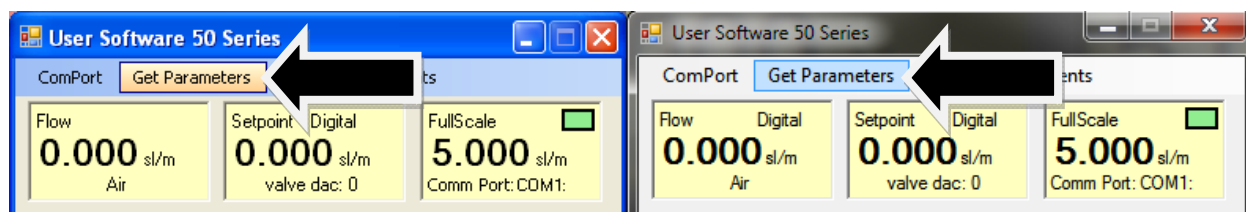


As shown above, use the pull-down menu to choose the port number that corresponds to the serial port channel your 50 Series is connected to. Depending on whether the unit is RS-232 or RS-485, you'll need to select the proper "ASCII Commands" setting to match as shown above right.

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.



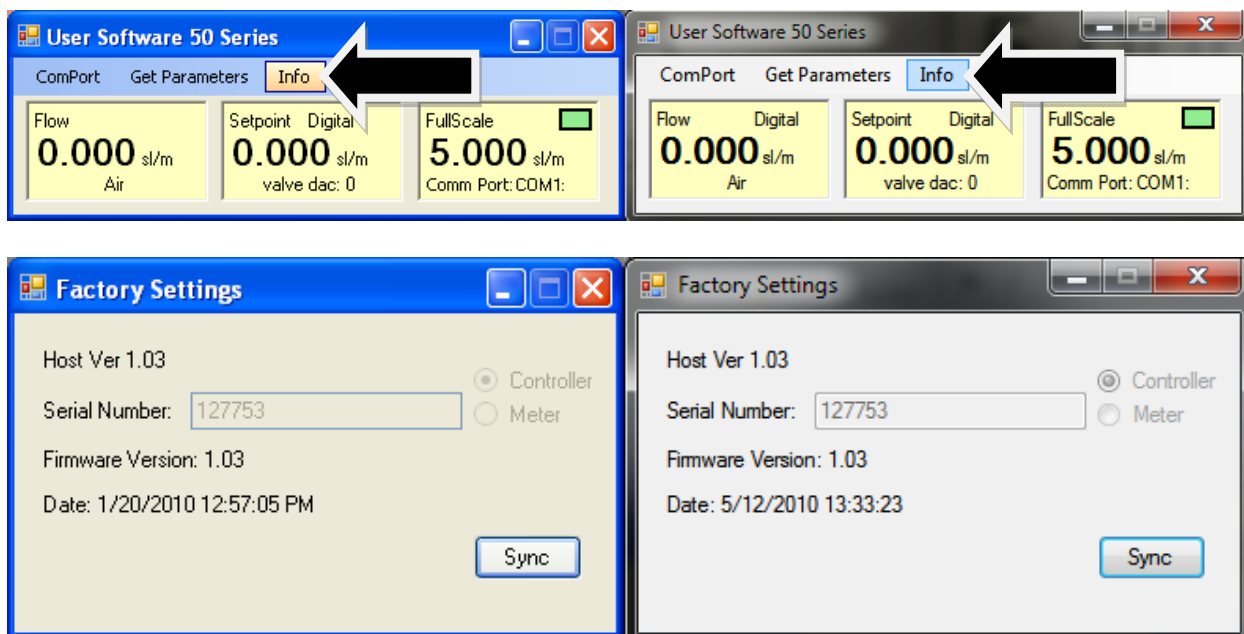
4. Close the window using the X button in the upper right corner of the dialog box. The communications are set up, and the unit should be communicating with the computer, as evident by the changing numbers right of the COM1: port in the picture below. If the numbers are not changing, click 'Get Parameters.'



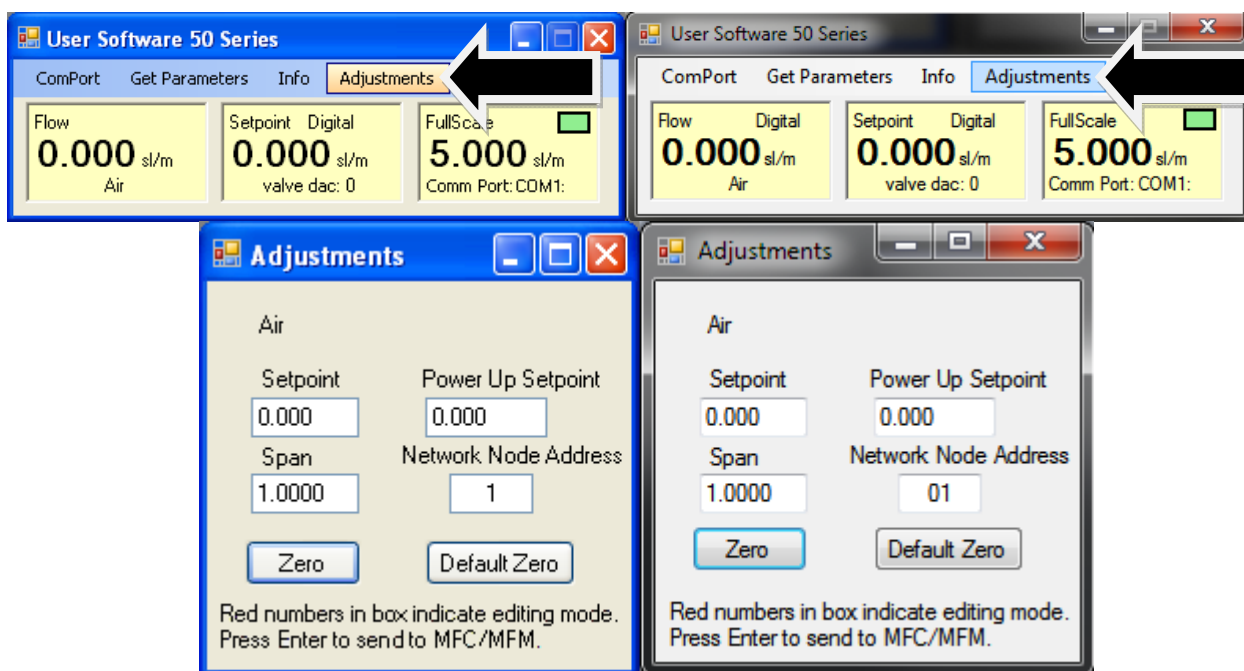
RESET NOTE: If you are not able to establish communication with your instrument be sure you have the proper ComPort selected to match your PC port then hit the "Reset Host Port To Default" button in the Port Dialog Box and power down your instrument. Next, power up the instrument again and hold the zero 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 Smart-Trak® 50 Series User Software

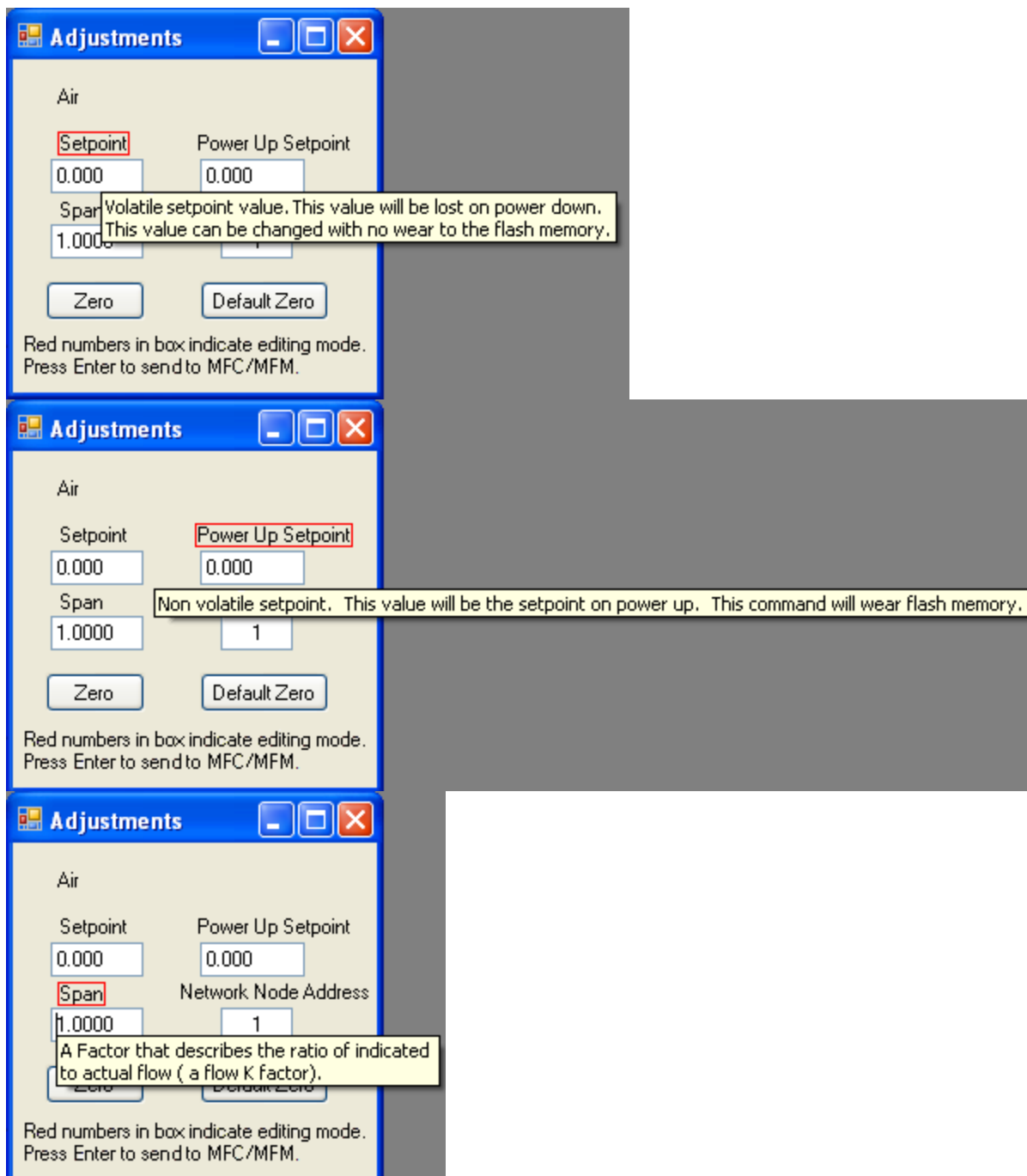
You can learn more about your unit, including the Serial Number, Firmware Version, etc., by clicking on the 'Info' button.

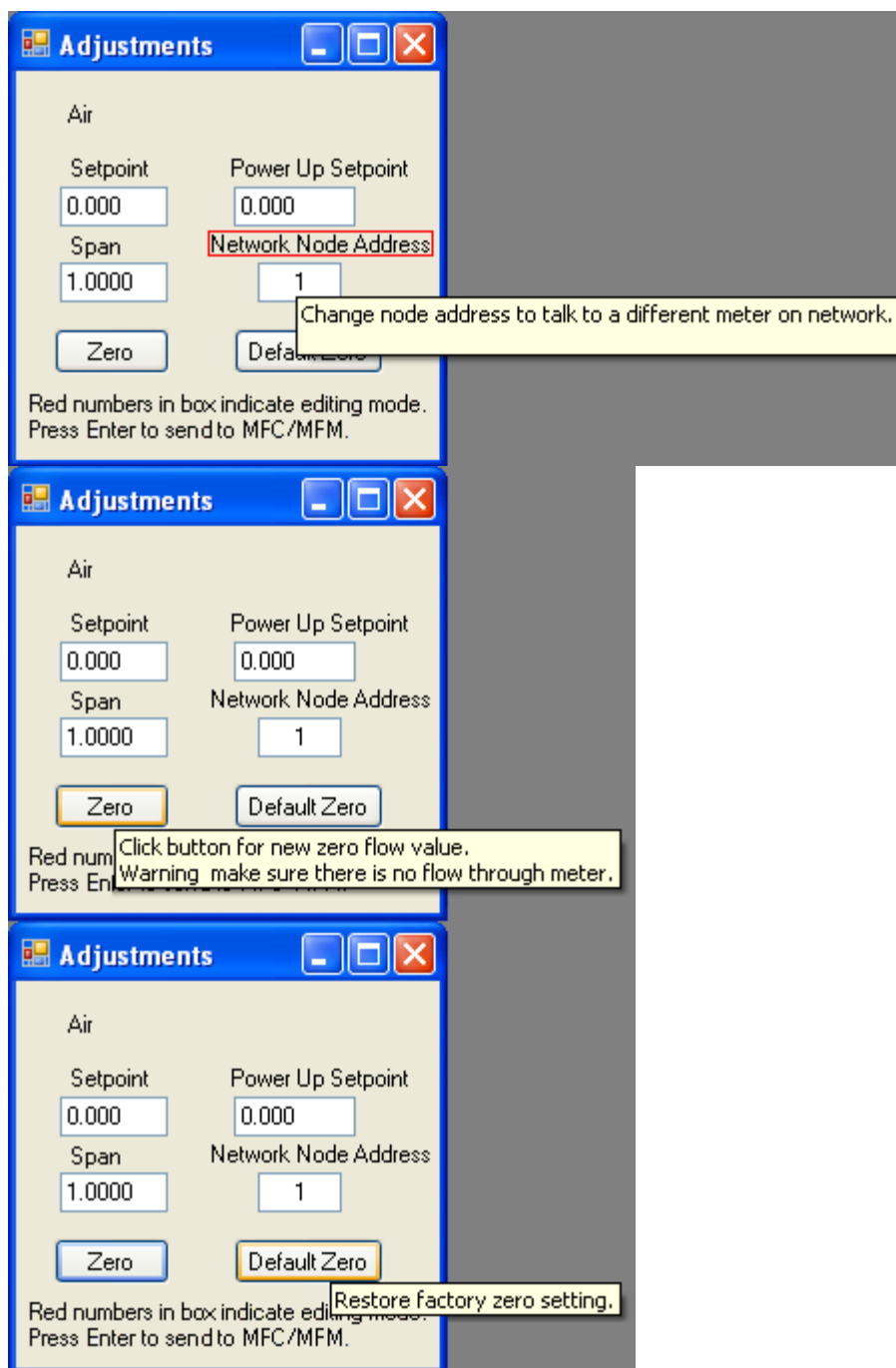


The final window below will provide control of the system. Click the 'Adjustments' button.

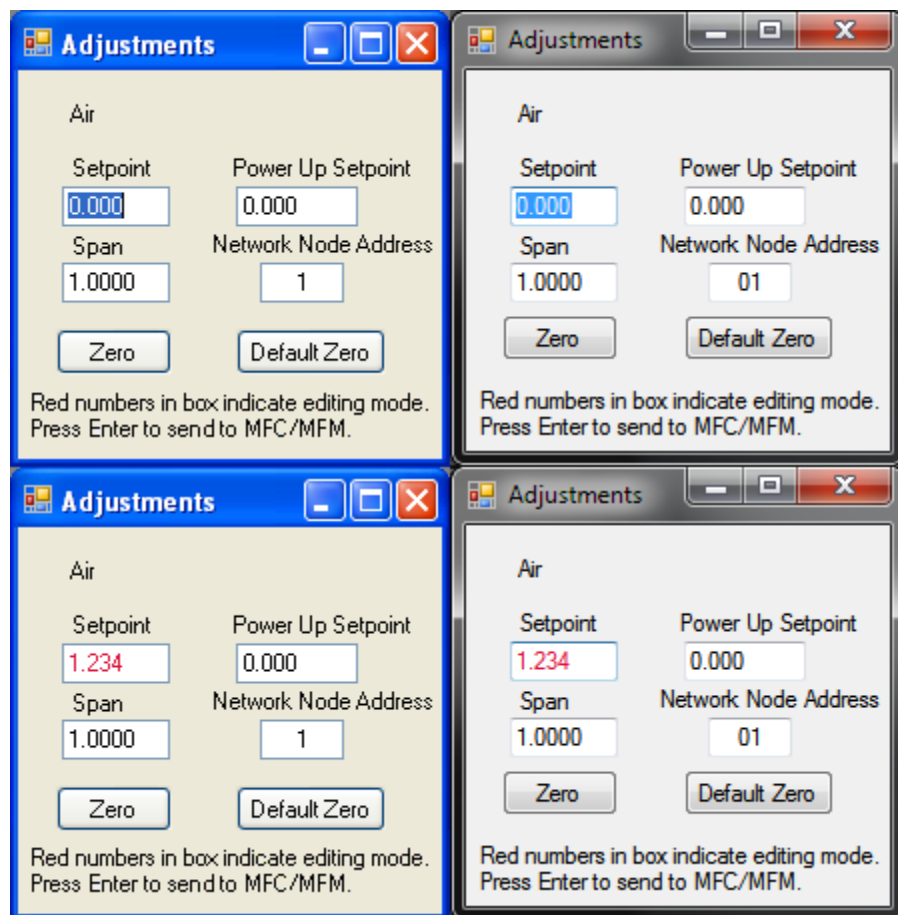


Hovering the mouse pointer over the input fields and buttons listed above will give you a description of its purpose. For your reference, this is shown below.

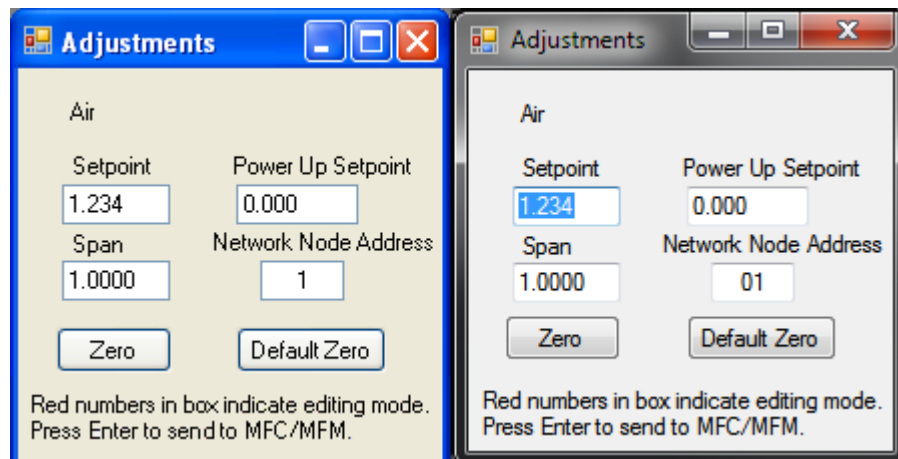




Change the value in any input field by selecting the data and inputting a desired value. Below left, for example, we have selected Setpoint. Below right, we have entered 1.234



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

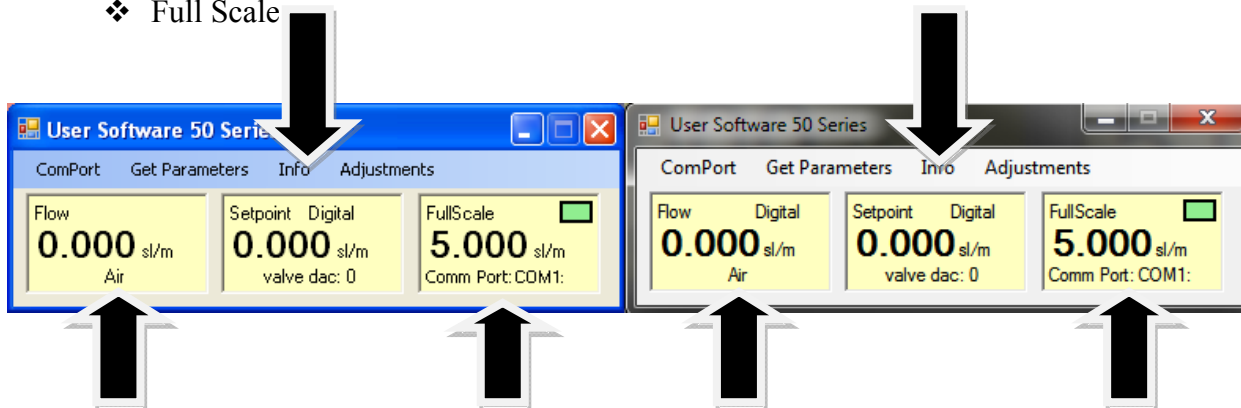


Using the 50 Series Software

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 Smart-Trak® 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 Smart-Trak® 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 Smart-Trak® 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 Smart-Trak® 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 Smart-Trak® 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) Smart-Trak® 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 $\pm 2\%$ of the selected flow rate.



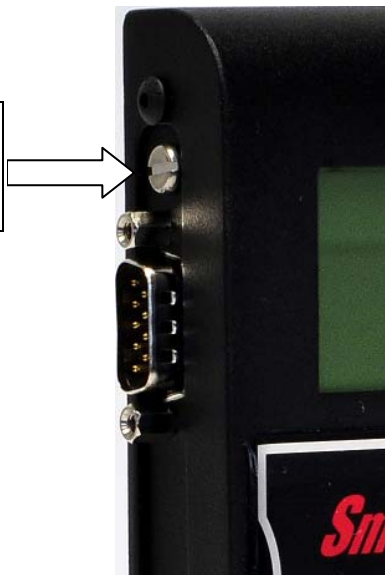
CAUTION! DO NOT LEAVE A SETPOINT APPLIED FOR AN EXTENDED PERIOD OF TIME TO A CONTROLLER WHEN THE GAS SUPPLY IS SHUT OFF OR BLOCKED.

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 and push the zero button. This performs an automatic zero adjustment, if you believe you performed this adjustment incorrectly, repeat the steps above.

Remove the silver screw to expose the zero adjustment port



Over-Range Condition

If the mass flow rate exceeds the full scale range listed on the Smart-Trak® 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. Our expedite fees are: three-day turnaround 25%, two-day turnaround 40%.

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

1. Obtain a Return Materials Authorization (RMA) number from Sierra Instruments. You may obtain an RMA number by three different methods.
 1. Go to <http://www.sierrainstruments.net/rma.aspx> and fill in the form. Hit Submit and print a copy of the RMA (that now includes RMA #) send a copy of the RMA form along with your meter back to the factory.
 2. Call Sierra at 800-866-0200 or +1-831-373-0200 Monday through Friday between 7:00 a.m. and 5:00 p.m.
 3. Email Customer Service for an RMA number at service@sierrainstruments.com
2. 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.
3. 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). This is particularly important when shipping the medium and high flow versions. Due to their weight, they can be damaged in transit if not packed properly.
4. 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)

Appendix A: Gas Tables & K-Factor Calculations

K-Factor Calculations--

Using Smart-Trak® 50 Series with Other Gases

If you will be using Smart-Trak® 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 standard 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 Valve Seat	
Acetylene	C ₂ H ₂	.581	.4036	1.079	1.162		
Air		1.000	.240	1.200	1.293		
Allene (Propadiene)	C ₃ H 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
Bromotrifluoromethane (Freon-13 B1)	CBrF ₃	.371	.1113	6.168	6.644		
1,3-Butadiene	C ₄ H ₆	.321	.3514	2.240	2.413		
Butane	C ₄ H ₁₀	.261	.4007	2.407	2.593	NEO	KR
1-Butane	C ₄ H ₈	.301	.3648	2.324	2.503	NEO	KR
2-Butane	C ₄ H ₈ CIS	.325	.336	2.324	2.503	NEO	KR
2-Butane	C ₄ H 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	ClF 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 ₂ ClF ₅	.241	.164	6.398	6.892		KR
Chlorotrifluoromethane (Freon-13)	CClF ₃	.381	.153	4.326	4.660		KR
Cyanogen	C ₂ N ₂	.611	.2613	2.156	2.322		KR
Cyanogen Chloride	ClCN	.611	.1739	2.545	2.742		
Cyclopropane	C ₃ H ₅	.461	.3177	1.742	1.877		KR
Deuterium	D ₂	1.002	.1722	1.670	1.799		
Diborane	B ₂ H ₆	.441	.508	1.147	1.235		KR
Dibromodifluoromethane	CBr ₂ F ₂	.190	.15	8.691	9.362		KR
Dibromomethane		.471	.075	7.204	7.76		KR
Dichlorodifluoromethane (Freon-12)	CCl ₂ F ₂	.351	.1432	5.008	5.395		KR
Dichlorofluoromethane (Freon-21)	CHCl ₂ F	.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) ₂ SiCl ₂	.251	.1882	5.345	5.758		KR
Dichlorosilane	SiH ₂ Cl ₂	.401	.150	4.183	4.506		KR
Dichlorotetrafluoroethane (Freon-114)	C ₂ Cl ₂ F ₄	.220	.1604	7.079	7.626		KR
1,1-Difluoroethylene (Freon-1132A)	C ₂ H ₂ F ₂	.185	.224	2.652	2.857		KR
Dimethylamine	(CH ₃) ₂ NH	.371	.366	1.867	2.011		KR
Dimethyl Ether	(CH ₃) ₂ O	.391	.3414	1.908	2.055		KR
2,2-Dimethylpropane	C ₃ H ₁₂	.220	.3914	2.988	3.219		KR
Ethane	C ₂ H ₆	.501	.4097	1.246	1.342		
Ethanol	C ₂ H ₆ O	.391	.3395	1.908	2.055		KR
EthylAcetylene	C ₄ H ₆	.321	.3513	2.240	2.413		KR
Ethyl Chloride	C ₂ H ₅ Cl	.391	.244	2.673	2.879		KR
Ethylene	C ₂ H ₄	.601	.358	1.161	1.251		
Ethylene Oxide	C ₂ H ₄ O	.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 ₃ F	.331	.1357	5.690	6.129		KR
Freon-12	CCl ₂ F 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 ₂ F	.421	.140	4.597	4.952		KR
Freon-22	CHClF ₂	.461	.1544	3.581	3.858		KR
Freon-113	CCl ₂ FCClF ₂	.200	.161	7.761	8.360		KR
Freon-114	C ₂ Cl ₂ F ₄	.220	.160	7.079	7.626		KR
Freon-115	C ₂ ClF ₅	.241	.164	6398	6.892		KR
Freon-C318	C ₄ F 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 ₂ F ₆	.241	.1834	5.716	6.157		KR
Hexane	C ₆ H 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 ₂ Se	.792	.1025	3.354	3.613		KR
Hydrogen Sulfide	H ₂ S	.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 ₄ H 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 ₃ OH	.581	.3274	1.327	1.429		
Methyl Acetylene	C ₃ H ₄	.431	.3547	1.659	1.787		KR
Methyl Bromide	CH ₃ Br	.581	.1106	3.932	4.236		
Methyl Chloride	CH ₃ Cl	.193	2.253	2.092			KR
Methyl Fluoride	CH ₃ F	.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 ₃ SH	.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 ₂ H ₅ NH ₂	.351	.387	1.867	2.011		KR
Monomethylamine	CH ₃ NH 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 ₂ O	.716	.2088	1.836	1.964		
Octafluorocyclobutane (Freon-C318)	C ₄ F 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 ₅ H ₉	.261	.38	2.614	2.816		KR
Pentane	C ₅ H ₁₂	.210	.398	2.988	3.219		KR
Perchloryl Fluoride	ClO ₃ F	.391	.1514	4.243	4.571		KR
Perfluoropropane	C ₃ F 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 ₃ H ₈	.335	.3885	1.826	1.967		
Propylene	C ₃ H 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 ₂ F ₂	.391	.1543	4.235	4.562		KR
Teos		.090				800 Series Recommended	
Tetrafluorahydrazine	N ₂ F ₄	.321	.182	4.307	4.64		KR
Trichlorofluormethane (Freon-11)	CCl ₃ F	.331	.1357	5.690	6.129		KR
Trichlorosilane	SiHCl ₃	.331	.1380	5.610	6.043		KR
1,1,2-Trichloro-1,2,2 Trifluoroethane (Freon-113)	CCl ₂ FCClF ₂	.200	.161	7.761	8.360		KR
Trisobutyl Aluminum	(C ₄ H ₉)Al	.061	.508	8.214	8.848		KR
Titanium Tetrachloride	TiCl ₄	.271	.120	7.858	8.465		KR
Trichloro Ethylene	C ₂ HCl ₃	.321	.163	5.523	5.95		KR
Trimethylamine	(CH ₃) ₃ N	.281	.3710	2.450	2.639		KR
Tungsten Hexafluoride	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 ₂ CHBr	.461	.1241	4.430	4.772		KR
Vinyl Chloride	CH ₂ CHCl	.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

Performance Specifications

Accuracy

Air, N₂, O₂, CO₂, CO, Ar: +/-1.5 % of full scale including linearity over 32°F to 122°F (0°C to 50°C) and 5 to 145 psig (0.3 to 10 barg)

Other gases: +/- 3 % of full scale including linearity at operating conditions (consult factory)

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)

Operating Specifications

Gases

All neutral, non-contaminated dry and clean gases (air, nitrogen, carbon dioxide, argon, methane, hydrogen, helium, etc.) compatible with wetted materials aluminum, stainless steel and Viton®

Mass Flow Rates

From 0 to 20 sccm or nml/m to 0 to 50 slpm or nlpm; flow ranges specified are for an equivalent flow of air at 760 mm Hg and 21°C (70°F) for standard conditions, 760 mm Hg. and 0°C (32°F) for normal conditions, other gases will have other ranges (consult factory); other units are available (e.g., scfh or nm³/h).

F1 or N1: 20 sccm or nccm. Minimum flow is zero. You must specify full scale. Must fall within listed range.

F2 or N2: 200 sccm or nccm, **F3 or N3:** 1.0 slpm or nlpm, **F4 or N4:** 5.0 slpm or nlpm, **F5 or N5:** 10.0 slpm or nlpm, **F6 or N6:** 20.0 slpm of nlpm, **F7 or N7:** 50.0 slpm or nlpm.

Other ranges in other units are available (e.g., scfh or nm³/h), but may extend lead time (consult

factory).

For measuring or controlling flows below 5 sccm, please consider Micro -Trak™ Model 101. Above 50 slpm, please consider the Smart -Trak® Model 100 Series

Gas Pressure:

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

Differential Pressure Requirement 1 to 20 psid (0.07 to 1.38 bard), flow range dependent

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

Leak Integrity

5 X 10⁻⁵ atm cc/sec of helium maximum

Power Requirements

Meter: 15 or 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 (standard)
- Linear 4 - 20 mA or 0 - 5 VDC optional, 500 ohms maximum load resistance.
- RS-485 optional (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

Pressure Drop (1/4" standard fittings)

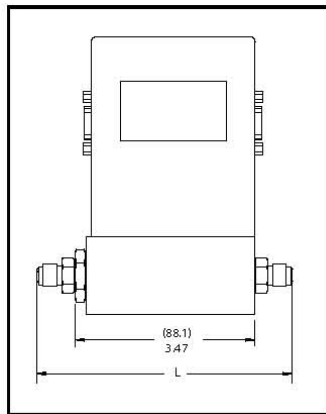
Flow Range	Flow Rate	Meter	Controller
	slpm	Minimum Delta P psi (mbar)	Minimum Delta P psi (mbar)
1	0.02	0.45 (31.0)	1.0 (69.0)
2	0.2	0.45 (31.0)	1.5 (103.4)
3	1.0	0.50 (34.5)	2 (137.9)
4	5	0.60 (41.4)	4 (275.8)
5	10	0.80 (55.2)	7.5 (517.1)
6	20	1.2 (82.7)	12.5 (861.8)
7	50	3.0 (206.8)	15 (1034.2)

Physical Specifications & Dimensions

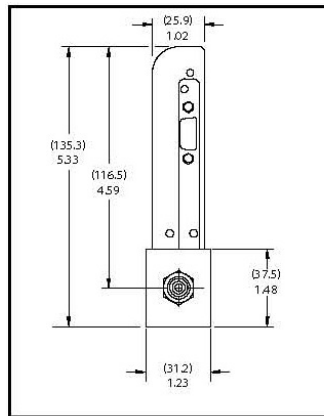
Wetted Material

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

50 Series - Front View



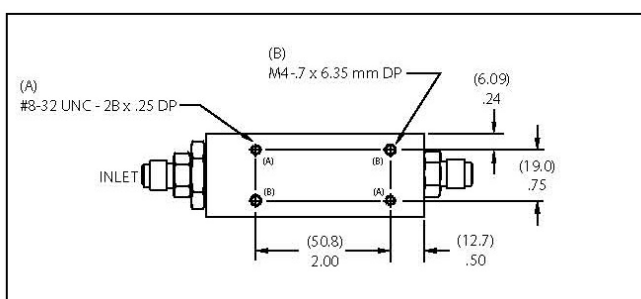
50 Series - Side View



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

NOTE: Units in inches (mm in parenthesis)

50 Series – Bottom View



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

Performance Specifications

Accuracy

+/- 1.5% of full scale including linearity 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. May be tuned to be faster or slower (consult factory)

Operating Specifications

Gases

All neutral, non-contaminated dry and clean gases 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:

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)

Gas and Ambient Temperature

32°F to 122°F (0°C to 50°C)

Leak Integrity

5 X 10⁻⁹ atm cc/sec of helium maximum

Power Requirements

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 optional RS-232 communications cable

Display

Flow rate, units, full scale, and setpoint.

Pressure Drop (3/8" standard fittings)

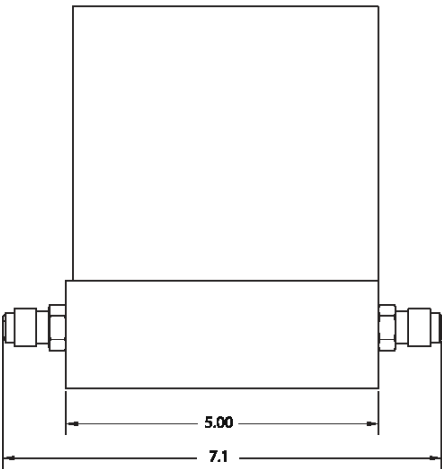
Minimum Pressure Drop for Air, Mass Flow Controller	
Flow Rate(slp_m)	Medium Flow 3/8 or 1/2 inch fittings Pressure Drop in PSI (mbar)
20	1 (68)
30	1.2 (82)
40	1.6 (110)
50	2 (136)
100	5 (340)
150	10 (680)
200	15 (1020)

Physical Specifications & Dimensions

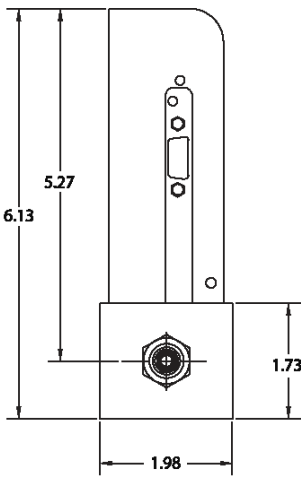
Wetted Material

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

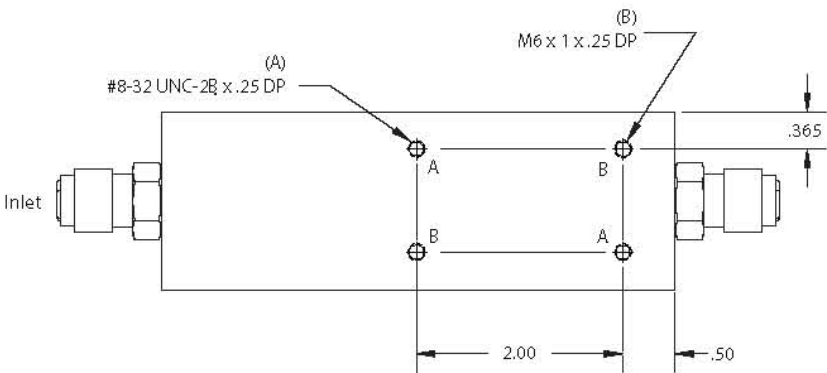
50 Series - Front View



50 Series - Side View



50 Series - Bottom View



Appendix C:

Quick Start Guide

Smart-Trak® 50 Series Low & Medium Flow

INTRODUCTION

Congratulations on your purchase of the Smart-Trak® 50 Series digital gas mass flow controller designed to meet the low-cost budgetary requirements of OEM's while maintaining excellent quality and performance. This reference guide is not meant to replace the Instruction Manual included on the CD-ROM in your shipment, but rather is a great supplement to it that will help you install and operate your instrument and begin to measure or control mass flow.

SAFETY 1st

1. Apply power only after reviewing the wiring diagrams on page 2 of this guide or in the Instruction Manual.
2. Apply gas flow only after checking plumbing connections for leaks.
3. **NEVER TEST FOR LEAKS WITH LIQUID LEAK DETECTOR.** If liquid seeps into the electronics or the hidden sensor compartment, the instrument may be damaged. Instead use a pressure-decay test (if liquid **MUST** be used at all, limit it to the fittings and keep it off the body of the instrument).

INSTALLATION

1. **Consult the instrument's Data Label (on the back of the instrument)** for ALL proper operating parameters. If the information on the Data Label does not match your process conditions, contact your Representative or Sierra Instruments Customer Service at the contact information on the footer of the sheet.
2. **Install a 10 micron in-line filter upstream of your instrument.** If the gas contains any moisture, use an appropriate dryer or desiccant. Particles larger than 10 micron and moisture may damage your instrument.
3. **Mount according to Data Label orientation.** Horizontal flow is preferable and factory default unless the factory calibration was performed specifically for vertical flow upward or downward, as listed. Orientation is listed on Data Label and on the Calibration Certificate.
4. This instrument is not a loop-powered device! Do NOT apply power to the 4-20 mA / 0-5 VDC output or setpoint connections.
5. **Wire your instrument per the diagramed pin-out** on the back of this card and in Chapter 2 of the Instruction Manual. For convenience of wiring, there are two DB9 connector ports; the unused DB9 is capped off. Apply power to your choice of port and cap unused port. It is recommended you allow 15 minutes for the instrument to warm up for maximum accuracy.
- 6.

OPERATION

1. **Power the unit.** If you are using the Sierra provided power supply, it is recommended you attach the D-sub connector to the 50 Series before plugging the adapter into the wall. The unit may take longer to start than normal if otherwise. This will not damage the unit in any way.
2. **Our Mass Flow Controllers with a digital setpoint option** are shipped with a *zero setpoint* in the power-up setpoint box in the software. **For safety considerations, it is recommended YOU confirm this prior to applying gas to the unit.**

3. **Apply the gas listed on the Data Label** to the inlet at the recommended pressure (listed on the Data Label/Calibration Certificate). Your 50 Series will begin to measure mass flow. This will be displayed on the user software or local display.
4. You will need a setpoint input in order to control flow. **Do so carefully!** You can digitally input a setpoint using the user software or control directly with your analog setpoint source if you ordered the analog option. **NOTE:** The unit ships in the configuration ordered. This information is also listed on the Data Label and on the Calibration Certificate. This information is also inherent in the model code. See the Instruction Manual for more details.
5. **DO NOT** leave a setpoint applied for an extended period of time to a controller when the gas supply is off or blocked. **Damage may result from excessive heating, and the unit will become hot enough to burn you.** In this case you should adjust your setpoint to 0.000 or power down the unit.

WIRING THE OPTIONAL COMMS CABLE **(Pin-out)**

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

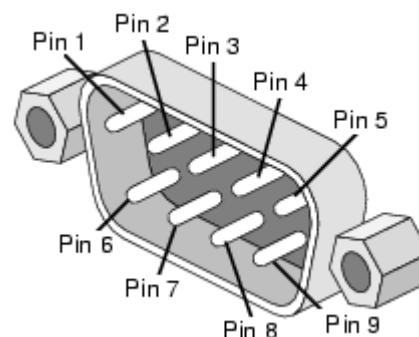


Figure: DB9 Pin-out (There are two DB9 connectors, one on each side of the enclosure. Assure block off plate covers unused DB9).

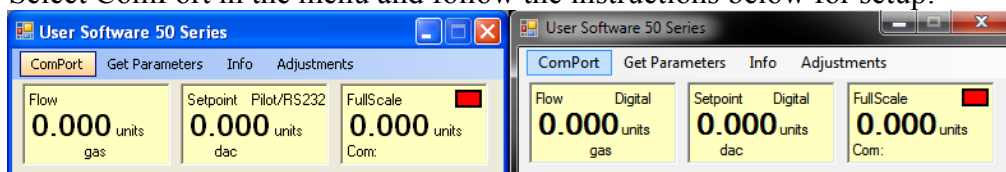
USER SOFTWARE INSTALLATION

Each Smart-Trak[®] 50 Series order is shipped with a CD-ROM containing the Smart-Trak[®] 50 Series Software. This software allows you to view the mass flow rate, full scale flow rate value, and setpoint. Use the software to zero the instrument, revert to the default zero, change the span, change setpoint or power-up setpoint, or change the address of the unit software is talking to (RS-485 only). Locate this disk. At this point, **EXIT OUT OF ANY OPEN APPLICATIONS BEING RUN ON YOUR COMPUTER.**

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

RUNNING THE USER SOFTWARE

Locate the program named “50 Series User Software” and open it. You will see the following main screen. Select ComPort in the menu and follow the instructions below for setup:



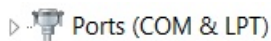
SELECTING THE COMMS PORT USING DEVICE MANAGER

The program must be set up to communicate with your unit depending on whether it utilizes RS-232 or RS-485 (Optional) communications protocol. It is **IMPORTANT** that you properly set up communications between the computer and instrument based on whether the instrument has RS-232 (also called Serial) or RS-485. The instruments' communication type is listed on the Data Label on the back of the unit and additionally on the Calibration Certificate, if ordered. In order to identify the communications port the 50 series is using, perform the following steps:

1. Identify the Communications Port

- **Windows XP or Older**

- o Left Click Start Button > Left Click Control Panel.
- o Double Left Click 'System.'
- o Left Click Hardware Tab, Left Click 'Device Manager' dialog button.
- o Expand Root Menu 'Ports (COM & LPT)' by Left Clicking arrow left of name. It will look like this:



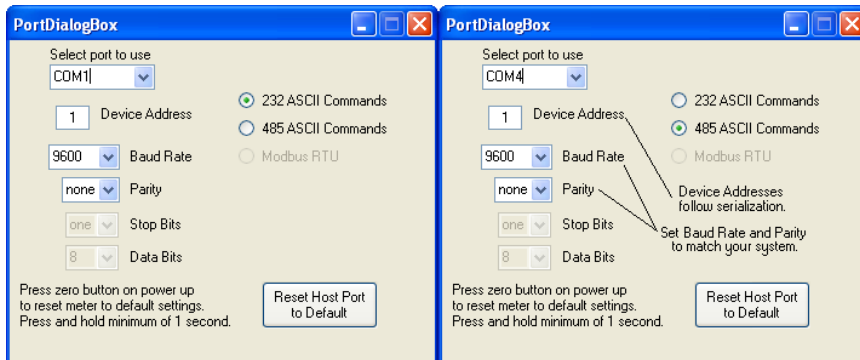
- o Identify port to be used by the 50 series.

- **Windows 7**

- o Right Click on 'Computer' in the Start Menu, then Left Click 'Properties' from there, 'Device Manager' is listed in the left-hand frame menu. **NOTE:** Device Manager links look like this in Win7:  Device Manager
- o Left Click 'Device Manager' dialog button and expand the root menu and continue as with the Windows XP steps above

2. Enter the Communications Port into the User Program

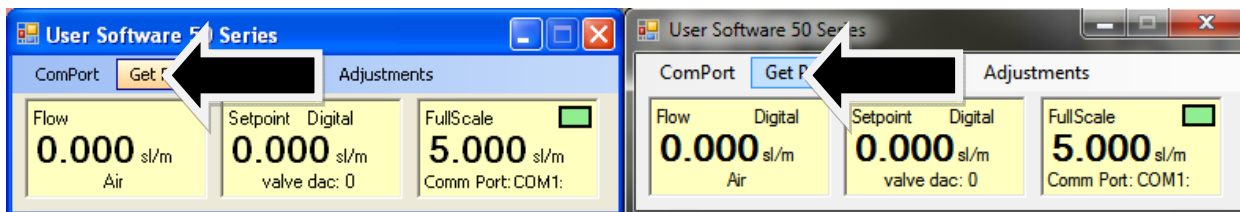
Below is the communications setup screen for the provided user software. If the unit utilizes RS-232, follow the left screen shot. If the unit utilizes RS-485, follow the right screen shot. ENTER THE COM PORT IDENTIFIED ABOVE IN THE "Select Port to use" pull-down menu:



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.

3. Establish Communications

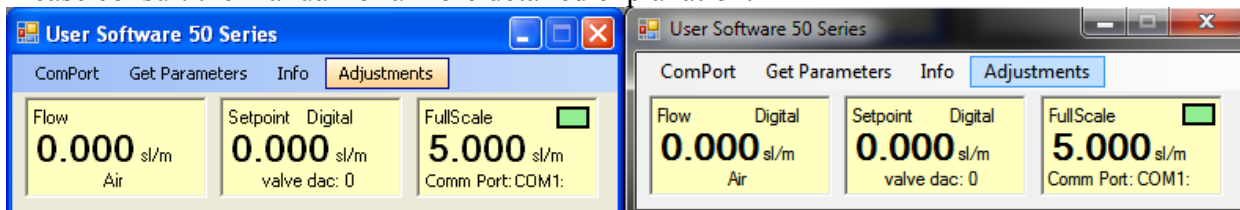
Close the window using the X button in the upper right corner of the dialog box. The communications are set up, and the unit should be communicating with the computer, as evident by changing numbers to the right of the Comm Port and a Green status light. If the numbers are not changing, click 'Get Parameters.'



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.

4. Read and Perform Adjustments

With communications established you can now read flow, gas, units, setpoint and full scale, along with communications and valve status. You can also adjust setpoint, zero and span. Please consult the manual for a more detailed explanation.



QUESTIONS? We are here to help when you need us!

Email Tech Support: service@sierrainstruments.com

24 Hour Website Service: www.sierrainstruments.com (Click “Sales & Service” button).

Tech Support:

N. America: 800.866.0200 or 831.373.0200

Europe: + 31 72 5071 400

Asia Pacific: + 8620 3435 4870